ROMANIA - ROUMANIE

Adhering Organization

Romanian Academy
RNCGG Secretariat
P.O. Box 31-54
024270 Bucharest

Contact: C.S. SAVA

NATIONAL COMMITTEE

President: D. ZUGRAVESCU **Vice President: C. DEMETRESCU**

Secretary General: C.S. SAVA

NATIONAL CORRESPONDENTS OF THE ASSOCIATIONS

IACS:	R. BOJARIU	**IAG:**	J. NEUNER	**IAGA:**	A. SOARE
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IASPEI:	M. RADULIAN D. ENESCU	**IAVCEI:**	A. SZAKACS		

BOJARIU
Dr. Roxana
IACS National Correspondent

National Administration of Meteorology
Sos. Bucuresti - Ploiesti, nr. 97
013686 Bucharest
ROMANIA

T: 40 21 316 3645
F: 40 21 316 7762
bojariu@clicknet.ro

DEMETRESCU
Dr. Crisan
Vice President, National Committee

Institute of Geodynamics
"Sabba S. Stefanescu"
19-21, Jean-Louis Calderon Str.
020032 Bucharest
ROMANIA

T: 40 21 317 2126
F: 40 21 317 2120
crisan@geodin.ro

ENESCU
Prof. Dr. Dumitru
IASPEI National Correspondent

National Institute of Earth's Physics
12, Calugareni Street
P.O. Box MG-2
Bucharest-Magurele
ROMANIA

T: 40 21 493 0118
F: 40 21 493 0052
denescu@infp.ro

NEUNER
Prof. Dr. Johann
IAG National Correspondent

Technical University of Civil Engineering
Bdul Lacul Tei, nr. 124
020396 Bucharest
ROMANIA

T: 40 21 243 3621
F: 40 21 242 0793
neuner@geodezie.utcb.ro

PANIN
Prof. Dr. Nicolae
IAPSO National Correspondent

National Institute of Marine Geology &
Geoecology - GeoEcoMar
23-25 Dimitrie Onciu Street
024053 Bucharest
ROMANIA

T: 40 21 252 2594
F: 40 21 252 2594
panin@geoecomar.ro

RADULIAN **Dr. Mircea** *IASPEI National Correspondent*	National Institute of Earth's Physics 12, Calugareni Street, P.O. Box MG-2 077125, Bucharest-Magurele Ilfov, ROMANIA	T: 40 21 493 0118 F: 40 21 493 0052 mircea@infp.ro
SAVA Dr. Constantin Stefan *Secretary General, National Committee* *Nationally Accredited Delegate to the 24th* *Council of the Union, 2007*	National Institute of Marine Geology & Geoecology - GeoEcoMar P.O. Box 31-54 024270 Bucharest ROMANIA	T: 40 722 786 434 F: 40 21 345 2056 sava@upcnet.ro
SOARE Mr. Alexandru *IAGA National Correspondent*	Geological Institute of Romania National Geophysical Observatory "Liviu Constantinescu" Surlari 8211 Moara Vlasiei, Ilfov ROMANIA	T: 40 21 252 5512 F: 40 21 252 2594 andisol@digi.ro
STANCALIE Dr. Gheorghe *IAMAS National Correspondent*	National Administration of Meteorology Sos. Bucuresti - Ploiesti, nr. 97 013686 Bucharest ROMANIA	T: 40 21 316 6098 F: 40 21 316 7762 gheorghe.stancalie@meteo.inmh.ro
STANCIU Dr. Petre *IAHS National Correspondent*	National Institute of Hydrology and Water Management Sos. Bucuresti - Ploiesti, nr. 97 013868 Bucharest ROMANIA	T: 40 21 317 9992 F: 40 21 318 1116 stanciu@hidro.ro
STEFAN Prof. Dr. Sabina *Member at Large, IAMAS* *IAMAS National Correspondent*	University of Bucharest Paculty of Physics P.O. Box MG-11, Magurele 077125 Bucharest ROMANIA	T: 40 21 780 4770 F: 40 21 420 8625 sabina_stefan@yahoo.com
SZAKACS Dr. Alexandru *IAVCEI National Correspondent*	Sapientia University Environment Sciences Department 4 Matei Corvin Street 400112 Cluj-Napoca ROMANIA	T: 40 21 741 534 405 F: 40 264 593 693 szakacs@sapientia.ro
ZUGRAVESCU Prof. Dr. Dorel *President, National Committee*	Institute of Geodynamics "Saaba S. Stefanescu" Str. Barajul 41A, sc. B., et. II, ap. 8 014121 Bucharest ROMANIA	T: 40 21 317 2126 F: 40 21 317 2120 dorezugr@geodin.ro

ROMANIAN ACADEMY

ROMANIAN NATIONAL COMMITTEE
OF GEODESY AND GEOPHYSICS

NATIONAL REPORT*

ON GEODETIC AND GEOPHYSICAL ACTIVITIES IN ROMANIA

2007 – 2011

Prepared for the XXVIth IUGG General Assembly
Melbourne - AUSTRALIA
28 June -7 July 2011

Bucharest
2011

** Final version will be installed on the IUGG website after the General Assembly*

FOREWORD

The National Report of the Romanian Committee of Geodesy and Geophysics (RNCGG) prepared for the XXVI-th General Assembly of IUGG aims at presenting the main directions and results of newly initiated and/or developed scientific researches of Romanian geoscientists, corresponding to the component associations, regarding the interdisciplinary study of the planet Earth.

In the framework of this volume, each section of the RNCGG has displayed, under the guidance of the national correspondents, the involvement of Romanian scientists and specialists in major national (especially in the frame of the National Programme of Research of Rsearch and Development - PNCDI) and international research projects (especially in the frame of the FP 6 and FP 7 Programme), the organization of significant conferences and symposia, as well as the main topics discussed by the Romanian participants.

A selective bibliography is presented as an important part of every contribution within the National Report, allowing to those interested to continuously follow the development of the research projects as well as the involved working groups, in view of establishing contacts that we hope will prove to be mutually profitable in the next future.

This report, conceived as an ensemble that allows the interested reader to get an accurate image upon the activity in geodesy and geophysics in Romania, includes the interval 2007-2011.

The possibility of presenting a quite comprehensive volume is a consequence of the continuous improvements in the organizational policy of the RNCGG, by appointing a new national correspondent (IACS) as well as new members and secretaries of the associations' committees. Significant efforts and dedicated work have been provided by Dr. Constantin Stefan Sava, RNCGG Secretary General and by all the associate editors. Their most important contribution is acknowledged and thanked.

The National Report represents also homage to our dear professors and former presidents of the Romanian National Committee of Geodesy and Geophysics, founders of the Romanian school of geophysics, Acad. Sabba S. Stefanescu and Acad. Liviu Constantinescu.

Prof. Dr. Dorel ZUGRAVESCU
Corresponding Member of the Romanian Academy

ROMANIAN ACADEMY

ROMANIAN NATIONAL COMMITTEE OF GEODESY AND GEOPHYSICS

Secretariat: PO Box 31-54
024270 Bucharest
ROMANIA

Phone: +40-21-252512; +40-722-786 434
Fax: +40-21-3452056
Email: savac@b.astral.ro

NATIONAL COMMITTEE:

President: **Dorel ZUGRAVESCU**, Corresponding Member of the Romanian Academy — dorezugr@geodin.ro

Members: **Mihail IANAS** — ianas@hades.ro
Dumitru IOANE — ioane@gg.unibuc.ro:

Secretary General: **Constantin Stefan SAVA** — savac@b.astral.ro

NATIONAL CORRESPONDENTS:

IAG: **Johann NEUNER** — neuner@geodezie.utcb.ro

IASPEI: **Dumitru ENESCU** — denescu@infp.ro
Crisan DEMETRESCU — crisan@geodin.ro

IAVCEI: **Alexandru SZAKACS** — szakacs@geodin.ro

IAGA: **Andrei SOARE** — andisol@digi.ro

IAMAS: **Gheorghe STANCALIE** — gheorghe.stancalie@meteo.inmh.ro
Sabina STEFAN — sabina_stefan@yahoo.com

IAHS: **Petre STANCIU** — stanciu@hidro.ro

IAPSO: **Nicolae PANIN** — panin@geoecomar.ro

IACS: **Roxana BOJARIU** — bojariu@meteoromania.ro

NATIONAL REPORT

Co-ordinator: **Constantin Stefan SAVA**

Editors:

IAG: **Tiberiu RUS**

IAGA: **Gabriela CUCU, Dumitru STANICA Sorin RADAN**

IASPEI: **Dumitru ENESCU Crisan DEMETRESCU**

IAMAS: **Gheorghe STANCALIE, Sabina STEFAN, Sorin BURCEA**

IAVCEI: **Alexandru SZAKACS**

IAHS: **Ada PANDELE**

IACS: **Roxana BOJARIU Erna TUDOSE**

IAPSO: **Florin DUTU**

ROMANIAN ACADEMY

ROMANIAN NATIONAL COMMITTEE OF GEODESY AND GEOPHYSICS

IACS ACTIVITIES IN ROMANIA

2007 - 2011

Prepared for the XXV IUGG General Assembly
Melbourne, 2011

NATIONAL REPORT ON CRYOSPHERIC SCIENCES

IACS RELATED ACTIVITIES IN ROMANIA
2007-2011

Romanian IACS Committee

National Correspondents:
Dr. Roxana Bojariu [1)] bojariu@clicknet.ro

Members:
Dr. Tudor Negoiță [2)]
Dr. Andrei Diamandi[1)] diamandi@meteoromania.ro

Secretary:
Erna Tudose [1)] erna.tudose@meteoromania.ro

1) National Meteorological Administration
Sos. Bucureşti-Ploieşti 97
013686, Bucharest, Romania
Tel: +40-21-3162140; Fax: +40-21-3163143

2) Romanian Polar Institute
1 Libertatii Blvd, Bucharest - 4, Romania
Tel/fax:0040213372986

FOREWORD

The present report describes the activities carried out in Romania in the field covered by the "Cryosphere" section of the National Romanian Committee of Geodesy and Geophysics. Three main domains are represented: Snow and Avalanches, Continental Glaciers/ Permafrost and Cryosphere, Atmosphere and Climate.

Snow and Avalanches related issues covered by Romanian scientists consist of:

- monitoring of snowcover;
- assessing avalanche risk for Fagaraş and Bucegi mountains;
- evaluation of water accumulated in snow cover over river basins using teledetection and GIS techniques.

In the field of Continental Glaciers and Permafrost the most significant results of Romanian scientific community are referring to:

- glacial and periglacial geomorphology;
- the permafrost monitoring and prediction in Southern Carpathians;
- ice caves (a form of sporadic permafrost and/or extra-zonal permafrost).

Recent results of Romanian scientist referring to Cryosphere, Atmosphere and Climate are:

- analysis of snow cover variability and change for the Romanian territory;
- predictive potential of Eurasian cryospheric components for Arctic Oscillation.

With great sadness, we announce that Dr. Tudor Negoiţă, founder and chairman of Romanian Antractica Foundation and Romanian Polar Institute, passed away on 25th March 2011.

Foto: xtrem.ro

PART I: Snow and Avalanches

The monitoring of snow cover evolution in the mountain area of Romania has two main goals, close-connected each other: economic and protection-related ones. The economic demands aim mainly at maintaining optimal transport conditions and to ensure electricity supply in the rural and urban areas, etc.

On the other hand, high mountain areas of Romania have associated avalanche risk. A program of nival meteorology has started in February 2004, after a preparation period, under the coordination of Meteo France, "Centre d'Etudes de la Neige" - Grenoble, purposely tailored to meet the demand for information related to snow cover, and investigate the avalanche-generating conditions.

The National Meteorological Administration (http://www.meteoromania.ro) and West University of Timisoara, Department of Geography are the leading institutions for snow and avalanches related activities (figure 1). In order to assess the avalanche risk, nival measurements, meteorological conditions evolution and geomorphologic data are used as input data in a model to determinate the avalanche risk according to the European risk scale.

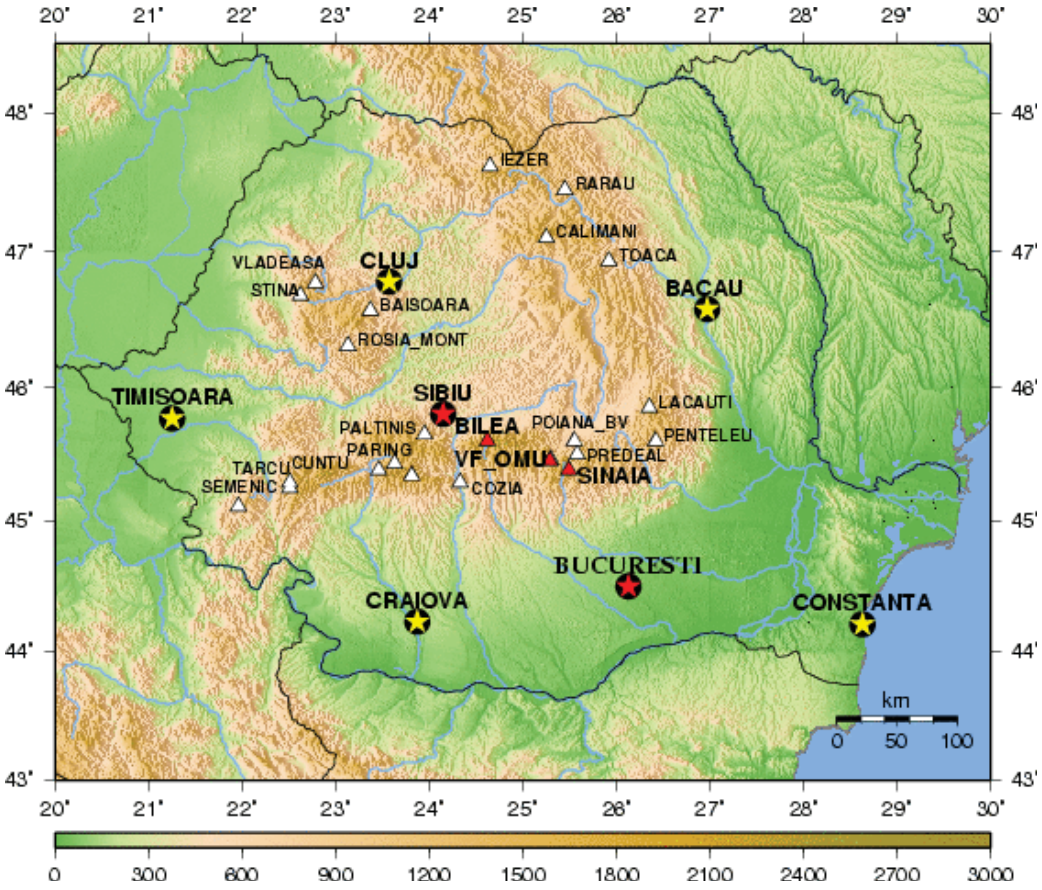

Figure1. 1. Meteorological centers (red stars for those involved in avalnches risk assessment) and meteorological mountain stations (white triangle), including those for which the avalanche risk is operationally estimated (red triangles).

Dr. Mircea Voiculescu (West University of Timisoara, Department of Geography) have investigated avalanche hazards in the Făgăraş massif, a representative mountain unit in the Southern Carpathians that is dominant due to its glacial and periglacial relief, high

altitudes and high avalanche risk.

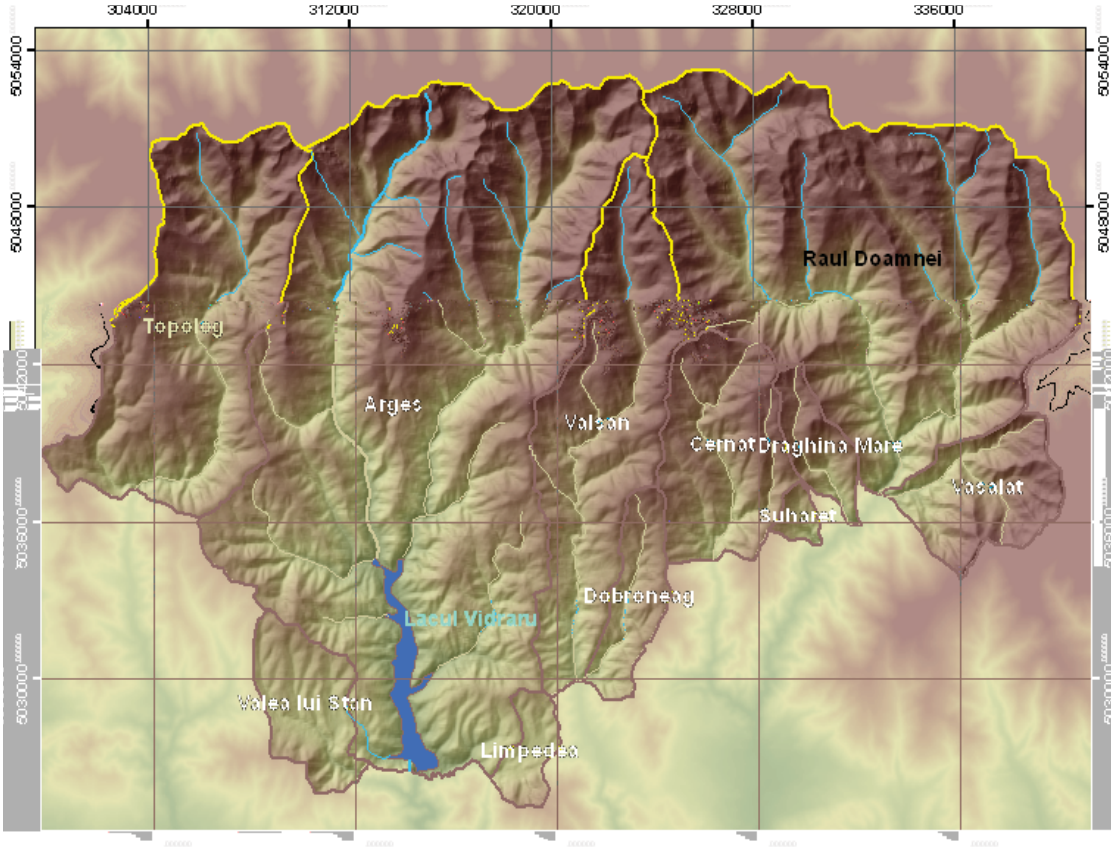

Figure 2. Evaluation of water accumulated in snow cover using teledetection for Argeş basin/Vidraru Lake area (Romania).

The team of Remote Sensing and GIS laboratory from National Meteorological Administration (Bucharest, Romania) has developed tools to assess the water accumulated in snow cover in order to contribute to the prevention of flood risks and water management for hydronergy. For this purpose they use MODIS MYD10A1 products (snow cover extent). GIS-integrated high resolution satellite data and weather station data were used to this end. When processed, data are transmitted in due time to the National Institute of Hydrology and Water Management's Operative Department for Hydrological Forecasts.

PART II: Continental Glaciers and Permafrost

There are several activities carried out by Romanian scientists interested in glacial and periglacial geomorphology in the last years. Professor Petru Urdea (West University of Timisoara, Department of Geography) has coordinated studies of permafrost in Southern Carpathians. His team monitored the summer temperatures (July and August) of the springs at the base of the rock glaciers' fronts and talus cones of Făgăraş and Retezat Mountains. These water measurements have been made since 1986. Measurements of bottom temperature of snow (BTS) have been made in the same areas, during the second and third weeks of February, since 1992. Professor Petru Urdea has contributed with these studies to Data and Information Service for CliC (http://clic.npolar.no/). Recent investigations tackle glacial and periglacial geomorphology in Şureanu Mountains, too.

Application of 2D electrical resistivity tomography (ERT) began with measurements in the Făgăraş, Retezat and Şureanu mountains on different geomorphic landforms such as rock glaciers, scree slopes, solifluction lobes, fossil patterned grounds and a glacial overdeepening depression filled with postglacial sediments. ERT results of the Ana and Pietrele rock glaciers of Retezat Mountains indicated typical structures, and the presence of ice-rich bodies. The presence of permafrost in the area was also indicated by BTS measurements, and by the low temperatures (< 2ºC) of the springs situated at the base of the front of rock glaciers. Core samples were extracted from cores of glacial lakes and also tree rings for the reconstruction of the postglacial landscape. Glacial cirques in the mountains of Romania indicating the distribution of former glacier sources have been analyzed by Dr. Marcel Mîndrescu from the University of Suceava.

The ice structure and thickness of Glacier Scărişoara from Apuseni Mountains was explored with ground penetrating radar by the team of Dr. Bogdan Onac from the Department of Geology, "Babeş-Bolyai" University, Cluj Napoca. The ice deposit in Scărişoara Ice Cave could be older than 3000 years.

PART III: Cryosphere, Atmosphere and Climate

The results of Bojariu and Dinu (2007) show that over Romania, like over many midlatitude land areas of Northern Hemisphere, the strongest warming during the snow season and associated downward trend in snow depth are observed in mid-late winter (January to March). Most of the warming related to these changes has occurred over the last half of 20th century and seems to be associated with large scale circulation patterns such as North Atlantic Oscillation. The diminishing of snow depth over Romanian territory is related to the tendency toward the positive phase of North Atlantic Oscillation. In mid-late winter, snow amounts exhibit significant downward trends in the western, north-eastern and some south-western Romanian regions. So, the tendency of prevailing zonal circulation in mid-late winter over the central Europe can partially explain the snow reduction especially for the regions situated at low altitude, in extra-Carpathian areas. These conclusions are also supported by Micu (2009).

The present analysis draw the attention to possible climate-change related impacts on snow in several Romanian regions and hence to the climate-change influences on related socio-economic activities. Numerical experiments with regional climate models have to be used to investigate in more detail the physical mechanisms involved in regional response to present and future global warming.

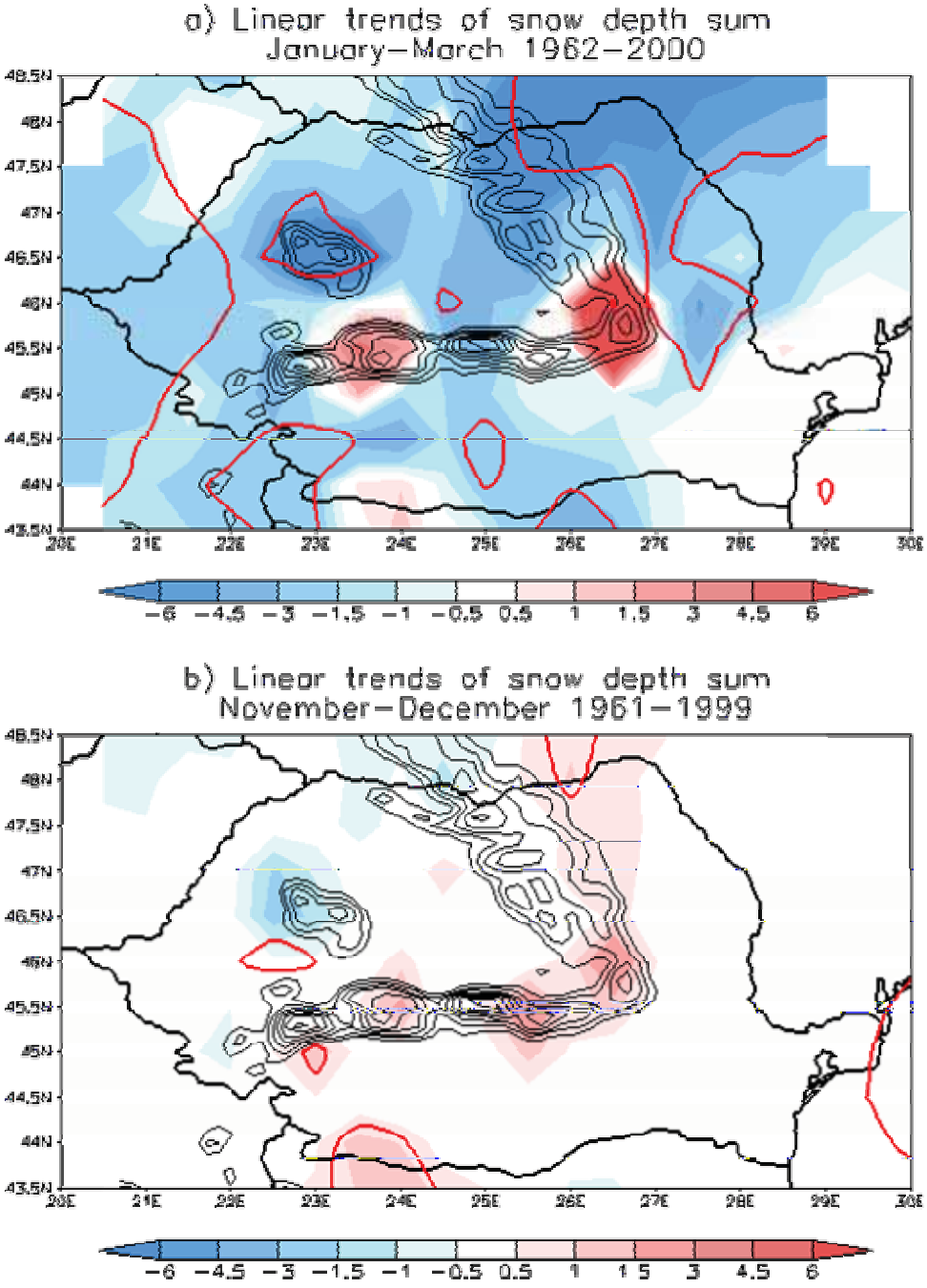

Figure 3. Linear trends of snow depth sum (m) for January-March (a) and November – December (b) intervals (1961-2000). Areas with statistically significant trends are marked with red lines. Black lines show the topography (500 m intervals starting from 1000 m).

Ocean is favoured as the most likely forcing of North Atlantic Oscillation/Arctic Oscillation (NAO/AO) related atmospheric variability, given the time scales of oceanic circulation and its large heat capacity. Bojariu et al. (2008) have revealed the role of the land - atmosphere interaction in the predictive relationship between the NAO in winter (December–

March) and Siberian snow cover in the previous warm season (April–October). The time-lagged NAO/AO-snow relationship has an important predictive potential that can be useful if a viable physical mechanism exists for the relationship. Observational and numerical experiments suggest that warm season (April to October) soil conditions affect the land-atmosphere coupling in October over the key region (Southern Siberia) (Figure 3). Land-atmosphere coupling is mediated by snow cover frequency and impacts on October jet stream anomalies. Observed data for the interval 1967-2000 show that zonal wind anomalies in October over our key region is related to NAO/AO type patterns of geopotential anomalies at 500 hPa in the next December.

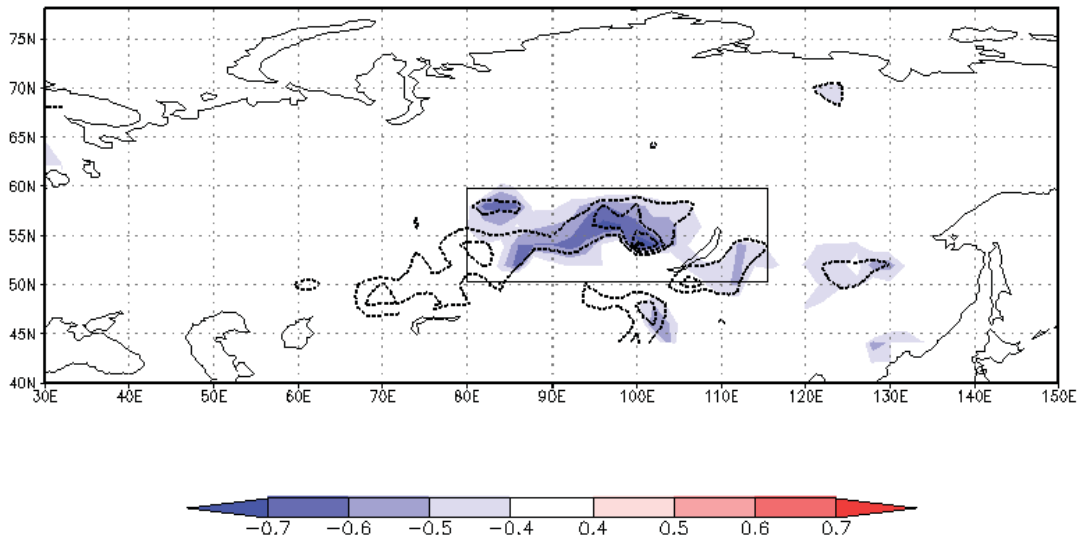

Figure 4. Correlation map between snow frequencies in April to October and next winter (December to March) index of NAO/AO (1973-2002).

Participation of the Romanian specialists in national and international projects or programmes

National programs and projects for research and developement:

"The impact of the climatic changes upon the Holocene and present dynamics of the alpine environment from the Romanian Carpathians. Implications in the risk management and landscape's arrangement' (MEDALP)" - financed by National Council for Superior Education Scientific Research.
Period: 2007
Project managers: P. Urdea (West University of Timişoara) and A. Vespremeanu-Stroie (University of Bucharest)

International programs and projects for research and development

European FP6 International Polar Year - Climate of the Arctic and its Role for Europe (IPY-CARE)
Period: 2005-2007
Project managers (for the Romanian team): R. Bojariu (National Meteorological Administration, Bucharest, Romania)

European FP7 CryoLand - GMES Service for snow and land ice
Period: 2011-2015
Project managers (for the Romanian team): A. Diamandi (National Meteorological Administration, Bucharest, Romania)

PARTICIPATION OF THE ROMANIAN SPECIALISTS IN THE NATIONAL AND INTERNATIONAL SYMPOSIUMS AND CONFERENCES

EGU General Assembly 2007-2010, Vienna, Austria

REFERENCES 2007-2010

2007

Bojariu R. and M. Dinu, 2007: Snow variability and change in Romania. In: STRASSER, U. & VOGEL, M. (Eds.): Proceedings of the Alpine*Snow*Workshop (www.alpinesnowworkshop.org), Munich, October 5-6, 2006, Germany. Berchtesgaden National Park research report, Nr. 53, 34-38.

Flueraru, C., Gh. Stancalie, V. Crăciunescu, Elena Savin, 2007: A Validation of MODIS Snowcover Products in Romania: Challenges and Future Directions, Transactions in GIS, Vol. 11 Issue 6, Blackwell Publishing, p 927–941.

Reuther, A.U., Petru Urdea, Christian Geiger, Susan Ivy-Ochs, Hans-Peter Niller, Peter W.

Kubik, Klaus Heine, 207: Late Pleistocene glacial chronology of the Pietrele Valley, Retezat Mountains, Southern Carpathians constrained by 10Be exposure ages and pedological investigations, Quaternary International, Volumes 164-165, From the Swiss Alps to the Crimean Mountains - Alpine Quaternary stratigraphy in a European context, Pages 151-169, ISSN 1040-6182, DOI: 10.1016/j.quaint.2006.10.011.

2008

Bojariu, R., R. Garcia-Herrera, L. Gimeno, T. Zhang, and O. W. Frauenfeld. Cryosphere-Atmosphere Interaction Related to Variability and Change of Northern Hemisphere Annular Mode, 2008: In L. Gimeno, R. García-Herrera, R. M. Trigo (eds.), Trends and Directions in Climate Research: Ann. N. Y. Acad. Sci. , 1146, pp. 50-59. DOI: 10.1196/annals.1446.018.

Karel Zak, Bogdan P. Onac, Aurel Persoiu, Cryogenic carbonates in cave environments, 2008: A review, Quaternary International, Volume 187, Issue 1, Archives of Climate and Environmental Change in Karst, Pages 84-96, ISSN 1040-6182, DOI: 10.1016/j.quaint.2007.02.022.

2009

Micu D., 2009: Snow pack in the Romanian Carpathians under changing climatic conditions. Meterology and Atmospheric Physics. Volume 105, Numbers 1-2, 1-16, DOI: 10.1007/s00703-009-0035-6.

Voiculescu, M., 2009: Snow avalanche hazards in the Făgăraş massif (Southern Carpathians): Romanian Carpathians—Management and perspectives. Natural Hazards, 51 (3), pp 459-475, Doi: 10.1007/s11069-008-9281-z

2010

Mîndrescu, M., Evans, I. S. and Cox, N. J. 2010. Climatic implications of cirque distribution in the Romanian Carpathians: palaeowind directions during glacial periods. J. Quaternary Sci., Vol. 25 pp. 875–888. ISSN 0267-8179.

2011

Perşoiu, A., B. P. Onac, J. G. Wynn, A. V. Bojar, and K. Holmgren (2011), Stable isotope behavior during cave ice formation by water freezing in Scărişoara Ice Cave, Romania, J. Geophys. Res., 116, D02111, doi:10.1029/2010JD014477.

Feurdean, A, Aurel Perşoiu, Anna Pazdur, Bogdan P. Onac, 2011: Evaluating the palaeoecological potential of pollen recovered from ice in caves: A case study from Scarisoara Ice Cave, Romania, Review of Palaeobotany and Palynology, Volume 165, Issues 1-2, Pages 1-10, ISSN 0034-6667, DOI: 10.1016/j.revpalbo.2011.01.007.

Voiculescu, M., F. Popescu, 2011: Management of Snow Avalanche Risk in the Ski Areas of the Southern Carpathians-Romanian Carpathians in Sustainable Development in Mountain Regions (Ed. Zhelezov, G.), pp103-121. Springer Netherlands. Isbn: 978-94-007-0131-1. Doi: 10.1007/978-94-007-0131-1_10

The International Association of Geomagnetism and Aeronomy
International Union of Geodesy and Geophysics

DIVISION I – Internal Magnetic Fields

Working Group I-2 : Electromagnetic Induction in the Earth

The variable external geomagnetic field induces a response of the Earth's interior both by magnetic induction in the magnetic rocks above the Curie temperature and by electromagnetic induction in the conductive crustal and mantle structures. These two components of the internal response are evidenced in case of the external variation, by means of a magnetic induction model applied to the mentioned variation. The calculated values of the model carry information on the magnetic properties of (generally) crustal rocks, while the model residuals carry information of the electric properties of mantle and crustal conductive structures. External sunspot-cycle-related variation (variation) in annual means of the geomagnetic elements from European geomagnetic observatories was compared to the external source considered, namely the symmetric part of the ring current, represented by the external component of the Dst geomagnetic index (Est). Results were presented at international meetings (see below). Also, the magnetic induction model was applied to diurnal variation from European observatories network and from the Hokkaido magnetometric array, using as inducing force the geomagnetic field recorded at a reference station (Dobrica et al., 2008-2009). Based on the two components of the internal response, information on the lateral variation of the magnetic properties of the crust down to the Curie temperature and of the electric properties of the crust and mantle was inferred.

Published papers

Dobrica, V., Mogi, T., Demetrescu, C., Takada, M., 2008-2009, Magnetic induction effects of the diurnal variation. Case study: the Hokkaido magnetometric array, *Revue Roumaine de Geophysique, 52-53, 33-47.*

Conferences

Dobrica, V., Demetrescu, C., Inferred lateral variation of magnetic and electric properties of the European crust and mantle from diurnal variation data. *The 33rd International Geological Congress (IGC)***,** *Oslo, Norway, August 6-14, 2008*..

Demetrescu, C., Dobrica, V., An induction-based magnetic model of the European lithosphere. *11th Scientific Assembly of International Aeronomy and Geomagnetism Association (IAGA), Sopron, Hungary, August 22-30, 2009.*

Dobrica, V., Demetrescu, C., Large-scale european mantle electric structure as derived from ring current and geomagnetic observatory data. *11th Scientific Assembly of International Aeronomy and Geomagnetism Association (IAGA), Sopron, Hungary, August 22-30, 2009.*

Dobrica, V., Demetrescu, C., Electromagnetic response of the European underground to magnetospheric ring current variations. *11th Scientific Assembly of International Aeronomy and Geomagnetism Association (IAGA), Sopron, Hungary, August 22-30, 2009.*

Demetrescu, C., Dobrica, V., Magnetic induction in the European crust by symmetric and asymmetric ring current features, *EGU General Assembly, Vienna, Austria, May 2-7, 2010.*

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Working Group I-3: Palaeomagnetism

Working Group I-4: Rock Magnetism

PALAEOMAGNETIC, ROCK MAGNETIC AND ENVIROMAGNETIC STUDIES, IN THE GEOLOGICAL INSTITUTE OF ROMANIA (G.I.R.), IN THE 2007 – 2011 PERIOD

Dr. Sorin – Corneliu Rădan, Geophysicist

1. Introduction

Since 2007, the research activity in the *Laboratory of Palaeo-, Rock- and Environmental Magnetism* of the *Geological Institute of Romania* has focused on both ***Palaeomagnetism*** and ***Rock Magnetism*** (according to the IAGA Working Groups I-3 and I-4, respectively), but also on the ***Environmental Magnetism***. It is worth to mention the contribution of our studies to the investigation of the state of the "*magnetic recording medium*", which is of fundamental importance in order to decipher correctly the Earth's magnetic field structure in the geological past. Based on a huge magnetic susceptibility data bank covering around 35 years of recent sediments investigation, various cases from the most important wetlands in the (southeastern) Romania were approached. Moreover, several papers concerning magnetostratigraphic, petromagnetic, magnetic or enviromagnetic results obtained in/by our laboratory were mentioned and/or analysed by other either Romanian or foreign authors, in publications issued in the 2007 – 2011 period (**References**: List **IV**).

All of these aspects concerning the research activity in the above-mentioned fields in the G.I.R. are supported by comprehensive references [*i.e*., publications (**I**), papers presented at different international meetings (symposia, workshops and congresses; **II**] and scientific reports (**III**)], which are listed at the end of this brief review.

2. Palaeomagnetism and Rock Magnetism

The opportunity to observe the porcelanite occurrences that was offered by the palaeomagnetic sampling works for the magnetostratigraphic investigation of the succession of well-exposed Pliocene deposits in lignite quarries (Rădan, **I**-2008, **I**-2009, **IV**-2009a, **IV**-2010) provided interesting elements with regard to certain "fragments" of the "*magnetic recording medium*", in which are present – in adjacent positions – two different "states": one, "original" ("initial"), the other, modified by underground coal palaeofires ("subsequent"). Various geophysical signatures (*i.e*., magnetic, palaeomagnetic and rock magnetic) were discovered in southwestern Romania (western Dacic Basin). The studies show that deposits of rocks, spatially situated in an adjacent position, at the same stratigraphic level, or in a superposed position along an up to 10 m stratigraphic distance, are temporally placed at a "distance" of about 3.5 Ma. This is explained by the anomaly occurred within the geomagnetic palaeofield record, as a consequence of the thermal perturbation produced by underground coal fires in Quaternary, within a zone of the *m.r.m*. represented by Upper Pliocene cyclic lignite-clay sequences (Rădan, **I**-2007, **II**-2010, **III**-2009b; Rădan & Rădan, **I**-2011a,b,c,d,e,f, **II**-2007a).

Palaeo-/rock-/magnetic, thermomineralogical and geochemical signatures were recovered from porcelanites and clinkers – markers of this past natural autocombustion

phenomenon – and they are analysed within a "case history"-paper, which was firstly presented in 2010, in Germany (dbb forum Berlin), at the *"Second International Conference on Coal Fire Research"* (*ICCFR2*), held during 19-21 May 2010 (Rădan & Rădan, **II**-2010a, **I**-2010e) and then in the Czech Republic, at the *12th "Castle Meeting – New Trends in Geomagnetism. Palaeo, Rock and Environmental Magnetism"*, held at the Castle of Nové Hrady, August 29 – September 4, 2010 (Rădan & Rădan, **II**-2010b, **I**-2010g). Furthermore, this paper was included within a composite poster (Rădan, 2010), which was exhibited in the *Geological Institute of Romania Showcase*, at the SEG Denver 2010 – "*Imaging our future*", *International Exposition and 80th Annual Meeting* (Colorado Convention Center, 17 – 22 October 2010, Denver, USA). Besides, an abstract and a scientific note concerning the above-mentioned case history were accepted for publication in the Book of Abstracts and in the Proceedings Book, respectively, which were distributed at the "*International Meeting of Fire Effects on Soil Properties*" (*FESP III*), held in Guimarães (Portugal), during 15-19 March, 2011 (Rădan & Rădan, **I**-2011c,e).

To present some geophysical and thermo-mineralogical features determined for porcelanite deposits, three examples from the Lupoaia lignite quarry are given in Figures 1, 2 and 3.

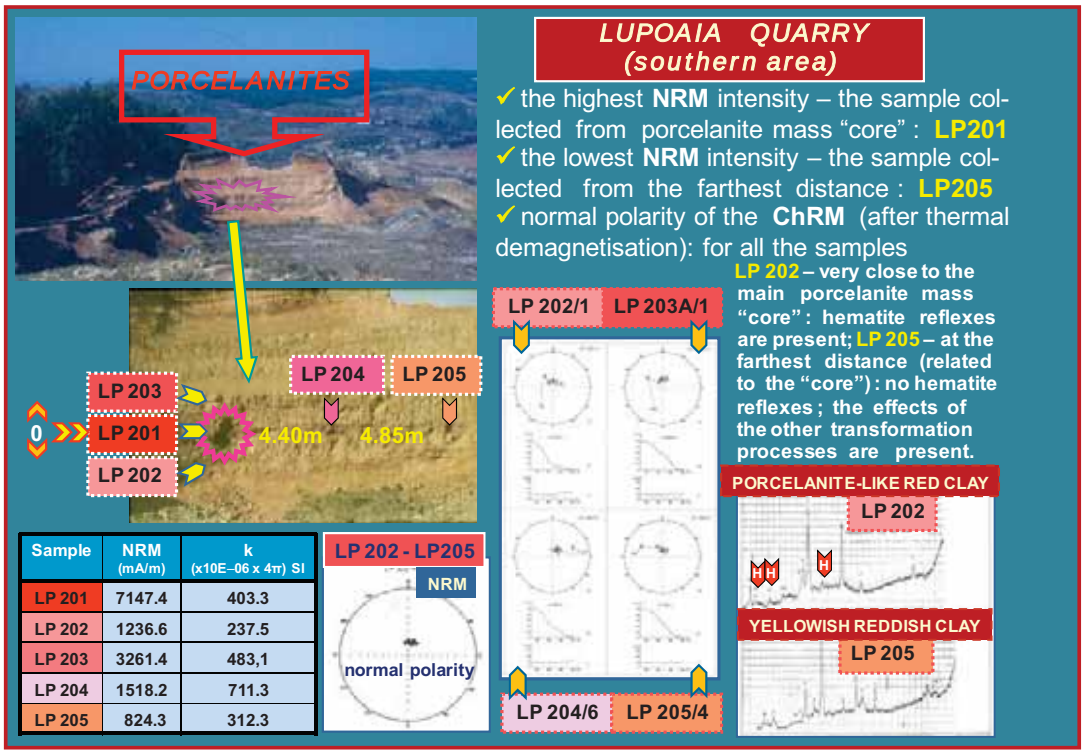

Figure 1. Model showing some rock magnetic, palaeomagnetic and mineralogical signatures recovered from porcelanites and porcelanite-like clays (Lupoaia quarry, western Dacic Basin) (from Rădan & Rădan, **I**-2010g, **I**-2011b, **II**-2007a).

A conclusion which integrates the thermo-mineralogical, geochemical and rock-magnetic signatures recovered from both the porcelanites and the unbaked clays is the following: there is a strong contrast of magnetic properties between the two categories of rocks, so that magnetic anomalies are easily measured with portable magnetometers. The examples coming from the western Dacic Basin reveal amplitudes up to 1880 nT (Fig. 4).

The case of the porcelanites as a magnetic anomaly source (petromagnetic and palaeomagnetic data added) was presented together with that of another type of red sedimentary rocks – the bauxites from the Pădurea Craiului Massif (Apuseni Mountains, Romania). Both cases were the subject of an abstract accepted at the *IAGA 11th Scientific Assembly,* held in Sopron, Hungary, during 24 – 29 August, 2009 (abstract 117-1037; Rădan & Rădan, **I**-2009b).

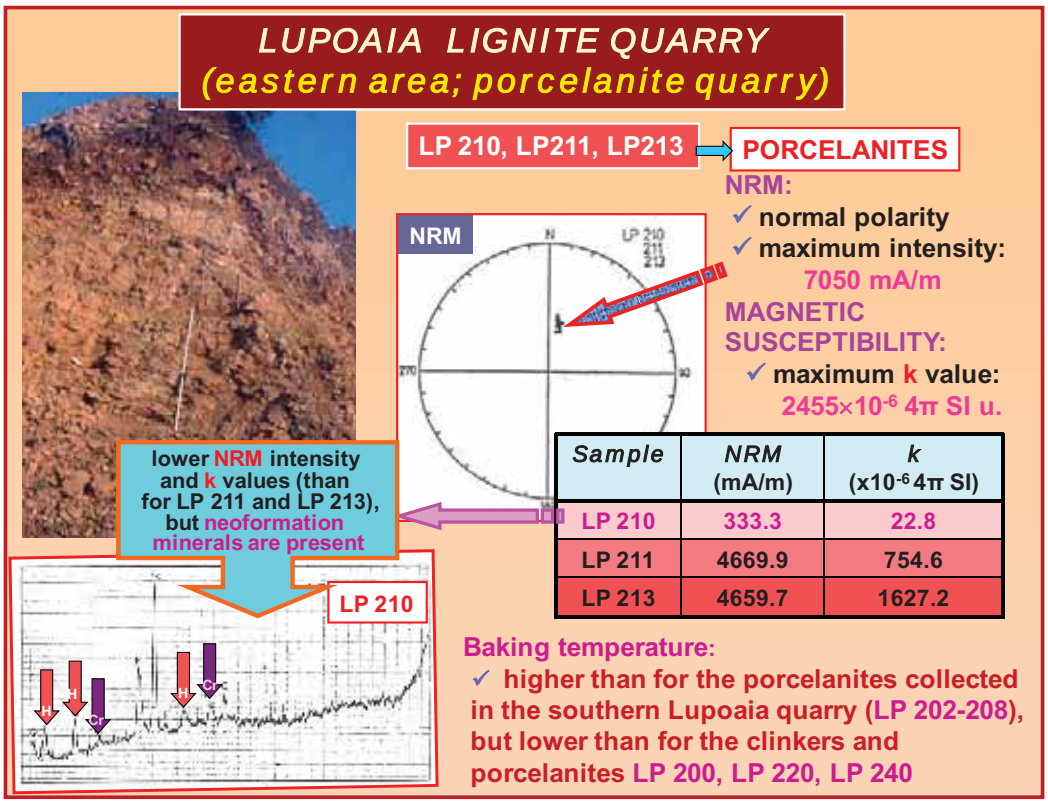

Figure 2. Example of the effects of the coal fires on the clays: thermo-mineralogical and rock-magnetic signatures recovered from a "porcelanite quarry" in the western Dacic Basin (Romania) (from Rădan & Rădan, **I**-2011b, **II**-2007a).

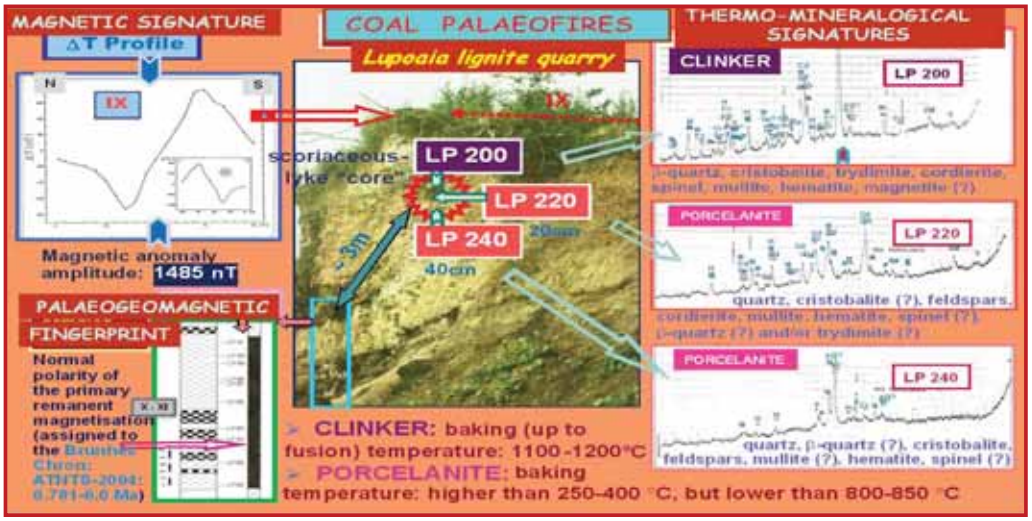

Figure 3. Integrated model illustrating an example of interdisciplinary approach to the effects of the coal palaeofires on the clays: geomagnetic, thermo-mineralogical and palaeomagnetic signals received from clinkers and porcelanites (Lupoaia quarry, western Dacic Basin, Romania)
(from Rădan & Rădan, **I**-2011b, **II**-2007a, with modifications).

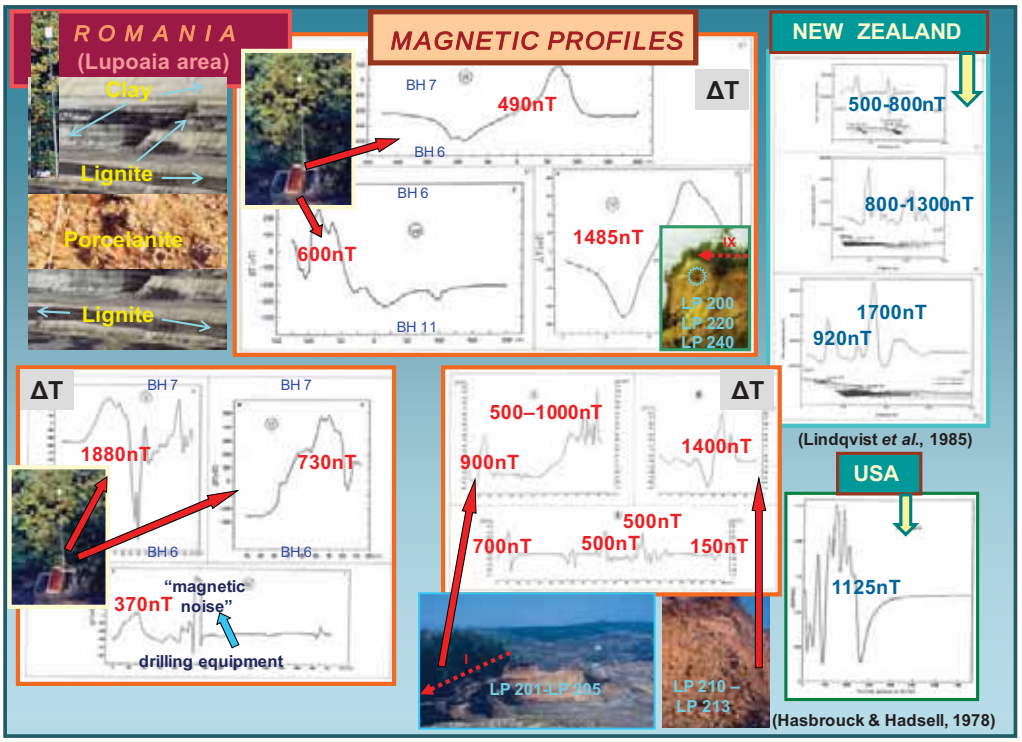

Figure 4. Magnetic profiles carried out in the Lupoaia – Motru area (western Dacic Basin, Romania), showing the anomalies caused by the porcelanites and clinkers. *Note*: examples from New Zealand and USA are presented on the right side (from Rădan & Rădan, **I**-2011b, **II**-2007a).

Referring further to the case from the Dacic Basin only, it is known now that some Pliocene clays, assigned to the Gilbert Chron, C2Ar Subchron (4.187 – 3.596 Ma; ATNTS-2004), according to the recovered palaeogeomagnetic signature, were burned after about 3.5 Ma by the fires that had been caused by the natural autocombustion of certain coal seams with petrographic-mineralogical availability for autoignition. These processes have taken place near surface, usually when lignite beds are to be exposed to erosion. The shallow burial position of the porcelanite horizons is confirmed by three boreholes carried out southward of Lupoaia quarry, which showed a depth ranging between 9 – 34 m. A paper deals with *how coal fires affect the clays*; to explain this, an interdisciplinary approach is needed (Rădan & Rădan, **I**-2011d,f).

Many contributions of Romanian and/or foreign researchers refer to the ages of the Dacic Basin sedimentary deposits. Still, an unique (and unanimously accepted) chronostratigraphic framework has not been achieved, yet (Fig. 5).

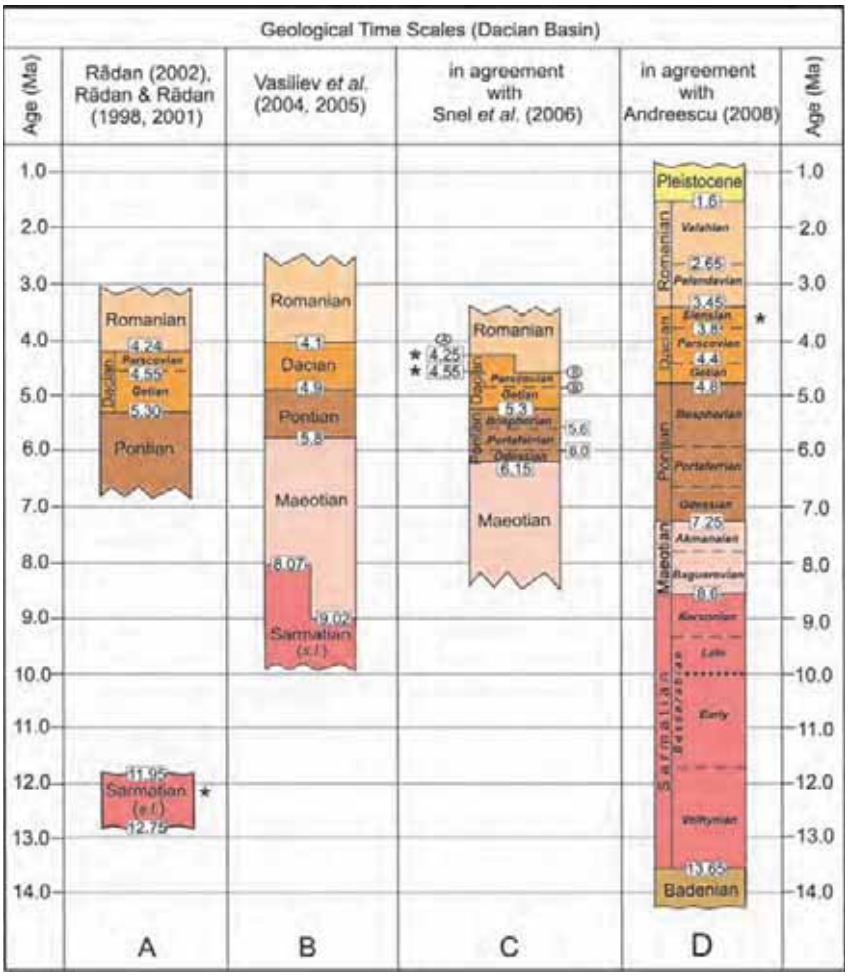

Figure 5. Geologic Time Scales referring to the chronostratigraphic framework of the Dacic Basin, as inferred from magnetobiostratigraphic and astrochronologic studies published throughout the last decade (from Chapter 1.2.2 – author S.C. Rădan, in Jipa & Olariu, 2009).

To reach a high-resolution dating of the *Miocene* and *Pliocene* (sub)stage boundaries, various new techniques have been integrated with the traditional biostratigraphy, mainly the magnetostratigraphy, astrochronology and cyclostratigraphy. A chapter (*i.e.*, 1.2.2) in the Jipa

& Olariu's book (2009) is directed "*towards a reliable chronostratigraphic and geochronologic framework of the Dacic Basin*" (Rădan, **I**-2009). This book, *i.e*. "*Dacian Basin. Depositional architecture and sedimentary history of a Paratethys sea*" (authors: D.C. Jipa & C. Olariu; contributors: L. Mațenco, R. Olteanu, C. Poenaru and S.C. Rădan), was submitted to the Romanian Academy to receive one of the 5 prizes in the Earth Sciences field, which are yearly awarded (this December, the Academy Prizes will be given for the 2009 year).

It is worth mentioning that a synopsis of the most important data regarding the various signatures (*i.e*., geophysical, geological and geochemical) that were discovered in southwestern Romania, which provide evidence of past coal-bed fires, was accepted for publication in the volume 2 of the book "*Coal and Peat Fires: a Global Perspective*" (Eds.: Stracher, G.B, Prakash, A., Sokol, E.V.), to be printed by Elsevier, in 2011 (Rădan & Rădan, **I**-2011a). The changes induced by the coal palaeofires in the *magnetic recording medium* constituted by cyclic lignite-clay sequences, as inferred from porcelanites and clinkers sampled in the western Dacic Basin, are analysed and explained. In the above-cited volume (*Photo and Multimedia Tour*), it is also included (Rădan & Rădan, **I**-2011b) the power point presentation of the paper given at the XXIVth IUGG General Assemby, held in Perugia (Italy), July 2 – 13, 2007 (Rădan & Rădan, **II**-2007a). The paper's topic was the remagnetisation as evidence of a natural thermal event in the history of the lignite-clay sequences from the Dacic Basin (based on the magnetic signals received from porcelanites) (Rădan, **I**-2007).

Finally, we remark that a Project within the "***Core Programme***" framework (2009 – 2011) studies the characteristics of the *magneto-recording medium* from areas with coal deposits, on the basis of the palaeo-/rock-magnetic properties of the Pliocene sequences from the western Dacic Basin. Three phases planned within the *PN 09-21-03-07 Project* have already been carried out. They refer to the following problems: 1. "the analysis of the *magneto-recording medium* represented by Pliocene coal-bearing formations intercepted in lignite quarries and bore holes (Motru – Jilț – Peşteana zone)" (*Phase 1*; Rădan, **III**-2009a); 2. "the study of the effects of the post-depositional thermal perturbations on the *magneto-recording medium* characteristics from areas with coal deposits (Motru – Jilț zone)" (*Phase 2*; Rădan, **III**-2009b); 3. "the study of the *magneto-recording medium* in the case of a sedimentation gap between its constituent Pliocene coal-bearing formations (Husnicioara zone), on the basis of the magnetic fabric and remanent magnetisation (*i.e*., natural and characteristic) data" (*Phase 3*; Rădan, **III**-2010).

Recently, a study on the magnetic susceptibility of some eruptive rocks from the Călimani Mountains (Eastern Carpathians), approached in a petrological context, has been finished (Rădan, **III**-2011).

3. Environmental Magnetism

The enviromagnetic studies referring to the 2007 – 2011 time period deal with various geoecological and ecohydrological applications of a magneto-lithological tool, which was used in the most important wetlands of Romania (Fig.6), *i.e*. the *Danube Delta*, the *Razelm – Sinoie lagoonal Complex* and the *Black Sea Littoral Zone* (*e.g.*, Rădan & Rădan, **I**-2007a,b, **I**-2008a,b, **I**-2009a,d, **I**-2010d,f,i; Rădan, **III**-2007a,b, 2008, in Rădan *et al*., 2007a,b, 2008).

The investigation of different (hydro)sedimentary environments and processes in the deltaic, lagoonal and littoral lakes, on the basis of the integrated magnetic susceptibility and lithological studies, is one of the main directions in which the enviromagnetic technique was applied over the last 4 years (*e.g*., Rădan & Rădan, **I**-2007d; **I**-2008a,c; **I**-2009c,d; **I**-2010c,d,f; Rădan, **III**-2007a,b, 2008, in Rădan *et al*., 2007a,b, 2008). Additionally, magnetic susceptibility measurements were carried out on a number of samples collected from the main

sedimentary environments in the northwestern Black Sea area, during several cruises performed by the GeoEcoMar Institute (Bucharest-Constanța, Romania), in 2010.

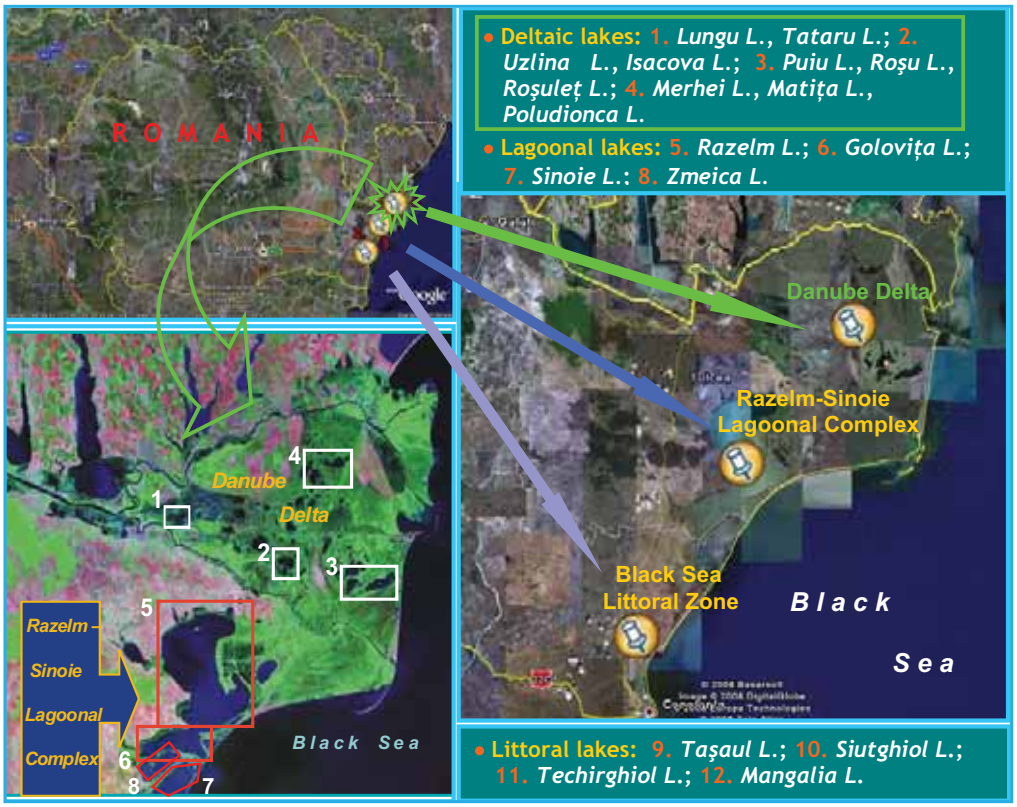

Figure 6. Aquatic areas in the southeastern Romania and location of the investigated wetlands.

In all the cases, the recent sediments were sampled with the "Van Veen"-type grabs and/or with a Hydro-Bios hand corer. Material from each sediment level (marked "a", "b", "c" *etc*.) was collected for magnetic susceptibility (**MS**) measurements and lithological analyses (*i.e.*, *total organic matter/**TOM**, carbonate/**CAR*** and *mineral-siliciclastic/**SIL** fractions*). Ternary diagrams were drawn up to show the lithological classification of the bottom sediments. Composite models were achieved and the correlations between the magnetic parameter (**MS**; **k**) and the main lithological components (***TOM***, ***CAR*** and ***SIL***) were analysed.

For example, in Fig.7 are presented some results concerning the integrated **MS**-lithological study of the sedimentary environments associated with three important lakes from the *Fluvio-Marine Delta Plain* (**3**, in Fig.6), based on the May 2009 and May 2006 campaigns (Rădan & Rădan, **I**-2009d, **I**-2010c,h).

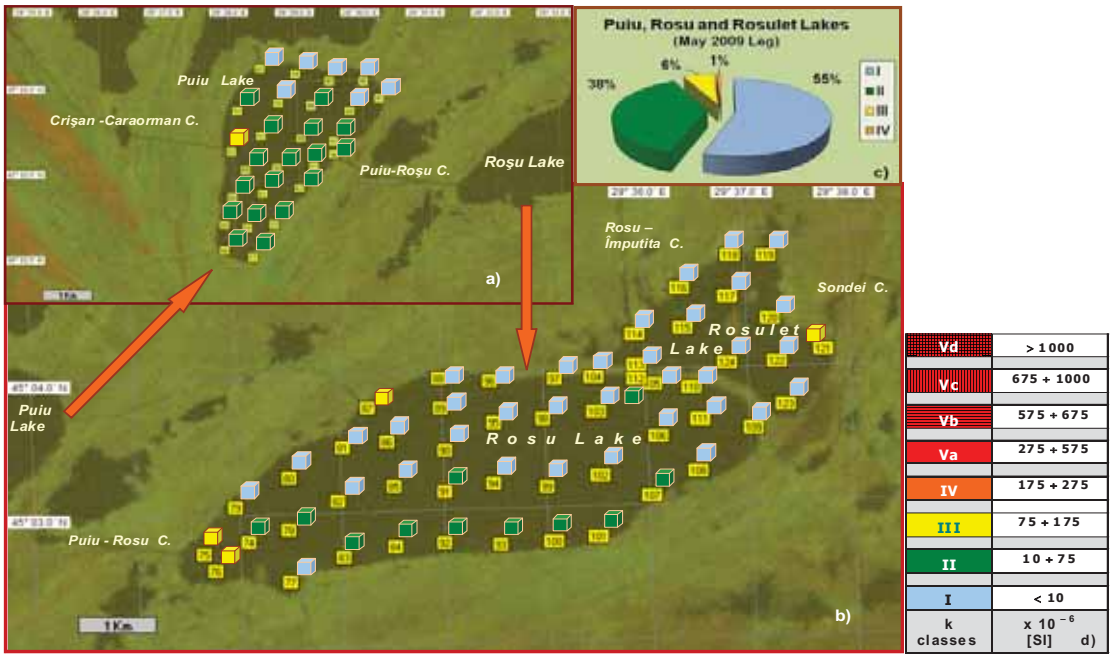

Figure 7. Model showing the magnetic susceptibility (**MS**; **k**) characterisation of the bottom sediments sampled in the 2009 campaign in the Puiu, Roşu and Roşuleț lakes (Danube Delta, Lumina – Roşu Depression; **3**, in Fig.6) (from Rădan & Rădan, **I**-2010h). *Note*: The **k** values "illustrated" by coloured cubes in **a)** and **b)** are correlated to the **MS** scale classes shown in **d)**.

Regarding the connection between the magnetic susceptibility and the lithological components, a negative correlation was shown by **k** *vs* **TOM,** whereas for **k** *vs* **SIL** a positive correlation was determined (Rădan & Rădan, **I**-2010c,h). The results completed in 2009 confirm the magneto-lithological models achieved on the basis of the bottom sediments sampled from the *Puiu*, *Roşu* and *Roşuleț lakes* in the 2006 campaign (Rădan & Rădan, **I**-2009d). Besides, several sediment cores were investigated. An example showing the vertical distribution of the magnetic susceptibility along two cores taken from a lake in the same aquatic area is illustrated in Fig.8. A sudden change of the **MS** values was recorded at the 23-33 cm level. The magnetic susceptibility regime that characterises the two sediment cores could be explained by the interception of an older sandy sequence in the the *Roşu Lake* sampling zone (Rădan & Rădan, **I**-2010h).

The magnetic susceptibility (**MS**) results which were presented – independently or integrated with lithological data – with regard to the bottom sediments sampled from some representative lakes and a delta meandering distributary, located in three previously mentioned important southeastern Romania wetlands (Fig.6), demonstrate the capability of the petromagnetic parameter (**k**; **MS**) to decipher sedimentogenetic, environmental and geoecological contexts. Moreover, the composite models, commented in several papers and scientific reports, argue that the magnetic susceptibility is a sensitive proxy parameter for characterising the lithology of the sedimentary environments from deltaic, lagoonal and littoral wetlands (Rădan & Rădan, **I**-2007d, **I**-2008b, **I**-2009a, **I**-2010b,d; Rădan *et al*., **I**-

2008c, **I**-2009, **I**-2010b,c,d,e; Rădan, **II**-2010; Rădan & Rădan, **II**-2007d, **II**-2008; Rădan *et al*., **II**-2008a,b,c; Rădan, **III**-2007a,b, **III**-2008, in Rădan *et al*., **III**-2007a,b, **III**-2008).

Related to the deltaic lakes, the models emphasise the specific enviromagnetic fingerprints that characterise the allochthonous and autochthonous sedimentation, respectively.

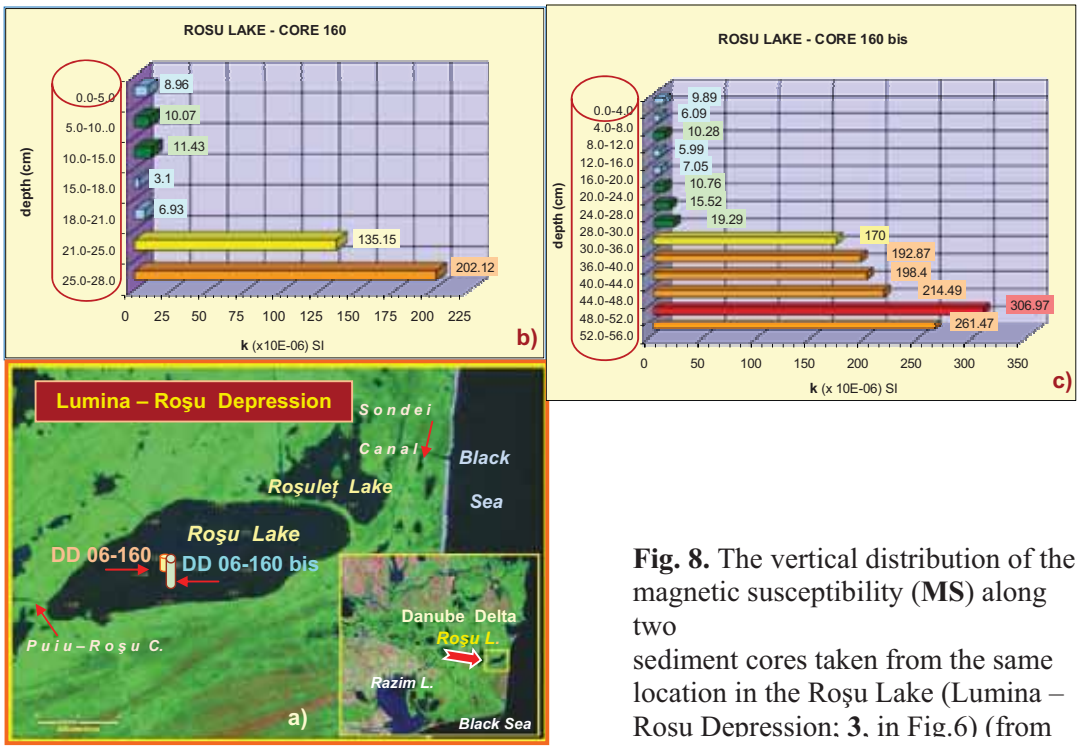

Fig. 8. The vertical distribution of the magnetic susceptibility (**MS**) along two sediment cores taken from the same location in the Roşu Lake (Lumina – Rosu Depression; **3**, in Fig.6) (from

As regards the lagoonal and the littoral lakes (examples in Figure 9 and Figure10, respectively), the coincidence between the sedimentary areas characterised by higher **MS** values and those defined as dominantly siliciclastic, and the good correlation between the sedimentary zones described by low **MS** intensity fingerprints and those rich in organic matter, respectively, are well reflected by corresponding anomalies of maximum and minimum values of the various parameters pertaining to the specific (**k**, **SIL**, **TOM**) maps (*e.g*., Rădan & Rădan, **I**-2007c; Rădan & Rădan, **II**-2007d, in Rădan, **I**-2008; Rădan *et al*., **I**-2008a).

Therefore, by measuring the magnetic susceptibility in laboratory, well-defined **MS** fingerprints can be recovered from the recent sediments (*e.g*., Rădan & Rădan, **I**-2009a,c, **I**-2010a,c,f, **II**-2009, **II**-2010c). They are associated with different lithological characteristics, making possible some connections with the distinct positions of the lakes related to the fluvial supplies, the hydrodynamic context or specific source-areas. The results achieved for various sedimentary environments, investigated in four representative zones located in both the Fluvial Delta Plain and Fluvio-Marine Delta Plain (**1**, **2**, **3**, **4**, in Fig. 6), demonstrate that the recent sediments fingerprinting in the Danube Delta lakes is feasible by using composite magnetic susceptibility (**MS**)-lithological signatures.

The integrated **MS**-lithological studies make possible a quantifiable reasoning of the differentiation of the sedimentary environments which exist in the Danube Delta, and also of the sedimentation processes, clearly revealing the allochthonous sedimentation (predominantly detrital in the lacustrine ecosystems directly influenced by the Danube River)

versus the dominantly autochthonous sedimentation present in the distal zones, in which the organic component predominates.

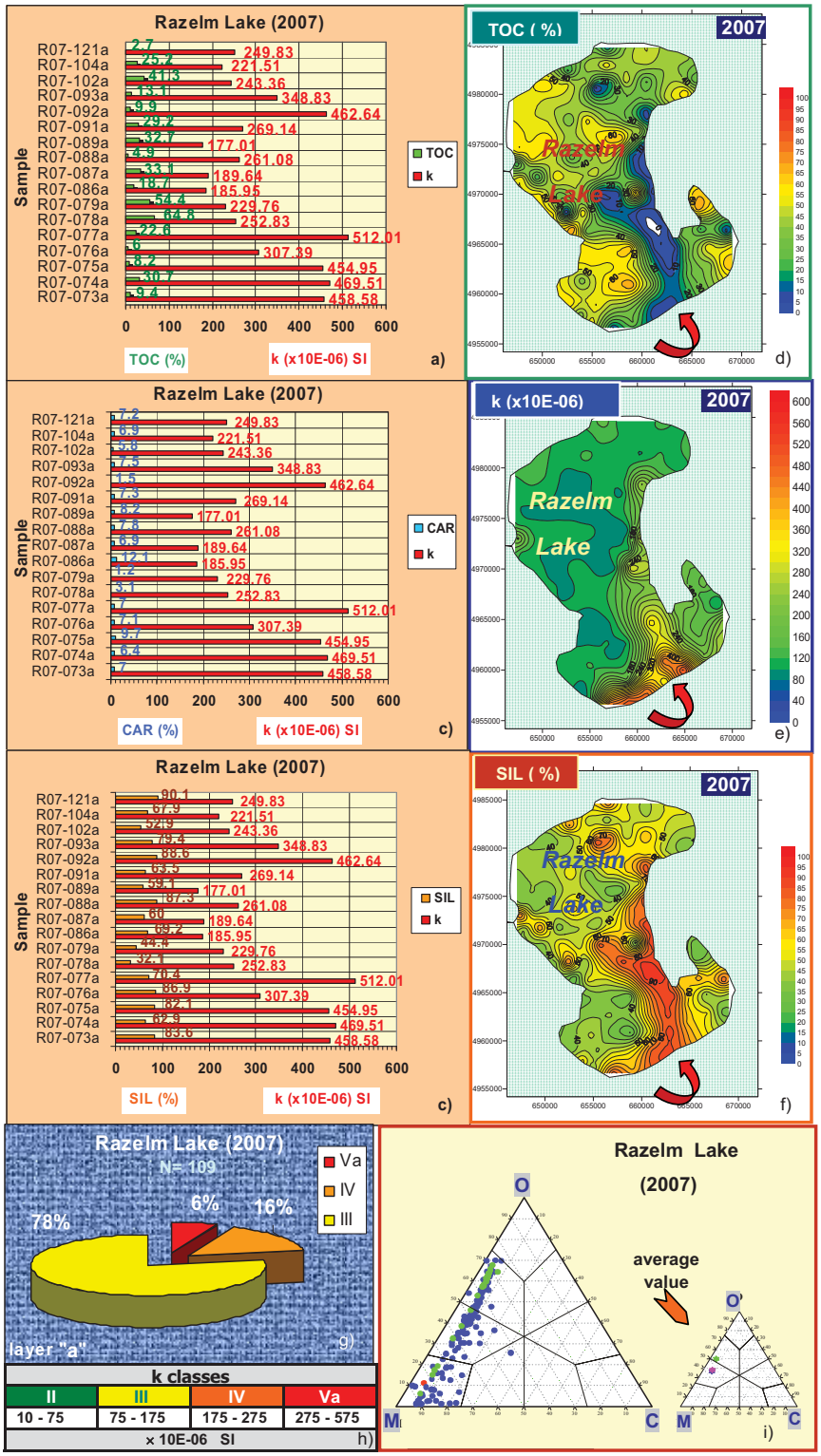

Figure 9. Magneto-lithologic model for bottom sediments from the Razelm Lake (**5**, in Fig.6). *Legend*: **k** – magnetic susceptibility; **TOC** – organic fraction; **CAR** – carbonatic fraction; **SIL** – mineral/ siliciclastic fraction (from Rădan, 2008, in Rădan *et al.*, **III**-2008).

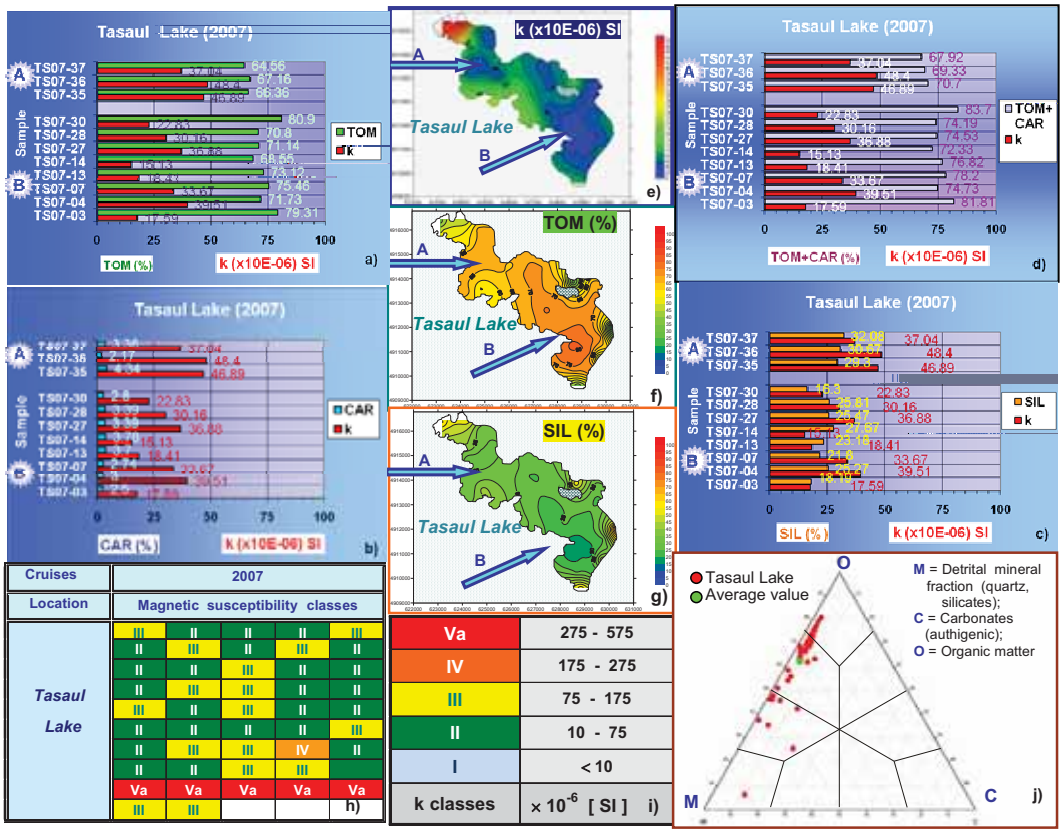

Figure 10. Magneto-lithological model for bottom sediments sampled in the Taşaul Lake (Black Sea Littoral Zone; Fig.6). *Note*: The arrows **A** and **B** show two zones of minimum values revealed by the magnetic susceptibility (**k**) map chosen for correlation with the (spatial) coincident sectors from the **TOM** and **SIL** lithological maps (from Rădan & Rădan, **I**-2010i). *Note*: A parralel model related to the zones of maximum values outlined in the **k** map is given in Rădan *et al*., **I**-2008a.

Therewith, the (**k**) magnetic signatures detected within the lake sediments sampled at different time intervals – during more than 3 decades – can be reliable proofs for the evaluation of the changes that were produced within the aquatic ecosystems as a result of the impact of the human activities in the area (*e.g*., Rădan, **II**-2010; Rădan & Rădan, I-2007a,b; **II**-2007b,c; Rădan *et al*., **I**-2010a). Two particular cases regarding the effects of the human intervention on the deltaic and fluvial-deltaic ecosystems (Danube Delta) were analysed. They show the alterations of the hydrological regime generated changes of the sedimentary environments, and consequently, the modifications of the magnetic susceptibility signatures. Therefore, the case of digging a new canal (*i.e. Cn. "Mila 36"*) between the *Tulcea* and *Chilia Branches*, in the western zone of the *Mesteru – Fortuna Depression*(**1**, in Fig.6), and the case of cutting-off the meanders of the *Sf. Gheorghe Danube distributary* prove the capability for ecohydrological applications of the enviromagnetic tool based on magnetic susceptibility measurements on bottom sediments (*e.g*., Rădan & Rădan, **I**-2010i). Concerning the first case,

the *Lungu* and *Mesteru Lakes* are the most affected, the high sedimentation rate leading to a rapid filling-up with sediments, particularly in their northern and western sectors, respectively. With regard to the latter case (an example, in Fig.11), some hydrobiological consequences were shown by comparing the fauna identified in the upstream sectors of the cut-off meanders of the *Sf. Gheorghe Danube distributary* with the fauna detected in the downstream zones, which get lacustrine trends (they are going to become "oxbow"-type lakes).

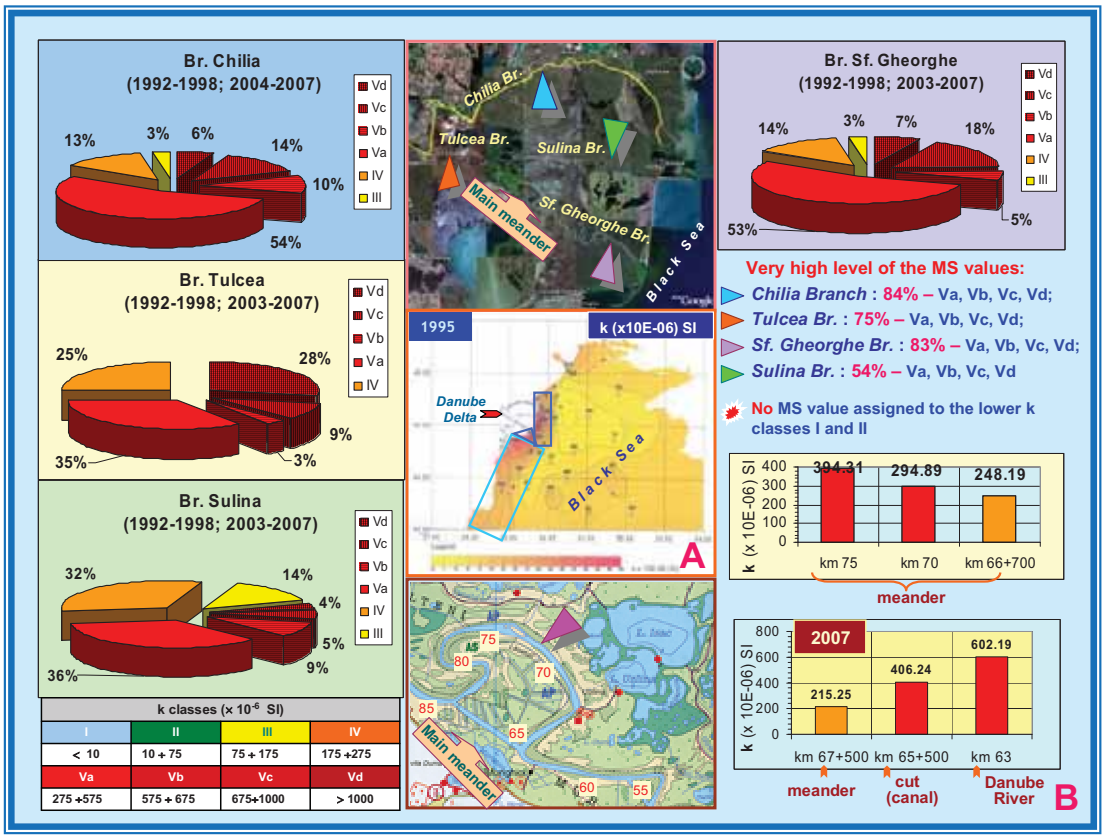

Figure 11. A synoptic model showing the magnetic susceptibility (**MS**) characterisation of the bottom sediments of the Danube Delta distributaries and an ecohydrological application of the enviromagnetic tool related to the Sf. Gheorghe Branch meanders case (from Rădan & Rădan, 2010i).

Recovering the magnetic fingerprints imprinted in the recent sediments, approaching the magnetic susceptibility distribution, both in the horizontal and the vertical planes, by means of the investigation of the grab samples and the sediment cores, respectively, an useful and innovative contribution to the environmental and geoecological studies, as well as to the investigation of the hydrosedimentary processes, is achievable.

We conclude that the data presented in all the papers published during 2007 – 2011, as well as in the scientific reports carried out in the same period with regard to the modern sediments sampled from deltaic, lagoonal and littoral lakes, some of them representing parts of some "case-studies" or "history cases", contribute to the development of the enviromagnetic archives recovered from some of the most important wetlands of Romania. Actually, a (poster) paper presented at the ***2007 AGU Fall Meeting***, held in San Francisco (10 – 14 December), had the title "*Modern Sediments as Enviromagnetic Archives. A Case Study:*

Danube Delta and Northwestern Black Sea" (authors: Sorin Corneliu Rădan & Silviu Rădan). This paper was presented in the session GP06 "*Enviromagnetic Fingerprints Recovered From Modern Sediments*", which was proposed by Dr. S.C. Rădan (Geological Instiute of Romania), approved by the *Fall Meeting Program Committee* and included afterwards in the Programme of the ***Section "Geomagnetism and Paleomagnetism"*** **(**the sponsor of the session GP06). Convenor was Dr. S.C. Rădan (*Geological Institute of Romania*) and co-convenor – Ann M. Hirt (*Institute for Geophysics,* ETH Zurich, Elveția). Two sessions were organized: GP51A (Oral presentations) and GP53B (Poster presentations). Related to the GP51A session (chairperson: S.C. Rădan and A. M. Hirt), there were 5 invited speakers (*i.e*., Andrew Roberts, Christoph Geiss, Kenneth Kodama, Daniel Rey and Barbara Maher) and 3 contributed papers (1 – student paper). As regards the GP53B session (chairperson: S.C. Rădan and A. M. Hirt), 15 contributed (poster) papers (6 – student papers) were presented. The papers demonstrated once more that the *modern sediments are valuable enviromagnetic archives*.

4. Other aspects related to the rock magnetic, palaeomagnetic and enviromagnetic activities carried out in the Geological Institute of Romania.

A Profile *Dr. Sorin-Corneliu Rădan* (photo included) was published in the booklet "*Conference Guide*" (55p.), distributed to the participants at the "*Second International Conference on Coal Fire Research*" (ICCFR2), organised by the Sino-German Coal Fire Research Initiative, in close cooperation with a BMZ/GTZ Project, in dbb forum Berlin, Germany, 19 – 21 May, 2010. The title of the Project *PN 09 21 03 07*, *i.e.* "*Study of Magnetic Recording Medium from Areas with Coal Seams on the Basis of Palaeo-/Rock Magnetic Properties of Pliocene Deposits from the Western Dacic Basin (Romania)*", carried out in the Geological Institute of Romania, in the framework of the "Core Programme", as well as the titles (and the associated references) of 5 papers (*i.e*., Rădan, 2003, Rădan & Rădan, 2010a,b, Rădan *et al*., 2000, 2001; see ***References*-IV**), which have topics connected with that of the Conference (ICCFR2), were added to the above-mentioned Profile in the "*Conference Guide*".

Additionally, a composite material regarding the paper "*Coal Palaeofires in the Western Dacic Basin: Geophysical, Mineralogical and Geochemical Signatures Recovered from Porcelanites and Clinkers; a Case History*", presented (*poster*) at the "*Second International Conference on Coal Fire Research*" (ICCFR2*),* 19 – 21 May 2010, Berlin, Germany, as well as at the "*12th Castle Meeting. New Trends in Geomagnetism – Paleo, Rock and Environmental Magnetism*", August 29 – September 4, 2010, Castle of Nové Hrady, Czech Republic (*poster* and *oral/ppt presentation*), was accepted to be published in the book "*Coal and peat fires: A global perspective*", Volume 2, *Photograps and Multimedia Tours* (Elsevier; in print).

Finally, we mention that several papers concerning palaeomagnetic and/or rock magnetic data, as well as enviromagnetic results obtained in the Laboratory of Palaeo-, Rock and Environmental Magnetism of the ***Geological Institute of Romania***, published before the time interval to which the present ***National IAGA Report*** refers (*e.g*., Rădan, 2000, 2002; Rădan & Rădan, 1998a,b; Rădan *et al*., 1999, 2004; see ***References*-IV**), were cited and/or analysed in several papers, books and PhD Theses, which have been published by other Romanian and foreign authors, during 2007 – 2011.

Some of them (*e.g*., Jimenez-Moreno *et al*., **IV**-2007, Jipa, D., **IV**-2009, Snel., E., **IV**-2010) refer to the results concerning the study of the palaeogeomagnetic field in a magnetobiostratigraphic context, particularly related to the Late Miocene – Pliocene magnetostratigraphic scale. Our data are mainly originated in the cyclic lignite – clay

sequences from the western Dacic Basin (Romania), and a small part from the Comăneşti Basin (Romania). In the Chapter 1 of his PhD Thesis on the chronology and the palaeoenvironment in the (circum-) Mediterranean area (in connection with the Messinian salinity crisis), Snel (**IV**-2010) presents an "age model" illustrating the magneto- and biostratigraphic correlation of several sections from the Dacic Basin with the Astronomical Polarity Time Scale (*APTS*). In the discussion on the Pontian, Dacian and Romanian stages, the author refers to Rădan and Rădan (1998a), Rădan (2000, 2002), among others.

Other authors mention in their papers (*e.g*., Gangopadhyay, **IV**-2007, Masalehdani *et al*., **IV**-2007, Huang and Liu, **IV**-2008, Henao *et al*., **IV**-2010) or in "PhD Theses" (Gangopadhyay, **IV**-2008, Reyes, **IV**-2008) some of our published rock magnetic and palaeomagnetic results concerning the porcelanites and clinkers investigated in the western Dacic Basin. Therefore, in the book on the "*Geology of Coal Fires: Case Studies from Around the World*", edited by Professor Glenn B. Stracher (East Georgia College, Georgia, USA), Gangopadhyay (**IV**-2007) mentions *Romania* among *the countries from Europe where the occurrence of coal fires has been reported*, citing the paper published by Rădan and Rădan (1998b). Also, in the same book, Masalehdani *et al*. (**IV**-2007) includes *Romania* among the *many localities around the world where from geological features associated with the baked and fused sediments produced by coal-combustion have been described*, citing the same paper (Rădan and Rădan, 1998b). Besides, Quintero *et al*. (2009) include Romania – mentioning Rădan and Rădan (1998b) – among the areas in the world where the *geologic features* concerning the *clinkers* [*baked and fused sedimentary rocks associated to the subsurface spontaneous combustion of coal seams during the recent geologic past (since early Pliocene time)*] *have been reported*.

Regarding the enviromagnetic data, two papers (Rădan *et al*., 1999, 2004) were cited by Tiron (**IV**-2010) in her PhD Thesis on *the Danube Delta – Sf. Gheorghe distributary, focused on the morphologic mobility and hydrosedimentary dynamics in the last 150 years.*

Certainly, the citations can not be exhaustively recovered from the worldwide geophysical and geological literature. Yet, we can add that an important number of papers based on the results obtained in/by the Laboratory of Palaeo-, Rock and Environmental Magnetism of the ***Geological Institute of Romania*** are included in a series of Databases, *e.g.* **GeoRef** (American Geological Institute, USA), **Wanfang Data** (China), **Zonal Scientific Library of Voronezh State University** (Russia), **SAO/NASA Astrophysics Data System (ADS)** (SUA), **WorldWideScience.org. – ETDE World Energy Base** (SUA).

Another direction in which the rock-, palaeo- and enviromagnetic results obtained in the Geological Institute of Romania were presented, during 2007 – 2011 time period, was in the framework of several short (intensive) invited courses, which were held by the author (S.C.R.) of this Chapter of the IAGA Report, at the University of Bucharest, Faculty of Geology and Geophysics. The lectures (based on Power Point Presentations), given to the students in Geophysics, were related to "*Rock-Magnetism, Palaeomagnetism and Environmental Magnetism: From theory to applications and case studies"*(2008), "*Rock-Magnetism, Palaeomagnetism, Environmental magnetism: theoretical elements and techniques, applications and case studies*" (2009), "*Rock-Magnetism, Palaeomagnetism, Environmental magnetism: definitions, techniques, applications"*(2010) and "*The magnetic properties of rocks and sediments in geophysical, geological and geoecological context"*(2011).

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The author of this synopsis on the activities carried out during 2007 – 2011 with regard to the IAGA Working Groups I-3 and I-4, a senior scientist in the Geological Institute of Romania, is member of the IAGA Romanian Committee, member of the American

Geophysical Union, Emeritus Member of the European Geosciences Union and Associate Member of the Society of Exploration Geophysicists.

References

I. *Publications*

Dimitriu, R.G., Oaie, G., Gomoiu, M.T., Begun, T., Szobotka, S.A., **Rădan, S.C.**, Fulga, C. (2007a) – The Geoenvironmental Status of the Razelm – Sinoie Lacustrine Complex at the Beginning of the 21st Century, *the XVIth International Symposium "Deltas and Wetlands 2007"*, Tulcea, Romania, 20 – 22 Sept. 2007, *Programme and Abstracts Volume*.

Dimitriu, R.G., Oaie, G., Szobotka, S.A., Sava, C.S., **Rădan, S.C.**, Fulga, C. (2007b) – Hydro-geomorphological Mapping of the Sfântu Gheorghe – Vadu Littoral Zone. Results of the Integrated, Geophysical - Geoenvironmental Research Carried out during 2005 – 2006, *the XVIth International Symposium "Deltas and Wetlands 2007"*, Tulcea, Romania, 20 – 22 Sept. 2007, *Programme and Abstracts Volume*.

Duliu, O., Mihăilescu, N., Costea, C., Baltreş, A., **Rădan, S.C.**, Alexe, V., Anastase, S. (2007) – Evaluation of the environment quality modifications through a new methodology based on high sensitivity analytical techniques (*in Romanian*), *Workshop –Natural Hazard: Tsunami Events in the Black Sea* (coord. G. Oaie), GeoEcoMar, Bucureşti, 7 sept. 2007, p.141-144.

Rădan, S.C. (2007*)* **–** Remagnetisation as evidence of a natural thermal event in the history of the lignite-clay sequences: magnetic signals from porcelanites (Dacian Basin, Romania), *the XXIVth IUGG General Assemby*, *"Earth: Our changing planet", Abstracts, IAGA, Inter-Association Symposia and Workshops,* July 2 – 13, 2007, published by *Umbria Sci. Meet. Ass.* (*USMA*), Perugia, Italy, December, 2007, Abstract 2591, p.129.

Rădan, S.C., Rădan, S. (2007a) **–** The magnetic signature of present environmental changes in lake sediments induced by hydrotechnical work; a case study from the Danube Delta (Romania), *the XXIVth IUGG General Assemby, "Earth: Our changing planet",* July 2 – 13, 2007, *Abstracts, IAGA, Inter-Association Symposia and Workshops,* published by *Umbria Sci. Meet. Ass.* (*USMA*), Perugia, Italy, December, 2007, Abstract 2616, p.156.

Rădan, S.C., Rădan, S. (2007b)* **–** The magnetic signature of present environmental changes in lake sediments induced by hydrotechnical work; a case study from the Danube Delta (Romania), the *XVIth International Symposium "Deltas and Wetlands 2007"*, Tulcea, Romania, 20 – 22 Sept. 2007, *Volume of Program and Abstracts*.

Rădan, S.C., Rădan, S. (2007c) **–** A magnetic susceptibility scale for lake sediments; inferences from the Danube Delta and the Razim – Sinoie lagoonal Complex (Romania), *Geo-Eco-Marina*, **13**, Bucureşti-Constanța, p.61-74.

Rădan, S.C., Rădan, S. (2007d) **–** Modern Sediments as Enviromagnetic Archives. A Case Study: Danube Delta and Northwestern Black Sea, *EOS Transactions, American Geophysical Union*, 88(52), Fall Meet. Suppl., San Francisco, USA, Abstract GP53B-1220.

Dimitriu, R.G., Oaie, G., Szobotka, S.A., **Rădan, S.C.**, Opreanu, G., Dan, S. (2008a) **–** Rapid changes of the seabed hydro-geomorphological features within the Sfântu Gheorghe – Vadu littoral zone (Romanian Black Sea coast), *the 33rd International Geological Congress*, Oslo, Norway, 6 – 14 August, 2008, Abstract CD-ROM.

Dimitriu, R.G., Oaie, G., Szobotka, S.A., **Rădan, S.C.**, Opreanu,G., Dan, S., Stănescu, I. (2008b)* **–** Rapid changes of the seabed hydro-geomorphological features within the Sfântu Gheorghe – Vadu littoral zone (Romanian Black Sea coast), *the XVIIth International Symposium "Deltas and Wetlands"*, Tulcea, Romania, 18 – 20 Sept. 2008, *Abstracts*, p.34-35.

Dimitriu, R.G., Oaie, G., Gomoiu, M.T., Begun, T., Szobotka, Şt., **Rădan, S.C.**, Fulga, C. (2008c) – An interdisciplinary characterisation of the geoecological status of the Razelm-Sinoie lagoonal Complex at the beginning of the XXI century (*in Romanian*), *Geo-Eco-Marina*, **14**, *Suppl. no.1*, Bucureşti-Constanța, p.69-74.

Dimitriu, R.G., Oaie, G., Szobotka, Şt., Sava, C., **Rădan, S.C.**, Fulga, C., Opreanu, G. (2008d) – Hydro-geomorphological mapping of the Sfântu Gheorghe – Vadu Littoral Zone. First results of the integrated

geophysical - geoecological research carried out during 2005 – 2006 (*in Romanian*), *Geo-Eco-Marina*, **14**, *Suppl. no.1*, Bucureşti-Constanța, p.75-80.

Rădan, S., Pavel, A., Bălan, S., Opreanu, P., Jugaru, L., **Rădan, S.C.**, Milu, C. (2008) – Natural greenhouse gas emissions in the wetlands of Romania, focus on the Danube Delta and the Black Sea Littoral Zone ("GASERO") (*in Romanian*), *2005-2008 Excellence Research Programme, MENER 2008 – Environment*, Polytechnic University, Bucharest, Faculty of Energetics, Volume of Papers, p.743-757.

Rădan, S.C. (2008) – The direct problem and the inverse problem in Petromagnetology and Palaeomagnetology; a discussion, with exemplification in Geophysics, Geology and Geoecology (*in Romanian*), *Geo-Eco-Marina*, **14**, *Suppl. no.1*, Bucureşti-Constanța, p.197-211 (with 3 plates).

Rădan, S.C., Rădan S. (2008a) – Magnetic properties of the Pliocene sedimentary sequences in the western Dacic Basin (Romania): A case study from the lignite-clay doublets, *Contributions to Geophysics and Geodesy*, **38**, *Special Issue*, Geophys. Inst. Slovak Acad. Sci., Bratislava, Slovakia, p.111-115.

Rădan, S.C., Rădan, S. (2008b)***** – Modern sediments as enviromagnetic archives. A case study: Danube Delta and northwestern Black Sea*, the XVIIth International Symposium "Deltas and Wetlands"*, Tulcea, Romania, 18 – 20 Sept. 2008, *Abstracts*, p.25-26.

Rădan, S.C., Rădan S., Cazacu, C., Milu, C. (2008a) – Magnetic susceptibility and lithological characterisation of the lake sediments from the southeastern Romania wetlands; environmental significances, *Contributions to Geophysics and Geodesy*, **38**, *Special Issue*, Geophys. Inst. Slovak Acad. Sci., Bratislava, Slovakia, p.107-110.

Rădan, **S.C.**, Rădan, S., Cazacu, C., Milu, C. (2008b) **–** Magneto-lithological models for recent sediments: examples from deltaic, lagoonal and littoral lakes, *the XVIIth International Symposium "Deltas and Wetlands"*, Tulcea, Romania, 18 – 20 Sept. 2008, *Abstracts*, p.23-24.

Rădan, **S.C.**, Rădan, S., Cazacu, C., Milu, C. (2008c)*** –** Magnetic susceptibility and lithological characterisation of the lake sediments from the southeastern Romania wetlands; environmental significances, *the XVIIth International Symposium "Deltas and Wetlands"*, Tulcea, Romania, 18 – 20 Sept. 2008, *Abstracts*, p.24-25.

Rădan, S.C. (2009) – Toward a reliable chronostratigraphic and geochronologic framework of the Dacian Basin, p.23-27, in D. C. Jipa and C. Olariu – *Dacian Basin. Depositional Architecture and Sedimentary History of a Paratethys Sea*, *Geo-Eco-Marina*, Special Publication no. **3**, GeoEcoMar, Bucharest, 264p.

Rădan, S.C., Rădan, S. (2009a) **–** Characteristic fingerprints of the lacustrine sedimentary environments retrieved from the magnetic susceptibility records in the wetlands of southeastern Romania; geoecological inferences, *Abstract Book of the IAGA 11th Scientific Assembly*, 24 – 29 August, 2009, Sopron, Hungary (abstract 116-1035).

Rădan, S.C., Rădan, S. (2009b) **–** Red sedimentary and combustion metamorphic rocks as magnetic anomaly sources; rock magnetic and palaeomagnetic signatures recovered from bauxites and porcelanites, *Abstract Book of the IAGA 11th Scientific Assembly*, 24 – 29 August, 2009, Sopron, Hungary (abstract 117-1037).

Rădan, S.C., Rădan, S. (2009c) – Lake sediments fingerprinting in the Danube Delta, using composite magneto-lithological signatures; an environmental approach, *the XVIIIth International Symposium "Deltas and Wetlands"*, 24 – 25 September, 2009, Tulcea, Romania, *Abstracts*.

Rădan, S.C., Rădan, S. (2009d) – Integrated magnetic susceptibility and lithological studies on lacustrine recent sediments from the Danube Delta, *Geo-Eco-Marina*, **15**, Bucharest, p.177-197.

Rădan, S.C., Rădan, S., Cazacu, C., Milu, C. (2009)*** –** Magneto-lithological models for recent sediments: examples from deltaic, lagoonal and littoral lakes, *Abstract Book of the IAGA 11th Scientific Assembly*, 24 – 29 August, 2009, Sopron, Hungary (abstract 116-1041).

Rădan, S.C., Rădan, S. (2010a)***** – Lake sediments fingerprinting in the Danube Delta, using composite magneto-lithological signatures; an environmental approach, *BALWOIS 2010 – Conference on Water Observation and Information System for Decision Support*, 25-29 May 2010, Ohrid, Republic of Macedonia, *ABSTRACTS*, vol. **II** – *Ecohydrology and Hydrobiology*, ISBN 978-608-4510-04-08, p.526-527; also, on-line: http://www.balwois. com/balwois/abstract.php?id=1945.

Rădan, S.C., Rădan, S. (2010b)***** – Modern sediments as enviromagnetic archives. A case study: Danube Delta and northwestern Black Sea, *BALWOIS 2010 – Conference on Water Observation and Information System for Decision Support*, 25-29 May 2010, Ohrid, Republic of Macedonia, *ABSTRACTS*, vol. **II** – *Ecohydrology and Hydrobiology*, ISBN 978-608-4510-04-08, p.528-529; also, on-line:

http://www.balwois.com/balwois/ abstract.php?id=1947.

Rădan, S.C., Rădan, S. (2010c) – Lake sediments fingerprinting in the Danube Delta, using composite magneto-lithological signatures; an environmental approach, *BALWOIS 2010 – Conference on Water Observation and Information System for Decision Support*, 25-29 May 2010, Ohrid, Republic of Macedonia, CD published by the Balkan Institute of Water and Environment, France; also, on-line: http://www.balwois.com/balwois/administration/ full_paper/ffp-1945.pdf, p.1-9.

Rădan, S.C., Rădan, S. (2010d) – Modern sediments as enviromagnetic archives. A case study: Danube Delta and northwestern Black Sea, CD published by the Balkan Institute of Water and Environment, France; also, on-line: http://www.balwois.com/balwois/administration/ full_paper/ffp-1947.pdf, p.1-7.

Rădan, S.C., Rădan, S. (2010e) – Coal Palaeofires in the Western Dacic Basin: Geophysical, Mineralogical and Geochemical Signatures Recovered from Porcelanites and Clinkers; a Case History, p.400-401. In: Drebenstedt, C., Fischer, C., Meyer, U., Jianjun, W., Bing, K. (Eds.) – *Latest Developments in Coal Fire Research. Bridging the Science, Economics and Politics of a Global Disaster*, Proceedings of "ICCFR2/Second International Conference on Coal Fire Research" (19-21 May 2010, dbb forum Berlin, Germany, TU Bergakademie Freiberg, Germany, 2010, ISBN 978-3-86012-397-3, 439p; *DVD* – "*Conference Materials: Presentations, Posters, Photos*", ICCFR2, Second International Conference on Coal Fire Research, 19 – 21 May 2010, dbb forum Berlin, Germany.

Rădan, S.C., Rădan, S. (2010f)***** – Lake sediments fingerprinting in the Danube Delta, using composite magneto-lithological signatures; an environmental approach, *Travaux Géophysiques*, **XXXIX**, Abstracts of the 12th *"*Castle Meeting – New Trends in Geomagnetism. Palaeo, Rock and Environmental Magnetism", Castle of Nové Hrady, Czech Republic, August 29 – September 4, 2010, p.68-69.

Rădan, S.C., Rădan, S. (2010g)***** – Coal Palaeofires in the Western Dacic Basin: Geophysical, Mineralogical and Geochemical Signatures Recovered from Porcelanites and Clinkers; a Case History, *Travaux Géophysiques*, **XXXIX**, Abstracts of the 12th "Castle Meeting – New Trends in Geomagnetism. Palaeo, Rock and Environmental Magnetism", Castle of Nové Hrady, Czech Republic, August 29 – September 4, 2010, p.66-67.

Rădan, S.C., Rădan, S. (2010h) – The use of the magnetic susceptibility to study (hydro)sedimentary environments and processes in Danube Delta, *Geo-Eco-Marina*, **16**, Bucureşti-Constanța, p.37-46.

Rădan, S.C., Rădan, S. (2010i) – Ecohydrological applications in southeastern Romania wetlands based on a magneto-lithological tool, *Geo-Eco-Marina*, **16**, Bucureşti-Constanța, p.47-66.

Rădan, S.C., Rădan, S., Cazacu, C. (2010a) – Parallel magnetic susceptibility calibration and lithological classification of the lake sediments from the Black Sea Littoral Zone (Romania): natural and anthropogenic inferences, *the XIXth International Symposium "Deltas and Wetlands"*, 1 – 3 September, 2010, *Abstracts*, Tulcea, Romania, Abstract 21.

Rădan, S.C., Rădan, S., Cazacu, C., Milu, C. (2010b)*** –** Magnetic susceptibility and lithological characterisation of the lake sediments from the southeastern Romania wetlands; environmental significances, *the 2010 GeoEcoMar International Symposium 2010 "Rivers – Deltas – Seas"*, Bucharest, Romania, 21st – 22nd October 2010, *Book of Abstracts*.

Rădan, S.C., Rădan, S., Cazacu, C., Milu, C. (2010c)*** –** Magneto-lithological models for recent sediments: examples from deltaic, lagoonal and littoral lakes, *the GeoEcoMar International Symposium 2010 "Rivers – Deltas – Seas"*, Bucharest, Romania, 21st – 22nd October 2010, *Book of Abstracts*.

Rădan S.C., Rădan, S., Cazacu, C., Milu, C. (2010d)***** – Magneto-Lithological Models for Recent Sediments: Examples from Deltaic, Lagoonal and Littoral Lakes, BALWOIS 2010 – Conference on Water Observation and Information System for Decision Support*,* 25-29 May 2010, Ohrid, Republic of Macedonia, *ABSTRACTS,* vol. **II** – *Ecohydrology and Hydrobiology*, ISBN 978-608-4510-04-08, p.527-528; also, on-line: http://www.balwois. com/balwois/abstract.php?id=1946.

Rădan, **S.C**., Rădan, S., Cazacu, C., Milu, C. (2010e) **–** Magneto-Lithological Models for Recent Sediments: Examples from Deltaic, Lagoonal and Littoral Lakes, *BALWOIS 2010 – Conference on Water Observation and Information System for Decision Support*, 25-29 May 2010, Ohrid, Republic of Macedonia, CD published by the Balkan Institute of Water and Environment, France; also, on-line: http://www.balwois.com/balwois/administration/ full_paper/ffp-1946.pdf, p.1-9.

Rădan S.C., Rădan, S. (2011a) – Changes induced by coal paleofires in the magnetic recording medium constituted by cyclic lignite-clay sequences, as inferred from porcellanites and clinkers (Western Dacic

Basin, Romania); a synopsis. In: Stracher, G.B., Prakash, A. and Sokol, E.V. (Eds.) – "*COAL AND PEAT FIRES: A GLOBAL PERSPECTIVE*", vol. **2 –** *Photos and Multimedia Tour*, Elsevier (*in press*).

Rădan, S.C., Rădan, S. (2011b) – Remagnetisation as evidence of a natural thermal event in the history of the lignite-clay sequences: magnetic signals from porcelanites (Dacian Basin, Romania), Power point presentation, in Stracher, G.B., Prakash, A., Sokol, E.V. (Eds.) – "*COAL AND PEAT FIRES: A GLOBAL PERSPECTIVE*", vol. **2 –** *Photo and Multimedia Tour*, Elsevier (*in press*).

Rădan, S.C., Rădan, S. (2011c)***** – Coal Palaeofires in the Western Dacic Basin: Geophysical, Mineralogical and Geochemical Signatures Recovered from Porcelanites and Clinkers; a Case History, "*FESP III – International Meeting on Fire Effects on Soils Properties"*, 3rd Edition, 15-19 March, 2011, University of Minho – Guimãraes, Portugal, *Book of Abstracts*, Abstract 2749.

Rădan, S.C., Rădan, S. (2011d) – How coal fires affect the clays: An interdisciplinary approach, "*FESP III – International Meeting on Fire Effects on Soils Properties"*, 3rd Edition, 15-19 March, 2011, University of Minho – Guimãraes, Portugal, *Book of Abstracts*, Abstract 2750.

Rădan, S.C., Rădan, S. (2011f) – How coal fires affect the clays: An interdisciplinary approach, p.148-152, in Gonçalves, António Bento and Vieira, António (Eds.) – "*Fire Effects on Soil Properties*: *Proceedings of the 3rd International Meeting of Fire Efects on Soil Properties*", Guimarães, Universidade do Minho – NIGP e CEGOT, 2011, ISBN 978-989-97214-0-1, 280p.

Rădan, S.C., Rădan, S. (2011e) – Coal Palaeofires in the Western Dacic Basin: Geophysical, Mineralogical and Geochemical Signatures Recovered from Porcelanites and Clinkers; a Case History, p.266-270, in Gonçalves, António Bento and Vieira, António (Eds.) – "*Fire Effects on Soil Properties*: *Proceedings of the 3rd International Meeting of Fire Efects on Soil Properties*", Guimarães, Universidade do Minho – NIGP e CEGOT, 2011, ISBN 978-989-97214-0-1, 280p.

Note: ***** abstracts with identical titles (in some cases, with text and/or figures additions), published in different volumes of abstracts or in journals, distributed at more than one scientific meeting, where the papers were accepted for presentation.

II. *Papers presented (Posters included) at International and National Symposia, Workshops and Meetings*

Dimitriu, R.G., Oaie, G., Gomoiu, M.T., Begun, T., Szobotka, S.A., **Rădan, S.C.**, Fulga, C. (2007a) – The Geoenvironmental Status of the Razelm – Sinoie Lacustrine Complex at the Beginning of the 21st Century, *the XVIth International Symposium "Deltas and Wetlands 2006"*, 20 – 22 Sept. 2007, Tulcea, Romania.

Dimitriu, R.G., Oaie, G., Szobotka, S.A., Sava, C.S., **Rădan, S.C.**, Fulga, C. (2007b) – Hydro-geomorphological Mapping of the Sfântu Gheorghe – Vadu Littoral Zone. Results of the Integrated, Geophysical - Geoenvironmental Research Carried Out During 2005 – 2006, *the XVIth International Symposium "Deltas and Wetlands 2006"*, 20 – 22 Sept. 2007, Tulcea, Romania.

Duliu, O., Mihăilescu, N., Costea, C., Baltreş, A., **Rădan, S.C.**, Alexe, V., Anastase, S. (2007) – The evaluation of the environment quality change through the application of a new methodology based on high sensibility analytical techniques (*in Romanian*)*, Workshop – Natural Hazard: Tsunami Events in the Black Sea* (coord. G. Oaie), 7 sept., 2007, GeoEcoMar, Bucharest, Romania.

Rădan, S.C., Rădan, S. (2007a*)* – Remagnetisation as evidence of a natural thermal event in the history of the lignite-clay sequences: magnetic signals from porcelanites (Dacian Basin, Romania), *the XXIVth IUGG General Assemby*, July 2 – 13, 2007, Perugia, Italy.

Rădan, S.C., Rădan, S. (2007b) – The magnetic signature of present environmental changes in lake sediments induced by hydrotechnical work; a case study from the Danube Delta (Romania), *the XXIVth IUGG General Assemby,* July 2 – 13, 2007, Perugia, Italy.

Rădan, S.C., Rădan, S. (2007c)*** –** The magnetic signature of present environmental changes in lake sediments induced by hydrotechnical work; a case study from the Danube Delta (Romania), *the XVIth International Symposium "Deltas and Wetlands 2006"*, 20 – 22 Sept. 2007, Tulcea, Romania.

Rădan, S.C., Rădan, S. (2007d) – Modern Sediments as Enviromagnetic Archives. A Case Study: Danube Delta and Northwestern Black Sea, *American Geophysical Union Fall Meeting*, 10 – 14 December, 2007, San Francisco, USA.

Dimitriu, R.G., Oaie, G., Gomoiu, M.T., Begun, T., Szobotka, S.A., **Rădan, S.C.**, Fulga, C. (2008a) – The interdisciplinary characterisation of the geoecological status of the Razelm-Sinoie lagoonal Complex at the beginning of the XXI century (*in Romanian*), *Annual session of scientific papers*, GeoEcoMar, 27-28 March 2008, Bucharest, Romania.

Dimitriu, R.G., Oaie, G., Szobotka, S.A., Sava, C., **Rădan, S.C.**, Fulga, C., Opreanu, G. (2008b) – Hydro-geomorphological Mapping of the Sfântu Gheorghe – Vadu Littoral Zone. First results of the integrated geophysical - geoecological research carried out during 2005 – 2006 (*in Romanian*), *Annual session of scientific papers*, GeoEcoMar, 27-28 March 2008, Bucharest, Romania.

Dimitriu, R.G., Oaie, G., Szobotka, S.A., **Rădan, S.C.,** Opreanu, G., Dan, S. (2008c) – Rapid changes of the seabed hydro-geomorphological features within the Sfântu Gheorghe – Vadu littoral zone (Romanian Black Sea coast), *the 33rd International Geological Congress*, 6 – 14 August, 2008, Oslo, Norway.

Dimitriu, R.G., Oaie, G., Szobotka, S.A., **Rădan, S.C.**, Opreanu, G., Dan, S., Stănescu, I. (2008d) – Rapid changes of the seabed hydro-geomorphological features within the Sfântu Gheorghe – Vadu littoral zone (Romanian Black Sea coast), *the XVIIth International Symposium "Deltas and Wetlands"*, 18 – 20 Sept. 2008, Tulcea, Romania.

Rădan, S., Pavel, A., Bălan, S., Opreanu, P., Jugaru, L., **Rădan, S.C.**, Milu, C. (2008) – Natural greenhouse gas emissions in the wetlands of Romania, focus on the Danube Delta and the Black Sea Littoral Zone (*in Romanian*), *2008 MENER Scientific Session*, 4–7 September 2008, Sinaia, Romania.

Rădan, S.C., Rădan, S. (2008)***** – Modern Sediments as Enviromagnetic Archives. A Case Study: Danube Delta and Northwestern Black Sea, *the XVIIth International Symposium "Deltas and Wetlands"*, 18 – 20 Sept. 2008, Tulcea, Romania.

Rădan, S.C., Rădan S., Cazacu, C., Milu, C. (2008a) – Magnetic susceptibility and lithological characterisation of the lake sediments from the southeastern Romania wetlands; environmental significances, *the 11th Castle Meeting. Paleo, Rock and Environmental Magnetism*, Bojnice, Slovak Republic, June 22 – 28, 2008.

Rădan, S.C., Rădan S., Cazacu, C., Milu, C. (2008b) – Magneto-lithological models for recent sediments: examples from deltaic, lagoonal and littoral lakes, *the XVIIth International Symposium "Deltas and Wetlands"*, 18 – 20 Sept. 2008, Tulcea, Romania.

Rădan, S.C., Rădan S., Cazacu, C., Milu, C. (2008c)***** – Magnetic susceptibility and lithological characterisation of the lake sediments from the southeastern Romania wetlands; environmental significances, *the XVIIth International Symposium "Deltas and Wetlands"*, 18 – 20 Sept. 2008, Tulcea, Romania.

Rădan, S.C., Rădan, S. (2009) – Lake sediments fingerprinting in the Danube Delta using composite magneto-lithological signatures; an environmental approach, *the XVIIIth International Symposium "Deltas and Wetlands"*, 24-25 September, 2009, Tulcea, Romania.

Rădan, S.C., Rădan, S. (2010a) – Coal Palaeofires in the Western Dacic Basin: Geophysical, Mineralogical and Geochemical Signatures Recovered from Porcelanites and Clinkers; a Case History, *"Second International Conference on Coal Fire Research*" (*ICCFR2*), 19-21 May 2010, dbb forum Berlin, Germany; .

Rădan, S.C., Rădan, S. (2010b)***** – Coal Palaeofires in the Western Dacic Basin: Geophysical, Mineralogical and Geochemical Signatures Recovered from Porcelanites and Clinkers; a Case History, *12th "Castle Meeting New Trends in Geomagnetism. Palaeo, Rock and Environmental Magnetism"*, Castle of Nové Hrady, Czech Republic, August 29 – September 4, 2010.

Rădan, S.C., Rădan, S. (2010c)***** – Lake sediments fingerprinting in the Danube Delta, using composite magneto-lithological signatures; an environmental approach, *12th "Castle Meeting New Trends in Geomagnetism. Palaeo, Rock and Environmental Magnetism"*, Castle of Nové Hrady, Czech Republic, August 29 – September 4, 2010.

Rădan, S.C. (2010) – Enviromagnetic, paleomagnetic and rock magnetic studies in Romania. Geological Institute of Romania (GIR) (Composite Poster: 5 posters included) – *Geological Institute of Romania Showcase*, SEG Denver 2010 – "*Imaging our future*", *International Exposition and 80th Annual Meeting*, Colorado Convention Center, 17 – 22 October 2010, Denver, Colorado, USA:

Rădan, S.C., Rădan, S. (2007d, 2008)***** – Modern Sediments as Enviromagnetic Archives. A Case Study: Danube Delta and Northwestern Black Sea; firstly, presented at the *American Geophysical Union Fall Meeting*, 10 – 14 December, 2007, San Francisco, USA; also, presented at *the XVIIth International Symposium "Deltas and Wetlands",* Tulcea, Romania, 18 – 20 Sept. 2008;

Rădan, S.C., Rădan, S. (2007b)***** – The magnetic signature of present environmental changes in lake sediments induced by hydrotechnical work; a case study from the Danube Delta (Romania), *the XXIVth IUGG General Assemby,* July 2 – 13, 2007, Perugia, Italy;

Rădan, S.C., Rădan S., Cazacu, C., Milu, C. (2008a,c)***** – Magnetic susceptibility and lithological characterisation of the lake sediments from the southeastern Romania wetlands; environmental significances; firstly, presented at *the 11th Castle Meeting. Paleo, Rock and Environmental Magnetism*, Bojnice, Slovak Republic, June 22 – 28, 2008; also, presented at *the XVIIth International Symposium "Deltas and Wetlands",* Tulcea, Romania, 18 – 20 Sept. 2008;

Rădan, S.C., Rădan, S. (2009, 2010c)***** – Lake sediments fingerprinting in the Danube Delta, using composite magneto-lithological signatures; an environmental approach; firstly, presented at *the XVIIIth International Symposium* "*Deltas and Wetlands"*, 24 – 25 September, 2009, Tulcea, Romania, *Abstracts*; also, presented at the *12th* "*Castle Meeting – New Trends in Geomagnetism. Palaeo, Rock and Environmental Magnetism"*, Castle of Nové Hrady, Czech Republic, August 29 – September 4, 2010;

Rădan, S.C., Rădan, S. (2010a,b)***** – Coal Palaeofires in the Western Dacic Basin: Geophysical, Mineralogical and Geochemical Signatures Recovered from Porcelanites and Clinkers; a Case History; firstly, presented at "*Second International Conference on Coal Fire Research*" (*ICCFR2*), 19-21 May 2010, dbb forum Berlin, Germany; also, presented at *the 12th* "*Castle Meeting New Trends in Geomagnetism. Palaeo, Rock and Environmental Magnetism",* Castle of Nové Hrady, Czech Republic, August 29 – September 4, 2010.

Note: ***** papers with identical titles, presented as posters (in some cases, with a previous short oral introduction/ppt, given in an associated session), at more than one scientific meeting, where the papers were accepted and included in the programme.

III. *Scientific reports related to national research projects (unpublished works; Geological Institute of Romania/G.I.R. – GeoEcoMar Archives*)

Rădan, S.C. (*G.I.R.*) (2007a) – "Magnetic susceptibility of the sediments from the Razim and Golovița Lakes", p. 38-93, in:

Rădan, S., Pavel, A., Jugaru, L., Bălan, S., Grosu, D. (*GeoEcoMar*), **Rădan, S.C.** (*G.I.R.*), Milu, C. (*University of Bucharest*) (2007a) – "Natural greenhouse gas emissions from wetlands in Romania, focus on the Danube Delta and the Black Sea littoral zone (GASERO). IV. Measurement, mapping and quantification of the greenhouse gas flux in the Danube Delta and Razim (Razelm) – Sinoie Lagoonal Complex, and the complex characterisation of the water and sediments", CEEX Project 2005-619, *GeoEcoMar – GIR Archives*, Bucharest, 158 p. – Text, Figures and Tables (*in Romanian*).

Rădan, S.C. (*G.I.R.*) (2007b) – "Magnetic susceptibility of the bottom sediments from the Taşaul Lake", p.32-60, in:

Rădan, S., Opreanu, P., Bălan, S., Cazacu, C., Grosu, D. (*GeoEcoMar*), **Rădan, S.C.** (*G.I.R.*), Milu, C. (*University of Bucharest*) (2007b) – "Natural greenhouse gas emissions from wetlands in Romania, focus on the Danube Delta and the Black Sea littoral zone (GASERO). V. Measurement, mapping and quantification of the greenhouse gas flux in the Danube Delta and in the lakes from the Black Sea Littoral Zone, and the complex characterisation of the water and sediments", CEEX Project 2005-619, *GeoEcoMar – G.I.R. Archives*, Bucharest, 80p. – Text, Figures and Tables (*in Romanian*).

Rădan, S.C. (*G.I.R.*) (2008**)** – "Environmental magnetic susceptibilimetry for recent sediments from deltaic, lagoonal and littoral lakes. New data and synoptic considerations", p.93-155, in:

Rădan, S., Opreanu, P., Bălan, S., Jugaru, L., Cazacu, C., Grosu, D. (*GeoEcoMar*), **Rădan, S.C.** (*G.I.R.*), Milu, C. (*University of Bucharest*) (2008) – "Natural greenhouse gas emissions from wetlands in Romania, focus on the Danube Delta and the Black Sea littoral zone (GASERO). VI. Modelling of the greenhouse gas flux in specific environments (*i.e*., aquatic, terrestrial, natural and setted up) from the Danube Delta, Razim (Razelm) – Sinoie Lagoonal Complex and the Black Sea Littoral Zone, and the evaluation of the role of the biogas emissions in the carbon and nitrogen cycle. Synthesis of data", CEEX Project 2005-619, *GeoEcoMar – G.I.R. Archives*, Bucharest, 182p. – Text, Figures and Tables (*in Romanian*).

Rădan, S.C. (*G.I.R.*) (2009a) – "Study of the characteristics of the magneto-recording medium from areas with coal deposits, on the basis of the palaeo-/rock-magnetic properties of the Pliocene sequences from the western Dacic Basin. I. Analysis of the magneto-recording medium represented by Pliocene coal-bearing

formations intercepted in lignite quarries and bore holes (Motru – Jilţ – Peşteana zone)", PN 09-21-03-07 Project, "Core Programme", *G.I.R. Archive*, Bucharest, 119p. – Text, Figures and Tables (*in Romanian*).

Rădan, S.C. (*G.I.R.*) (2009b) – "Study of the characteristics of the magneto-recording medium from areas with coal deposits, on the basis of the palaeo-/rock-magnetic properties of the Pliocene sequences from the western Dacic Basin. II. Study of the effects of the post-depositional thermal perturbations on the magneto-recording medium characteristics from areas with coal deposits (Motru – Jilţ zone)", PN 09-21-03-07 Project, "Core Programme", *G.I.R*., Bucharest, 18p. – Text, Figures and Tables (Phase 2 Report – a short version, *in Romanian*).

Rădan, S.C. (*G.I.R.*) (2010) – "Study of the characteristics of the magneto-recording medium from areas with coal deposits, on the basis of the palaeo-/rock-magnetic properties of the Pliocene sequences from the western Dacic Basin. III. Study of the magneto-recording medium, in the case of a sedimentation gap between its constituting Pliocene coal-bearing formations (Husnicioara zone), on the basis of the magnetic fabric and of the (natural and characteristic) remanent magnetisation data", PN 09-21-03-07 Project, "Core Programme", *G.I.R*, Bucharest, 24p. – Text, Figures and Tables (Phase 3 Report – a short version, *in Romanian*).

Rădan, S.C. (*G.I.R.*) (2011) – "Geophysical researches – Magnetic susceptibility study of some eruptive rocks from the Călimani Mountains (Eastern Carpathians)" Research Report, *G.I.R. Archive*, Bucharest, 41p. (*in Romanian*).

IV. *Books, PhD Theses, Papers (with authors other than GIR researchers), appeared in the 2007 – 2011 interval, and International Databases, which refer to the published results obtained in the Laboratory of Palaeo-, Rock and Environmental Magnetism of the Geological Institute of Romania*.

Gangopadhyay, P.K. (2007) **–** Application of remote sensing in coal-fire studies and coal-fire–related emissions, 239-248, *in* Stracher, G.B. (Ed.), *Geology of Coal Fires: Case Studies from Around the World*, Geological Society of America Reviews in Engineering Geology, v. **XVIII**, 283p.

Gangopadhyay, P.K. (2008) **–** *Coalfires related CO_2 emissions and remote sensing*, International Institute for Geo-information Science and Earth Observation, Enschede, ITC PhD Thesis No. 153, University of Utrecht, ISBN 978-90-6164-267-1, 156p.

Jimenez-Moreno, G, Popescu, S.-M., Ivanov, D., Suc, J.-P. (2007) **–** Neogene flora, vegetation and climate dynamics in southeastern Europe and the northeastern Mediterranean, *Geological Society Special Publication*, 503-516.

Masalehdani, M.N.-N., Black, P.M., Kobe, H.W. (2007) **–** Mineralogy and petrography of iron-rich slags and paralavas formed by spontaneous coal combustion, Rotowaro coalfield, North Island, New Zealand, 117-131, *in* Stracher, G.B. (Ed.), *Geology of Coal Fires: Case Studies from Around the World*, Geological Society of America Reviews in Engineering Geology, v. **XVIII**, 283p.

Huang, L., Liu, C.-Y. (2008) – Petrologic and REE geochemical characters of burnt rocks, *Diqiu Kexue – Zhongguo Dizhi Daxue Xuebao/Earth Science – Journal of China University of Geosciences*, **33**, *4*, 515-522.

Jipa, D. (2009) – The Dacian Basin source-to-sink system, p.71-88, in Panin, N., Melinte, M.-C., Jipa, D. (Coords.), *Topo-Europe Summer School on Carpathian – Danube Delta – Black Sea sedimentary systems*, European Science Foundation EUROCORES Programme, Murighiol, 2009, September, 25th – October, 10th, GeoEcoMar, Bucureşti-Constantza, 88p.

Henao, J.A., Carreño, A.M., Quintero, J.A., Candela, S.Á, Ríos, C.A., Ramos, M.A., Pinilla, J.A. (2010) – Petrography and application of the Rietveld method to the quantitative analysis of phases of natural clinker generated by coal spontaneous combustion, *Earth Sci. Res. J.*, Vol. **14**, No. 1, 17-30.

Quintero, J.A., Candela, S.A., Ríos, C.A., Montes, C., Uribe, C. (2009) – Spontaneous combustion of the Upper Paleocene Cerrejón Formation coal and generation of clinker in La Guajira Peninsula (Carribean Region of Colombia), *International Journal of Coal Geology*, **80**, 196-210.

Reyes, C.A.R. (2008) **–** *Synthesis of zeolites from geological materials and industrial wastes for potential application in environmental problems*, Doctoral Thesis, University of Wolverhampton, School of Applied Sciences, United Kingdom.

Snel, E. (2010) – *The Messinian salinity crisis: chronology and paleoenvironment in the (circum) Mediterranean*, Geologica Ultraiectina, No. **317**, Universiteit Utrecht, ISBN/EAN 978-90-5744-177-6, 187p.

Tiron, L. (2010) – *Delta du Danube – Bras de St. George. Mobilité morphologique et dynamique hydro-sédimentaire depuis 150 ans*, Geo-Eco-Marina, Special Publication no. **4**, GeoEcoMar, Bucureşti, ISBN 978-973-0-08552-5, 281p.

Databases

GeoRef – American Geological Institute, Copyright 2008, SUA (38 papers and abstracts cited, containing data obtained in GIR, related to the activities associated with the IAGA WG I-3 and WG I-4).
SAO/NASA Astrophysics Data System (ADS) – Digital Library for Physics and Astronomy, High Energy Astrophysics Division, Harvard-Smithsonian Center for Astrophysics, SUA.
Wanfang Data – Institute of Scientific & Technological Information of China (ISTIC), Chinese Ministry of Science & Technology, China.
WorldWideScience.org – Energy Technology Data Exchange – ETDEWEB/ETDE World Energy Base – U.S. Department of Energy's Office of Scientific and Technical Information, SUA.
NSA VSU – Zonal Scientific Library, Voronezh State University, Russia.

Among the cited papers/abstracts in other scientific publications or in databases (**IV**) are Rădan, 1983, 2000, 2002, 2003; Rădan & Rădan, 1981, 1985, 1987, 1989a,b, 1998a,b, 2001, 2004, 2005; Rădan *et al*., 1983a,b,c, 1985, 1989, 1994, 1995, 1998a,b, 1999, 2000a,b, 2001, 2004. They are mentioned in detail in the *References* assigned to the IAGA Division, particularly to the Chapter devoted to the Rock-, Palaeo-, Enviro-/magnetic Activities, part of the previous IUGG National (Romania) Reports (period 1979 - 2007); the last one (2003 - 2007) is accessible on-line:
http://www.iugg.org/members/nationalreports/Romania_National%20Report%20for%20IUGG_2003-2007.pdf)

DIVISION IV – Solar Wind and Interplanetary Field

In the recent years, a new research direction, namely space climate/space weather, has been developed at the Institute of Geodynamics of the Romanian Academy, in close relation with programmes of the International Heliophysical Year and COST Action ES0803 "Developing space weather products and services in Europe". The space climate concept refers to long-term change in the Sun, and its effects in the heliosphere and upon the Earth, including the atmosphere and climate; the space weather regards the short-term variations in the different forms of solar activity, their prediction and effects on the near-Earth environment and technology.

These studies have been focused on the following research lines:
– analysis of long-term (decadal, inter-decadal and centennial) solar and geomagnetic activity;
– solar/geomagnetic forcing on terrestrial climate;
– analysis of the solar wind impact on geomagnetic activity;
– study of slow solar wind sources and of coronal mass ejections (CMEs).

The geomagnetic activity at global scale, described by the aa, IHV, IDV geomagnetic indices, and solar activity, described by the sunspot number R, were studied. It was showed that the variation depicted by 11-year running averages of aa and R results from the superposition of Hale and Gleissberg cycles signatures in the corresponding time series, and several characteristics of the two signals in the solar and geomagnetic activities were discussed (Demetrescu and Dobrica, 2008; Pirvutoiu et al., 2009).

Also, long-term variability of the heliosphere-magnetosphere environment has been studied by analysis of long time series of measured and reconstructed parameters characterizing processes in the Sun, heliosphere and magnetosphere. Signatures of the magnetic Hale cycle (MC) and of the Gleissberg cycle (GC) of the solar activity have been evidenced in the available open solar flux, modulation strength, cosmic ray flux, total solar irradiance data, reconstructed back to 1700, solar wind parameters (speed and density) and the magnitude of the heliospheric magnetic field at 1 AU, reconstructed back to 1870, as well as the time series of geomagnetic activity indices (aa, IDV, IHV), going back to 1870. The long-discussed centennial increase of geomagnetic activity and the doubling of solar open flux in the twentieth century, defined in terms of 11-year averages of geomagnetic indices and open solar flux, have been shown to be the result of the superposition of the MC and GC signatures in the data (Demetrescu et al., 2010). Characteristics of high speed streams and their geoeffectivenes have been studied as well (Maris and Maris, 2010 a; b).

The influence of solar and geomagnetic activity on climate has been investigated by using surface air temperature and solar/geomagnetic indices. A set of 24 time series of air temperature measured at European stations between 1900 and 2006, and 4 European and 14 Romanian stations with 150 year long records, has been processed to show solar/geomagnetic activity signatures at decadal and centennial timescales. Results showed a similar temporal behaviour at all analysed stations with amplitude differences that can be understood in terms of large-scale atmospheric circulation patterns influenced by the solar/geomagnetic forcing at the corresponding timescales, but with local intensity differences (Dobrica et al, 2009; Dobrica et al., 2010).

The analysis of LASCO-C1 spectral data in order to find the source of the slow solar wind and determine the dynamic properties of the low corona (from 1.1 to 3 solar radii) (Mierla et al. 2007, 2008a, 2011).

Coronal mass ejections (CMEs) are enormous eruptions of magnetized plasma expelled from the Sun which can create major disturbances in the interplanetary medium and trigger severe magnetic storms when they collide with the Earth's magnetosphere. It is important to know their real speed and propagation direction in order to accurately predict their arrival time at the Earth. By applying different reconstruction techniques on data from SECCHI coronagraphs onboard the STEREO mission, which was launched in October 2006. The real speed, propagation direction and 3D configuration of the CMEs can be derived (Mierla et al. 2008b, 2009, 2010). The impact of several CMEs on the Earth's magnetic field was also investigated (Chiricuta et al. 2011). The studies related to CMEs were initiated while M. Mierla was with The Astronomical Institute of the Romanian Academy (2007-2009).

Published papers

Chiricuta, O., Chifu, I., Besliu-Ionescu, D., Mierla, M., 2011, Studies of solar-terrestrial connections: geomagnetic storms induced by coronal mass ejections, *Romanian Astronomical Journa, accepted.*

Demetrescu, C., Dobrica, V**.,** 2008, Signature of Hale and Gleissberg solar cycles in the geomagnetic activity, *J. Geophys. Res., 113, A02103, doi:10.1029/2007JA012570*.

Demetrescu, C., Dobrica, V., Maris, G., 2010, On the long-term variability of the heliosphere-magnetosphere environment. *Adv. Space Res*., *46, 1299-1312, doi: 10.1016/j.asr.2010.06.032*.

Dobrica, V., Demetrescu, C., Boroneant, C., Maris, G., 2009, Solar and geomagnetic activity effects on climate at regional and global scales: Case study – Romania, *J. Atmos. Solar-Terr. Phys., 71, 1727-1735, doi:10.1016/j.jastp.2008.03.022*.

Dobrica, V., Demetrescu, C., Maris, G., 2010, On the response of the European climate to the solar/geomagnetic long-term activity, *Annals of Geophysics,53, 39-48*.

Maris, G., Maris, O., 2010a, WHI High-Speed Streams at Geospace, in: *Highlights of Astronomy, Volume 15, Part III, p. 494-497, J.F. Corbett ed., Cambridge Univ. Press., doi:10.1017/S1743921310010379.*

Maris, G., Maris, O., 2010b, Rapid Solar Wind and Geomagnetic Variability during the Ascendant Phases of the 11-yr Solar Cycles, in: *Proc. IAU Symposium 264 "Solar and Stellar Variability Impact on Earth and Planets", A.G. Kosovichev, A.H. Andrei and J.-P. Rozelot eds., pp. 359-362, doi: 10.1017/S1743921309992924, Cambridge Univ. Press.*

Mierla, M., Schwenn, R., Teriaca, L., Stenborg, G., Podlipnik, B., 2007, The Dynamic of the Solar Corona in the Period August-October 1996, *Advances in space Research 40, 1049-1053.*

Mierla, M., Schwenn, R., Teriaca, L., Stenborg, G., Podlipnik, B., 2008a, Analysis of the Fe X and Fe XIV Line Width in the Solar Corona using LASCO-C1 Spectral Data, *Astronomy and Astrophysics 480, 509*.

Mierla, M., Davila, J., Thompson, W., Inhester, B., Srivastava, N., Kramar, M., StCyr, O.C., Stenborg, G., Howard, R.A., 2008b, A Quick Method for Estimating the

Propagation Direction of Coronal Mass Ejections using STEREO-COR1 Images, *Sol. Phys, 252, 385.*

Mierla, M., Inhester, B., Marque, C., Rodriguez, L., Gissot, S., Zhukov, A., Berghmans,

D.and Davila, J., 2009, On 3D Reconstruction of Coronal Mass Ejections: I Method description and application to SECCHI-COR Data, *Solar Physics, 259, 123 – 141.*

Mierla, M., Inhester, B., Antunes, A., Boursier, Y., Byrne, J.P., Colaninno, R., Davila, J., de Koning, C.A., Gallagher, P.T., Gissot, S., Howard, R.A., Howard, T.A., Kramar, M., Lamy, P., Liewer, P.C., Maloney, S., Marqué, C., McAteer, R.T.J., Moran, T., Rodriguez, L., Srivastava, N., St. Cyr, O. C., Stenborg, G., Temmer, M., Thernisien, A., Vourlidas, A., West, M.J., Wood, B.E., Zhukov, A.N., 2010, On the 3-D reconstruction of Coronal Mass Ejections using coronagraph data, *Annales Geophysicae*, *28, 203-215.*

Mierla, M. and Schwenn, R., 2011, The Slow Solar Wind: Observations and Models, *Research Signpost, Kerala, India, in press*.

Pirvutoiu, C., Vladoiu, D., Maris, G., 2009, On the relationship between solar wind characteristics and geomagnetic activity. In: *Space Plasma Physics, I. Zhelyazkov (Editor), American Institute of Physics Conf. Proc., 1121, pp. 141-150, doi:10.1063/1.3137935*

Conferences

C. Demetrescu, V. Dobrica, G. Maris, Long-term space climate variations as evidenced by geomagnetic field variations, *7th EMS Annual Meeting, San Lorenzo de El Escorial, Spain, October 1-5, 2007.*

V. Dobrica, C. Demetrescu, G. Maris, C. Boroneant, Solar and geomagnetic forcing of climate changes during the instrumental period in Romania, *7th EMS (European Meteorological Society) Annual Meeting, San Lorenzo de El Escorial, Spain, October 1-5, 2007.*

Maris, G.; Maris, O.; Dobrica, V., Demetrescu, C., Rapid Solar Wind Streams during Solar Cycle 23 and Their Geomagnetic Imprint, *7th EMS Annual Meeting / 8th European Conference on Applications of Meteorology, San Lorenzo de El Escorial, Spain, October 1-5, 2007.*

Maris, G., Mierla, M., Asymmetry of the Soft X-ray Solar Flares, *The Fourth European Space Weather Week, Brussels, Belgium, November 5–9, 2007.*

Dobrica, V., Demetrescu, C., Maris G., Pirvutoiu C., The relationship at decadal and centennial timescales between European temperature data and solar/geomagnetic activity, for the 20th century. *8th EMS Annual Meeting, Amsterdam, The Netherlands, Sept. 28–Oct. 4, 2008*.

Maris, G., Dobrica, V., Demetrescu, C., Maris, O., Geomagnetic Effectiveness of the High Speed Streams in the Solar Wind, *EGU General Assembly 2008, Vienna, Austria, April 13 – 18, 2008.*

Maris, G., Maris, O., Characteristics of the High Speed Streams during Polarity Reversals of the Solar MagneticField, *UN/ESA/NASA/JAXA Workshop on the International Heliophysical Year 2007 and Basic Space Science "First Results from the International Heliophysical Year 2007", Sozopol, Bulgaria, June 2-6, 2008.*

O. Maris, G. Maris, V. Dobrica, C. Demetrescu *Rapid Solar Wind Impact on the Geomagnetic Variability during four Solar Cycles (Nos. 20 –23)* UN/ESA/NASA/JAXA Workshop on the International Heliophysical Year

2007 and Basic Space Science "First Results from the International Heliophysical Year 2007" 2-6 June 2008, Sozopol, Bulgaria

G. Maris, O. Maris *The rapid solar wind analysis during the Whole Heliospheric Interval (Carrington Rotation 2068)* EMS Annual Meeting, European Conference on Applied Climatology (ECAC), 29 September – 03 October 2008, Amsterdam, The Netherlands

G. Maris, O. Maris *The variation of geomagnetic indices under external influences (invited paper)* IAGA International Symposium "Space weather and its effects on Spacecraft", Cairo, Egypt, October 5-9, 2008

G. Maris, C. Demetrescu, O. Maris, V. Dobrica *The first Romanian results in IHY (invited paper)* IAGA International Symposium "Space weather and its effects on Spacecraft", Cairo, Egypt, October 5-9, 2008

G. Maris, V. Dobrica, C. Demetrescu, O. Maris *Solar Wind and Geomagnetic Activity during the Descending and Minimum Phases of the 11-yr Cycle* Fifth European Space Weather Week, 17-21 November, 2008, Brussels, Belgium

Demetrescu, C., Dobrica, V., Maris, G., On the long-term variability of the heliosphere-magnetosphere environment. *3rd Space Climate Symposium, Saariselka, Finland, March 14-22, 2009.*

Dobrica, V., Demetrescu, C., Maris, G., On the response of the European climate to the solar/geomagnetic long-term activity. *3rd Space Climate Symposium, Saariselka, Finland, March 14-22, 2009.*

Demetrescu, C., Dobrică, V., Maris, G., Signature of Hale and Gleissberg solar cycles in the heliosphere-magnetosphere environment. *11th Scientific Assembly of the International Association of Aeronomy and Geomagnetism (IAGA), Sopron, Hungary, August 22-30, 2009.*

Maris, G., Periodicities of the Solar Wind and its Fast Streams*, Workshop "Solar Influences on the terrestrial magnetosphere and ionosphere", Sozopol, Bulgaria, July 9-13, 2009.*

Maris, G., Maris, O. Rapid Solar Wind and Geomagnetic Variability during the Ascending Phases of the 11-yr Solar Cycles, *XXVIIth IAU General Assembly, IAU Symposium 264 "Solar and Stellar Variability Impact on Earth and Planets", Rio de Janeiro, Brasil, August 3 -7, 2009.*

Maris, G., Maris, O., WHI High-Speed Streams at Geospace*, XXVIIth IAU General Assembly, Joint Discussion 16: "IHY Global Campaign Whole Heliosphere Interval" Rio de Janeiro, Brazilia, August 11-14, 2009.*

Maris, G., Maris, O., Dynamics of the high speed streams during the last four solar minima*, IHY-ISWI Regional Meeting, Heliophysical phenomena and Earth environment, Šibenik, Croatia, September 7-13, 2009.*

Maris, G., Maris, O., High Speed Stream during SC 23 – A Romanian Contribution to IHY*, UN/NASA/ESA/JAXA Workshop on Basic Space Science and the International Heliophysical Year, Dajeon, South Korea, September 21-25, 2009.*

Dobrica, V., Demetrescu, C., Maris, G., Solar/geomagnetic activity effects on climate. Case study: European air temperature time series, *EGU General Assembly, Vienna, Austria, May 2-7, 2010.*

Demetrescu, C., Dobrica, V., Maris, G., Signature of Hale and Gleissberg solar cycles in the heliosphere-magnetosphere environment, *2nd Workshop "Solar influences on the ionosphere and magnetosphere", Sozopol, Bulgaria, June 7-11, 2010.*

Mierla, M., Rodriguez, L., Berghmans, D., Besliu-Ionescu, D., Chifu, I., Dammasch, I., de Groof, A., Demetrescu C., Dobrica, V., Gissot, S., Hochedez, J.-F., Inhester, B., Magdalenic, J., Maris, G., Nitoiu, D., Seaton, D., Srivastava, N., West, M., Zhukov, A., Multispacecraft observations of 3 and 8 April 2010 Coronal Mass Ejections, *CESRA 2010: Energy storage and release through the solar activity cycle - models meet radio observations, La Roche, Belgium, June 15-19, 2010.*

Mierla, M., Balmaceda, L., Cremades, H., Mandrini, C., Rodriguez, L., Analysis of 26 April 2008 Coronal Mass Ejection, *AGU Meeting of the Americas, Iguassu Falls, Brazil, August 8-13, 2010.*

Maris, G., Maris, O., Dobrica, V., Demetrescu, C., Recurrent High Speed Streams in the Solar Wind during Solar Cycle 23 and their Geomagnetic Imprints, *AOGS Annual General Assembly, India, Hyderabad, July 5-9, 2010.*

Mierla, M., Seaton, D.B., Berghmans, D., Stenborg, G., 3D reconstruction of the 13 April 2010 prominence eruption using SWAP and EUVI data, *SIPWork V: Fifth Solar Image Processing Workshop, Les Diablerets, Switzerland, September 12-16, 2010.*

Maris, O., Dobrica, V., Demetrescu, C., Maris, G., Fast Solar Wind and Geomagnetic Storms during Solar Cycle 23 (1996-2008), *European Space Weather Week 7 (ESWW7), Bruges, Belgium, November 15-20, 2010.*

Mierla, M., Rodriguez, L., Berghmans, D., Besliu-Ionescu, D., Chifu, I., Dammasch, I., de Groof, A., Demetrescu C., Dobrica, V., Gissot, S., Hochedez, J.-F., Inhester, B., Magdalenic, J., Maris, G., Nitoiu, D., Seaton, D., Srivastava, N., West, M., Zhukov, A., Multispacecraft observations of 3 and 8 April 2010 Coronal Mass Ejections*, European Space Weather Week 7 (ESWW7), Bruges, Belgium, November 15-20, 2010.*

Mierla, M., Rodriguez, L., Study of Coronal Mass Ejections and their Impact on the Earth Magnetic Field, *European Space Weather Week 7 (ESWW7), Bruges, Belgium, November 15-20, 2010.*

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DIVISION V – Geomagnetic Observatories, Surveys and Analyses

Working Group V-OBS: Geomagnetic Observation

A. Secular variation studies

A.1. *National Network of Repeat Stations*

Since about 1964 a systematic survey of the geomagnetic field at the National network of repeat stations has been undertaken. The network (26 stations at present) is being reoccupied as much as possible every year. Measurements have been done in the report time interval by means of a LEMI-204 DIFlux instrument, 2 Geometrics G-856 proton magnetometers, and 2 QHMs. The values obtained for the geomagnetic elements H, D, I, Z and F have been reduced to the middle of the year (geomagnetic epoch year.5) in which measurements were taken, by means of records provided by the Surlari geomagnetic observatory (IAGA code SUA). Results have been reported at MagNetE (a European initiative regarding repeat stations) meetings (see below). QHM measurements taken in the time interval 1980-2004 in the stations of the Romanian repeat station network have been processed to obtain a complex and detailed model of the lateral and temporal evolution of the horizontal component of the main geomagnetic field and of its secular variation. For magnetic mapping purposes, maps of the horizontal component for certain geomagnetic epochs and isopore maps for characteristic time intervals were presented (Demetrescu et al, 2010).

Published papers

Demetrescu, C., Ene, M., Dobrica, V., 2010, Geomagnetic field change in Romania, 1980-2004, *Romanian Journal of Physics*, online http://www.nipne.ro/rjp/accpaps/061-Demetr9aa1d0241cb9dce71485.pdf.

Conferences

Dobrica, V., Demetrescu, C., Ene, M., Soare, A., Cucu, G., The 2006 geomagnetic repeat station survey – Romania, *The 3rd Workshop on European Geomagnetic Repeat Station Survey, Bucharest, Romania, 2007*

Dobrica, V., Ene, M., Demetrescu, C., Soare, A., Cucu, G., Isac, A., The 2007-2008 geomagnetic repeat station survey – Romania. *4th MagNetE Workshop, 8-10 June 2009, Helsinki, Finland.*

A.2. ***Recent secular variation. New insights from long time series of observatory data***

The annual means from 24 observatories world wide with 100-150 years long time series were analyzed. The existence of high frequency secular variation ingredients at 11, 22 and ~80 years timescales, superimposed on a so-called steady variation that carries the largest part of the field has been revealed. These ingredients are highly significant in terms of secular variation at regional and local scale, as well as in defining the geomagnetic jerks. The analysis of 400 years-long declination time-series from three European locations (London, Munich, Rome) resulted in tracing back of the ~80-year variation to the 15th century and showed that what we called 'steady variation', based on 150 years of observatory data, proves to be only a part of a larger timescale variation, when 400 years of data are available. According to our results, the term 'jerk' loses its presently accepted meaning of sudden change in the temporal evolution of secular variation. A more complex concept in describing the secular variation of the main field, namely the superposition of several effects, corresponding to specific core processes at various time scales, should be used instead (Demetrescu and Dobrica, 2011). Also, data from the European network of geomagnetic observatories in the time interval 1960 –2004, have been processed to obtain a complex and detailed model of the lateral and temporal evolution of the main geomagnetic field and of its secular variation (Dobrica et al., 2011).

Published papers

Demetrescu, C., Dobrica, V., 2011, High-frequency ingredients of the secular variation of the geomagnetic field. Insights from long series of observatory data, *Physics of the Earth and Planetary Interiors*, under review.

Dobrica, V., Demetrescu, C., Stefan, C., 2011, Toward a better representation of the secular variation. Case study: the European network of geomagnetic observatories, *Annales Geophysicae*, under review.

Conferences

Dobrica, V., Demetrescu, C., On the 22-year variation seen in the observatory annual means of the geomagnetic field, *XXIV IUGG General Assembly, Perugia, Italia, 02-14 July 2007.*

Demetrescu, C., Dobrica, V., Zonal westward movement of short-term variations of the observed geomagnetic field. Consequences for core surface fluid flow morphology, *XXIV IUGG General Assembly, Perugia, Italy, July 02-14, 2007.*

Dobrica, V., Demetrescu, C., Mapping the secular variation. Significance of various trends in data. *EGU General Assembly, Vienna, Austria, April 13-19, 2008*.

Demetrescu, C., Dobrica, V., Long-term trends in geomagnetic observatory data: ingredients of the observed field, consequences on recent secular variation. *EGU General Assembly, Vienna, Austria, April 13-19, 2008*.

Demetrescu, C., Dobrica, V., Observatory data. Short-term components of the secular variation, *GeObMag - Anniversary Meeting of Surlari Geomagnetic Observatory, 2008.*

Demetrescu, C., Dobrica, V., High frequency secular variation as revealed by 150 years of observatory data and global geomagnetic field models. *The 33rd International Geological Congress (IGC), Oslo, Norway, August 6-14, 2008*.

Demetrescu, C., Dobrica, V., Văduva I., On the high frequency ingredients of the secular variation. *4th MagNetE Workshop, Helsinki, Finland, June 8-10, 2009*.

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B. Geomagnetic Observatories, Instruments and Standards

Surlari National Geomagnetic Observatory (SNGO), as a part of Global Magnetic Observatories Network, studies permanently the structure and complex phenomena of planetary magnetic field.

Research carried out at the observatory during its almost seventy years of continuous work has largely contributed to the Romanian geosciences field. Surlari National Geomagnetic Observatory takes part in many national, bilateral (Germany, Poland, Ukraine), regional or European cooperation programs, along with IAGA for momentary values, characterization indices of "magnetic status " and international reference geomagnetic field (IGRF).

Nowadays Surlari contributes also at some of the ways in which geomagnetism becomes useful in today's world:

- establishing global indices describing magnetic activity and finding other new parameters for an objective evaluation of the "magnetic status", important in the study of inductive effect in electric power transmission systems, of induction in long pipelines, as well as in communication system, satellite damage and tracking;
- quantification of geomagnetic storms which can create overburdens in national energetic system, in high frequency radio communications network, disruption of GPS or strong disturbances in the geomagnetic field with significant and yet incompletely known effect;

At the same time many studies reveal specific connections such as the well-known covariation of sunspot solar activity and geomagnetic disturbances or the possibility that the thermospheric heating by electric currents associated with magnetic storms may cause global modification of the atmospheric pressure and year-to-year changes in growing-season length, rainfall, thunderstorms and in the end, climatic variation in solar-weather relationship. These connections to global weather and with living organisms are future interesting directions for geomagnetic activity predictions at SNGO.

Since 1998, Surlari observatory is an IMO (INTERMAGNET observatory).

Lately the basic equipment of the observatory has been affected by significant physical and moral wear, especially under the context of rapidly developing technologies and of high performance acquisition process, so that the observatory risks to be excluded from the community of reference international stations.

Only during the summers 2006, 2007 and 2008 the reconstruction and the refurbish of the magnetic laboratories complex and the variometer room were carried out.

In the underground-variometer room and absolute measurements laboratory- electrical fittings, heaters, door hardware, were all carefully selected to be non-magnetic. Sand, gravel and other materials used in the construction of the buildings were carefully selected to be non-magnetic also. Buried power lines and signal cables, in carefully separated conduits, connect all laboratories in the compound with the main building.

Over the next years, the basic equipment of the observatory has been affected by significant physical and moral wear, especially under the context of rapidly developing technologies and of the high performance acquisition process, so that the observatory was faced a growing risk not to continue to be part of the INTERMAGNET observatory network.

It was maybe due to the hazard that our country was part of the European Union starting from 2007, just before our 65th Anniversary, in the 16th of October,2008. At that anniversary, the Helmholtz Centre Potsdam - GFZ German Research Centre for Geosciences agreed to become our partner in the frame of international cooperation. At that time Surlari Geomagnetic Observatory was well equipped with a THEO 010B / MAG01H DI-flux theodolite and a Geometrics G856 proton magnetometer for absolute measurements. But the continuous recording of the geomagnetic variations needed to be improved to meet really INTERMAGNET standard. Surlari had at that time a Bartington variometer for xyz only.

Since March 2009, in the frame of international cooperation, the Helmholtz Centre Potsdam – GFZ German Research Centre for Geosciences supports the Geological Institute of Romania to upgrade its traditional and reliable observatory for the up-to-date INTERMAGNET standard (a long collaboration existed also between Surlari Observatory and Adolf Schmidt Geomagnetic Observatory Niemegk-the observatory operates since the beginning continuously a classical set of photographic magnetographs Askania and Mating & Wiesenberg, Potsdam). The general objective of the project consisted in increasing competitiveness in order to maintain partnerships, as well as to add innovative products and services capable of meeting present and future requirements.

The installation of the new digital equipment was carried out on March, 2009 by two specialists from Niemegk observatory and all Surlari staff. GFZ supported Surlari with further software upgrades and preparation of definitive data.

Contribution of each partner was:

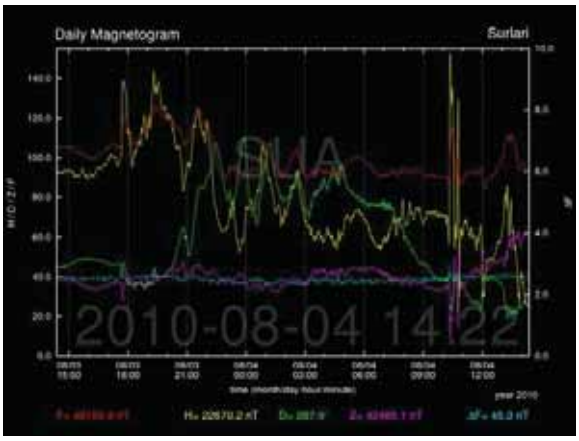
● from GFZ, as a gratuitous loan: a three-axial flux-gate magnetometer FGE, a data logger MAGDALOG-developed at the Geomagnetic Adolf Schmidt Observatory in Niemegk for the special purpose of data acquisition at a geomagnetic observatory, a GPS Receiver and fiber optical cables and several other components.

● from IGR-Surlari: an Overhauser proton magnetometer GEM Systems GSM90, two PCs, one operating under Linux and one under DOS, installation and maintenance of the local area network (LAN), which allows the joint operation of both PCs to store the variometer data and reduce absolute measurements and installation and maintenance of a suitable uninterruptible power supply unit to guaranty a permanent operation of the magnetic measurement instruments and the data logger.

With this upgrade, a long tradition of cooperation between Niemegk and Surlari observatory has been continued. GFZ supports Surlari with further software upgrades and preparation of definitive data. In that way, for another long-term geomagnetic observatory with real-time data on INTERMAGNET web site, the status of an IMO has been and will be applied.

Surlari observatory operates now more than one variometer, so an inter-comparison can be carried out. It is possible to detect problems of one of the variometers as base line jumps or drifts, scale value errors or internal or external perturbations.

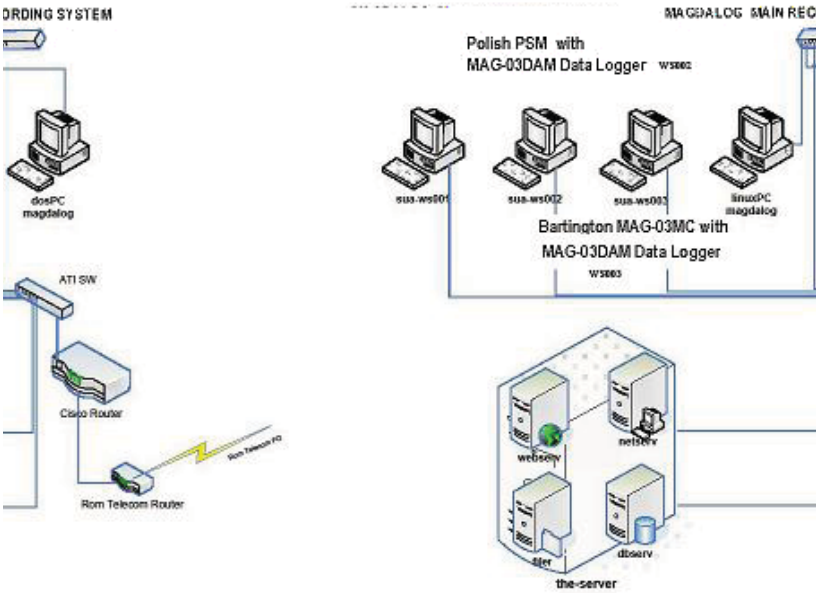
The daily plot of delta-F is used to identify problems in FGE vector variometer. Jumps, spikes or drifts indicate problems of the base line values, scale values and internal or external magnetic perturbations.



Plot of MAGDALOG-24 hours of Surlari observatory, displaying the vector variometer components H, D and Z, the independently recorded total intensity F and Delta-F calculated as Delta-F = sqrt(H^2 + Z^2) – F.

Starting from May 2009, a close collaboration with Belsk observatory was kept. A PSM magnetometer based on Bobrov's torsion quartz variometers was added as the second spare recording system in Surlari.

Especially useful is the existence of PSM and Bartington old variometers, based on different measurement principles or produced by different manufacturer (see below Surlari's new acquisition network).



The base line of these instruments is determined by means of regular DI-flux measurements. The observatory staff was hardly trained to carry out the D and I absolute measurements by means of Bartington THEO 010B DI-Flux instrument. They were also instructed to reduce the measurements by means of EXCEL tables, which were also provided by GFZ Potsdam. Data are transmitted in 1-hour blocks and full remote control via Internet. The comparisons of the old and modern systems and the first results of the absolute measurements reductions are made daily and monthly as an evaluation of Data Quality. Focus is now shifting to a high resolution magnetic observatory.

References

Dumitras C., Asimopolos L., Niculici E., Pestina A., Soare A., Cucu G., Isac A., Plati M., Simion E., 2008, Establish the location of geomagnetic station for absolute calibration in repetition national network, The 3rd Anniversary Symposium- GeObMag 2008 – Surlari National Geomagnetic Observatory "Liviu Constantinescu" – 65 years of continuous work, 16- 18th October 2008", Bucharest, Romania;

Isac, A., Mandea, M., Linthe, H.J., 2009, „Surlari Observatory: where we have been and where we are", IAGA 11th Scientific Assembly, Sopron, Hungary;

Mandea M., Isac A., 2010, „Geomagnetic Field, Measurement Techniques" chapter in Encyclopedia of Solid Earth Geophysics, Harsh K. Gupta (ed.), Springer Science Business Media B.V., http://publications.copernicus.org/, DOI 10.1007/978-90-481-8702-7, (in press);

Niculici E., Pestina A., Asimopolos L., 2008, Modalities for Establish the Base Line of Geomagnetic Records Affected by Antropic Noises, The 3rd Anniversary Symposium – GeObMag 2008 - – Surlari National Geomagnetic Observatory "Liviu Constantinescu" – 65 years of continuous work, 16- 18th October 2008, Bucharest, Romania;

Pestina A. M, Asimopolos, L., Niculici, E., Iancu, L., 2009, Comparative Analysis of Geomagnetic Data Acquired with Different Equipment in the Surlari Observatory, GEO 2009 – The scientific meeting of the Faculty of Geology and Geophysics, University of Bucharest, 20-21 May 2009, Romania;

Soare A., Cucu, G., Isac, A., 2007, – Surlari National Geophysical Observatory – fundamental station for the national geomagnetic network, The 3rd MagNetE Workshop on European Geomagnetic Repeat Station Survey, 2005-2006, Bucharest, Romania;

This report was prepared by Andrei Soare, Anca Isac and Gabriela Cucu

Working Group V-DAT: Geomagnetic Data and Indices

Surlari National Geomagnetic Observatory, founded on October 16, 1943 by the Geological Institute of Romania, celebrated the 65th years of continuous work in October 2008. The main topics of the Symposium and Workshop were the practical and theoretical problems associated with observations of the natural geomagnetic field at geomagnetic observatories.

Sessions and Workshops were planned on:

1. Magnetic Observatories: from compass to flux-gate epoch;

2. From deep core to space: long term and short term variations of geomagnetic field;

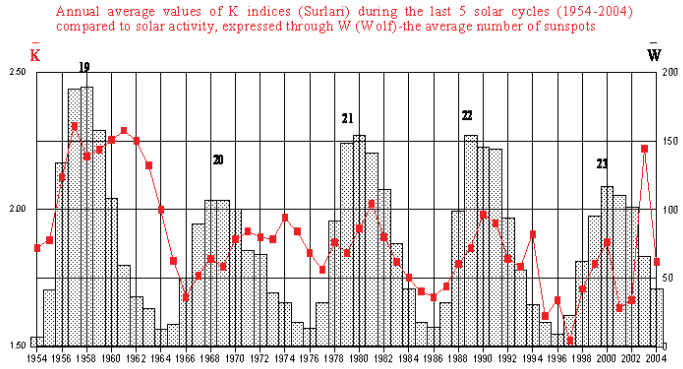
3. Magnetic Observatories and Satellites: a needed synergy to characterize the geomagnetic field;

The intent was to stimulate participant discussions in aim of the exchange of information and experience related to the methodology of such observations. Contributors were invited for poster and oral presentation in the areas of observatory practice and application relating to observatory data (space weather, solid Earth studies, etc.)

Magnetic activity is due to the part of transitory geomagnetic field that has exclusively external sources, mainly the corpuscular radiation of the sun. It develops either series of

irregular fluctuations as intensity and periodicity, or singular phenomena with a morphology typified through international agreements. Evaluation proceedings for magnetic activity are used to study the ionosphere phenomena with prolongations in outer space, their inductive effects inside the Earth, but also the possible criteria for the prediction of major disturbance sequences and implicitly the possibilities of warning their incidence. Application of these procedures is specific to geomagnetic observatories, which dispose of long time series and they follow, in the first stage, the dissociation between geomagnetic variations due to the corpuscular flux of the Sun or to undulatory radiations. The world geomagnetic observatories community whereby Surlari National Geomagnetic Observatory (SNGO) belongs has been especially concerned by the quantification of Earth's "magnetic state "evolution through more and more objective indices of characterization.

Examination of the geomagnetic activity over 5 solar cycles leads to the conclusion that the amplitude of current geomagnetic activity can provide global information on the solar cycle character in the next 6-8 years, especially that at present we are in a minimum of the activity, at the borderline separating the end of a solar cycle and the beginning of another, more specifically on the decreasing slope of the 23 cycle. There is a about 6 years difference between the maximum values of geomagnetic activity in the previous cycles and the maximum values in solar activity (seen in the figure below).



The disturbing phenomena rendered evident through K indices have larger frequency and amplitude during the periods of high solar activity, corresponding to the well known 11 years solar cycle.

In 65 years of continuous work, comprising over six cycles of solar activity, Surlari have delivered a consistent time series data base which, analysed through specific proceedings, may suggest several evaluation criteria for the incidence of major magnetic perturbations and in the forecast of solar activity.

Two of the most used space weather indices are smoothed sunspot number (SSN/W) and the geomagnetic planetary A index (Ap) with its logarithmic cousin Kp, give a measure of the storminess of the Earth's magnetic field. Many studies, carried out by Surlari's staff present results about magnetic activity based on the analysis of the Surlari magnetic data, especially K provisional data series which have similar statistical properties as the definitive ones, Kp. Precursor methods for the prediction of maximum amplitude of the solar cycle have previously been found to provide the most reliable indication for the size of the following cycle, years in advance. The newer precursor methods are based on the size of the geomagnetic index maximum, which, since cycle 12, has always occurred during the declining portion of the solar cycle, usually several years before subsequent cycle minimum.

As a result of their unique temporal and local coverage, these remarkable data series of Surlari National Geomagnetic Observatory, allow for instance statistical studies over long time periods (about 55 years in the cases of *a, K* and *ssc, sfe*) of the solar wind - magnetosphere coupling. It is then possible to characterize the physical processes driving the

coupling and its dependence on solar wind parameters. Because they provide a continuous monitoring of the magnetic signatures of processes taking place in the ionosphere and magnetosphere, geomagnetic indices are basic data in the development of 'Space weather' research.

Thus, for solar flare effects (sfe), statistical study reveals that out of 2015 singular phenomena, 1765 were followed by magnetic storms at time intervals between 12-48 hours. Considering the same recording period, the cycles of magnetic storms registered at Surlari showed recursive phenomena after 25 days for 65% of it, after 50 days for 30% of it, this phenomenon being more striking in the years with maximum of solar activity when the persistency of sun spots was obvious.

Understanding magnetic storms is important for risk mitigation. Storm-induced currents in the crust can be a nuisance for electric-power industry, since they can find their way into power lines and transformers through ground connections. Magnetic storms interfere with magnetic crustal surveys undertaken for mapping and mineral exploration, and they interfere with in situ magnetic orientation systems used for directional drilling. During magnetic storms, long-distance radio communication can be difficult and the accuracy of global positioning systems can be reduced. In space, satellite electronics can be damaged and satellite orbital drag enhanced. Astronauts and high-altitude pilots might be subjected to increased radiation. The standard measures of magnetic storm-size are defined using magnetic-observatory data.

Despite the stationary continuous recordings of geomagnetic field - which started in 1943 at Surlari and in variometer stations: Deva (1972-1981), Dreptu (1987-2000), Miorcani (2008-), and the temporary recordings initiated between 1966 – 1972 in more than 200 mobile stations distributed all over the country, until today no systematic preoccupations have existed in Romania regarding the effects of geomagnetic phenomena on human activity.

At present, a data base adequately structured, as well as a methodological experience in processing phenomena with large enough spatial distribution and spectrum of periods, will bring information of high interest not only in warning criteria for the magnetic status evolution but also in the factors correlating these with some human activities.

Real-time observatories, like SUA-Surlari National Geomagnetic Observatory, must be used for low-cost monitoring or "nowcasting" of Space Weather. And historical observatory data enable statistical studies of how storms are distributed in time and how big they can be.

At present, a data base adequately structured, as well as a methodological experience in processing phenomena with large enough spatial distribution and spectrum of periods, will bring information of high interest not only in warning criteria for the magnetic status evolution, but also in the factors correlating these with some human activities.

References

Asimopolos L, Pestina A.M., Niculici E., 2008, – Statistical Analyses of Geomagnetic Field from Database over Six Decades at Romanian Geomagnetic Observatory, IAGA WG 1.2 on Electromagnetic Induction in the Earth, 19th Workshop, Beijing, China;

Asimopolos L., Niculici E., Pestina A., 2008, Analyses in Space –Time and Frequency Domains of Geomagnetic Data. Geo 2008 The Scientific Meeting of the Faculty of Geology and Geophysics, University of Bucharest, Romania;

Asimopolos L., Pestina A., Niculici E., Soare A., Cucu G., Isac A., Dumitras C., 2008, Analyse of geomagnetic field from data acquisitioned at Surlari National Geomagnetic Observatory, The 3rd Anniversary Symposium- GeObMag 2008 – Surlari National Geomagnetic Observatory "Liviu Constantinescu" – 65 years of continuous work, 16- 18th October 2008", Bucharest;

Asimopolos, L., Pestina A. M., 2009, Temporal, spectral and wavelet analysis applied for geomagnetic data, 9th SEGJ International Symposium- Imaging and Interpretation- Sapporo, Japan;

Asimopolos, L., Pestina A. M., 2009, Complex analysis of geomagnetic field, International symposium "Mineralogy and geodiversity", Bucharest, Romania;

Asimopolos, L., Pestina A. M.,Dumitras, C., 2009, Wavelet Analysis Of Geomagnetic Data, GEO 2009 – The scientific meeting of the Faculty of Geology and Geophysics, University of Bucharest., 20-21 May 2009, Romania;

Asimopolos, L., Asimopolos, N.S., Pestina A. M., 2010, Analyses of geomagnetic field for a long period from Geomagnetic Observatories, Chinese Journal of Geophysics (in press);

Asimopolos, L., Cristea, P., Vijdea, A.M., Pestina A. M., 2010, Environmental activity in Geological Institute of Romania, Proceedings of the 9th SEGJ International Symposium- Imaging and Interpretation- Sapporo, Japan.

Iancu, L., 2010 - "Contributions to Diurnal Variations of Geomagnetic Field, using Geomagnetic Observatories' Data", master dissertation at Faculty of Geology and Geophysics, University of Bucharest, Bucharest, Romania;

Isac A., Cucu G., Soare A., 2008, Evaluation and prediction criteria for magnetic activity, GEO 2008, The scientific meeting of the Faculty of Geology and Geophysics, University of Bucharest, Romania, Abstract volume, GEO 2008, ISBN: 978-973-7600-49-3;

Isac, A., Linthe, H.J., Mandea, M. Iancu, L., 2010, „Surlari Observatory's data improvements, 2008-2009", The XIVth *IAGA Workshop* on Geomagnetic Observatory Instruments, Changchun, Jilin Province, CHINA;

Iancu, L., Isac, A., 2010, „The geomagnetic perturbations produced by one of the most powerful solar flare on record-the bright blip near the sun's middle, on October 28, 2003", The scientific meeting of the Faculty of Geology and Geophysics, University of Bucharest, GEO 2010, Bucharest, Romania;

Niculici, E., Pestina A. M, Asimopolos, L., Iancu, L., 2009, Geomagnetic non-periodic phenomena produced during 2007 on the Earth, GEO 2009 – The scientific meeting of the Faculty of Geology and Geophysics, University of Bucharest, 20-21 May 2009, Romania;

Pestina A., Asimopolos L., Niculici E., 2008, Geomagnetic Stroms Analyses and Corelation between Observatories, The 3rd anniversary symposium – GeObMag 2008 - – Surlari National Geomagnetic Observatory "Liviu Constantinescu" – 65 years of continuous work, 16- 18th October 2008, Bucharest, Romania;

Pestina A., Asimopolos L., Niculici E., 2008, Emergence Frequency Analyses of Geomagnetic Storms from Data Acquisitioned in Long Time at Surlari National Geomagnetic Observatory, GEO 2008 - The Scientific Meeting of the Faculty of Geology and Geophysics, University of Bucharest, Romania;

Reda J., Fouassier D., Isac A., Linthe H.J., Matzka J., Turbitt C., 2010, IAGA Special Sopron Book Series, Data Quality chapter, „Improvements in geomagnetic observatory data quality", ed. Springer (in press);

Soare A., Isac A., Cucu G., Asimopolos L., Pestina A., Niculici E., 2008, Geomagnetic activity, evaluation and some prediction criteria in the forecast of solar activity, using Surlari K-index , covering the period 1954 to 2008, The 3rd Anniversary Symposium- GeObMag 2008 – Surlari Nationl Geomagnetic Observatory "Liviu Constantinescu" – 65 years of continuous work, 16- 18th October 2008", Bucharest, Romania;

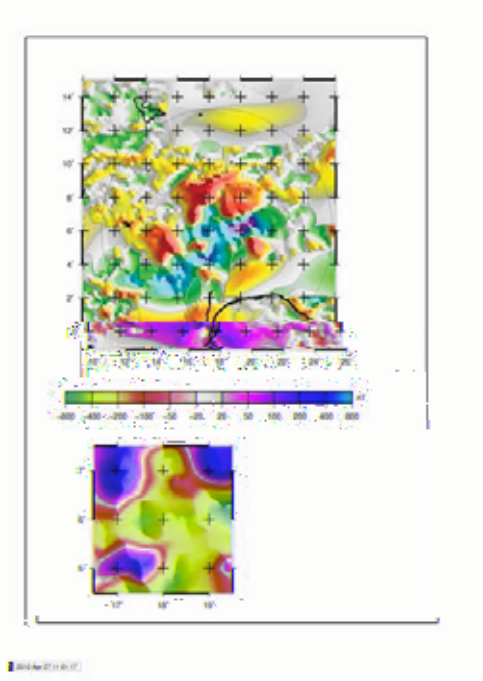
This report was prepared by Andrei Soare, Anca Isac and Gabriela Cucu

Working Group V-MOD: Geomagnetic Field Modelling

The terrestrial planets are open systems and impacting was and it can be a very important process for planetary evolution. Earth has an active dynamo, however neither Moon and Mars have an active one. The magnetized rocks in their crusts suggest that in their earlier history, dynamos may have been operating in the metallic core of these bodies. Because of its

large iron core the possibility of an ancient operating Martian dynamo is more likely, but the small lunar core and the age of the magnetized lunar rocks, have brought in debate a possible dynamo origin of lunar magnetism. The magnetic fields have been observed at global scale only for the Earth, Mars and Moon, and very conspicuous magnetic anomalies have been observed on these three bodies. For this study, we have used the largest impact structures for the Earth, Mars and Moon. Thereafter, we have extended our work to smaller terrestrial impact craters (>30 km diameter), cataloging them in order to obtain information about the impact crater magnetic signatures, positions, shapes and diameters.

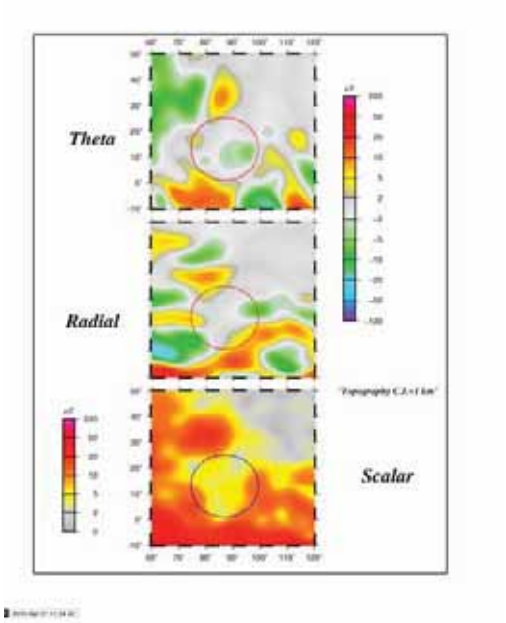
Earth retains the poorest record of impact craters amongst terrestrial planets. Many impact structures are covered by younger sediments, others are highly eroded or heavily modified by erosion, only few impact craters being well preserved on the surface. Vredefort is Earth's oldest and largest impact structure, and so it is our best analogue for the giant Martian impact basins. The crater has a diameter of roughly 250 - 300 km, larger than the 200 km Sudbury Basin and the 170 km Chicxulub crater, and their magnetic signature has been discussed previously. However, one of the most intriguing potential impact structure is the Bangui magnetic anomaly. This feature is one of the largest terrestrial magnetic anomalies, and covers most of the Central African Republic.



The Bangui magnetic anomaly is coincident with a 120 mGal Bouguer gravity anomaly. Low resolution topographic data suggests the presence of a 810 km diameter ring around the magnetic and gravity anomalies (Girdler et al., 1992). The rocks exposed near the center of the anomaly are Late Archean in age. Using the WDMAM, the situation was shown on the left side.

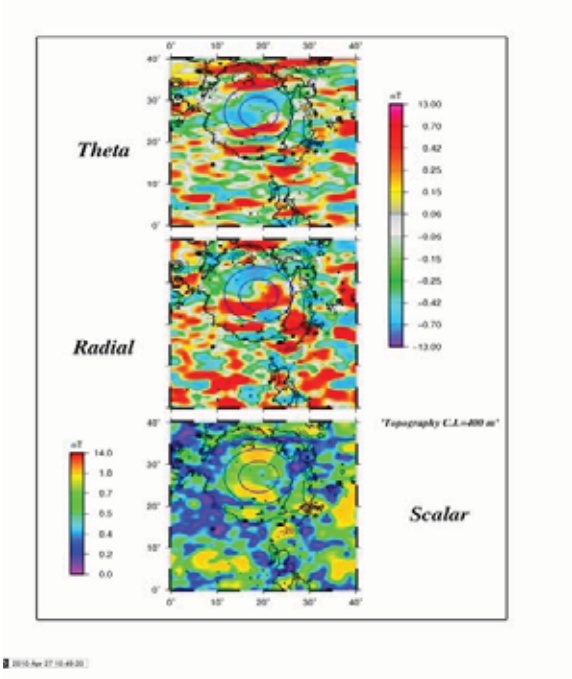
A systematic search for Quasi-Circular Depressions was carried out by superposing LOLA gridded topography on Lunar Prospector magnetic maps for the Moon and Mars Orbiting Laser Altimeter (MOLA) gridded data on Mars Global Surveyor magnetic data for Mars. The results obtained for Mars and the Moon, and for a larger number of craters, allow to have a statistical view of the geodynamical parameters.

MGS mission revealed the complex nature of the lithospheric magnetic field of Mars. Intense anomalies are located above the southern cratered highlands, while some giant impact basins (Hellas, Argyre, Utopia, and Isidis) and the northern smoothed lowlands do not show significant anomalies. The magnetic signatures near Mars reveal that it has no internal dynamo magnetic field at the present time.



The martian ionospheric magnetic field is dynamic and as yet poorly understood and complicates our ability to extract the crustal field. We superimposed on the magnetic anomaly maps of Lillis et al. (2010) the locations of the circular crater rims with diameters larger than 400 km (MOLA's altimetry data). Isidis, shown here, is one of several very large craters on Mars with weaker magnetic fields inside the crater rim, suggesting the absence of a dynamo field when this impact occurred (fig.left).

Proposed sources of the lunar crustal magnetization include the solar wind magnetic field, the geomagnetic field, transient magnetic fields produced by impacts, and a lunar dynamo. Analyses of the magnetic anomalies may provide insight into the possible existence of a former core dynamo if the anomalies within the basins are produced by crustal thermoremanent magnetization. It is possible that the processes that formed these features may also have magnetized the crustal rocks.



A magnetic model of the lunar crust from Purucker (2008) was utilised to show the magnetic fields in and around Serenitatis, one of the largest multi-ring basins of Nectarian age. Stronger magnetic fields are evident inside the basin rim, especially between the inner and outer rings. The stronger magnetic fields may be a consequence of cooling of a melt sheet after the impact in the presence of an ambient magnetic field, perhaps associated with a lunar dynamo (fig.left).

The magnetic signature of terrestrial impact structures is the combined effect of the disruption of the main magnetic field due to the shock or/and thermal magnetization and high-amplitude and short wavelength magnetic anomalies in the center of large impact structures.

The aim of the analysis was to identify demagnetization and magnetization signatures associated with impact, and to compare and contrast those signatures across the terrestrial planets and Moon.

References

Isac A., Mandea M., Purucker M., 2009, „How impacts have shaped the magnetic field of Earth, Mars and Moon", Proceedings of ESA's Second Swarm International Science meeting, http://www.esa.int/esapub/pi/proceedingsPI.htm, or www.congrex.nl/09c24/S2_Posters/S2_P04_Isac_paper.pdf;

Isac, A., Mandea, M., Purucker, M., 2010, „Impact structures seen by magnetic anomaly maps", 2010, EGU General Assembly, Vienna, Austria;

This report was prepared by Anca Isac

INTER-ASSOCIATION BODIES

Working Group on Electromagnetic Studies of Earthquakes and Volcanoes (EMSEV)

The electromagnetic studies were carried out byt the Institute of Geodynamics of the Romanian Academy (IGRA). During the IAGA period 2007 – 2011, the electromagnetic researches have included the following activities:

1. Modeling of block and fault system related to the geodynamic active Vrancea zone:
    - Elaboration of the 2D and 3D electromagnetic tomographic images of the block and fault systems in the seismic-active Vrancea zone (Eastern Carpathians-Romania) in order to emphasize the geodynamic torsion process of the relic slab;
2. Assessment of the electromagnetic precursory parameters associated to both the earthquakes characteristic to the seismic-active Vrancea zone and the landslides associated to the active faults, by emphasizing:
    - Time series of the precursory parameter Bzn (daily mean values) related to the Vrancea intermediate depth earthquakes;
    - Real time distributions of the parameters skew, strike, anisotropy and resistivities ($\rho\perp$ and $\rho_{||}$), associated to the landslide activity in the Provita de Sus - test site;

The time series of the parameter Bzn (daily mean values) have been used in order to emphasize its precursory character related to the intermediate depth earthquakes occurred in the Vrancea zone. With some days before an EQ occur this parameter has un anomalous behavior marked by a significant increase, in respect with its pattern establish in non

geodynamic condition, as a result of the electrical conductivity changes that may be associated with the dehydration-induced faulting processes and fluid mitigation through the faulting system developed inside the seismogenic volume and its neighboring areas.

As regards landslide activity, by using a specific ground-base monitoring system, the following activities have been accomplished: (i) optimization of the specific sensors structure in laboratory and field conditions; (ii) experiment and continuous improvement of the specific ground-base monitoring system at the peculiar conditions of the Provita de Sus -test site for pattern recognition; (iii) getting of the specific data to produce two-dimensional tomographic images as a first step for the risk assessment; (iv) assessment of the electromagnetic parameters related to both the earthquakes characteristic to the seismic-active Vrancea zone and the landslides associated to the active fault. The final results highlight the possibility of merging electromagnetic parameters with tomographic images and with low frequency electric signals occurred prior the stress to reach a critical value. Subsequently, in the Provita de Sus test site, after implementing this complex monitoring system, it was possible to provide early-warning against the risk arising from landslide triggered by the earthquakes occurred in the Vrancea zone.

I. Papers published /in print):

1. D. Stanica and Maria Stanica, Electromagnetic monitoring in geodynamic active areas, Acta Geodinamica et Geomaterialia, Vol.4, No.1(145), 99-107, Prague, 2007.

2. D. STANICA and M. STANICA, Modeling of Block and Fault Systems of the Active Vrancea Zone (Eastern Carpathians-Romania); Evidence of the Geodynamic Torsion Process, the Ninth Workshop on Non-linear Dynamics and Earthquakes Predictions The Abdus-Salam International Centre for Theoretical Physics (ICTP), 01-13 Oct. 2007, electronic paper (11 pages as Pdf.), http://www.agenda.ictp.trieste.it/ smr.php? 1864-3

3. D. Stanica, M. Stanica, and C. Diacopolos, Real time Ground-base monitoring system for earthquakes and associated natural hazards assessment and risk mitigation, the Ninth Workshop on Non-linear Dynamics and Earthquakes Predictions, the Abdus-Salam International Centre for Theoretical Physics (ICTP), 01-13 Oct. 2007, electronic paper (11 pages as Pdf.), http://www.agenda.ictp.trieste.it/smr.php?1964-1

4. D. Stanica and M. Stanica, Specific electromagnetic approaches related to the short - term precursory parameters associated to intermediate depth earthquakes (Vrancea zone, Romania), the Ninth Workshop on Non-linear Dynamics and Earthquakes Predictions, the Abdus-Salam International Centre for Theoretical Physics (ICTP), 01-13 Oct.2007, electronic paper (11 pages as Pdf.), http://www.agenda.ictp.trieste.it/ smr.php?1964-2

5. D. Stanica and D. A. Stanica: Relationship Between the Deep Structure and Geodynamics of the Carpathians' Arc Bend, 19-th IAGA -WG1.2. Workshop on Electromagnetic Induction in the Earth, electronic paper, Vol.1, S1.2_E05, 137-142, Beijing, 2008, http://www.19emiw.cn/Abstracts_Vol_1.pdf

6. Stanica D, Stanica D.A., 2009, Carpathian electrical conductivity anomaly (CECA) acting as high sensitive path to emphasize the EM precursory parameters associated to seismic events. Extended abstract in: Papers Collection of the 9 th International Geo-electromagnetic Workshop (CIGEW), China, 4-7.

7. Stanica D.A., Stanica Maria, Diacopolos C, 2009, Electromagnetic responses in the seismic induced landslides areas. Extended abstract in: Papers Collection of the 9th International Geo-electromagnetic Workshop (CIGEW), China, 8-11.

8. Stanica D, Stanica D.A., 2010, Constraints on correlation between the anomalous behaviour of electromagnetic normalized functions (ENF) and the intermediate depth seismic events occurred in Vrancea zone (Romania), Terr. Atmos. Ocean. Sci., 21, 675-683, doi: 10.3319/TAO.2009.09.09.01(T).

9. Dragos Armand Stanica, Analysis of electromagnetic data related to significant earthquakes occurred in February-March period, 2010, in Vrancea zone, Extended abstract in: Abstract Volume, at Workshop on

"Electromagnetic Signals Associated with Earthquakes and Volcanoes" October 3-6, 2010, Chapman University, Orange, CA, USA.,81-84

10. Dragos Armand Stanica and Dumitru Stanica, Specific ground-based monitoring system for landslides activity, Romanian Journal of Geophysics (Rev. Roum. GEOPHYSIQUE), 2010, in print.

II. Abstracts and conferences attended:

1. Dumitru Stanica and Dragos Armand Stanica, An improved geodynamic model for the seismic active Vrancea zone, Romania, EGU, Geophysical Research Abstracts, Volume 10, Vienna, Austria, 2008, ISSN: 1029-7006.

2. Dumitru Stanica, Dragos-Armand Stanica, Nicoleta Vladimirescu and Marian Popescu: Ground-based monitoring technique used to emphasize the precursory electromagnetic marks associated to the Vrancea's intermediate depth earthquakes (Romania), EGU, Geophysical Research Abstracts, Volume 10, Vienna, Austria, 2008, ISSN: 1029-7006.

3. Dragos Armand Stanica, Dumitru Stanica and Constantin Diacopolos, Real–time monitoring system for risk mitigation due to the landslides triggered by seismic activity, 33rd International Geological Congress, Oslo, August 2008.

4. Dumitru Stanica and Maria Stanica, Geodynamic torsion process of the seismogenic relic slab and the intermediate depth seismicity of the Vrancea zone, EMSEV-DEMETER joint workshop, Program and Abstracts,1.1, 19, Sinaia, September, 2008 (în Pdf. format pe http://www.geodin.ro/ ~prezentare/EMSEV/emsev.html).

5. D. Stanica, D.A. Stanica, N. Vladimirescu and M. Popescu, Short-term EM precursory parameters related to the intermediate depth Earthquakes, EMSEV-DEMETER joint workshop, Program and Abstracts, 2.14, 36, Sinaia, September, 2008 (in Pdf. format pe http://www.geodin.ro/~prezentare/ EMSEV/emsev.html).

6. D. A. Stanica, D. Stanica and C. Diacopolos, Ground-base monitoring system for the natural hazards assessment due to landslide activity, EMSEV-DEMETER joint workshop, Program and Abstracts, 6.2, 75, Sinaia, September, 2008 (în Pdf. format pe http://www.geodin.ro/~prezentare/ EMSEV/emsev.html).

7. Dumitru Stanica, Armand Stanica and Marian Popescu, National Geophysical Observatory Surlari used for monitoring of the Electromagnetic Prercursory Parameters Related to Intermediate Depth Earthquakes, 3rd Anniversary Symposium GeObMag 2008, proceedings, p.22-26, Bucharest, October 2008

8. D. A. Stanica and D. Stanica, A specific ground-base monitoring system for the landslides activity, 19-th IAGA -WG1.2. Workshop on Electromagnetic Induction in the Earth, Vol.1, S1.1_S10, 92, Beijing, October 2008

9. D. Stanica, D. A. Stanica, M. Popescu, N. Vladimirescu: Surveying the seismic hazard by using ground based analysis of Earth's electromagnetic field, EGU, Geophysical Research Abstracts, Volume 11, April, Vienna, Austria, 2009, ISSN: 1029-7006.

10. D.A. Stanica, M. Stanica and C. Diacopolos: Electromagnetic studies on geodynamics related to the landslides associated to the seismic events, EGU, Geophysical Research Abstracts, Volume 11, April, Vienna, Austria, 2009, ISSN: 1029-7006.

11. M. Stanica and D. Stanica: Vrancea zone geodynamics and the explanation of the earthquakes mechanism, Abstracts Volume at JPGU Meeting, May 2009, Chiba, Japan.

12. D. Stanica and M. Stanica: Electromagnetic methodology on seismic hazard assessment, Abstracts Volume at JPGU Meeting, May 2009, Chiba, Japan

13. Dumitru STANICA and Maria STANICA : Earthquake-induced landslides geohazard assessment (south Subcarpathians) by using electromagnetic data, Abstract Volume IAGA meeting, August 23-30, 2009, Sopron, Hungary.

14. Dragos Armand Stanica, Near-Real Time Analysis of the Electromagnetic Precursors for Seismic activity, AOGS, Program and Abstracts, IWG07, p343, Singapore, 2009, ISBN 978-981-08-2846-2.

15. Dumitru Stanica and Dragos Armand Stanica, Electromagnetic pre-seismic responses associated with the intermediate depth earthquakes, EGU, Geophysical Research Abstracts, Volume 12, May, Vienna, Austria, 2010, ISSN: 1029-7006.

16. Dragos-Armand Stanica, Dumitru Stanica and Constantin Diacopolos, Landslides induced by earthquakes reflected by electric and electromagnetic data, EGU, Geophysical Research Abstracts, Volume 12, May, Vienna, Austria, 2010, ISSN: 1029-7006.

17. Dumitru Stanica, Dragos Armand Stanica, EM pre-seismic responses related to the intermediate depth earthquakes occurred in the active Vrancea zone, Romania, Abstracts Volume at JPGU Meeting, May 2010, Chiba, Japan.

18. Dragos Armand Stanica, Dumitru Stanica, EM images used for emphasizing the tectonically-induced electrical conductivity anomaly by the Trans-European Suture Zone in Romania, Abstracts Volume at Japan Geophysical Union Meeting, May 2010, Chiba, Japan.

19. Stanica Dumitru and Stanica Dragos Armand, Investigation of the electromagnetic anomalies induced by intermediate depth earthquakes (M > 4) occurred in Vrancea zone, Abstract Volume, at Workshop on "Electromagnetic Signals Associated with Earthquakes and Volcanoes" October 3-6, 2010, Chapman University, Orange, CA, USA.

This report was prepared by Dr. Dumitru Stanica and Dragos Armand Stanica

ROMANIAN ACADEMY
ROMANIAN NATIONAL COMMITTEE OF GEODESY AND GEOPHYSICS

INTERNATIONAL ASSOCIATION OF GEODESY

NATIONAL REPORT
ON GEODETIC AND GEOPHYSICAL ACTIVITIES

2007 – 2011

Prepared for the XXVth IUGG General Assembly

Melbourne, 2-13 July, 2011

BUCHAREST
2011

Romanian IAG Committee

President

Prof. Dr. Johan NEUNER
Technical University of Civil Engineering
Bucharest

Phone: +40-21-243 36 21
Fax: +40-21-242 07 93
E-mail: hneuner@gmail.ro

Members

Prof. Dr. Constantin MOLDOVEANU
Technical University of Civil Engineering
Bucharest

Phone: +40-21-243 36 21
Fax: +40-21-242 07 93
E-mail: c.moldoveanu@gmail.ro

Dr. Lucian BESUTIU
Institute of Geodynamics "Saba Stefanescu"
Romanian Academy

Phone: +40-21-317.21.27
Fax: +40-21-317.21.20
E-mail: besutiu@geodin.ro

Secretary

Dr. Tiberiu RUS
Technical University of Civil Engineering
Bucharest

Phone: +40-21-243 36 21
Fax: +40-21-242 07 93
E-mail: rus@utcb.ro

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Contributions in Geodesy

Section I: POSITIONING AND REFERENCE FRAMES

1. Background

For the time interval 2007-2010 geodetic activities in Romania were in progress according to the economy and social situation. Economical development in our country after integration into European Union concluded to some positive effects mainly for the time interval 2007-2009. The professional bodies reorganized and for geodetic activities the Geodesists Order was created by Law 17/2006 for organizing the geodesists profession according to the Law 7/1996 – Cadastre and Real Estate law. A drawback on this activity was done by suspending the Geodesists Order Law.

The National Agency for Cadastre and Land Registration (NACLR) under Ministry of Administration and Interior is the state responsible institution for geodetic and mapping activities in Romania. From a self financing public institution NACLR was transformed since 2009 in a state budget institution. NACLR includes the national mapping activities and 42 Cadastre and Land Registration Offices. As research and production institution acts the National Centre for Geodesy, Cartography, Photogrammetry and Remote Sensing. Due to the difficult economical situation, in 2009 and 2010, NACLR was reorganized by decreasing the employees number.

2. Global Navigation Satellite System (GNSS) Network

According to the global and European trends in the field of modern geodetic networks, Romania followed this trend by promotion and implementation of a new high accurate geodetic network in the time interval 2007-2010. The new geodetic network it is build as an active continuously operating network. As technological equipments the GNSS (GPS and GPS+GLONASS) receivers are included into the network.

Starting 1999, when it was installed the first GPS permanent station in Romania at the Faculty of Geodesy - Technical University of Civil Engineering Bucharest (BUCU) in cooperation with Federal Agency for Cartography and Geodesy Frankfurt a.M. (Germany), the new methods of global satellite positioning were introduced in Romania.

In 2001 the National Office for Cadastre, Geodesy and Cartography (reorganized in 2004 as National Agency for Cadastre and Land Registration) installed 5 GPS permanent stations in Braila, Suceava, Cluj, Sibiu, Timisoara (BRAI, SUCE, CLUJ, SIBI, TIMI) as a necessity for the precise geodetic measurements in the area. Romania as a CERGOP (Central European Regional Geodynamic Project) country member installed two GPS permanent stations in Craiova and Constanta in 2004 (CRAI, COST). In 2005 the continuously modernization of the National GNSS Permanent Network consisted in the installation of 5 new GPS permanent stations in Bacau, Deva, Baia Mare, Oradea and Sfântu Gheorghe (BACA, DEVA, BAIA, ORAD, SFGH). With their own funds or from PHARE and World Bank the GNSS network was continuously extended by the National Agency for Cadastre and Land Registration (NACLR) in 2007-2010. At the end of 2010 the Romanian GNSS permanent network included 60 GPS and GNSS permanent stations installed by NACLR and one GNSS permanent station installed at the Faculty of Geodesy, Technical University of Civil Engineering Bucharest Bucharest. The EUREF(EPN) station BUCU was introduced into the IGS network since 2005 and was modernized in 2008 with the help of the Federal Agency for Cartography and Geodesy Frankfurt a.M. (Germany). Other 6 stations were modernized in

2009 by replacing old equipments (Leica System 530) with new equipments (Leica 1200 GNSS+, AR25 antennas).

Romania it is member of the EUPOS (European Position Determination System) organization contributing to the standards adopted by members from 18 Central and East European countries and EUPOS infrastructure by realizing *ROMPOS (Romanian Position Determination System)* based on the 60 GPS and GNSS permanent stations.

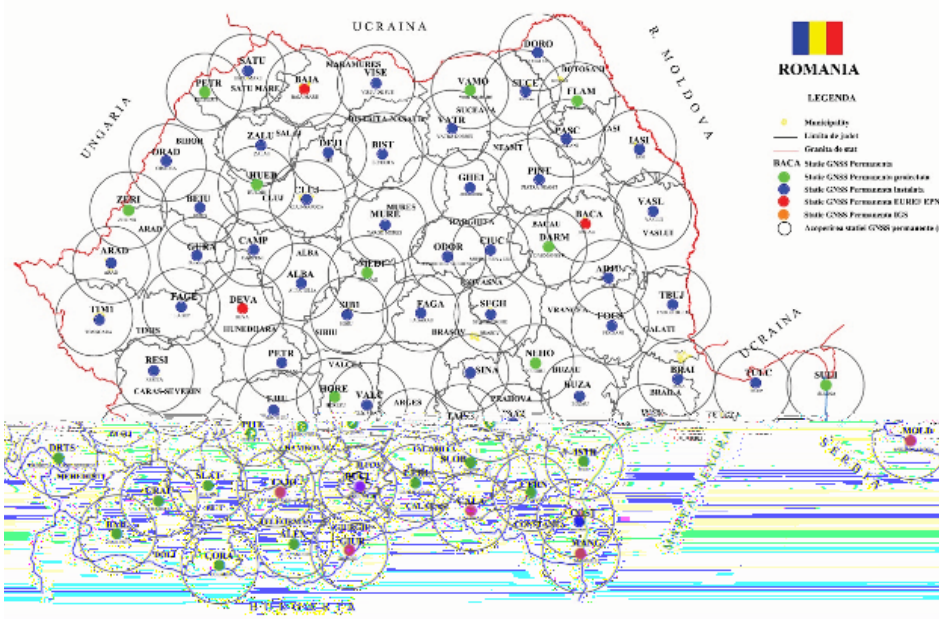


Figure 1a. Romanian National GNSS Permanent Network (ROMPOS) – 2010
(red – IGS/EUREF/EUPOS sites; blue – EUPOS sites; green – future sites)

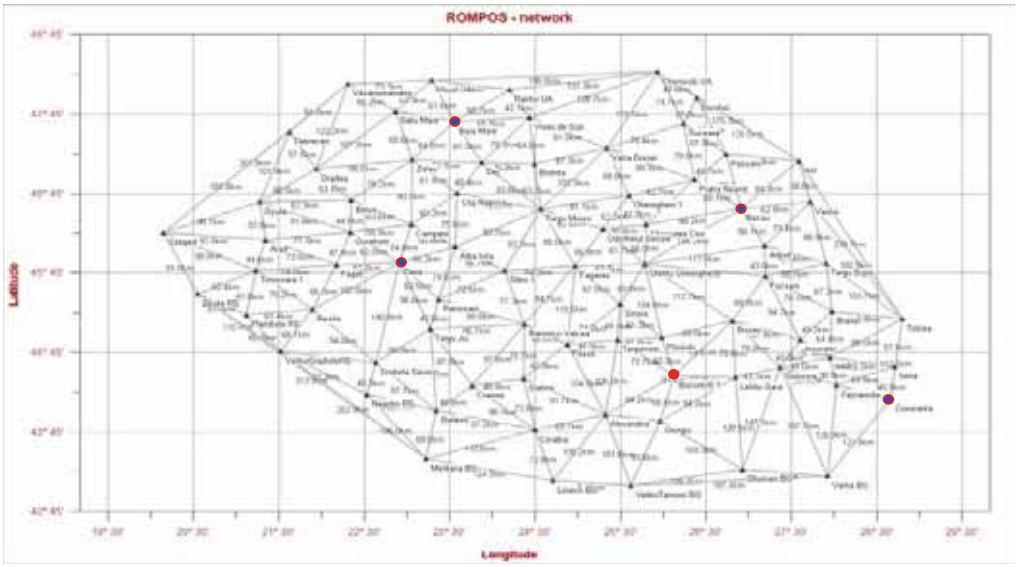


Figure 1b. ROMPOS – 2010 – distances between permanent stations
(red – IGS/EUREF/EUPOS sites; included stations from BG, SR, HU and UA))

In January 2006, the NACLR integrated in the EUREF-EPN (European Permanent Network) 4 new GPS permanent stations: BACA, BAIA, COST and DEVA as a contribution to the European reference frame maintenance and other special projects. The EUREF-EPN GPS station in Constanta (COST) it is located near to a tide gauge and it is connected with this by precise leveling. The accuracy for the coordinates of the stations are better than +/- 1cm. All stations are Class A according to EUREF-EPN standards.

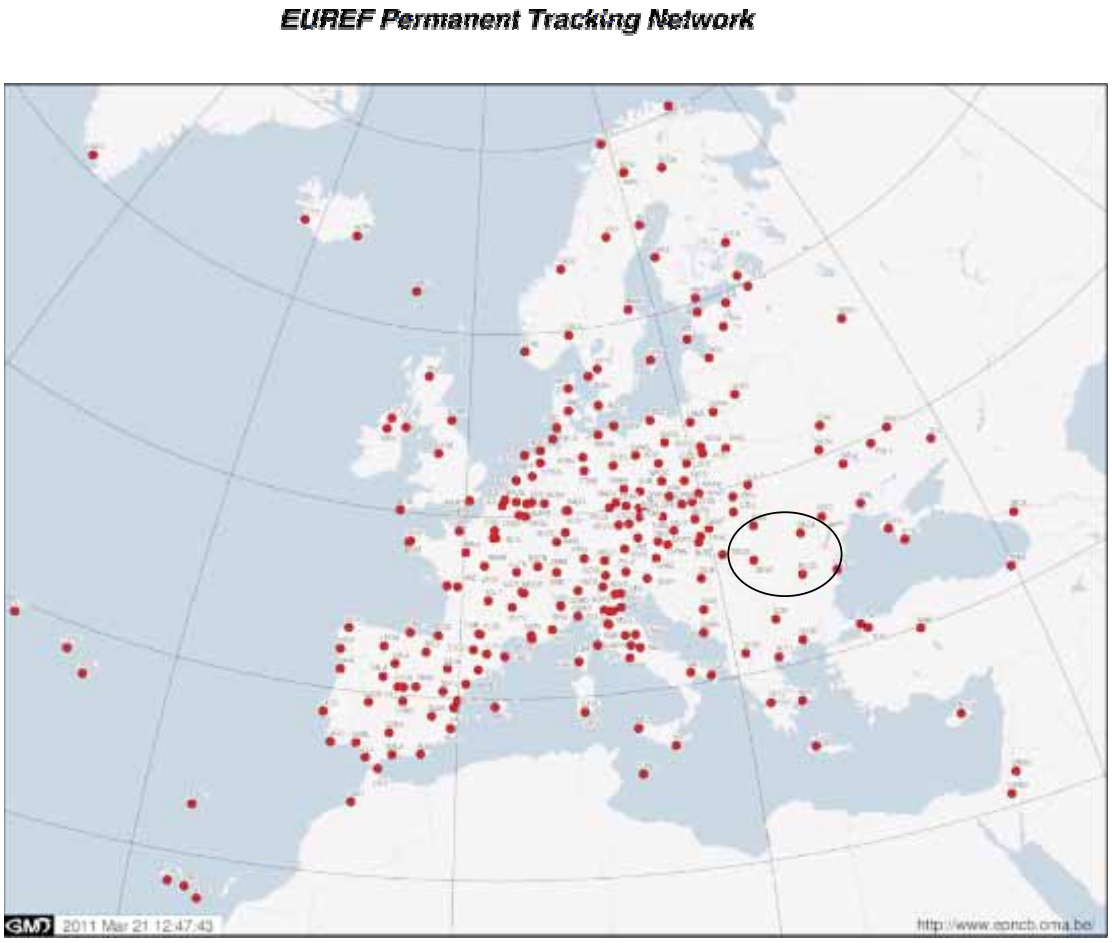


Figure 2. IGS and EUREF-EPN stations in Romania (Bucu, Baia, Baca, Cost, Deva)

The National Space Geodetic Network (GNSS) was proposed to be divided into "classes" to be separated from the old triangulation network divided in "orders". The proposed classes and present status are presented in the next table.

The National Spatial Geodetic Network (NSGN) is formed from the total ground points that have coordinates determined in the ETRS89 Coordinate Reference System and normal heights in Black Sea 1975 reference system, with the possibility to be transformed into the Vertical European System (EVRS).

National Spatial Geodetic Network is structured on classes, using the precision and density criteria, as in the following table.

Table 1. Classification of the NSGN components

Network class	ID	MSE (cm)	No. points/Density/ Distribution	Domain / Observations
National Spatial Geodetic Network Class A0	A0	1.0	*5 GNSS permanent stations (IGS and EUREF-EPN) 1 point / 50000 km^2 Uniform distribution*	- link to the global and European geodetic networks; - regional and local geodynamics measurements, deformation determination real time positioning services, meteorology
National Spatial Geodetic Network Class A	A	1.0	*73 GNSS permanent stations 1 point / 3250* km^2 *Uniform distribution*	- link to the class A0 network, - regional and local geodynamics measurements, deformation determination real time positioning services, meteorology
National Spatial Geodetic Network Class B	B	2.0	*330 points 1point ./700km^2 Uniform Distribution*	- regional and local geodynamics measurements, high precision topographic determinations
National Spatial Geodetic Network Class C	C	3.0	*About 4750 points 1point/50km^2 Uniform distribution*	- high precision topographic measurements, cadastre; -partial realized
National Spatial Geodetic Network Class D	D	5.0	*At least 1point/5km^2 even distribution*	- topographic measurements, densification networks, G.I.S. - partial realized

MSE – Mean Square Error of the 3D position determination

Figure 3. Class B - National Spatial Geodetic Network (NSGN)
(green – new monuments; blue – old monuments from triangulation network)

Class B network was observed in 2003 and the results were included into national database in 2005. From the total number of stations about one third have geometric leveling. A number of 86 stations are old triangulation markers observed by GPS with coordinates in national geodetic reference system Krasovski ellipsoid and Stereographic 1970 projection system). The Class B network was constrained on the Class A network. The precisions for the coordinates of these stations are less than 2cm. Class C network including more than 1000 stations was observed since 2005 till present and it is not yet complete. The precisions for the coordinates of these stations are less than 3cm. Class D network will be realized in general for cadastre with a no uniform distribution and the precision of these stations will be less than 5 cm. (http://gnss.rompos.ro)

3. Leveling Network - Romanian Contribution to EVRS Realization

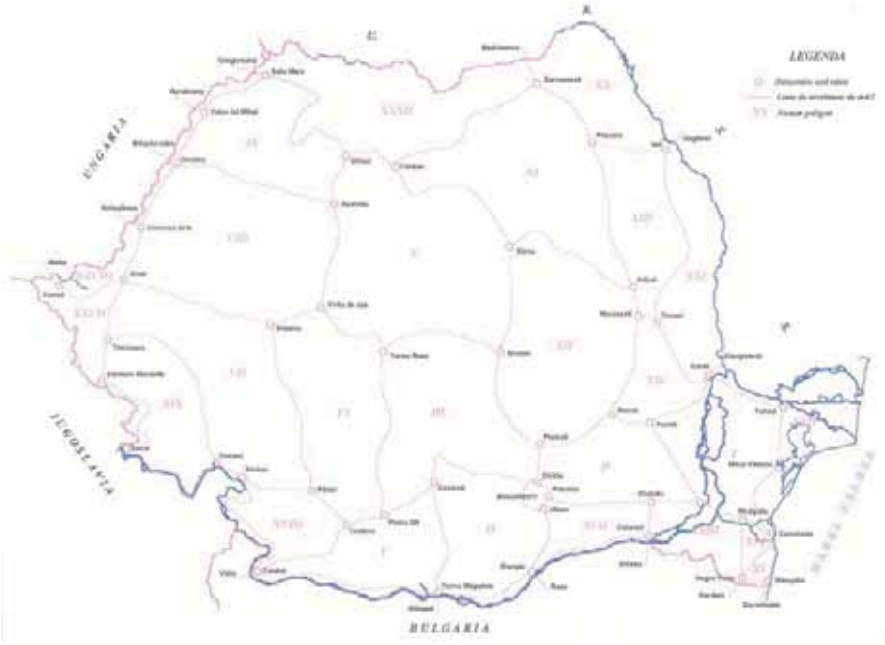


Figure 4. Romanian Leveling Network

The National Leveling Network it is divided in 5 orders (function of precision). The National Precise Leveling Network of Ist order consists in a number of 19 polygons with a length of 6600 km and includes 6400 points with a density of 1 point/km^2. 24 leveling lines establish the connections with neighbour countries: 2 with Ukraine, 1 with Republic of Moldova, 6 with Bulgaria, 10 with Serbia/Montenegro and 5 with Hungary.

This network was densified till 32 polygons with levelling networks of IInd -Vth order (see Figure 4). Normal heights are available for the National Leveling Network.

The Romanian contribution to UELN (2000) contains the nodal points of the polygons of first order (65 points) and 89 levelling observations.

In 2007 the National Agency for Cadaster and Land Registration introduced officially the results of a new adjustment of the leveling network performed by National Center for Geodesy, Cartography, Photogrammetry and Remote Sensing and Technical University of Civil Engineering Bucharest as “Black Sea 1975 datum (Edition 1990)”.

The EUVN97 (European Unified Vertical Network 1997) included 4 points from the Romanian Levelling Network: RO01 (Sirca-Iasi), RO02 (Constanta), RO03 (Timisoara) and RO04 (Tariverde – Height 0) points measured with GPS technology and absolute gravity. For these points the known ETRS89 coordinates and normal heights (precise levelling) in Black Sea 1975 datum were determined together with absolute gravity. For the ECGN project in September 2004, Austrian Federal Office of Metrology and Surveying (BEV– Bundesamt fuer Eich-und Vermessungswessen) in cooperation with Romanian National Agency for Cadastre and Land Registration (NACLR) and Military Topographic Directorate, performed an absolute gravity observation campaign in Romania. A number of 4 absolute gravity stations were observed by JILAg-6 absolute gravimeter. Romania participated with such information to the EVRS realization - EVRF2000.

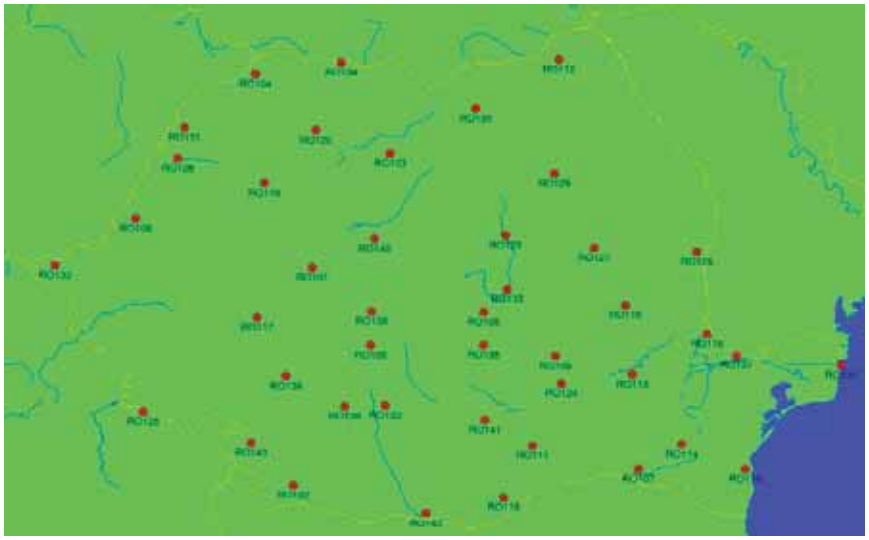


Figure 5. Romanian contribution to EUVN_DA project (2009)

After 2000 year Romania further contributed by providing new data including 43 stations with ETRS89 ellipsoidal heights and normal heights in national height reference system (Fig.5). This was the contribution to the EUVN_DA (Densification Action) project with final result the EVRF2007 realization. 25 European countries participated and submitted the data of more than 1500 high quality GPS/leveling benchmarks. The submitted data was validated and converted into uniform reference frames. The final report was discussed at Technical Working Group meeting and presented at the EUREF2009 symposium, held in Florence (Italy). The results were circulated to all contributing National Mapping Agencies including Romanian National Agency for Cadastre and Land Registration.

This action it is continued in Romania by NACLR. For each county it is planned to be realized a number of minimum 5 such stations. In 2010 there are fully covered a number of 10 counties (about 25% of total). New data will be provided periodically to the EUREF for inclusion in new EVRF realizations.

As a final EVRF2007 realization in Romania, a standard transformation parameters were computed by EVRF computing centre from Federal Agency for Cartography and Geodesy (BKG, Germany). These set of parameters realize the transformation of normal heights from Black Sea 1975 System to EVRF2007 (RO_CONST / NH to EVRF2007).

Transformation parameters were derived from 48 identical points (UELN nodal points) with a transformation RMS of 0.004 m, and residual deviation between -0.012 m and +0.013 m.

A general view of the EVRF2007 realization in comparison with national height reference systems can be seen on the next picture.

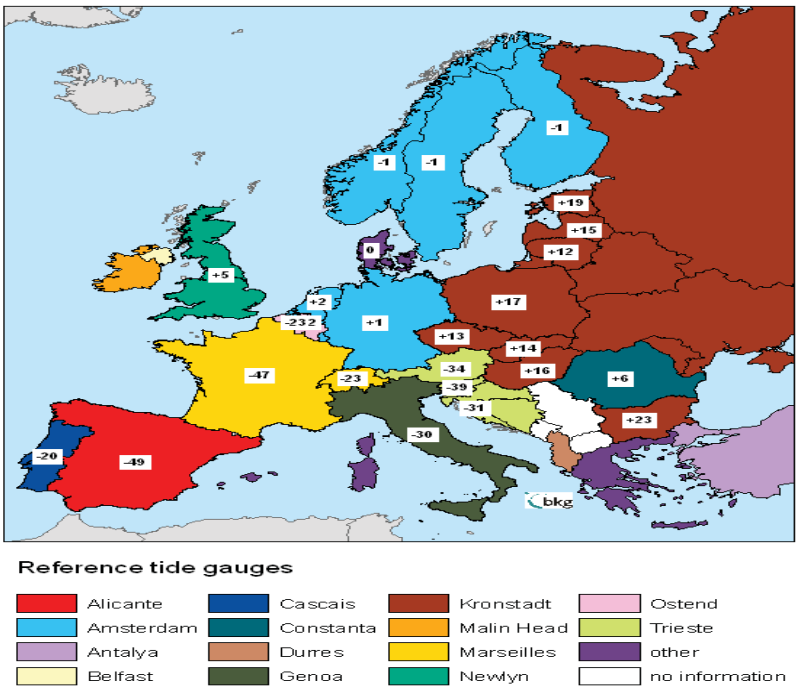


Figure 6. Mean differences between EVRF2007 and national height reference systems (+6cm Romania)

In 2009, NACLR finalized the coordinate transformation including a distorsion model from ETRS89 system to S42 (Krasovski ellipsoid) – Stereographic 1970 projection system and provided *TransDatRo* software and algorithm for the users.

Transformation of normal heights from Black Sea 1975 System to EVRF2007, finalized at the present moment, complete the most recent link between the national coordinate reference systems and pan-European systems. NACLR intends to include this option in the software package for coordinate transformation *TransDatRO* which is already published on internet and will be implemented on national geoportal for spatial data harmonization and interoperability. The transformation parameters were published on the on-line information system *(http://www.crs-geo.eu/),* which contains the descriptions of the different national Coordinate Reference Systems (CRS) for position in Europe as well as the transformation parameters from the national systems to the ETRS89 according to the ISO standard 19111 Geographic information - Spatial referencing by coordinates.

- About 60% of the GNSS permanent stations included in the national GNSS reference network, are connected by leveling with the national leveling network (precise leveling close to the building and than precise trigonometric leveling to the antenna).
- A new leveling campaign was started by NACLR in 2010 and will be continued in 2011 in the metropolitan area of Bucharest. The goal of the project it is to establish and densify the national leveling datum for this area by precise (geometric) leveling. The project will include gravity observations in this area in order to compute a local quasigeoid.

4. PROJECTS

Romania participate especially by National Agency for Cadastre and Land Registration to the international and national projects. The most important projects are mentioned below.

- **European Position Determination System (EUPOS) – interregional cooperation (IRC)** – 4E00261 (2006/2007)
  The main objectives of the project were to strengthen the cooperation and cohesion between the participating countries and regions and to create awareness for the benefits of satellite-based applications. It can be reported that the goal was achieved by the operation. The cooperation between the countries and regions was extended from only some higher level persons to the working level by the cooperation of the GNSS National Service Centres or Know-how offices, by the regional workshops and study visits.
  A new proposal of INTERREG IVC was launched in 2011 by representative institutions mainly from EUPOS countries.
- **Twinning project** RO 2006 / IB / OT – 01; PHARE 2006 / 018 - 147.02.01.03: (National Agency for Cadastre and Land Registration – NACLR – Romania / Cadastre, Land Registry and Mapping Agency - Kadaster – Olanda): *Geodetic Network Modernization and National Spatial Data Infrastructure,* was a project to support a good cooperation between similar (cadastre) agencies from EU and to transfer good practices from one institution to the other one. The project included more components, mainly geodesy and cartography including the new problems related with EU INSPIRE directive for national spatial data infrastructures.
- **EuroBoundaryMap (EBM) –** The objective of the project it is to realize a geospatial data set for Europe including the administrative limits of Romania, their codes and names for 1:100000 scale. In October 2008 version 3.0 was released, and in 2009 these limits were updated for the beginning of 2009 year.
- **EuroGlobalMap (EGM) –** The objective of the project it is to realize a uniform set of geospatial data at 1:1000000 scale for the entire Earth. Version 3.0 of this product was released in 2009 and the next update will be in 2011.
- **EuroRegionalMap (ERM) -** The objective of the project it is to realize a uniform set of geospatial data for Europe at 1:250000 scale structured in seven thematic layers: administrative boundaries, hydrographs, transport, localities, vegetation and soil, topographic names, and others (high power lines, tourist buildings, parks, national parks et al.). Update rate for this products it is one year.
- **Underpinning the European Spatial Data Infrastructure with a Best Practice Network (ESDIN) –** represents the european spatial data infrastructure realized based on the UE member states national spatial data infrastructures. ESDIN has as objective a better use of spatial data, reuse of digital data and realization of new products and services.
- **New ortophoto products in Romania –** In the time interval 2007-2011, new ortophoto products were realized as: large scale ortophoto for Bucharest (1: 500 scale) and at 1:1000 scale for other main cities in Romania (Ploiesti, Târgoviste, Constanta, Brăsov et al.); Starting with 2010 year, Military Topographic Directorate will provide ortophoto products for Ministry of Agriculture and other state institutions.

- **Cadastre and land registration** activities were continuously performed on private initiatives but also on state projects. Some projects were developed as the *CESAR (**"**Complementing EU Support for Agriculture Restructuring")*. Romania has received financing in the amount of EUR 47,700,000 equivalent from the World Bank toward the cost of the Complementing European Support for Agricultural Restructuring, and it intends to apply part of the proceeds toward payments under the contract for systematic registration of immovable properties. The National Agency for Cadastre and Land Registration (NACLR) invited eligible bidders for executing systematic registration of immovable properties in 19 administrative territorial units (UAT) within 13 counties.
  It is planned for CESAR project to support the *extension of national GNSS reference network with 15 new permanent stations* in order to finalize this network. For areas without or with bad GSM/GPRS coverage in Romania on the same project will be possible to achieve few mobile radio transmitters with a good coverage (30-50 Km radius) to be deployed in such areas to be able to broadcast RTK data (from ROMPOS system or locally generated corrections) for GNSS RTK users involved in projects as CESAR or other projects including RTK positioning.
- **GNSS technology for disaster management**
  In 2010 on the Danube and other rivers as Siret and Prut significant floods damaged the river surrounding areas in Romania. National Agency for Cadastre and Land Registration (NACLR) supported by GPS observations and leveling 3D positioning in the flooded area. Topographic and geodetic determination for flooded areas included mainly the accurate heights determination for the Siret and Danube level and surrounding areas. Rapid data transmission and data processing were necessary.

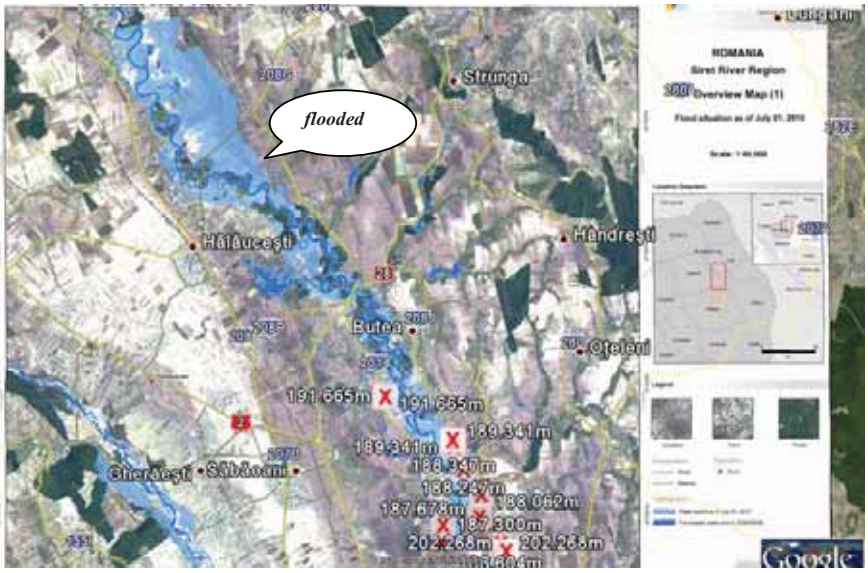


Figure 7. Flooded area on the Siret river - July, 2010 (red X – GNSS epoch stations)

Transformation from one reference system (ETRS89) to another (national reference system), plotting and interpretation together with other involved institutions and government bodies was necessary.
The main task of the geodetic services was the fast delivery of accurate and reliable results, especially heights. Special projects were performed along the Danube and

Siret river. GNSS technology provided a great support in disaster management and underlined the significant potential of this technology. Further improvement by use of DGPS/RTK capabilities provided by ROMPOS (EUPOS) services were proposed to be improved for a better response on emergency and disaster situations in cooperation with remote sensing registration provided by international and/or European agencies.

- **CERGOP (Central European Regional Geodynamic Project)**

The main objective of the project is to monitor the recent crust movements, detecting the borders of the tectonic plates and quantifying their three dimensional rates. The objective is achieved especially by the use of GPS technology and other significant data sources. Romania participate at this project since 1995 by Technical University of Civil Engineering and National Centre for Geodesy, Cartography, Photogrammetry and Remote Sensing Bucharest (former Institute for Cadaster, Geodesy, Photogrammetry and Cartography) to the Work Package 10. „Geodynamics of Central Europe", WP.10.2. *Three Dimensional Plate Kinematics in Romania*.

Figure 8. CEGRN network (http://cergop.oeaw.ac.at)

The main tasks of the project are:

- Romanian geodynamic research integration with Central European research;
- Establishment of reference geodetic network for geodynamic – CEGRN – Central European Geodynamic Regional Network, with less than 1cm accuracy;
- Tectonic plate velocity estimation on Romanian territory by geodetic methods (mainly GNSS);
- Realization of the monograph of Romanian geotectonic components;
- New technologies and methods for geodetic data processing;
- Close cooperation with similar institutions from participating countries;
- Dissemination of research results by different means (publications);

- New research projects proposals on geodynamic.

In the frame of the CERGOP a Central European Regional Geodynamic Network (CEGRN) was designed and realized including permanent and epoch stations observed by GPS technology. CEGRN was designed for geodynamic purposes (tectonic and geological position, markers, repeatability). The coverage includes the Central Europe (CEI countries) and was observed yearly (1994-1997) and every two years after (1999 – 2009). CEGRN was continuously extended with new stations, especially permanent stations in the last decade.

- **INDEGEN Project**

Based on the previous geological and geophysical information a special network for geodynamic monitoring of the Romanian territory has been designed and achieved. The network consists of three lines crossing the major lithosphere contacts: the Tornquist-Teisseyre Zone *(TTZ)* separating the East European Plate from the Intra-Alpine Microplate *(IaP)*, Peceneaga-Camena Fault, as the boundary between EEP and Moesian Microplate *(MoP),* and the Trans-Getica Fault *(TGF)* between MoP and IaP. The fourth line is crossing the Vrancea active geodynamic area located in the bending area of East Carpathians.

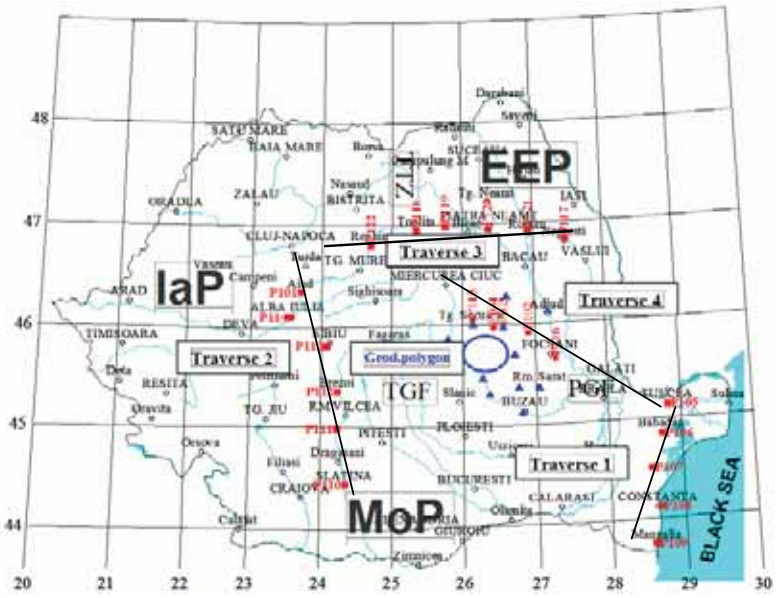


Figure 9. INDEGEN (geodynamic) network

The project INDEGEN (grant CEEX-2 MENER no. 732/2006-2008) started in 2006 with a duration of three years, managed by the Institute of Geodynamics of the Romanian Academy in co-operation with other scientific organizations: Technical University for Civil Engineering – Faculty of Geodesy, University of Bucharest, Geological Institute of Romania, and National Institute for Earth Physics. The main task of geodetic activities was to perform repeated GPS and leveling observations combined with other observation techniques as gravity. The geodetic network was observed in two campaigns from 2007 and 2008. Further investigation are necessary in order to calculate displacements and velocity vectors for that region.

Section II: ADVANCED SPACE GEODESY

- **EUPOS (European Position Determination System)**

Romania participate by National Agency for Cadaster and Land Registration at the EUPOS (European Position Determination System). The EUPOS initiative is an international expert group of public organizations coming from the field of geodesy, geodetic survey and satellite deployment. Partners from 18 CEE (Central and East European) countries have come together with the aim to establish in their countries compatible spatial reference infrastructures by using the Global Navigation Satellite Systems (GNSS) GPS, GLONASS and as soon as available GALILEO by building up Differential GNSS *EUPOS* reference station services. The *EUPOS* services *(RTK, DGNSS and Geodetic)* will allow a high accuracy and reliability for positioning and navigation and provide a wide range of geoinformation applications on this basis.

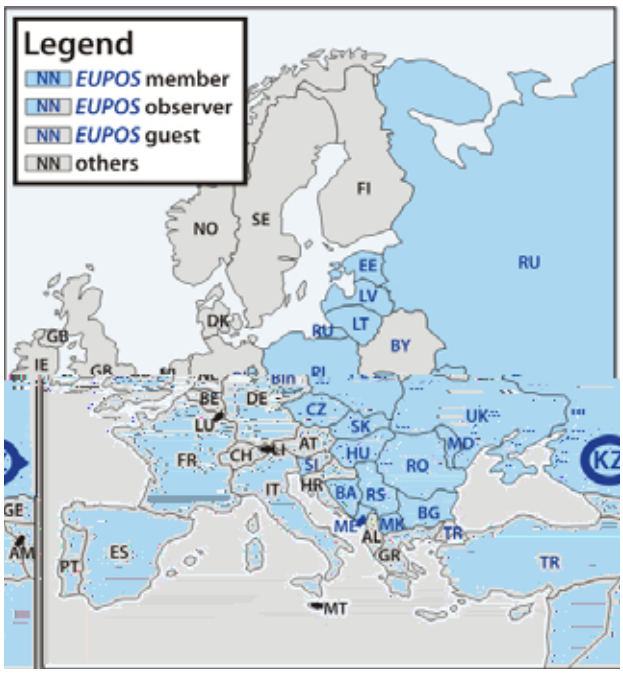


Figure 10. Distribution of EUPOS permanent stations (www.eupos.org)

Members of the *EUPOS* cooperation are topically Bosnia and Herzegovina, Bulgaria, Czech Republic, Estonia, Hungary, Kazakhstan, Latvia, Lithuania, Macedonia, Moldova, Montenegro, Poland, Romania, Russia, Serbia, Slovakia, Ukraine and the German State Berlin. Slovenia has an observer status.

This fundamental infrastructure is based technically on a network of DGNSS reference stations and adequate communication lines. The data products can be used in many different applications requiring accuracy better than 3 m up to the 1 cm level in real-time *(DGNSS and RTK services)* and sub-centimeter precision by post-processing *(Geodetic service)*. This "full scale accuracy" concept aiming all types of users from environmental protection, transport and public security, hydrography, maritime surveying, river and maritime traffic, fishing, machinery and vehicle control, to spatial data infrastructure developers and to geodesy. *EUPOS* is independent of private company solutions and uses only international and

unlimited worldwide usable standards. In case international agreed standards do not exist, *EUPOS* is working on the standardization in the corresponding organizations like the Radio Commission on Maritime Services, Special Committee 104 (RTCM SC 104). *EUPOS* provides the GNSS observation data and real-time corrections for high precise positioning and navigation with guaranteed availability and quality.

The responsibility of developing and operating the *EUPOS* reference station network is distributed among participating organizations on national level, which give the characteristic flavor of the organization. The backbones of the developments are the International *EUPOS* Steering Committee (ISC) and the National Service Center (NSC) concept, that requires the establishment of a NSC in every participating country.

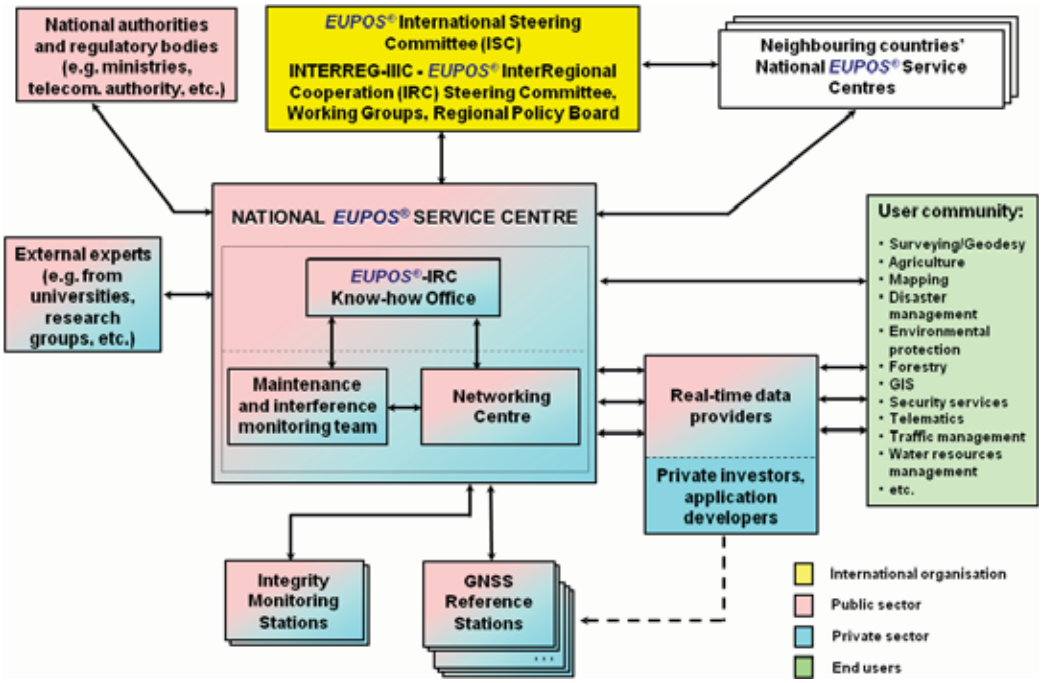


Figure 11. EUPOS National Service Centre structure

The NSCs are responsible not only for network developments and operation, but they are the focal points of user information, quality and integrity assurance and international relations with other *EUPOS* countries. The International *EUPOS* Steering Committee decides and agrees the organizational and technical framework of *EUPOS*. The ISC Office (ISCO) at the Senate Department for Urban Development in Berlin/Germany is the central point of contact for interests of international importance.

With the creation of the European Terrestrial Reference System (ETRS 89) in 1989, a three dimensional geodetic reference system became available for the whole Europe for the first time. Its spatial referencing connection is maintained up-to-date, notably through the EUREF Permanent Network (EPN), which contains the European stations of the International GPS Service (IGS). The ETRF base on the worldwide ITRF. *EUPOS* provides DGNSS correction data referred to ETRS.

Table 2. Number of the *EUPOS* reference stations

Country	Area [km^2]	Number of planned *EUPOS* reference stations	Number of realized *EUPOS* reference stations
Bosnia and Herzegovina	**51 000**	**26**	***(realization in 2009)***
Bulgaria	**110 950**	**23**	**12**
Czech Rep.	**78 870**	**27**	**27**
Berlin (Germany)	**891**	**4**	**4**
Estonia	**45 220**	**17**	**9**
Hungary	**93 030**	**36**	**35**
Kazakhstan	**2 724 900**	**500**	
Latvia	**64 600**	**19**	**19**
Latvia-Riga City	**307**	**5**	**5**
Lithuania	**65 300**	**25**	**25**
Macedonia (FYROM)	**25 434**	**14**	**14 (test network)**
Moldova	**33 700**	**15**	**2 in 2009**
Poland	**323 520**	**98**	**98**
Romania	***237 500***	***73***	***58***
Russian Federation	**17 075 400**	not defined currently	**31***
Serbia	**88 360**	**32**	**32**
Slovak Republic	**46 035**	**21**	**21**
Ukraine	**603 700**	**27** up to 2012 - only for *EUPOS* DGNSS and Geodetic	**9**
Slovenia (Observer status)	**20 270**	**15**	**15** *EUPOS* compatible

* Information not up-to-date

NACLR has implemented in September 2008 the EUPOS services by Romanian Position Determination System (ROMPOS) according to the EUPOS standards based on the GNSS network with 48 permanent stations. Since 2010 the station number increased to 58 and will be finalized at 73 stations with station's spacing of about 70km.

ROMPOS services includes three services:

- *ROMPOS-DGNSS*
- *ROMPOS-RTK*
- *ROMPOS-GEO*

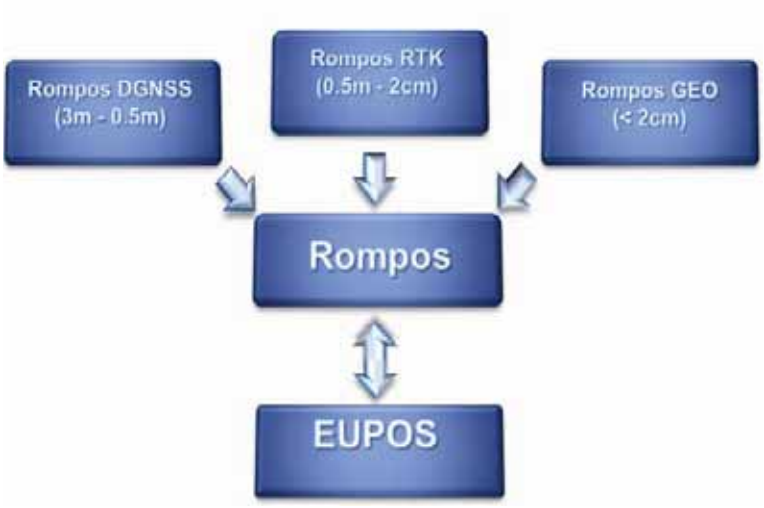


Figure 12. ROMPOS (Romanian Position Determination System) Services

- *ROMPOS DGNSS* for real-time DGNSS applications by code and code-phase measurements with metre up to sub-metre accuracy;
- *ROMPOS RTK* for real time DGNSS applications by carrier phase measurements with centimetre accuracy;
- *EUPOS Geodetic* for post processing applications by code and phase measurements in static or kinematic mode with decimetre up to sub-centimetre accuracy.

In the EUPOS frame, Romania established a very closed cooperation with specialists from EUPOS countries including all neighbour countries (Bulgaria, Serbia, Hungary, Ukraine and Republic of Moldova). GNSS cross-border data exchange was technically already realized between GNSS stations from Romania and agreements are signed with Hungary and Moldova.

New applications of the ROMPOS reference stations will be developed in the near future. Research activities are performed at Technical University of Civil Engineering Bucharest (Faculty of Geodesy) for GNSS meteorology and ionosphere/troposphere influences, reference frame establishment (ITRF, ETRF), geodynamics, engineering surveying based on GNSS (large structures monitoring) et al.

- **EGNOS**

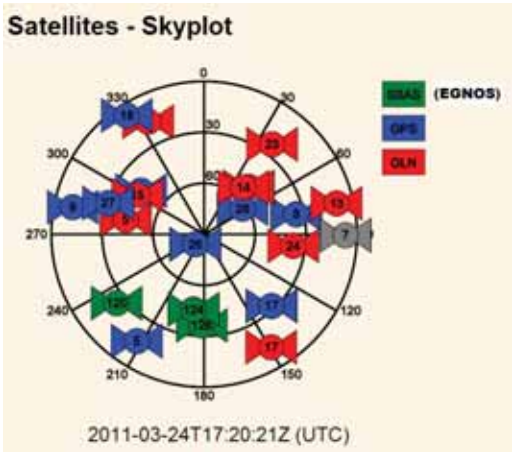
Known as a satellite-based augmentation system (SBAS), EGNOS provides both correction and integrity information about the GPS system, delivering opportunities for Europeans to use the more accurate positioning data for improving existing services or developing a wide range of new services. In the future EGNOS will be able to augment GALILEO in Europe.

The EGNOS signal is broadcast by two Inmarsat-3 satellites – one positioned east of the Atlantic, and the other above Africa – and by ESA's Artemis satellite, which is also above Africa. These three satellites' orbits are in the equatorial plane, at three different longitudes, with each able to broadcast EGNOS services across Europe. Unlike GPS, EGNOS will offer integrity of signal, increased accuracy, coverage and a service level agreement (e.g. alert within specified time). This makes it suitable to provide a number of navigation services. For the most common applications, EGNOS gives a positioning accuracy of one to three metres, compared to the less accurate 10 to 15 m provided by GPS alone. The three services available are:

- Open Service
- Safety-of-Life Service
- EGNOS Data Access Server (EDAS)

The EGNOS *Open Service* has been available since *1 October 2009*. EGNOS positioning data are freely available in Europe through satellite signals to anyone equipped with an EGNOS-enabled GPS receiver. EGNOS Certification is now being managed by the European Commission, who have announced that since *1 March 2011,* EGNOS *Safety-of-Life* signal was formally declared available to aviation. For the first time, space-based navigation signals have become officially usable for the critical task of vertically guiding aircraft during landing approaches. EGNOS provides also a terrestrial commercial data service called the EGNOS Data Access Service (EDAS). EDAS is the single point of access for the data collected and generated by the EGNOS infrastructure. It supports the multimodal use of EGNOS (and later on Galileo) by disseminating EGNOS' services in real time. In order to understand the market's interest for EDAS data, a beta test was designed and works to allow industry, research institutes, and private and public organizations to free access to EDAS' data. This test provides information to the provider of the EDAS service about potential users and how they use the data.

In Romania EGNOS system it is at present less used and needs a better promotion in order to inform the potential beneficiaries of services. According to geographic position of Romania, at the eastern border of EGNOS services, a better coverage would be necessary in the future if uniform services should be provided for all EU countries. The figure below presents the EGNOS signal acquisition at Faculty of Geodesy in Bucharest (GNSS permanent stations BUCU).



Satellites - Tracking Information

SV	Type	Elev. [Deg]	Azim. [Deg]	L1-C/No [dBHz]	L2-C/No [dBHz]	L1	L2	IODE	URA [m]	Type
120	SBAS	24.41	231.78	38.1	-	C	-	75	N/A	-
124	SBAS	45.79	188.14	41.9	-	C	-	75	N/A	-
126	SBAS	36.35	181.51	40.8	-	C	-	118	N/A	-

Figure 13a. GPS, GLONASS and EGNOS tracking at GNSS/EGNOS permanent station in Bucharest

The tracking data indicate that for this position the elevation angle it is less than 50 degrees for any of the EGNOS satellites and this situation could generate problems in satelllite's tracking especially in urban canyons or small obstacles.

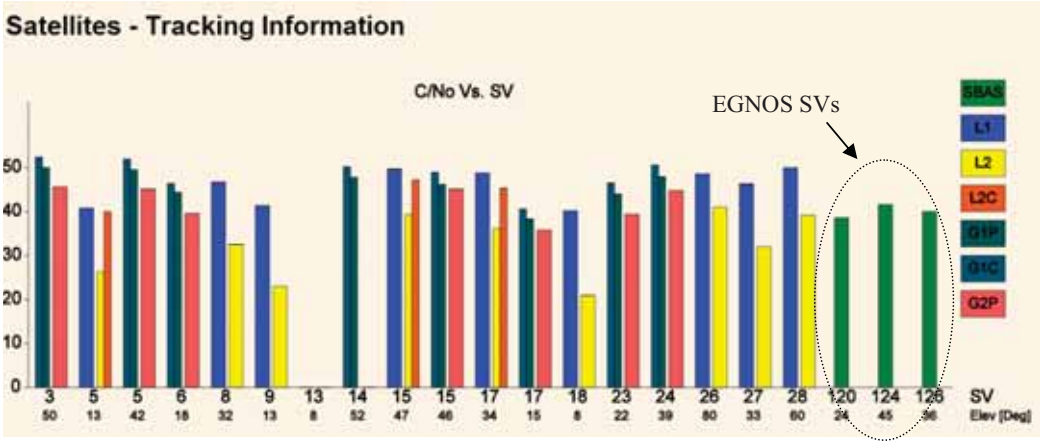


Figure 13b. GPS, GLONASS and EGNOS signal at GNSS/EGNOS permanent station in Bucharest

http://egnos-portal.gsa.europa.eu/discover-egnos/about-egnos
http://www.egnos-pro.esa.int/

Section III: DETERMINATION OF THE GRAVITY FIELD

The National Gravity Network of 1st and 2nd order (about 270 points) was observed by the Ministry of Defense – Topography and Cartography Directorate.

Gravity data at the present are not sufficient for the development of an geoid model with an accuracy of 10 cm or better. The EGG97 geoid model available from IAG was purchased by NACLR and tested in order to improve it locally by geometric method (local data and ellipsoidal heights from GPS). A new geometric quasigeoid solution was calculated in 2010 (TUCE Bucharest) based on EGG97 and about 600 ground markers with ETRS89 ellipsoidal heights and normal heights (Black Sea 1975 datum). Further efforts should be done for the modernization of the gravity network. Since 2004 there are no new absolute gravity determination in Romania.

This year (2011), Military Topographic Directorate intends start an important project with support from NIMA (USA) for gravimetric determinations in Romania. There are planned to be observed more than 17000 points in order to be able to generate a quasigeoid with an accuracy of better than 10cm.

Section V complements aspects of the gravity observations performed in Romania in the last time.

Section IV: GENERAL THEORY AND METHODOLOGY

The theoretical and practical aspects of the Geodesy as geoscience continued the evolution in 2007-2011 time interval. The uniform application of the new standards needed the elaboration of new methodologies for the success of the implementation. At the global level some standards organizations took the responsibility for the geosciences as **ISO**

(International Standards Organization). In Romania the counterpart of the ISO it is **ASRO** (Romanian Standardization Association).

The International GNSS Service (IGS), formerly the International GPS Service, is a voluntary federation of more than 200 worldwide agencies that pool resources and permanent GPS & GLONASS station data to generate precise GPS & GLONASS products. The IGS is committed to providing the highest quality data and products as the standard for Global Navigation Satellite Systems (GNSS) in support of Earth science research, multidisciplinary applications, and education. Currently the IGS includes two GNSS, GPS and the Russian GLONASS, and intends to incorporate future GNSS. You can think of the IGS as the highest-precision international civilian GPS community. The IGS global system of satellite tracking stations, Data Centers, and Analysis Centers puts high quality GPS data and data products on line in near real time to meet the objectives of a wide range of scientific and engineering applications and studies.

The IGS collects, archives, and distributes GPS observation data sets of sufficient accuracy to satisfy the objectives of a wide range of applications and experimentation. These data sets are used by the IGS to generate the data products mentioned above which are made available to interested users through the Internet. In particular, the accuracies of IGS products are sufficient for the improvement and extension of the International Terrestrial Reference Frame (ITRF), the monitoring of solid Earth deformations, the monitoring of Earth rotation and variations in the liquid Earth (sea level, ice-sheets, etc.), for scientific satellite orbit determinations, ionosphere monitoring, and recovery of precipitable water vapor measurements.

The primary mission of the International GPS Service, as stated in the organization's 2002-2007 Strategic Plan, “to provide the highest quality data and products as the standard for global navigation satellite systems (GNSS) in support of Earth science research, multidisciplinary applications, and education. These activities aim to advance scientific understanding of the Earth system components and their interactions, as well as to facilitate other applications benefiting society."

The IGS Terms of Reference (comparable to the by-laws of the organization) describes in broad terms the goals and organization of the IGS. To accomplish its mission, the IGS has a number of components: an international network of over 350 continuously operating dual-frequency GPS and GNSS stations, more than a dozen regional and operational data centers, three global data centers, seven analysis centers and a number of associate or regional analysis centers. The Central Bureau for the service is located at the Jet Propulsion Laboratory, which maintains the Central Bureau Information System (CBIS) and ensures access to IGS products and information. An international Governing Board oversees all aspects of the IGS.

The IGS is an approved service of the International Association of Geodesy since 1994 and is recognized as a member of the Federation of Astronomical and Geophysical Data Analysis Services (FAGS) since 1996.

Romania it is contributing to the IGS with postprocessing data from one GNSS permanent station *(BUCU*) and real time data (project *IGS-IP*).

EUREF *is the IAG Reference Frame Sub-Commission for Europe, integrated in the Sub-Commission 1.3, Regional Reference Frames, under Commission 1 – Reference Frames, following the implementation of the new IAG structure at the IUGG (International Union of Geodesy and Geophysics) General Assembly held in Sapporo, 2003.*

The Sub-Commission EUREF was founded in 1987 at the IUGG General Assembly held in Vancouver.

EUREF deals with the definition, realization and maintenance of the European Reference Frame - the geodetic infrastructure for multinational projects requiring precise geo-referencing (e.g. three-dimensional and time dependent positioning, geodynamics, precise navigation, geo-information) - in close cooperation with the IAG components (Services, Commissions, and Inter-commision projects) and EuroGeographics, the consortium of the National Mapping Agencies (NMA) in Europe. (www.euref-iag.net)

Romania it is contributing to EUREF/EVRF with GNSS permanent stations and epoch stations, leveling and gravity stations included as mentioned in *Section I*.

EuroGeographics as the central-hub for Europe's Geographic Information (GI) developments – a unique and diverse network working of all concerned with European GI; National Mapping and Cadastral Agencies (NMCAs), the European Commission and others. The websites contain information of national European Coordinate Reference Systems (CRS) and pan-European Coordinate Reference Systems for position and height. On the sites the following information can be found:

• Description of national Coordinate Reference Systems;

• Description of pan-European Coordinate Reference Systems (ETRS89 / EVRF2000);

• Description of Transformation parameters from national Coordinate Reference Systems to pan-European Coordinate Reference Systems including:

– qualitiy of transformation;

– verification data of transformation;

– possibility for online conversion and transformation of single points for test and verification purposes (position).

• The Joint **Research Centre of the European Commission** jointly organized with Eurogeographics and EUREF two Workshops (Spatial Reference Workshop 1999 and the Cartographic Project Workshop 2000 in Marne-la-Vallee). These Workshops laid the foundations for the definition of uniform European coordinate reference systems in position and height for the unique georeferencing of data. The Information System contains the description of national and pan-European Coordinate Reference Systems (CRS) for position and height orientates on the international standard 19111. It contains also the descriptions of transformations of national Coordinate Reference Systems of European countries to pan-European CRS. In the future a service module will be enabled for the transformation and conversion of coordinates for test purposes.

CRS-EU is a extension and advancement of the former existing and now in this system integrated information system about European Coordinate Reference Systems CRS (http://crs-geo.eu).

According to the international and European standards and recommendations, Romania has adopted or recommends the use of these standards. ***National Agency for Cadaster and Land Registration (NACLR)*** is the main civil public institution involved in the realization of standards and methodologies for cadastre, geodesy, cartography and land registration. NACLR implements the recommendations of the ISO, IGS, EUREF, Eurogeographics and EUPOS. Other Romanian institutions involved in the realization and implementation of geosciences standards are ASRO (Romanian Association for Standardization) and INM (National Institute of Metrology).

– One of the most important standard it is related to the Coordinate and Reference System to be used in Europe. Since 2008 in Romania was introduced ***ETRS89*** for GNSS applications and pan-European cartographic products. This reference system on present situation it is used in parallel with the national reference system S42 (Krasovsky ellipsoid)

mainly due to the huge cadastre information who need a long time to be converted to the new reference system.

– The ***INSIPIRE Directive*** of the EU was transposed into national legislation in 2009 and National Spatial Information Infrastructure Committee was created by government decision (no.493/19 May 2010). The Committee it is coordinated by National Agency for Cadastre and Land Registration (NACLR) and includes representatives from all ministries;

– Standards adopted by EUPOS (European Position Determination System) were implemented in Romania for GNSS network (Class A);

– New standards for national reference topographic map at scale 1:5000 were released by NACLR in 2009;

– Standards for scanning and georeferencing of old cadastral maps were adopted;

– Technical standards for digital ortophoto realization at 1:5000 scale were realized based on the twinning project RO 2006/IB/OT–01, PHARE 2006 /018-147.02.01.03;

– New rules were realized and adopted (2010) by NACLR for authorization of private and state institutions or persons (from Romania or EU) to realize cadastre works in Romania.

– An important step in implementation of the ETRS89 in Romania was the realization of the ***direct and inverse coordinate transformation between ETRS89 CRS and S-42 CRS.*** *The strategy for coordinate transformation from European Coordinate Reference System (CRS) ETRS89 to national CRS S-42 (Krasovski 1940 – Stereographic 1970 Map Projection) it is based on a knowledge of the pattern of distortion data (due to large errors in the survey control network) and it consists of two main steps:*

1. Global datum transformation that is accomplished by a conformal transformation;

2. Interpolation of residual coordinate corrections from a grid of coordinate shifts.

The grid of coordinate shifts was generated using least squares prediction method for the distortion modelling between ETRS89 and S-42 which ensures a continuous transformation process that does not destroy spatial relationships established on the national local datum.

In order to provide the compatibility and precise georeferencing of spatial data into the ETRS89 (European Terrestrial Reference System 1989) for the pan-european products, according to the INSPIRE (Infrastructure for Spatial Information in the European Community) directive of the Europe Parliament from 14.03.2007, Național Agency for Cadastre and Land Registration (NACLR) provided an Order of the NACLR General Director for adoption of the ETRS89 Coordinate Reference System (CRS) in Romania. The implementation of the ETRS89 in Romania and the actual tendencies of the GNSS satellite technologies applications for the most of the geodetic works required the implementation of an standard algorithm for spatial data transformation from ETRS89 CRS to national CRS (Stereo 1970 projection) and opposite. This situation from Romania, similar with other European or World countries, requires serious problems for spatial data transformation from the old CRS to the new CRS (ETRS89), due to large distortions inside the triangulation networks as effect of the classical datum orientation of the S-42 CRS.

In order to underline the distortions between ETRS89 and S-42 CRS from Romania, there was used an conform orthogonal transformation (2D Helmert), based on a common set of coordintes from both systems. Table 3 presents the statistics of coordinate differences (distortions).

Table 3 – Statistics of coordinate differences for common geodetic points after Helmert 2D transformation (before distortions modeling)

Grid step = 15000 m No of nodes = 2106		
Statistic	East	North
Medium:	0.0000	-0.0000
Standard deviation	0.2648	0.3756
Max.:	0.8466	1.3288
Min.:	-0.8632	-1.1928
Total no. of common points	894	894
No. of points above +/-3*(Std.Dev.):	8	3
% points in +/-3*(Std. Dev.):	99.11	99.66

Statistics situation shows that standard deviation of coordinate differences it is about +/- 0.30 m. The value and the surface disposal can be seen in figure14 (distortions are presented as vectors).

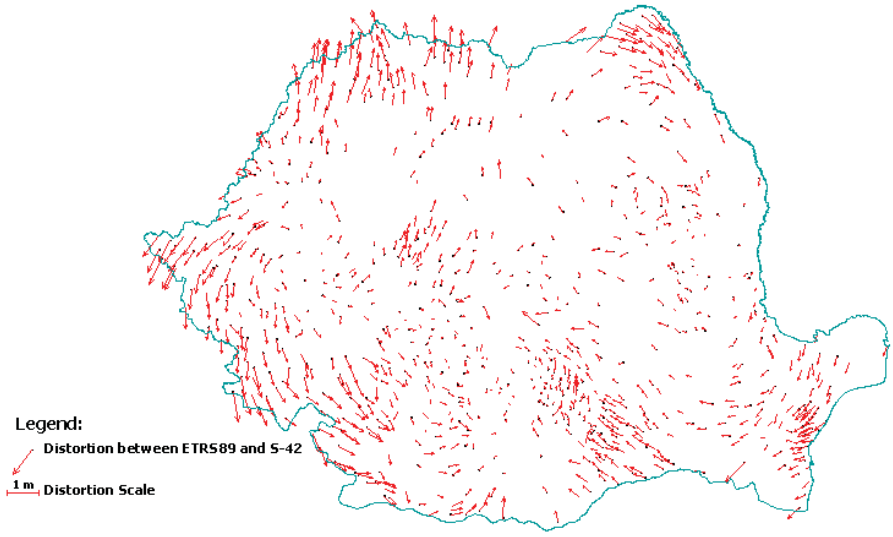


Figure 14. Distortion situation between ETRS89 and S-42

The big distortions observed in figure14 should be modelled by a proper technique according to the reality in order to provide a good transformation of spatial data from old datum to the new datum and oposite.

The transformation technique adopted it is similar to the techniques applied in other countries from Europe or abroad and this technique can be implemented also into the GNSS receivers for RTK applications and into the GIS databases for spatial data representation at big scales.

The existence of common points in a big number and well distributed positions on national surface it is a major requirement for the coordinate transformation from national CRS to the European CRS and oposite. Based on this set of data can be generated the distortion grids and can be predicted the distortions for any interest point in our country. NACLR included in his projects for this year the finalisation of the necessary common set of

coordinates by GNSS observations done in triangulation points and of the transformation grid wich will be introduced into the GNSS receivers observing in Romania.

Based on other countries experience in transition from local datums to the new geocetric reference systems (ETRS89, WGS84), we can conclude that the transformation errors and transformation accuracies of points in Romania will be around ±10-15cm, sufficient for the mapping on big scales.

The following table presents the statistic situation of coordinate differences on geodetic common points, available at the present moment, after distorsion modelling.

Table 4. Statistics of coordinate differences for common geodetic points after Helmert 2D transformation (after distortions modeling)

Grid step = 11000 m		
No of nodes = 3816		
Statistic	East	North
Medium:	0.0001	-0.0000
Standard deviation	0.0415	0.0456
Max.:	0.1750	0.1644
Min.:	-0.1729	-0.2022
Total no. Of common points	894	894
No. of points above +/-3*(Std.Dev.):	15	18
% points in +/-3*(Std. Dev.):	98.32	97.99

From this statistic situation analysis it can be deduced that the transformation algorithm adopted it is good and can provide precise and fiducial transformation results for all the users.

Meetings

- Romania it is a member of Eurogeographics organization and it is involved in their projects as *ESDIN, EBM, ERM* et al.. Romania by NACLR organized the ***8th EuroGeographics General Assembly in Sibiu, Romania from 5th - 8th October 2008***. More than 120 participants from 43 countries across Europe took part in that major event, having the opportunity to connect to the current requirements of modern societies with regard to the use of spatial information. The annual General Assembly focused on identifying the main priorities for the coming year and provided a mandate through a number of agreed actions. It was a real opportunity to bring together all EuroGeographics members for discussions, having the chance to vote on key issues such as association annual budget, membership subscriptions and the acceptance of new members. Last but not least existing relationship were strengthened and new ones were built.
- The ***2nd European Conference on Cadastre was held in Bucharest, Romania, 7-8 May 2010.*** The conference entitled "*The Cadastral surveyor – Paving the Way to the Future*" was organized by the European Council of European Geodetic Surveyors (CLGE) in cooperation with the Romanian Association of Private Surveyors, the Romanian Geodetic Union, and the Romanian Agency for Cadastre and Land Registration. The conference also included the launch of the adopted "*Code of Conduct of the European Surveyors*" that is an important and very useful document also in a global context as well as the adoption of the Bucharest Declaration stating some key principles of the role of the cadastral surveyors in serving society.

SELECTED REFERENCES

2007

RUS T., *EUPOS National Report*, Eupos ISC and EUPOS IRC Conference, 27-30 March, 2007, Riga, Latvia

RUS T., *EUPOS National Report*, Eupos ISC and EUPOS IRC Conference, 18-21 September, 2007, Vilnius, Lithuania

RUS T., NEUNER J., MOLDOVEANU C., MARCU C., DANCIU V., ILIEŞ A., DUMITRU P., CĂLIN A., VASILCA D., *Geodetic Monitoring for Support of Geodynamic Investigations – Indegen Project*, International Symposium On Strong Vrancea Earthquakes And Risk Mitigation, October 4-6, 2007, Bucharest

RUS T., *Status of the Romanian GNSS Network*, 2nd Annual Transportation & Logistic Conference for CEE, 7th February 2007, Bucharest, Romania

DRAGOMIR P., RUS T., DUMITRU P., FADUR M., "Perspectivele realizării sistemului de poziționare ROMPOS", Conferința Națională – Tehnologii Moderne pentru Milleniul III, Oradea, octombrie, 2007

*** IAG National Report on Geodetic and Geophysical Activities 2003-2006", XXIVth IUGG ,General Assembly, Perugia, 2-13 July 2007

2008

RUS T., MOLDOVEANU C., DANCIU V., *Contribuții actuale la determinări geodinamice în România*, simpozionul internațional GeoCAD08, Alba Iulia, 09-10 mai 2008 - articol publicat în Revista de Cadastru "RevCAD"

BESUTIU L., ATANASIU L., MITROFAN H., ZLAGNEAN L., RADULIAN M., POPA M., ROGOZEA M., SABAU G., NEGULESCU M., BALTRES A., RUS T., DANCIU V., MOLDOVEANU C., NEUNER J. , *New insights on the structure and dynamics of the intermediate-depth seismic zone located in the bending area of east Carpathians: INDEGEN project,* 33rd International Geological Congress, 6-14 August 2008, Oslo, Norway

2009

RUS T. , NEUNER J., MOLDOVEANU C., MARCU C., DANCIU V., DUMITRU P., CĂLIN A., *Results of geodetic investigations for geodynamics in Romania*, Monograph, IGAR, Editor Besutiu L., 2009;.

AVRAMIUC N., DRAGOMIR P., RUS T., *Algorithm for direct and inverse coordinate transformation between ETRS89 CRS and S-42 CRS*, , Simpozion Stiințific Internațional, "Actualitatea în cadastru", Alba Iulia, 7-9 Mai 2009

DRAGOMIR P., RUS T., AVRAMIUC N., DUMITRU P., FĂDUR M., SORTA V., *Utilizarea ROMPOS în realizarea planurilor parcelare,* Conferința Națională – Tehnologii Moderne pentru Milleniul III, Ediția a 7-a, Oradea, 6-7 Noiembrie 2009

RUS T., NEUNER J., MOLDOVEANU C., MARCU C., DANCIU V., DUMITRU P., CĂLIN A. *Satellite and Terrestrial Geodetic Methods in Support of Geodynamic Investigations*, , International Experts Meeting On Carpathian Geodynamic Network, 19 - 21 November 2009, Bucharest, Romania

DRAGOMIR P., RUS T., AVRAMIUC N., DUMITRU P., FĂDUR M., SORTA V., *ROMPOS for Cadastre Applications*, International Symposium on Global Navigation Satellite Systems, Space-Based and Ground-Based Augmentation Systems and Applications 2009, Berlin, Germany, 30 November - 2 December 2009

RUS T., NEUNER J., MOLDOVEANU C., MARCU C., DANCIU V*, Current Contributions to the Geodynamic Monitoring*, Conferința Națională – Tehnologii Moderne pentru Milleniul III, Ediția a 7-a, Oradea, 6-7 Noiembrie,

RUS T., *National Report of Romania*, 15th Conference of the International EUPOS® Steering Committee and 7th Meeting on EUPOS® WG on System Quality, Integrity and Interference Monitoring (SQII), Tallinn, Estonia, 28-29 April 2009

RUS T., *National Report of Romania*, 16th Conference of the International EUPOS® Steering Committee, 8th Meeting on EUPOS® WG on System Quality, Integrity and Interference Monitoring (SQII), and and 3rd EUPOS TCI Meeting, Berlin, Germany, 28 Nov.-3 Dec. 2009

RUS T., *10 Ani de la Infiinţarea Laboratorului de Geodezie Spaţială*. seminarul ştiinţific al Facultăţii de Geodezie, 17.12.2009, Bucureşti

DRAGOMIR P., RUS T., AVRAMIUC N., DUMITRU P., *EVRF2007 as Realization of the European Vertical Reference System (EVRS) in Romania*, simpozionul internaţional GeoCAD08, Alba Iulia, 09-10 mai 2010 - articol publicat în Revista de Cadastru RevCAD

2010

BUSUIOC M., RUS T., DRAGOMIR P., AVRAMIUC N., DUMITRU P., FĂDUR M., SORTA V., *Romanian Position Determination System – ROMPOS*, United Nations/Moldova/United States of America Workshop on the Applications of Global Navigation Satellite Systems, 17-21.05.2010, Chişinău, Rep. Moldova

RUS T., *National Report of Romania*, 17th Conference of the International EUPOS® Steering Committee, 9th Meeting on EUPOS® WG on System Quality, Integrity and Interference Monitoring (SQII), 27-28.05.2010, Novi Sad, Serbia

DRAGOMIR P., RUS T., AVRAMIUC N., DUMITRU P., *Draft of the Technical Normative Regarding the Realization of the National Spatial Geodetic Network and the Implementation of the ETRS89 in Romania*", Conferinţa Naţională – Tehnologii Moderne Pentru Milleniul III, Ediţia a 8-a, Oradea, 2010

Section V: GEODYNAMICS

STUDIES OF GEODYNAMICS

The Institute of Geodynamics runs a network of observatories of geodynamics, equipped with specific sensors. This report contains observations and research undertaken from 2007 to 2010 for the priority theme of the Romanian Academy "Complex geophysical research in geodynamical active areas with a special view to the Vrancea seismogenic area".

This time, we considered important to follow the pattern of atmospheric pressure variations on long-term crustal movements recorded at the level of underground geodynamic observatories, Crăciuneşti and Ursoiu, and the surface geodynamic observatory, Căldăruşani.

The Institute concentrated its efforts on:

1. Continuous monitoring of local deformations by sensors placed at the level of underground geodynamic observatories (Ursoiu, Crăciuneşti) and of the surface observatory (Căldăruşani)

2. Correlating the crustal deformations with two important geophysical parameters in order to:

a) Understand the mechanism of response of the crust to the pressure and temperature variations
b) Separate the crustal deformations caused by different causes (earth tides, loads due to rain, snow, etc.).

3. Observe the crustal deformation in the evolution of specific fingerprints of climatic and before major earthquakes.

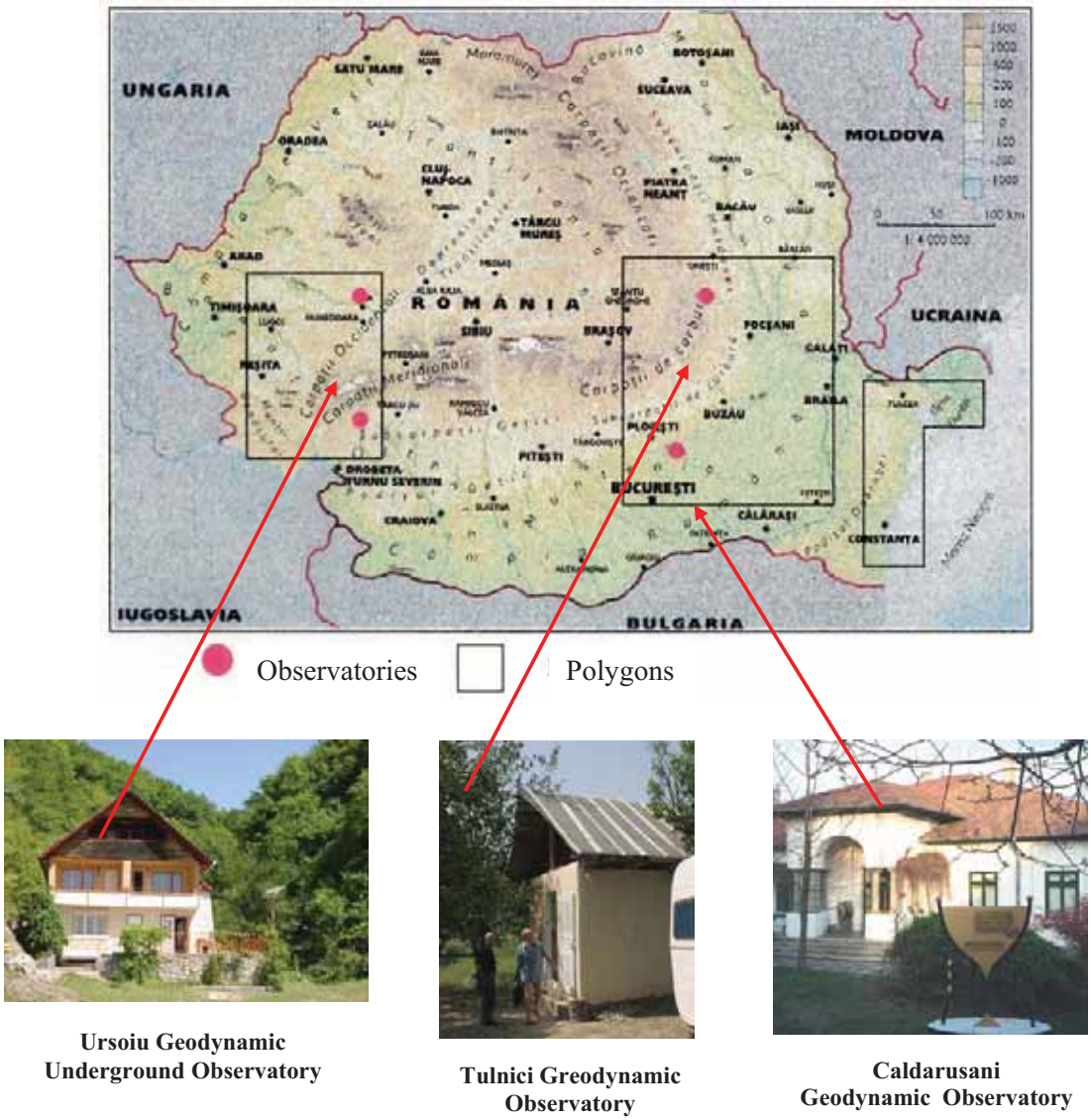
GEODYNAMIC OBSERVATORIES

We recall some important features of geodynamics observatories network coordinated by the Institute of Geodynamics of the Romanian Academy. It is composed of three polygons: Căldăruşani-Tulnici geodynamic polygon, Crăciuneşti-Deva, Sarmizegetusa-Regia, Padeş-Gorj geodynamic polygon and Delta Dunării – Mangalia geodynamic polygons (Fig.1).

The Geodynamics Observatory Căldăruşani is located in the Romanian Plain (26°16'12" longitude, 44°40'36 " latitude and altitude h = 75 m above), about 40 km N-NE of Bucharest, in a region associated with more active geodynamic stages, and an important fault (Intramoesic fault). The location of the observatory in this area allows the collection of useful information on the effects of the displacement of tectonic compartments, important information for understanding the mechanisms that lead to the accumulation of energy and the earthquakes triggering in the Vrancea region.

The Underground Geodynamic Observatory Ursoiu (22°53'51" longitude and 46°00'43 latitude) is situated at 470 m above sea level, in an old mine shaft, having between 600m and 800m from the entrance to the gallery, rooms with sealed doors to reduce drafts.

The Underground Geodynamic Observatory Crăciuneşti (22°52'28" longitude and 46°00'47 " latitude) is located in a disused mine shaft lies just north of Ursoiu observatory in similar geological conditions and altitude.



Ursoiu Geodynamic Underground Observatory

Tulnici Greodynamic Observatory

Caldarusani Geodynamic Observatory

Figure 1. Geodynamic Polygons and Observatories in Romania

The atmosphere is a complex interface between outer space and Earth's surface on the one hand, and an environment sensitive to its internal processing. From this perspective, atmospheric pressure and temperature are two important parameters whose variations can provide additional information related to the evolution of crustal deformation and, indirectly, subcrustal processes.

The air pressure changes reflected both the effect of temperature variations of the atmosphere, and the result of attraction of the Earth and its external bodies, mainly the moon and sun. In order to quantify these effects, we retained the variations of the atmospheric pressure, of the temperature and of the three directions of the crustal deformation: vertical, north-south and east-west.

We have used the north-south and east-west records from tiltmeters, vertical records from Askania gravimeters and the records from temperature and pressure sensors.

GEODYNAMIC SENSORS FOR CRUST DEFORMATION MEASUREMENTS

Analyzing the geodynamic phenomena by continuous recording of the crust deformations, indirect measurements were carried out, based on measurements of very small displacements of the sensitive elements from the system measurements. These displacements are measured by the help of displacement sensors which give a variable tension versus monitored displacement.

Water-tube tiltmeters (Figs.2 and 3) have a base of tens or hundreds of meters. For the complete recording of the variations in horizontal plane two clinometers are necessary, perpendicular on each other. Water-tube tiltmeters work in optimal conditions in a mining gallery where the temperature is constant. If the tiltmeters are situated in a location where the temperature has variations over $1^{o}C$, the measurement of the temperatures of the two terminals and the application of a temperature correction is necessary. The latter can be theoretically calculated, but it must be verified experimentally, especially in the case of tiltmeters that do not have identical environmental conditions at the two terminals.

Figure 2. Water-tube tiltmeter (single terminal)

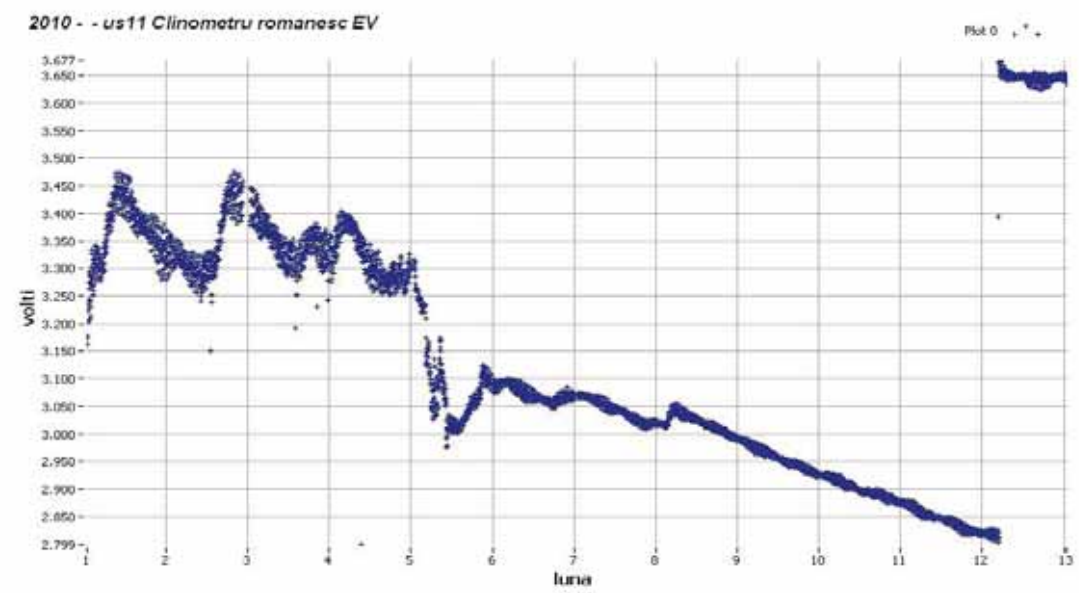


Figure 3. Tiltmeter primary recordings - 2010. URSOIU Geodynamical Underground Observatory

Tiltmeters with vertical pendulum (Fig.4) show the direction of G vector through a normal or inverse pendulum. The length of the pendulum represents the measurement base and is limited from design reasons at values of meters or tens of meters, fact that imposes a high sensitivity of the displacement sensors which are used. One pendulum can record the movement on two perpendicular directions in plane if it is equipped with displacement sensors.

Figure 4. Vertical pendulum

The recording gravimeters (Fig. 5) for observatory are ASKANIA GS11 type. This type of gravimeter was initially designated for the field measurements, using a direct reading, carried out by an operator. The instrument was modified and adapted for a continuous recording, replacing the system for reading with a displacement sensor of high sensitivity. In this way there are carried out continuous recordings of the variations of the intensity of G vector, with a higher sensitivity than the original device. The stability of the recordings was raised, as well, by assembling the instrument in fix location, continuous electric supply and by its maintenance in chambers with small variations of temperature. Gravimeters will be assembled on a concrete pile, very deeply embedded in terrain. The setting in perfect horizontal position has to be done periodically to eliminate the possible modifications of this position meantime, fact that have a sensitive influence over the recordings.

Figure 5. Askania gravimeter

The temperature of the chamber, in which gravimeter is set, must be rather constant for improving the thermostat functioning. This demand will be the best-achieved in underground observatories in which the variation of the temperature is maximum +/- 0.5^0C during one year.

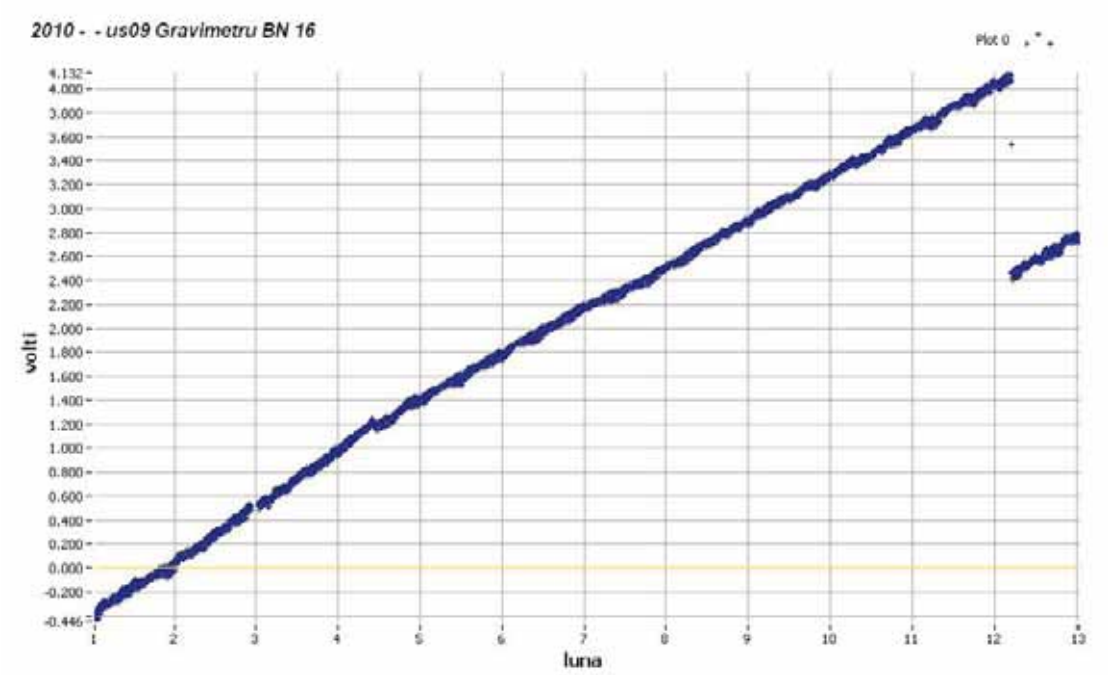


Figure 6. Gravimetric primary recordings - 2010. URSOIU Geodynamical Underground Observatory

At the other observatories the gravimeters are installed in special chambers, thermally insulated, situated in the underground, assuring a slow variation and small amplitude of temperature. In actual conditions the quasi-continuous recordings allow a good observation of the phenomenon of earth tides and allow noticing some anomalies, linked to the local conditions of surface or subsurface.

ACQUISITION SYSTEM

The electronic systems of acquisition of the data are different, from the professional ones of type National Instruments on 16 bites, with own software Lab View.

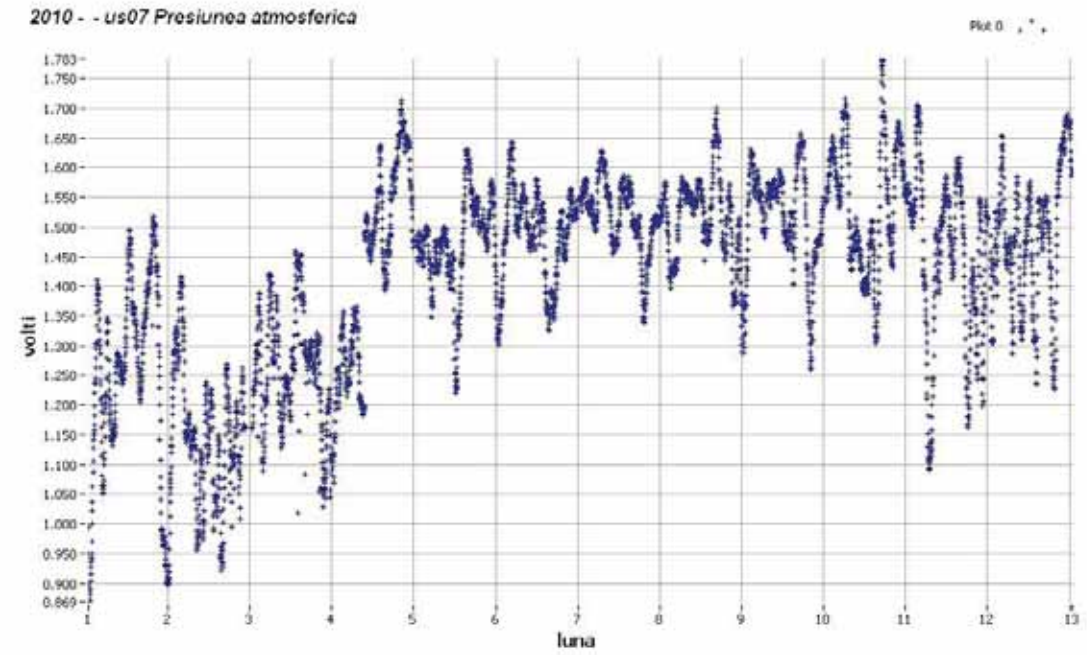


Figure 7. Pressure variations from Ursoiu - 2010.

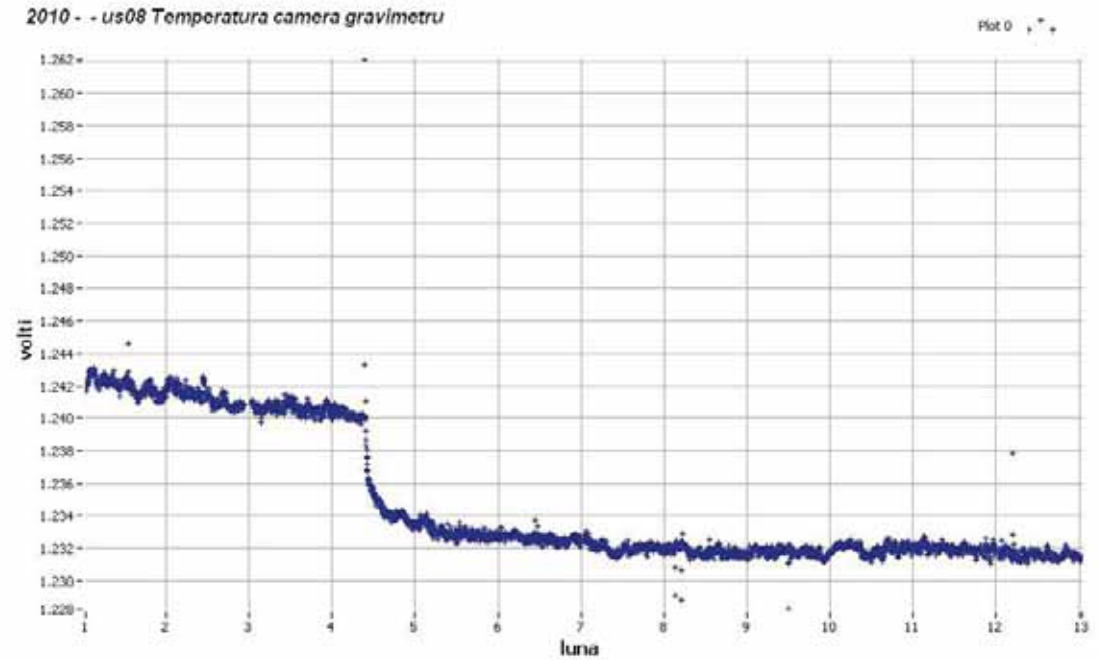


Figure 8. Temperature variations - 2010

We mention that the existence of a laboratory for calibration and ageing of the geodynamic equipment (LERAG) was necessary in the framework of the activity of research for realizing performing sensors for geodynamics.

NEW METHOD OF ANALYSIS OF THE DATA

A. Description of the HiCum stacking method of signal analysis, worked out in cooperation with the Royal Astronomical Observatory, Belgium

The analysis of any data bank representing a series of events fixed by time may prove the results to be random, non-random or a mixture of both. If the data is completely random no patterns will be found, but if any part of the data is non-random, then patterns can be detected either as a Gaussian distribution or, according to Fourier analysis, in a series of fundamental and harmonics of cosine waves. A common method of detecting these waves is to use Spectrum Analysis, which will detect the frequency and strength of all waves present, but it can be difficult to implement. However, in the situation where the detection of the presence or absence of a particular frequency is the primary objective, HiCum is a powerful tool.

HiCum is dependant on a large amount of data available and on the frequency of the wave to be detected. As each earth-tide component can be defined with a very high degree of accuracy, HiCum is a useful tool for determining whether earth-tides are influencing any of the parameters recorded in a series of timed events. ROMPLUS provides us a long series of timed events and is therefore suitable for analysis using HiCum. Using this method we are able to compare, for selected earth-tides component, the influence they may have on various parameters. In our case the parameters under consideration were occurrence, latitude, longitude, depth and magnitude.

The inspiration for HiCum came from the field of meteorology where stacking was first used in the late 19th century by Darwin. In general terms a signal has its time base divided into a series of selected constant length time periods *T*. For the detection of earth-tides signals this time period would be the time period of the earth-tide in question e.g. the Solar time clock, S1, or the lunar time clock, M1. This time period is then represented by 360°. The time base for each of these periods is then normalized as shown in Fig. 9. The occurrence of an event, E_i, at time t_i can then be represented by the phase α_i, which is the difference between the event E_i time and the time of the original event in the series, t_0, modulo T (except an integer number of periods T).

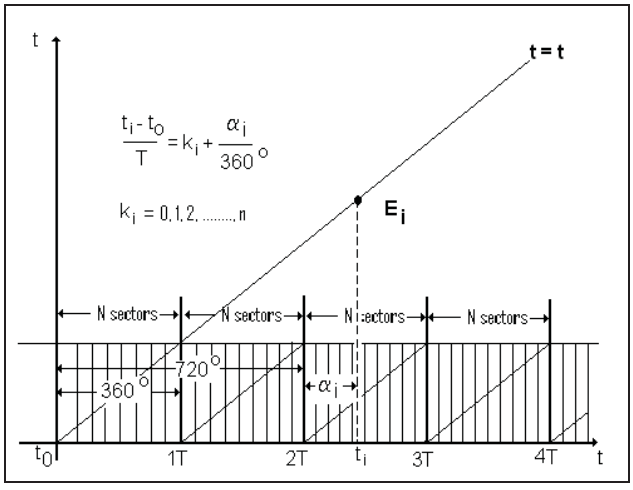


Figure 9. The time series partition into selected time period T. An event E_i occurring at time t_i will be α_i out of phase of the original event, t_0.

Each of these time periods are further divided into N sectors each of length 360°/N. The selection of an optimal number of sectors is done to find enough precision in phase and a significant number of events in each sector (even for small N).

For a parameter recorded at regular intervals, the data for each sector N (for example, in our case, the latitude, the longitude, the depth or the magnitude) is averaged and synchronized. These averages are then stacked producing a histogram bar representing the activity for this sector. This process is carried out for each sector until a complete histogram is produced for the time period under consideration (Fig.10). The histogram is then fitted, by nonlinear least square method, with the cosine function for that time period. The parameters of amplitude and phase are calculated. A graph can then be produced showing the link, in terms of phase and modulation, between the parameter under consideration and the chosen time period.

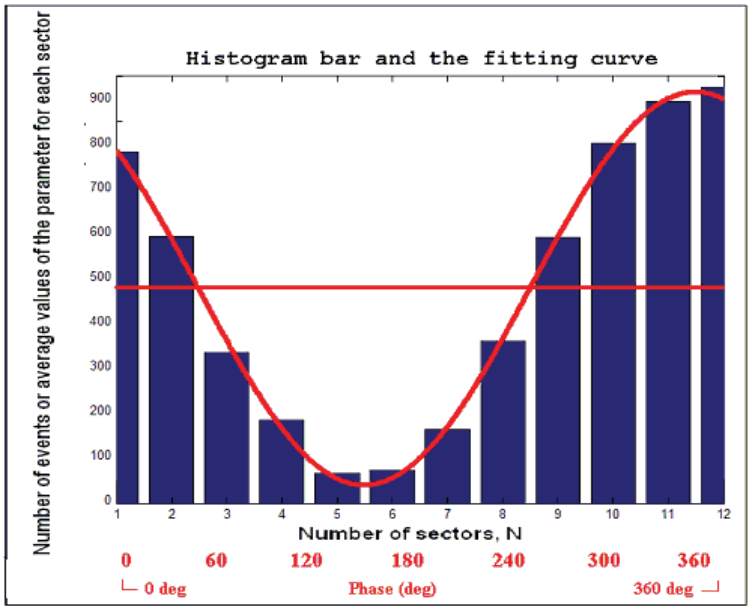


Figure 10. A histogram bar model, representing the distribution of the seismic activity or the average values of the parameter for each sector and a typical HiCum curve. The bars represent the results of the stacking of data, sector by sector (in this case N = 12 sectors). The cosine signal represents the phase of the detected signal in relation to the earth-tides under analysis and the amplitude of the modulation of the detected signal

In the case of data recordings of discrete events, such earthquakes, the total number of all events recorded in each sector N is the value of the histogram bar for that sector. The remainder of the computation is then carried out in exactly the same fashion as for continuous recordings.

HiCum is embedded in a computer program which can take the data from ASCII files and display simultaneously the parameters of the above trigonometric function in a series of graphs. Thus the tendencies for various parameters can be expressed in terms of period, phase, amplitude and amplitude modulation. The input format for the HiCum software is based on the Doodson argument [Melchior, 1978]. Figure 10 shows the characteristic features of a typical HiCum graph. The HiCum curve is a combination of the total output signal and the modulation of that signal by the selected earth-tides component, as detected by HiCum.

Using this method we are able to compare, for selected periodicities, influences on various parameters, in our case the parameters under consideration were occurrence, latitude, longitude, depth and magnitude. The selected time period will be that which is suspected to have an influence on the parameters in question e.g. the solar time clock S1. A time period is equivalent to an interval of width 360°. It is also necessary to select the optimal number of sectors for the HiCum computation.

B. HiCum Applied to the geodynamical data

We present a graphical example (Figs. 11a,b,c and 12a,b,c) of HiCum analysis for the three components of the theoretical earth tide data 2010 at the level of the Caldarusani and Ursoiu Geodynamical Observatories.

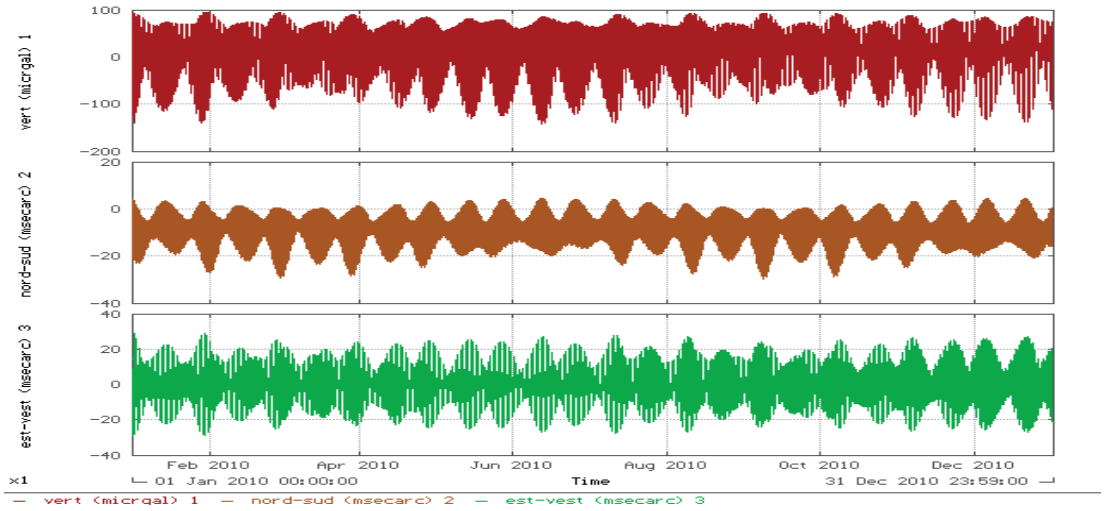


Figure 11a. Căldăruşani Geodynamical Observatory-2010. Theoretical variation of the earth tide components

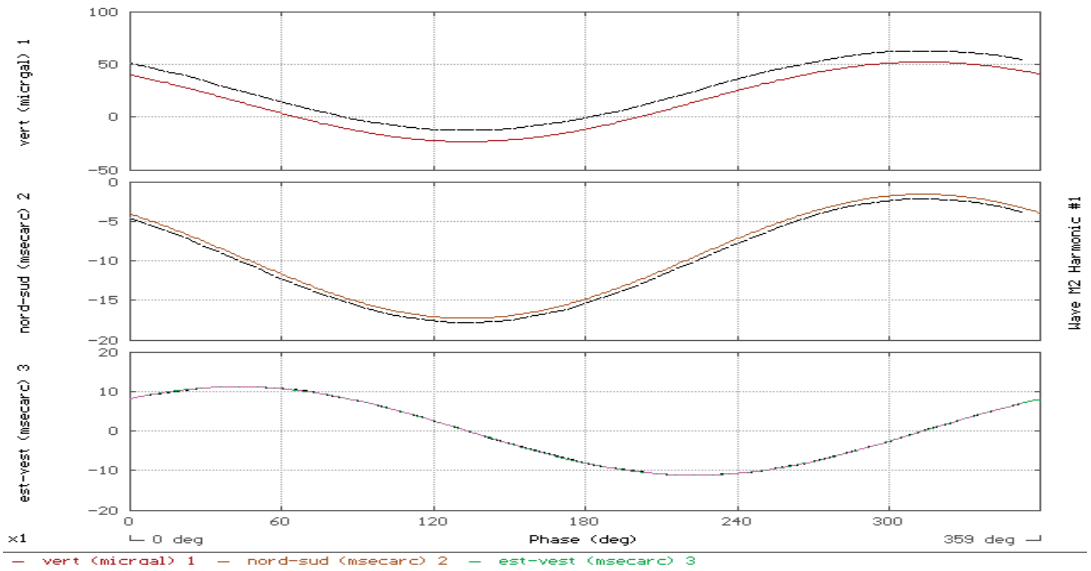


Figure 11b. Căldăruşani Geodynamical Observatory – 2010. The semidiurnal component of the three directions of the theoretical earth tides obtained by means of the HiCum method

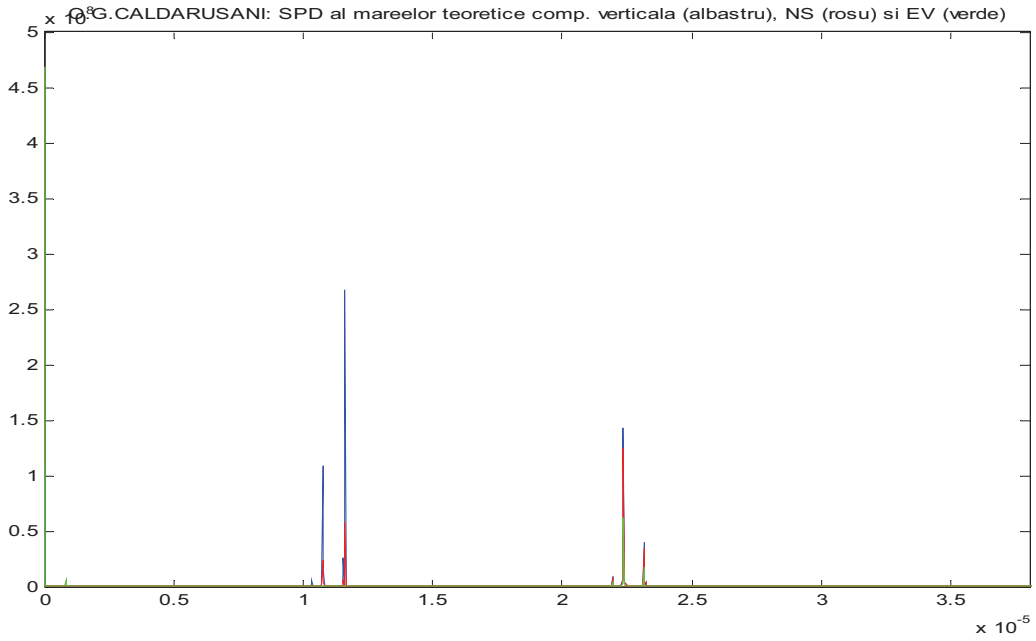


Figure 11c. Căldăruşani Geodynamical Observatory – 2010.
The power spectral density of the three components of the theoretical earth tides

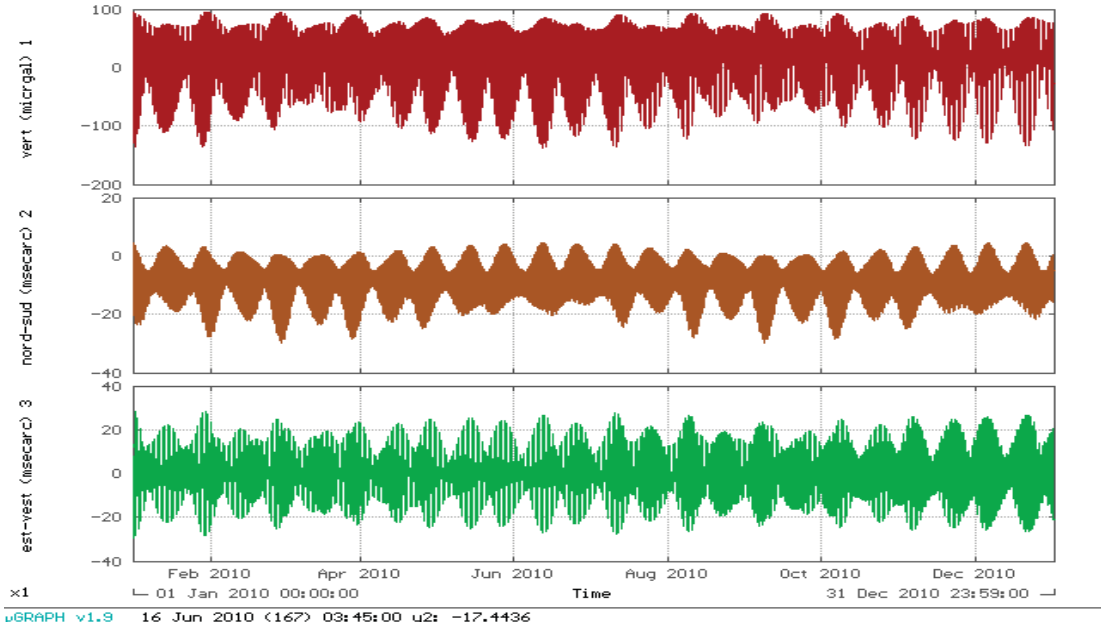


Figure 12a. Ursoiu Underground Observatory-2010.
Theoretical variation of the earth tide components

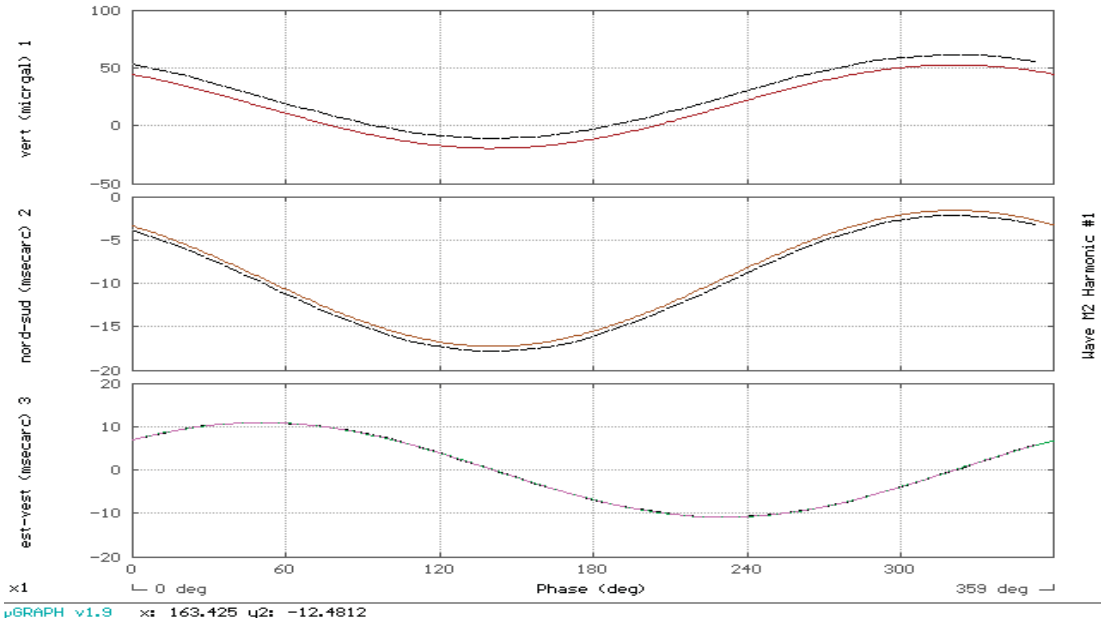


Figure 12b. Ursoiu Underground Observatory- The semidiurnal component of the three directions of the theoretical earth tides obtained by means of the HiCum method

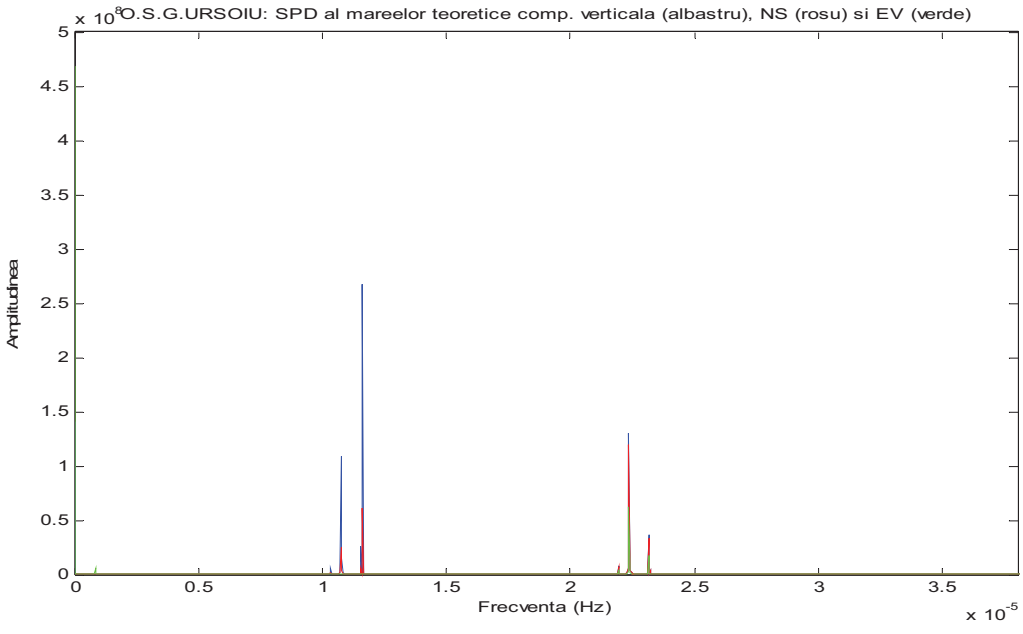


Figure 12c. Ursoiu Underground Observatory .The power spectral density of the three components of the theoretical earth tides

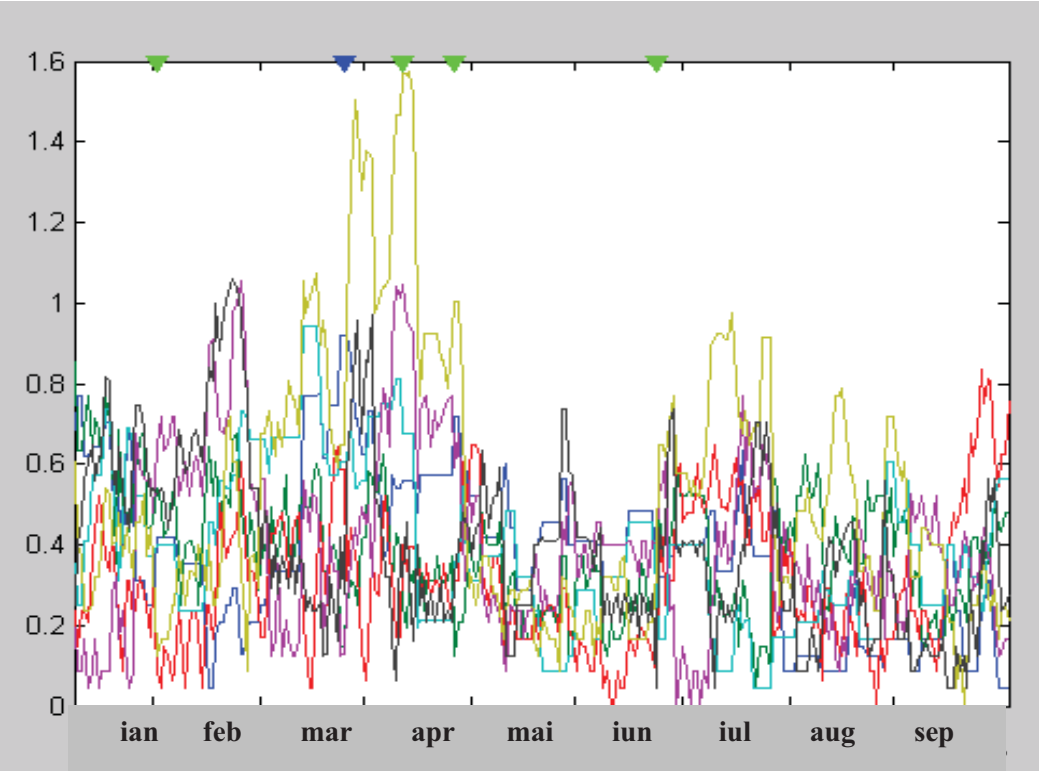


Figure 13. The amplitude variation of the sinusoidal curve obtained by interpolation HiCum method for seismic activity Vrancea area (January-October 2009), for seven different periods, using mobile windows of 33 day shifted by one day

▽- romanian earthquakes with magnitude **4.5** ≤ ***Mw*** < **5.0**

- romanian earthquakes with magnitude ***Mw*** ≥ **5.0**

Values of the amplitude of the sinusoidal curve obtained by interpolation HiCum method for seismic activity:

- T= 1 h
- T = 8h
- T = 12h
- T = 24h
- T = 7d
- T = 13.66 d (Mf period)
- T = 29 d (sinodical moon period)

THE PRESENCE OF THE PRESSURE VARIATIONS IN THE RECORDS

The study of the of the atmospheric pressure influences on the crustal deformation is not simple. The Earth's atmosphere, defined by highly fluctuating parameters, can be measured and survey only by advanced techniques and a dense network of observation stations. An example is the weather getting harder to do in terms of sudden changes, in terms of the variations of the coefficients of the nonlinear equations in the currently used algorithms.

Variations of different amplitudes and frequencies of some important geophysical parameter can be found in the geodynamical records (Ex: component daytime or semidiurnal). These parameters are: daily temperature variations associated with the corresponding atmospheric pressure variations, earth tides and anthropogenic activity.

We have analyzed by means of the FFT and HICUM methods, the common periods of the atmospheric pressure variations and crust deformation variations recorded by sensors mentioned in Chapter geodynamic observatories.

Processing of the data was done with the MICROGRAPH program and own programs written in MATLAB environment.

We found:

– A band of low frequency corresponding to the relatively random variation of the temperature and to the seasonal periods related to the movement of Earth's revolution around the sun and the rotation axis inclination to the ecliptic;

– A band of frequencies corresponding to diurnal solar attraction of the Moon on air masses and frequencies "daily" due to the Earth's rotation axis;

– A band of frequencies corresponding to the semidiurnal moon-sun attraction.

DISSEMINATION OF RESULTS

The researchers of the "Sabba S. Stefanescu" Institute of Geodynamics of the Romanian Academy were present with a lot of scientific communications to prestigious national and international symposium, conferences and workshops. Their scientific activity is also reflected in many papers published in appreciated scientific revues.

International cooperation

In the report interval, several important international cooperation programs of the Institute of Geodynamics have continued, such as:

Virtual International Laboratory of Geodynamics (2001-to present) - "Sabba S. Stefanescu" Institute of Geodynamics of the Romanian Academy in cooperation with the United Institute of Earth Physics "O. Yu. Schmidt" of the Russian Academy of Sciences

CIPACT 930173-ERB-351 PL 926540 Contract, Co-operation Program between the Royal Observatory of Belgium and the Institute of Geodynamics of the Romanian Academy - studies of the influences induced by earth tides on the geophysical data.

and others have been established:

Unesco Chair in Geodynamics (2004-to present) - Agreement between the United National Educational, Scientific and Cultural Organization and "Sabba S. Stefanescu" Institute of Geodynamics of the Romanian Academy (Romania)

Extreme Events, Causes and Consequences (**E2C2)** Project (2005 – 2008) E2-C2 is a Specific Targeted Research Project (STREP) within a Pathfinder Initiative aimed at Tackling

Complexity in Science and initiated by the New and Emerging Science and Technology (NEST) Program of the European Commission, as part of its Sixth Framework Program (FP-6). E2-C2 is coordinated by Michael Ghil (ENS), with Pascal Yiou (LSCE) as Associate Coordinator.

Research stages (2007-2008) at the Royal Observatory of Belgium in the frame program of a Phd on the theme "Studies of the gravimetrical influences induced bz earth tides on the intermediate Vrancea seismic activity".

THE UNESCO CHAIR IN GEODYNAMICS - ROMANIA

In the year 2005, within the Institute of Geodynamics "Sabba S. Stefanescu" was established **The UNESCO Chair in Geodynamics**, dedicated to the training of geoscientists in the field of Complexity science (non-linear approach, computational modeling, chaos theory, catastrophe theory, fractal geometry, etc.) and also to the coordination of inter- and trans- disciplinary research in the project: **The Earth – A Living Complex Planet**.

Context

To analyze and characterize **Complexity** is a challenge posed to the human mind which must structure *a new ontological framework*, a *new set of concepts*, a new *methodology* and an *adequate experimental technique* that would all be qualitatively different from those used today. This framework, labeled as the Science of Complexity [1], has been defined through the integration of last years results concerning the non-linear approach of phenomena in nature, results obtained by a series of new disciplines such as *Synergetic*, *Chaos Theory*, *The Catastrophes Theory* etc. Additionally, the appearance and progress in new related fields like *Fractals*, the *Theory of Bifurcations*, as well as the *Cellular Automatons Theory* and *Neural Computers* generated many novel and convenient mathematical models for describing the surrounding reality. Therefore, the **Science of Complexity** can be considered a collection of models and theories capable of allowing the understanding of local-global, part-whole type of relationships in a sufficiently general way so it can be applied to the study of all that is living, starting with genes, organisms and ecosystems and going as far as the study of transitions from atoms to materials and products, from computers to local networks and Internet, from citizen to group and society.

The Science of Complexity can be viewed as an integrating science, capable of ensuring an inter and trans-disciplinary approach [2], to generate connections between different areas of knowledge, to create bridges between specialists in different research areas, from different schools and from different cultures, bringing them together in interdisciplinary teams targeting strategically important topics, such as those demanded by ensuring a sustainable development.

The Science of Complexity is considered today the central pillar with which one can restructure information in a new and coherent paradigm that is comprehensible to all social levels, thus also having a catalytic role by accelerating the flow of information and knowledge to society. Furthermore, it generates the primary activities imposed by the joint Man-Environment evolution, a fact that traditionally has not been generally known or 'advertised' to the public at large since Evolution had been usually linked only with ecosystems and biological species, or – as a special case of the latter – to the appearance and gradual enrichment of the human intelligence along the ages. Nevertheless, one of the key contributions of the Science of Complexity towards a new paradigm is highlighting this

entwined two-fold interdependent concept of Man-Environment evolution that is both reflected and provided by a constantly more complex and far-reaching design, control and utilization of products and systems, themselves with a previously unseen level of complexity.

From this perspective, the sociological, economical or engineering studies/ sciences must be reconfigured and integrated in a larger and broader subject (meta-science) that transcends, yet combines them interdisciplinary in order to create this new framework in which each part would also depend on and be supported by elements from the other ones.

In a first stage, the generation and application into practice of the previously mentioned phenomenon has already been started as an increasing number of researchers more and more frequently refer to such novel meta-domains, e.g. *bioeconomy, biogeophyisics, geobiophyisics, astrobiophyisics* as well as *bioelectronics, microelectromechanics* and *jurisdynamics*. It should be clear that, once such a meta-science has been generated, disciplines like economics and sociology will no longer be studied separately or independently, but interdependently and always within the context of their interactive co-evolution with **the Planet Earth System**.

Mission:

Structuring a **Science of the Entire Earth** by integrating the expertise of the geosciences in an inter- and trans-disciplinary vision, able to allow the understanding of the co-evolution of processes that assure the Earth's geostasis.

Goals:

Consequently, in this new context one may expect increased interest and more intense studies in the following possible directions:

(1) Stimulating knowledge transfer between different fields and encouraging pluri- and inter-disciplinary approaches;
(2) Evaluating the capability of present day's methodologies of efficiently understanding theoretically and experimentally the transition from part to the whole, from complicated to complex;
(3) Discovering or/and inventing new experimental concepts, models, theories, methods and techniques of monitoring and evaluating hierarchical dissipative systems that evolve far from thermo-dynamical equilibrium;
(4) Developing researches and studies dedicated to conceptualizing and understanding co-evolutionary processes that assure planet Earth's geostasis, applicable in the design of durable development policies, social-economic development and the continuous training process of human resources.
(5) Developing and successfully using an educational infrastructure that can ensure the transfer and filtration of information and specific knowledge and know-how.

The main target is to educate the new generation and re-educate the current one by shifting from the current Newtonian paradigm to one related to nonlinearity and complexity. This should result in a better understanding of current phenomena, increased capacity and willingness to assimilate new knowledge and adopt an exploratory frame of mind in order to further generate new knowledge. Therefore, a long-term consequence of such a new educational infrastructure should be the creation and propagation through society of a life-long learning attitude, based on a formal 'standard' education but also including an informal one and a non-formal one as well, while at the same encompassing both localized and delocalized aspects (e.g. e-learning).

Partners:

The Romanian Academy of Scientist
The Academy of Technical Sciences, Romania
The Academy of Agricultural Sciences, Romania
The Polytechnic University of Bucharest, Faculty of Applied Sciences
The Polytechnic University of Bucharest, Faculty of Electronics and Telecommunications
The Polytechnic University of Bucharest, Faculty of Computer Science
The University of Bucharest, Faculty of Physics, Magurele
The International Institute of Biodynamic, Romania, UNESCO Institute

Activities:

1. Research projects, completed in bachelor, master and/or doctoral degree thesis
   - 1.1 Modeling of structuring by fragmentation processes, consequences in geodynamics
   - 1.2 Modeling the geodynamic active area: Vrancea zone by using cellular automata technique.
   - 1.2 Fractal Antennas: concept, applications, implications for bio-geophysical measurements
   - 1.3 Chaotic resonance, consequences in adapting measurement equipment and experimental protocols to the requirements imposed by a non-linear approach
   - 1.4 Synchronizing chaotic oscillators, experiments on Chua oscillators
   - 1.5 Wigner-Ville and Wavelet techniques; applications in processing of seismic records

Studies and researches

1. Geobiodynamics and Roegen[1] Type Economy [1] [2]

The evolution of economic phenomenon in today's exponential globalization and development of goods is defined as a "turbulent" evolution, in which predictability is continuously reduced and the influence of social or bio-geophysical phenomenon becomes important. Economic stability is becoming more and more dependent on the labor market mutations (information society, knowledge economy) and on global climatic changes.

The exponential growth of good production in the context of scarce global and unevenly distributed resources generates both social and economic problems. Solving these problems requires studies at the Geo – Bio – Socio – Economic interface.

In our studies we explore the vision of Nicolae Georgescu Roegen, who contributed significantly to **bioeconomics** and the ecological economics. The basic problem in this first

[1] "Nicholas Georgescu-Roegen, born Nicolae Georgescu (Romania, Constanta, Romania, 4 February 1906; Nashville, Tennessee, 30 October 1994) was a Romanian mathematician, statistician and economist, best known for his 1971 magnum opus [2], which situated the view that the second law of thermodynamics, i.e., that usable "free energy" tends to disperse or become lost in the form of "bound energy", governs economic processes. His book is considered a founding book in the field of thermoeconomics." Roegen introduced into economics the concept of entropy from thermo-dynamics and did foundational work which later developed into evolutionary economics. Also his work contributed significantly to bioeconomics and to ecological economics" - WIKIPEDIA

[2] The paper "Geobiodynamics and Roegen Type Economy", C. Udriste, M. Ferrara, D. Zugravescu, F. Munteanu received the 2010 Romanian Academy Award

approach was to find a model in which the entropy is related to the economical phenomena [3]. For this purpose a formal correspondence between economic processes and thermodynamic laws was identified, with heuristic implications for characterizing the dynamics and evolution of economical systems. Based on this formalism, the study of the problem of an economical equilibrium in the case of aggregating together initially stable and independent economical subsystems in a final functional entity was initiated, e.g. the set up of the European Community's economy.

Similarly, we intend to extend the physics' black hole concept in order to apply it in economy as well. The published results [4,5] represent a preliminary step in defining the bio-economic process and generating a model able to capture on one side, the coupling between geo-physical and clime processes, and on the other side, social and economic processes.

2. The study of time evolution of the mechanical oscillation measured the crust – atmosphere interface in an urban area

By using continuous monitoring systems specific to the experimental Geodynamics, the studies tries to discriminate between the anthropic and natural component, to characterize the "noise" that define the "normal" fluctuation of the mechanical oscillations (micro-seismicity). Some major objectives:

- identification of a pattern of the anthropic activity in a metropolis, the stability over time and,
- identification of some deviations from the specific pattern and the correlation with some socio-politic processes that generate the urban social dynamics.

The experiment fits in a broader theme that aims to study, from a non-linear perspective, the coupling between the processes and phenomena that assure the stability of an ecological system, to define specific parameters capable to characterize objectively the property called: life quality, to offer a conceptual and methodological basis for understanding and monitoring energy-material and informational evolution that assure the geostasis at the scale of the whole Earth.

For the experiment we use two different classes of sensors:

- a seismic accelerometer mounted on a special pillar inside the Laboratory for the Calibration and Verification of Geo-dynamic Devices (LERAG) of the Institute of Geodynamics (IG-SSS-AR) and
- a high-sensitivity hydrophone placed in a borehole executed near the same building, in the courtyard of the Institute (see picture 4-6)

Acquisition, signal processing and storage is done using an acquisition board (National Instruments type). Monitoring is done in an urban area, crowded, with intense human activities. The location of the sensors is in the pictures below.

Figure 1. The position of IG-SSS-AR on the Bucharest map.

Figure 2. General map of IG-SSS-AR

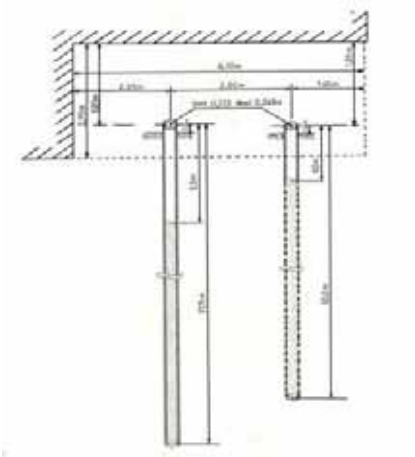


Figure 3. The boreholes(vertical section)

Figure 4. LERAG map (measure points)

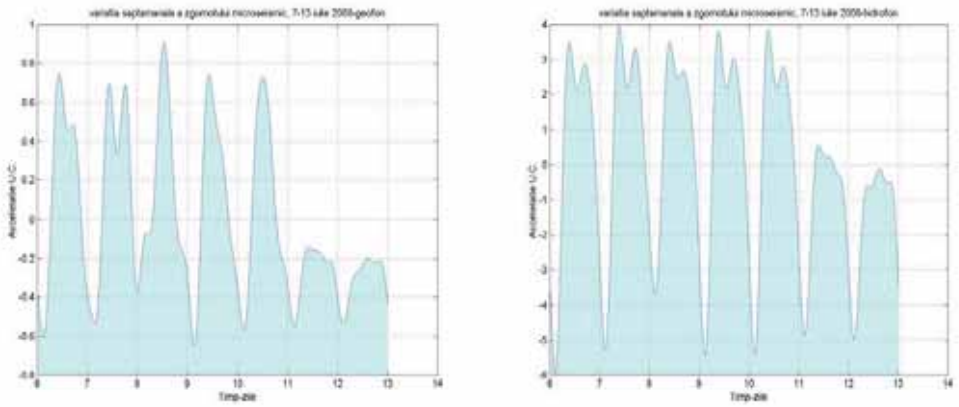


Figure 5. The weekly variation of the mechanical energy oscillations; 7 to 13 July 2008, geophone (left), hydrophone (right)

In Figure 5 is represented the variation of the average energy signals delivered by the geophone, respectively hydrophone, in the 0.1-250Hz band. We can see a daily pattern, more stable in the case of the hydrophone and significantly lower on Saturdays and Sundays. Continuous monitoring of these oscillations has revealed significant variations during legal holidays (picture 6 - Easter), but also on certain days of the week. The significance of these variations can be correlated with spontaneous (self-organized) or organized social processes. Application of nonlinear analysis methods of the acquired data and monitoring meteorological and socio-economic parameters allow the use of advanced processing techniques like data mining, thus contributing to a better understanding of the evolution of social community (self-organization / organization phenomenon) and of interaction between living and non-living systems inside an ecosystem with intense anthropic activity.

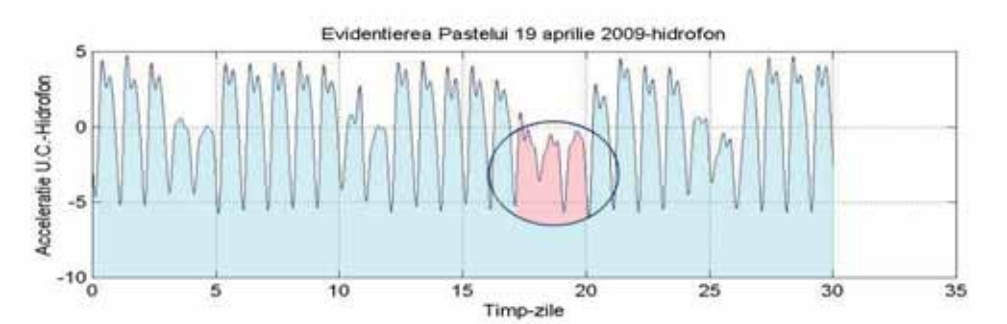


Figure 6. The variation of the mechanical energy oscillations during April 2009 (Easter holiday)

3. The design of an Artificial intelligence-based system for improved seismic risk assessment in VRANCEA zone

The accurate **evaluation of the seismic risk** of a certain geographical region is a major objective in modern geophysical research. Many studies were made to understand better the cumulative processes of stress build-up in seismic regions, as such processes are implicitly responsible for the ultimate triggering of earthquakes. Recently, such studies have had a new impetus due to the application of a very new set of theories and models that are all known as the 'Science of Complexity'. After Mandelbrot's introduction of the fractal geometry and the subsequent appearance and affirmation of the Chaos Theory and the Catastrophes Theory, seismic events have been reinterpreted as typical examples of manifestations for the dynamics of nonlinear systems. Self-organization has quickly become the most important and often used concept in modeling earthquakes [6,7]. Other studies, made using large databases that included any seismic events of magnitudes larger than 2 on the Richter scale, highlighted variations between intervals with acceptable or high predictability of the seismic events, and those in which such events seemed to have occurred randomly. This observation led to the conclusion that the degree of predictability itself for seismic events is a variable that changes in time. From this point of view, the earthquake was re-interpreted as an expression of the **geocomplexity**, and this new point of view reoriented the research in this area towards understanding complex phenomena. Specifically, this marked the beginning of a new stage in geosciences in general, and in seismologic research in particular, especially regarding the practical application of the main concepts, models, theories and methods provided by the new paradigm of Complexity.

In this research program, one assimilates a seismically active region with a **nonlinear complex and hierarchically structured system**, then the following features can be deduced or assumed as characterizing this system:

a) Each seismic event modifies irreversibly the system's structure, and for this reason a new re-assessment of the situation and re-adaptation of the analytical model has to be carried out permanently;

b) Each seismic event discharges a specific amount of energy (recorded in earthquakes as the magnitude, e.g. on the Richter scale), and this energetic variation modifies the internal state of the system and provides totally new and different initial conditions for the newly started phase of charging. The immediate result of such a behavior is a much reduced predictability, yet not impossible;

c) The energy discharged by each seismic event that 'resets' the local system is radiated/transferred to neighboring systems of equal or inferior hierarchical position. For this reason the accurate understanding of the evolution in time of a seismic region cannot be carried out without an initial thorough and multidimensional monitoring (at the same or from a higher hierarchical level) using a network of various types of sensors;

d) When the system is in the critical state preceding the seismic discharge, the triggering factors can alternate or combine with inhibiting ones, resulting in a reduced classic predictability of the seismic event. At the same time, this also highlights two necessary purposes (or requirements) for which a sensor network intended to monitor a seismically active region must be designed and set up: - capable to evaluate objectively when the monitored system (i.e. the seismic region) evolves in a critical state, and -closely monitor the low intensity processes that are resonant with the epicenter, and that could thus bring valuable information about how the triggering signal appears;

e) The monitored seismic region is just another element of a larger and also hierarchically organized system (Gaia) [8], being coupled and interdependent on the interaction with other similar systems in this super-system. This means that other important data can be obtained by monitoring the energy exchange, and other types of exchanges, between adjacent and subordinated systems, both living or not;

f) The changes in the structure of the system will always take place as a function of the variations in the fluxes of energy, information and matter. As such, these changes will obey universally valid laws (pattern, alometric constants) which can also be used in our analytical model that controls the system in order to characterize in real-time the evolution and behavior of the observed region.

The theoretical approach that is used for the scientific design of the **Artificial intelligence-based system** suppose to combine all the above listed principles and methods derived from the Science of Complexity. A preliminary critical review of the results obtained using classical, i.e. analytical, tools will be initially carried out in order to ensure the best results in the application of the cellular automata for the desired purpose. The other essential component of the system is the software for analysis, control and decision, and that will be obtained by the direct application of discrete modeling based on the concepts and laws of the Deterministic Chaos Theory. The set of simulation models thus obtained will be interlinked in an interactive assembly called **multimodel[3].** Once both the hardware and the software are

[3] A great deal of speciality terms have been used extensively in this project proposal. For the reader's convenience, we detail below their meaning for an easier understanding of this document.

1. Evolution - the trajectory followed by the system in an abstract mathematical space that is equivalent to the reality and describes it from a different point of view (e.g. topologically). Examples of such abstract spaces are the phase space (which can be used to describe the state of the system), and the morphological diagrams on a catastrophe surface.

realized and integrated together, the operation of the resulting hardware-software assembly will be tested by observing its detailed behavior when subjected to various stimuli. This testing will be practically implemented by subjecting the cellular automata-multimodel assembly to various experiments and/or by running numerous Monte-Carlo simulations. The obtained results will set up **a database** that will be interactively used to **train a neural network**. The ultimate aim is to make the neural network capable to discern the specific patterns associated to each model within the multimodel, and to permanently assess the similarity between the picked-up signals (originated from a battery of various sensors *a priori* installed in the seismically active region to be observed) and these characteristic patterns. We should highlight that this is one of the **key points of the originality** of this proposed project: by *integrating together cellular automata, a multimodel, a neural network and a data acquisition & processing block*, an entirely novel type of system is obtained, namely an **intelligent and self-adaptive, i.e. self-learning, monitoring system** capable to dynamically evaluate the on-ground situation in real-time. **To our knowledge, no such system is existent in Romania or in the entire Eastern and Southern Europe.** The system will be used to monitor a part of the Vrancea county, a very well-known seismically active region, where were located the epicentrum of most of Romania's high-magnitude earthquakes.

Recent studies have shown that a system with artificial intelligence that itself behaves chaotically will, under the influence of a specific flux of data/stimuli, synchronize itself with the monitored Reality. Therefore, it can be stated that the intelligent monitoring system proposed to be built and used in our project will asymptotically converge towards 'self-identification' with the monitored reality itself. It can be concluded that the project will bring an essential contribution to the understanding of the synchronization of chaotic systems and the application of such a phenomenon in an intelligent monitoring system intended to observe a part of the Vrancea county.

1. P Erdi, Complexity Explained, Springer, 2008
2. Transdisciplinarity - Theory and Practice , Basarab Nicolescu, (Ed.), Hampton Press, Cresskill, NJ, USA, 2008
3. T. M. Lenton, Gaia and natural selection, Nature, 394, (1998), 439 -447.
4. C. Udriste, M. Ferrara, F. Munteanu, D. Zugravescu, Economics of Roegen-Ruppeiner-Weinhold type, The International Conference of Differential Geometry and Dynamical Systems, University Politehnica of Bucharest, October 5-7, 2007.
5. Geobiodynamics and Roegen Type Economy" ,C. Udriste, M. Ferrara, D. Zugravescu, F. Munteanu,
6. Pak,P., Tang, C., Earthquakes as a self-organized critical phenomenon, J. Geophys. Res., 1994, 15635-15637;
7. Rundle, J., Turcotte, D. L., Rundle, P.B., Yakovle, G., Shcherbakov, R.,Pattern dynamics, pattern hierarchies, and forecasting in complex multi-scale earth systems, Hydrol.Earth Syst.Sci.Discuss., 2006, 3, 1045-1069
8. Lovelock, J. E.. Gaia: A New Look at Life on Earth, Oxford University Press, Oxford NewYork, 1987

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2. Multimodel – An assembly of models (dynamic systems) and computational simulations employing cellular automata (intelligent agents) capable to discriminate/classify the data flux (streaming) provided by the sensors from the monitored reality.

3. Informational filter– An assembly of methods for the multiscalar evaluation of a data flux (streaming) provided either by sensors directly from the monitored reality, or from the multimodel's database.

4. Inteligent (active) monitoring - Self-adaptive system (neural network) that processes the acquired sensor data and which ultimately provides information about the monitored system by extracting and processing the relevant data in accordance to the utilized multimodel.

5. Heuristics - System of logic procedures and methodical rules for theoretical (re)search activities.

SELECTED REFERENCES

2007

N. CADICHEANU, M. VAN RUYMBEKE (2007), *Research of tidal periodicities in the seismic hazards of the Vrancea zone (Romania),* European Geosciences Union 2007, Geophysical Research Abstracts, Vol. 9, 02156, 2007

M. VAN_RUYMBEKE, FR.BEAUDUCEL, A.SOMERHAUSEN, R. HOWARD, S.NASLIN, N. CADICHEANU and ZHU PING (2007), *Description of the HiCum method dedicated to periodical signals analysis,* European Geosciences Union 2007, Geophysical Research Abstracts, Vol. 9, 09858, 2007

MIHAELA POPA, NICOLETA CADICHEANU, LEONTINA L. ROMASHKOVA, MIRCEA RADULIAN, DUMITRU STANICA, VLADIMIR G. KOSSOBOKOV (2007), *Seismic monitoring aimed at intermediate-term prediction of strong earthquakes in the Vrancea region,* European Geosciences Union 2007, Geophysical Research Abstracts, Vol. 9, 06563, 2007

CADICHEANU, N., VAN RUYMBEKE, M., 2007*, Periodical tendencies in the seismic activity of the Vrancea zone,* Simpozionul Naţional de Geologie şi Geofizică, GEO2007, 25 mai, Bucureşti (oral presentation).

VAN RUYMBEKE, M., ZHU, P., CADICHEANU, N., AND NASLIN, S.: *Very Weak Signals (VWS) detected by stacking method according to different astronomical periodicities (HiCum),* Nat. Hazards Earth Syst. Sci., 7, 651–656, 2007.

CADICHEANU, N., VAN RUYMBEKE, M., and ZHU, P.: *Tidal triggering evidence of intermediate depth earthquakes in the Vrancea zone (Romania),* Nat. Hazards Earth Syst. Sci., 7, 733-740, 2007.

CADICHEANU N., *"Geodynamical implications of a possible characteristic time pattern of the tidal triggering effect on the intermediate-depth seismic activity in the Vrancea zone.* "International Symposium on Strong Vrancea Earthquakes and Risk Mitigation (CRC), October 4-6, 2007, Bucharest, Romania

CADICHEANU N., "*Spatial and temporal variations of the correlation coefficient between some earth tides components and earthquakes triggering for the intermediate-depth seismic activity zones*" The Third International Conference (CEI), SCIENCE AND TECHNOLOGY FOR SAFE DEVELOPMENT OF LIFE LINE SYSTEMS, 24-26 October, 2007, Bucharest, Romania

2008

CADICHEANU, **N.** ZHU, P. and VAN RUYMBEKE,M.: *Spatial and temporal variations of the correlation coefficient between M2 and S2 earth tides components and earthquake occurrence for the intermediate-depth seismic activity zones,* Acta Geodaetica et Geophysica Hungarica, vol. 43, 2, 2008, Special issues.

CADICHEANU NICOLETA, Zhu Ping şi Michel van Ruymbeke, *"Some aspects of seismic wave attenuation in the Vrancea (Romania) zone confirmed by the tidal tomography",* European Geosciences Union (EGU), Viena, 13-18 Avril, 2008.

NICOLETA CADICHEANU, Michel van Ruymbeke & Ping Zhu, *„Statistical tidal tomography of the Vrancea intermediate-depth seismic zone"*, International Earth Tides Symposium „New Challenges in Earth' Dynamics", 5-9 September 2008, Jena, Germany

Ping Zhu, NICOLETA CADICHEANU, Michel van Ruymbeke, *„Tidal triggering earthquakes a case study at Vrancea seismic zones",* International Earth Tides Symposium „New Challenges in Earth' Dynamics", 5-9 September 2008, Jena, Germany

Zhu Ping, Michel van Ruymbeke, NICOLETA CADICHEANU, Sebastien Naslin, *„A staking method (HiCum) and its applications",* International Earth Tides Symposium „New Challenges in Earth' Dynamics", 5-9 September 2008, Jena, Germany.

2009

PING ZHU, MICHEL van RUYMBEKE, NICOLETA CADICHEANU, *A stacking method and its applications to Lanzarote tide gauge records,* Journal of Geodynamics, 48, 138–143, 2009, doi:10.1016/j.jog.2009.09.038.

CADICHEANU NICOLETA: *Long-term quasi-period tendencies of the semidiurnal tidal influences on the intermediate-depth seismic activity zones detailed with statistical tidal tomography,* SECOND INTERNATIONAL SEMINAR ON PREDICTION OF EARTHQUAKES, Lisabona, 29-31 April, 2009.

CADICHEANU NICOLETA: *The statistical tidal tomography - a new investigation method for the intermediate-depth seismic activity* SESIUNEA STIINTIFICA ANUALA A FACULTATII DE FIZICA, 5 iunie 2009, Bucuresti.

2010

CADICHEANU, N.: *The statistical tidal tomography – a new investigation method for the intermediate-depth seismic activity,* Romanian Reports in Physics, Vol. 62, No. 4, P. 865–877, 2010

CADICHEANU NICOLETA & Michel van RUYMBEKE: *Statistical tidal tomography of the intermediate-depth Vrancea seismic zone*. THE XIX CONGRESS OF THE CARPATHIAN-BALKAN GEOLOGICAL ASSOCIATION, 23-26 September, 2010, Thessaloniki, Greece.

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IAHS

IAHS ACTIVITIES IN ROMANIA

2007 - 2011

Romanian IAHS Committee

National Correspondent:

Presidents of the Committee:

Petre STANCIU
National Institute of Hydrology and Water Management
Phone: +40-21-3181116
Fax: +40-21-3181116
E-mail: stanciu@hidro.ro

Members:

Sorin Teodor
National Institute of Hydrology and Water Management
Phone: +40-21-3181115/141
Fax: +40-21-3181116
E-mail: sorin.teodor@hidro.ro

Simona Matreata
National Institute of Hydrology and Water Management
Phone: +40-21-3181115/172
Fax: +40-21-3181116
E-mail: simona.matreata@hidro.ro

Emilia Branescu
National Institute of Hydrology and Water Management
Phone: +40-21-3181115/145
Fax: +40-21-3181116
E-mail: emilia.branescu@hidro.ro

Mita Pompiliu
National Institute of Hydrology and Water Management
Phone: +40-21-3181115/126
Fax: +40-21-3181116

Valentina UNGUREANU
National Administration "Apele Romane"
Phone: +40-21-0744522320
Fax: +40-21- 3122174
E-mail: valentina.ungureanu@rowater.ro

Secretary:

Ada PANDELE
National Institute of Hydrology and Water Management
Phone: +40-21-3181115, ext.167
Fax: +40-21-3181116
E-mail: ada.pandele@hidro.ro

SUMMARY

Chapter 1. IAHS ROMANIA ORGANIZATION

The activities of IAHS organization in Romania took place under the supervision of the above mentioned members of the Romanian IAHS committee.

Romanian IAHS activities implied not only different specialists and researcher in hydrology field, but also professional organizations or institutions, like:

Romanian Association of Hydrological Sciences
National Administration Romanian Waters
National Institute of Hydrology and Water Management
National Institute for Environment Protection Research and Development
National Institute of Research and Development - "Delta Dunarii"
National Institute of Marine Research and Development
Institute of Geography Bucharest

In 2009 National Institute for Environment Protection Research and Development , National Institute of Research and Development - "Delta Dunarii" and National Institute of Marine Research and Development were reunited under the name **National Institute for Environmental Protection Research and Development** (INCDPM),

One of the most important activities is education and efficiency increasing, which means the implication of some universities, like:

Faculty of Hydrotechnical Structures	-Technical University of Civil Engineering Bucharest
Faculty of Hydropower	-University "Politehnica" Bucharest
Faculty of Geography	
Faculty of Physics	- Bucharest University
Faculty of Mathematics	

Chapter 2. MAIN RESEARCH ORIENTATION IN THE FIELDS OF HYDROLOGICAL SCIENCES

During the last three years the Romanian hydrology achieved its activity through several exquisite research works covering practically all branches of hydrology.

The development of scientific hydrology in Romania had in view the basic needs of Romanian economy, the participation in the research of the present problems of hydrology as a whole, the harmonization of Romanian research activities with European research main direction, the elaboration of competitive methodologies and not in the last point, the adaptation of Eu Water Directive requirements to reality from Romania and the insurance of the adequate scientific frame in order to assure the implementation of WD.

The demands of the Water Framework Directive mainly extend the objectives of research in the following directions:

- To classify, identify and characterize the water bodies according to the unitary criteria at the level of the entire area of the European Community;
- To protect the inland surface waters, transboundary water courses, coastal waters and groundwater, the protection, maintenance and improvement of the state of the aquatic environment in the Community;
- To ensure the qualitative and quantitative monitoring of surface water and groundwater parameters, as well as the aquatic environment.

All these action directions pursue the preservation and improvement surface water quality, and especially groundwater for the supply of drinkable water for the population and leisure activities, as well as the restoration and protection of aquatic ecosystems affected by anthropogenic impact phenomena.

There are some major tendencies in the hydrological science in Romania now:

- insurance of the quality during the research process: measured data quality insurance, models quality, new approaches in model validation, considering the uncertainty and uncertainty analysis
- using the new technology of Geographical Informational System GIS in hydrologie and water management
- space-time analysis based on new data sets, including new types of hydrological data (new types of measurement sensors, new approaches in data analysis)

2.1. Global climate changes and water resources

The research orientation within these fields was approached in the context in which the global changes occurred in the direct and indirect human activity have a significant impact on the water resources which decrease while the water needs increase due to the socio-economic development. Knowledge of the present and future state of these strategic resources and of the time and space distributions is an imperative need for sustainable development and management. In this respect we would like to emphasize the following orientations:

- determination of water resources in the present state
- determination of the water resources in the global climate and landuse cover changes context.
- global distribution of water resources, water supply and water quality

Within these research directions the following issues were approached:

- advanced mathematical modeling of statistical and storage forecasting of hydrological data series
- regionalization methods of the qualitative and quantitative synthetic hydrological characteristics using new GIS technology
- rainfall-runoff deterministic mathematical models for the dynamic simulation of the hydrological data series
- Inventory of quantitative and qualitative water resources of improved resolution by using GIS procedures that define the time and space distribution and regime of water resources and also the vulnerable areas to flood, drought, pollution of the surface water and groundwater.
- Quantificationof the impact of climatic and anthropic changes on the components of the hydrological cycle regarding the flow and matter changes
- Quantification of human impact on the extreme hydrological events – flood and droughts. Combined research regarding the physically based analysis of the hydrological processes with socio-economical studied in view to monitor the future character of water resources changes
- Pollutant transport and diffusion models under the circumstances of land use and vegetation cover changes.

2.2. Hydrological processes dynamics

The research orientation for this field took inherent complexity of the hydrological processes which occurred under homogeneous condition of the vegetation cover, soil, relief, geology, precipitations, temperatures and human impact and also that they manifested differently at various variable time and space scales.

The research area cover study of physical, chemical and biological processes which occur in the water bodies and also the new field of ecohydrology, within the following items were approached:

- development of integrated mathematical models of the physical, chemical and biological processe within water bodies – rivers, lakes, groundwater
- development of determination models for nutrients and pollutant trajectories on slopes, river beds and groundwater
- sedimentation models of reservoirs and the Danube delta
- development of pollutant transport models in aquifers and non-satured zone
- research regarding the ecology of river systems and their major beds
- ecohydrology studies of the environment systems at basin level in view of determination of the way of working of theses systems as against water as transportation and accumulation environment
- establishing methodologies concerning in sizing of the protection area for the aquifer systems and for the groundwater catchments

2.3. Interconnection of systems and water management

In this field the approached research had in view that the hydrological methods and models had to be interconnected with operating systems and tactical and strategical decision on sustainable water management. The following issues were studied:

- decision systems, in the field of water management, based on hydrological forecast
- dynamic-statistical models for long term hydrological forecast coupled with decision systems of water resources supply to users
- automation of the hydrological data flux necessary to the forecast
- optimization models in water management in conflict situation between various

interests for the water users
- multicriterion modeling techniques for the substantiation of decision makers within water management system
- discrete decision in the elaboration of master plans related to risk and lack of certainty of hydrological data
- nonstructural measures in water management
- decision-making and water management measures once with the water resources changes as a consequence of possible climate changes and direct human impact (land use, vegetation cover changes etc)
- monitoring, assessment and management of transboundary water bodies
- developing of decision making system support for water management in extreme situations (flood, drought)

2.4. Interconnection of hydrological, hydrogeological and meteorological processes

The obvious dependency of the whole hydrological processes on the precipitation and temperatures features made these fields occupy an important place in the strategy of hydrological research.

For example, the coupling of hydrological and meteorological models in view to increase the accuracy and anticipation of the hydrological forecast on river basin and the development of mathematical models of groundwater dynamics in interconnection with surface waters and meteorological factors are two items very important that there were approached.

2.5. Development of hydrological informational systems

This activity is one of the most important, due to the great necessity to have numerous and good data. The optimization of the hydrological and hydrogeological stations network and the automation of receiving data from measure stations were developed.

It was also important the development of complexes hydrological databases and the integration of these with others environmental databases.

Implementation of monitoring programs for the operation of groundwater catchments concerning the evolution of exploited discharges, of the freshwater head and dynamic levels and of the water quality was one of the very important issues, in compliance with WD requirements.

2.6. Knowledge, information and technology transfer – formal/continuing education

For this field the research orientation was established taking into account that water is a vital element of life, important in all socio-economical aspects. In the same time, it is obvious the necessity of knowing all quantitative and qualitative aspects related to water, and as consequence, the dissemination of all tihis knowledge is necessary, but also at the level of direct involved ones on the population problems which should participate consciously in the elaboration and implementation of water policies.

Continuous hydrological educational and instructional systems concern instruction techniques and logistics for education at technicians and researchers level, learning techniques and knowledge testing assisted by computer, modern systems of formal hydrological education at all levels.

The information dissemination issue had approached by introducing elaboration in WEB pages regarding hydrological models representative, computation procedures and results of the operational activities. The public awareness regarding water issues was also integrated in those WEB pages.

Chapter 3. PARTICIPATION OF ROMANIAN SPECIALISTS IN WORKING GROUPS INVOLVED IN NATIONAL AND/OR INTERNATIONAL RESEARCH PROGRAMS

The participation of Romanian specialists in national and international programs and projects is an objective necessity mostly motivated by the requirements of the economy to know the main hydrological and hydrogeological characteristics of water resources. That is why the projects and programs had aimed to establish the most efficient methods and models to determine the status of water resources under various circumstances.

The participation of Romanian specialists in international programs aimed at similar objectives – this time expanded at regional level, using at the same time the experience of specialists coming from different countries, involved in giving solutions to the scientific and technical problems raised by socio-economical requirements.

At **national level** the research programs were achieved on concrete request of various ministries, which also financed these programs. Some of most important issues approached within those programs will be presented further on.

1. Development of hydrological, hydrogeological and water management modeling:

- the update of the hydrological parameter survey (mean and maximum runoff, and suspended sediment mean runoff) of Romanian rivers using GIS procedures
- The update of groundwater survey and the application of GIS procedures for the management of survey data, with their adequate allocation to the groundwater bodies identified in accordance to the Water Framework Directive 60/2000/EC;
- The development and implementation of coupled atmospheric, hydrological and hydraulic models
- The study of temporal and spatial variability of hydrological processes at regional and global scale, in an anthropogenically modified environment and prone to climatic changes:
- Studies concerning eco-hydrological processes and anthropogenic impact on aquatic ecosystems and environment
- Studies for the improvement of the development and management of river basins concept:
- The synthesis of surface runoff characteristics in small catchments:
- Studies regarding mitigation/elimination measures of the pollution effects on surface water and ground water resources:
- Study regarding the integrated management of Danube river water resources on Romanian sector

2. Development of hydrological informational system, hydrological databases and support activities using GIS

- The update of the national hydrological and hydrogeological national fund;
- The drawing-up of the support database in GIS format: digital terrain model 1:25.000 for Romania, thematic maps at hydrographic basin level (morphology, hydrografic network, geology, soils etc)
- Realization of new databases – extension of hydrologic databases in digital format
- Realization of automatic interfaces for hydrometeorological data capture from operative flux

- Correction and completion of the hydrological databases according to 2007/2/CE INSPIRE

3. Adaptation of methodologies for groundwater resources evaluation in compliance with WD

- The re-evaluation of groundwater resources in all hydrographic districts
- Characterization of the groundwater bodies at risk
- Elaboration of measures plans for groundwater bodies at risk in order to achieve the environmental objectives for 2015
- Re-evaluation of quality status for groundwater bodies
- Realization of the protection areas database for groundwater abstractions

At **international level** we can mention participation of Romanian specialists in important international programs and workgroups current activities, like those mentioned bellow:

1. **Participation to the current activities of the International Association for Hydrological Sciences (IAHS):**
   - General Assembly of IAHS members and General Assembly of the Geodesy and Geophysics National Romanian Committee – CNRGG where there were presented the national reports for the period 2004-2006,
2. **Participation within the activities of the Hydrological Workgroup "Regional Association VI – Europe" and WMO (2007, 2008, 2009)**
   - The 13th session of the Hydrological Committee of the World Meteorological Organization.
   - the 11th session of the Hydrology Workshop of the Regional Association VI (Europe) within the World Meteorological Organization
   - Technical Conference on the Strategic Plan Implementation of RA VI
   - the 15th Session of the Regional Session VI – Europe of the World Meteorological Organization.
   - the workshop of the World Meteorological Organization on the Flash – floods Assessment System

3. **Participation within the activities of the International Hydrological Program (IHP-UNESCO)**, which is the most important international programs in water domain:
   - Initial Launching Meeting by the Romanian National Committee for UNESCO and the MAB National Committee of the education and awareness actions concerning the public and scientific opinion on the Earth sciences, at the International Year of Planet Earth– 2008
   - The 21th Workshop on the Regional Hydrological Cooperation of the Danube countries within PHI – UNESCO
   - The ecohydrology seminar from September 5, 2008 at the Piscicultural Researches Institute from Kavala;
   - The meeting of the workshop for echohydrology from September 16, 2008
   - The 9th Kovacs colloquy within the UNESCO International Hydrologic Program
   - the 18th Session of the Intergovernmental Council of International Hydrological Program – UNESCO
   - the 22nd workshop of the "Regional Hydrological Cooperation of the Danubian countries" of the PHI – UNESCO
   - 23 working meeting of the regional hydrological cooperation of the Danubian countries organized under the aegis of UNESCO-PHI. Participation at the 24th meeting of experts in the "Regional Hydrological Cooperation" of the Danubian countries, held in PHI - UNESCO – 2010

4. **Participations to the current activities of the European Committee:**

- Chemical Monitoring Activity Plenary Meeting, Working Group C „Groundwater" Plenary Meeting; 2008 - Strategic Coordination Group – SCG) – 2007
- Workshop on the transboundary water resource management in Eastern and Northern Europe 2010

5. Participation at the current activities of the International Committee for the Protection of Danube River (ICPDR):

2007- the 8th meeting of the Workshop for achieving the Management Plan of the Tisa River Basin;
- the 9th meeting of the Workshop for achieving the Management Plan of the Tisa River Basin;
- the 5th meeting of the Workshop on groundwaters problems of ICPDR;

2008 - the 10th meeting of the Workshop on water management problems in Tisa river basin,
- the 11th meeting of the Workshop on water management problems in Tisa river basin and the workshop UNDP/GEF „Integrating multiple benefits of wetlands and floodplains into improved traunsboundary management for the Tisza river basin"

2009 – the 8 th meeting of the Workshop on groundwater problems (Groundwater Task Group Meeting – TG GW) of the International Committee for Danube Protection (ICPDR),
- the 12th meeting of the Workshop on Water Management in Tisa River Basin organized by the International Committee for the Protection of Danube River/ ICPDR,
- the 2nd workshop UNDP/GEF „Integrating multiple benefits of wetlands and floodplains in the context of improving the transboundary management of Tisa river basin,
- the 9th meeting on groundwaters problems (Groundwater Task Group).,
- the 13th of the Workshop on Water Management Problems in Tisa river basin organized by the International Committee for the Protection of the Danube River /ICPDR

2010 – the 10th meeting of the Workshop on groundwater problems (TG GW) of the International Committee for the Protection of the Danube River (ICPDR),
- the 14 th meeting of the workshop on water management problems in Tisa river basin and the workshop „Integrating land and water management in the Tisa river basin",
- the workshop: „*Nitrogen Pathways in the Danube Basin*" organized by the International Agency for Atomic Energy in colaboration with the International Committee for the Protection of Danube River (ICPDR),
- the 15th meeting of the Workshop on Water Management Problems in Tisa River Basin organized by the International Committee for the Protection of Danube River ICPDR,
- the 11th meeting of the Workshop on groundwater problems of the International Committee for the Protection of Danube River (ICPDR)

6. Participation within The Danube Countries Regional Hydrological Cooperation Programme

- Determination of the sediments balance on the Danube Romanian sector within the project launched in Austria „Achieving the guide on the implementation of the

sediments management within the Danube Basin Management Plan in accordance with the Water Framework Directive"

- Works within the Regional Cooperation of the Danubian Countries – UNESCO International Hydrologic Program on the project „Floods regime on the rivers from the Danube river basin" coordinated by Slovakia.
- Works within the Regional Cooperation of Danubian Countries – UNESCO International Hydrologic Program on the project coordinated by Bulgaria „Low flow and hydrological drought in the Danube river basin".
- the modeling of the erosion, transport and sedimentation processes on the Danube River and its main tributaries - SEDAN

Chapter 4. PARTICIPATION ON NATIONAL AND INTERNATIONAL SCIENTIFIC PROJECTS

1. Participation in national projects

Decision Suport System for Urban Water Management (URBWATER)

National Informational Monitoring System of Activities for the Prevention And Removal Of Effects Caused By National Disasters And Industrial Accidents (SINMAPIEDA)

Agro-environmental indicators based on numerical data to characterize the vulnerability of agricultural land in hilly areas (IAGINT)

Informational system for consultancy in agricultural management from areas vulnerable to pollution with nitrates from agricultural sources (SICOMANT)

Integrated platform for the use of environment isotopic techniques for the management of mineral water resources – case study in the area of Oriental Carpathians Mountains (PIMEGA)

Spatial data infrastructure for environmental applications (INSPAM)

Establishing a national network and a unified information system for managing information about land cover and use in support of GMES applications *(LUCIUS)*

The impact of climatic variability and anthropogenic interventions on the hydrological regime of the Danube River and the dynamics of the coastal sediments (DANUBERES)

Research conducted within a small catchment for the superior capitalization of slopes, prevention of torrential tendencies and floods (BHMVTI)

Methodologies for risk assessment of agro-physics degradation in the context of new European directives (RAMSOL)

Protected areas: evaluation of environment quality for the capitalization of natural resources and local sustainable development (PROMED)

Scientific foundation, conceptual and digital modeling of aquifer structures in view of the protection and sustainable use of groundwater resources in the Southern part of Romania (AQUASUD)

Satellite-based Information Service for the Management of Emergency Situations (SIGUR)

Evaluation and mapping of groundwater resources vulnerability for the ensurance of their sustainable use (ECAVAS)

The multidisciplinary evaluation of hydrodynamic and hydro chemical processes in the aim of the diagnosis of the vulnerability to pollution of water resources from South Dobrogea (EMHIPAD)

2. Participation in international projects

CECILIA (FP 6 STREP 037005) - Central and Eastern Europe Climate Change Impact and Vulnerability Assessment

ENSEMBLES (GOCE-CT-2003-505539) – Based Predictions of Climate Changes and Their Impacts

HYDRATE (FP 6 037024) - Hydrometeorologic databases and technologies for the efficient forecast of flash floods

CLAVIER (FP 6 STRP 037013) - Variability and climate change: impact in Central and Eastern Europe

PHARE 2004 CBC RO-BG / Integrated Management of Transboundary Groundwater between Romania - Bulgaria in Dobrogea Area

FLOODMED (INTERREG III B CADSES Program, 5D214) / Monitoring, forecasting and best practices for FLOOD Mitigation and prevention in the CADSES region

MOSES (INTERREG III B CADSES Program, 5Do63) - Improvement of Flood Management System

CCWATERS (South East Europe Transnational Cooperation Programme) - Climate Change and Impacts on Water Supply

SEE HYDROPOWER (South East Europe Transnational Cooperation Programme) - Hydropower targeted to improve water resources management for growing renewable energy production

RO0019-GAE-00121-E-V1 (EEA Grants) - Enhancement of Water Resources in Mures River Basin

EnviroGRIDS (FP7) - Building Capacity for a Black Sea Catchment Observation and Assessment System supporting Sustainable Development

CLEANWATER (LIFE09 ENV/RO/000612) – Integrated system for protect and analysis the status and trends of water threatened by nitrogen pollution

Chapter 5. PARTICIPATION ON NATIONAL AND INTERNATIONAL SCIENTIFIC CONFERENCES

The scientific manifestations organized in Romania – conferences, sessions, symposia, "round tables" – have included in their programs from all the branches of hydrology the following topics:

- high or low runoff on rivers, including the Danube
- alluvial runoff
- snow-melting runoff
- the influence of atonal factors (afforested or carstic areas) on the surface runoff, evapotranspiration
- hydrology
- modern methods for obtaining the main parameters of water and solid runoff

At national scientific conferences, as well as international ones, most of the papers have been elaborated by the specialists from National Institute of Hydrology and Water Management, where is the strongest nucleus of hydrology specialists. In this context, numerous manifestations were organized, on national and international level, by this institute.

There are collectives including very good specialists at other institute with same profile, too: IREE, IRDDD, RIMR, Institute of Geography Bucharest and other Institutes of university education: TUCB (Faculty of Hydrotechnics), Polytechnic University Bucharest (Faculty of Hydraulics and Hydraulic Engineers), University of Bucharest (Faculty of Geography-Hydrology section, Faculty of Geology – Hydrogeology section) and many others institutes from the country. Some of these institutions also organized scientific national and international manifestations.

National conference and other manifestation

NIHWM National Scientific Session **"Water Resources Management in Risk Conditions"** – 2007

Workshop on "ECONOMIC AND ECOLOGICAL RESIZE OF THE LOW DANUBE PLAIN ON THE DANUBE ROMANIAN SECTOR", organized by the National Institute of research – development "DANUBE DELTA", 2007, Tulcea

Workshop organized by UTCB on future orientation problems of postgraduate professional training in water management, 2007

Symposium "Management of floods and infrastructure works for reducing flood risk", 2007, Sinaia.

HYDRATE International Workshop, 2007, Bucharest

ECORYS conference „First Step in Public Participation and Communication in Water issues; developing Communication", Bucharest, 2007

NIHWM International Scientific Session **"Water Resources Management in Extreme Conditions"**, in cooperation with Romanian National Committee for the International Hydrological Programme of UNESCO and Romanian Association of Hydrological Sciences – 2008, organized in Bucharest. Must be mentioned here the extraordinary participation to the Conference of the **IAHS General Secretary, dr. Pierre Hubert**, also member in the

International Scientific Committee of the Conference.

The seminar „ Methodology for identifying small river basins susceptible to generate flash - floods", at the Technical Constructions University Bucharest, Hydrotechnic Faculty, 2008

Round table for discussing the sectorial project 345/2006 organized by ISPIF – Bucharest, 2008

Workshop on "Role of ichtyo fauna in the Water Framework Directive objectives organized by the Ministry of Environment and Sustainable Development and the National Administration Romanian Waters, 2008, Bucharest.

NIHWM National Scientific Session **"Extreme Hydrological Phenomena Estimation and Prediction"** – 2009

NIHWM - The **Jubilee Scientific Session dedicated to the celebration of 85 years since the establishment of the Romanian Hydrographic Service - "Hydrology and Water Management – Challenges for the year 2025 regarding the Sustainable Development of Water Resources"** - 2010.

Must be mentioned here the extraordinary participation at the Conference of **His Excellency Mr. ION ILIESCU**, former President of Romania, specialist of mark in hydrology domain.

The Jubilee Scientific Session facilitated a meeting between former and present officials who have worked or are working in the waters field and adjacent areas, exchanges of ideas between researchers and specialists in the fields of hydrology, hydrogeology and water management, between scientists from different fields of expertise.

More than 200 people accepted the invitation to the session, including leading experts in the field: former ministers and state secretaries in the Ministry of Environment and Forests, current and former Directors of the National Administration Romanian Waters, and current and former Directors of the National Meteorological Administration, personalities from the academic fields, specialists and experts in hydrology, hydrogeology and water management, who are currently working or who retired.

International Conference **"Air and Water – Environment Components",** Babes-Bolyai University, Cluj, 2010

International Symposium Geology and Natural Systems, Geo-Iasi, 2010

The 10th International Multidisciplinary Scientific Geo-Conference & Expo on Modern Management of Mine Producing, Geology and Environmental Protection - SGEM 2010

The IV International Water Forum, Institutul Central de Cercetări pentru Folosințe Complexe a Resurselor de Apă din Republica Belarus – Minsk, octombrie 2010

ECOMEDIU Conference , Arad 2010.

National Conference on Environmental Protection Practices and Experiences, Arad, 2010

AGIR Symposium, "Education-essential component of environmental policy", 25 June 2010.

Seventh National Conference of the Mountain Forum in Romania, 2010

International Symposium "Development Trends in European agriculture", the fourth edition, University of Agricultural Sciences and Veterinary Medicine of Banat, Faculty of Agriculture, 2010

Workshop „ Groundwater vulnerability assessment and mapping, "Univ. Bucharest, Fac. Geol. - Geophysics., Bucharest, 2010

International Conference "Rivers - DELTAS - Seas", Institute of Marine Geoecology, Bucharest, 20 to 22 October 2010

International conference

2007 – The XVth World Meteorological Organisation Congres – 3.5. Hydrology an Water Resources Programme – HWRP

– Workshop „Community preparedness and public participation for flash flood management in Europe".

– International Workshop „Regional Consultation on the Commission's Green Paper „Adapting to Climate Change in Europe – Options for EU Action" (Central Eastern Europe)"

– International Conference on Numerical Weather Predictions (2007),

– International Conference on Global Challenges that the National Hydrometeorologic Services are facing (2007), Texas, USA

– Conference 2007 of American Meteorological Society (2007), Texas, USA

– International workshops „Water Resources Management in the Mediterranean Region" and „Drought and Water Scarcity: Discussion in the Frame of EU Initiative", 2007 Athens, Greece

– International workshop„ SME Environment FP7 Matching Day", which took place in Budapest, Hungary 2007

– International workshop"LOGISTICS FLOODMED PGA Meeting: Monitoring, forcasting and best practices for FLOOD mitigation and prevention in the CADSES region", 2007, Budapest, Hungary.

– International workshop „Transboundary groundwaters in South-East Europe "2007 Greece, Thessaloniki.

– Seventh International Conference SGEM 2007 2007, Albena, Bulgaria 3rd International Conference on "Climate and Water", 2007 Helsinki, Finland

Workshop: „Flood impacts and structural and non-structural measures in order to increase public awareness and disseminate useful information to all the stakeholders and parties involved" (W.P.6.4), within the international project „*FLOODMED – Monitoring, forecasting, and best practices for FLOOD mitigation and prevention in the CADSES Region",* 2007 Bratislava, Slovakia

2008 – Third international workshop on flood alert system (EFAs)

– International Session dedicated to operational activities of forecasting and management of emergencies arising from floods: "The road to a perfect forecast and a perfect management of emergencies: Linking hydro-meteorological services and institutions responsible for emergency management and conference of American Meteorological Society;

– The symposium of General Assembly of the European Geoscience Union (EGU 2008);

– Third International Scientific Conference Balwois 2008, 12th Conference of "Euro-Mediterranean Network of Experimental and Representative Basins

– IV - Conference on "Siberian Rivers" organized by the Ecological Committee from Irtysh and of Omsk Steering Committee 2008 Russian Federation

– Workshop on „Floods-forecasting, operational aspects and monitoring under climate changes" 2008 Oslo, Norway

– Final Workshop within the FLOODMED project 2008 Chania, Greece.

2009 – Workshop on "Shared Groundwater Resources Management - Management of transboundary groundwater resources" Slovenia

– Workshop on Cartography and Geoinformatics for Early Warning and Emergency Management: Towards Better Solutions"

– 5th World Water Forum organized by the World Water Council.

– General Assembly of the European Geoscience Union 2009 organized by the European Union Geoscience

– The 15 th edition of the International Water Management and Ecological Fair 2009

– SGEM International Conference 2009 - „9th International multidisciplinary scientific geo-conference & expo. Modern management of mine producing, geology and environmental protection"

– International Conference The Water Framework Directive – Sharing experiences and meeting future challenges" within the annual meeting „*World Water Week*", 2009 Stockholm

2010 – International seminar "Development of the Biosphere Reserves in the sea areas and the Caucasus region", organized by the UNESCO-Brescia

– 4th International Water Forum - Strategic Issues regarding protection and use of water resources organized by the Central Research Institute for the use of Complex Water Resources of the Republic of Belarus

– General Assembly of the European Geoscience Union (EGU 2010)

– The 4th International Scientific Conference on Water Observation and Information System for Decision Support - BALWOIS 2010.

– Workshop "Stream physical restoration: Syntheses and methods for basin management, organizat de CEMAGREF, Franța.

– International conference „*Predictions for Hydrology, Ecology and Water Management: Changes and Hazards caused by Direct Human Interventions and Climate Change – HYDROPREDICT 2010*"

IAMAS

IAMAS ACTIVITIES IN ROMANIA

2007 - 2010

Romanian IAMAS Committee

National Correspondents:

Co-Presidents of the Committee:

Prof. Dr. Sabina STEFAN
University of Bucharest, Faculty of Physics
Dept. of Atmospheric Physics
P.O.BOX MG-11
077125, Magurele, Bucharest, ROMANIA
Phone &Fax: +40 21 4574521
E-mail: sabina.stefan@fizica.unibuc.ro; sabina_stefan@yahoo.com

Dr. Gheorghe STANCALIE
National Meteorological Administration
Soseaua Bucuresti – Ploiesti Nr. 97.
013686 Bucharest, ROMANIA
Phone & Fax: +40 21 3166098
E-mail: gheorghe.stancalie@meteoromania.ro

Members:

Dr. Florinela GEORGESCU
National Meteorological Administration
Soseaua Bucuresti – Ploiesti Nr. 97.
013686 Bucharest, ROMANIA
Phone&Fax : +40 21 3163732
E-mail : florinela.georgescu@meteoromania.ro

Dr. Rodica DUMITRACHE
National Meteorological Administration
Soseaua Bucuresti – Ploiesti Nr. 97.
013686 Bucharest, ROMANIA
Phone and Fax: +40 21 3166098
E-mail : rodica.dumitrache@meteoromania.ro

Claudia VARLAN
Romanian Civil Aeronautical Authority
Sos. Bucuresti-Ploiesti nr. 38-40, 013695 Bucharest, ROMANIA
Phone: +40-21-2081515
Fax: +40-21-2081565
E-mail: claudia.radu@caa.ro

Secretary:

Sorin BURCEA
National Meteorological Administration
Soseaua Bucuresti – Ploiesti Nr. 97.
013686 Bucharest, ROMANIA
Phone: +40 21 3166098
Fax : +40 21 3167762
E-mail : sorin.burcea@meteoromania.ro

PART I: ORGANIZATION

The International Association of Meteorology and Atmospheric Sciences (IAMAS) Organization for Romania, a Section of the Romanian National International Union of Geodesy and Geophysics (IUGG) Committee, was constituted at the National Meteorological Administration (the former National Institute of Meteorology and Hydrology - Bucharest) in cooperation with the Department of Atmospheric Physics of the Faculty of Physics from University of Bucharest.

The National Meteorological Administration (NMA) represents the national service in the field of meteorology and the General Manager is the Permanent Representative of Romania with the World Meteorological Organization (WMO). The Scientific Manager is the co-president of IAMAS for Romania. The main activities developed within NMA are: *basic operational activity* (weather forecast, observation system, telecommunication, climatological database), *research activity* (numerical modelling, climate variability and climate change, physics of the atmosphere, air pollution, remote sensing and GIS, agrometeorology), *education and training and international cooperation.* At the Faculty of Physics, the Department of Atmosphere Physics, the students and the teachers work in the fields of Dynamic Meteorology, Physics of Climate, Thermodynamic and Radiation of the Atmosphere, Electricity of the Atmosphere and they collaborate with the researchers from NMA and from the others Labs as the Remote Sensing of Environment of National Institute of Optoelectronics (INOE2000) or ICIM Bucharest. Many research laboratories in the field of air and water pollution monitoring are present at the National Institute of Environment Research and Engineering (ICIM - Bucharest). Studies related to upper air are being performed especially at the Astronomical Institute (that IAMAS - Romania intends to attract within the association the next year) and ROMATSA. ROMATSA includes a National Center of Aeronautic Meteorology with 17 offices and airport meteorological stations, units corresponding to the OACI standards.

IAMAS has 10 commissions:

- International Commission on Atmospheric Chemistry and Global Pollution
- (ICACGP);
- International Commission on Atmospheric Electricity (ICAE);
- International Commission on Climate (ICCL);
- International Commission on Clouds and Precipitation (ICCP);
- International Commission on Dynamical Meteorology (ICDM);
- International Commission on the Middle Atmosphere (ICMA);
- International Ozone Commission (IOC);
- International Commission on Planetary Atmospheres and their Evolution (ICPAE);
- International Commission on Polar Meteorology (ICPM);
- International Radiation Commission (IRC).

The general objectives of IAMAS (to promote the study of the science of the atmosphere, to initiate, facilitate and coordinate international cooperation, to stimulate discussion, presentation and publication of scientific results, to promote education and public awareness) are also the objectives of the organization in Romania, although the activities related to these sections are different, some sections, such as: dynamic meteorology, climatology or air pollution enjoying more interest as against upper air or polar meteorology.

In this view, we should mention the significant participation of the Romanian researchers in the international programs, especially the European ones, such as ALADIN, ETEX, and CLIVAR.

The Romanian Meteorological Society also supports the IAMAS activities for Romania.

Romanian IAMAS Activities

- **Dynamic Meteorology**
- **Climate**
- **Atmospheric Physics**
- **Agrometeorology**
- **Remote sensing and GIS**
- **Nowcasting**

Professional Organizations

- **Romanian Meteorological Society**

Institutions

- **National Meteorological Administration (NMA)**
- **Institute of Environment Research and Engineering (ICIM)**
- **National Institute of Optoelectronics- Lab. of Remote sensing of Environment**
- **Romanian Civil Authority for Aeronautics (ROMATSA)**
- **University of Bucharest:**
  Faculty of Physics
  Faculty of Geography

National Conferences

- **Annual Scientific Session of the National Meteorological Administration**
- **Annual Scientific Session of the Faculty of Physics, University of Bucharest**
- **Annual Conference of Physics**

Publications

- **Romanian Journal of Meteorology**
- **Romanian Reports in Physics**
- **Environment Engineering Management Journal**

PART II: PROFESSIONAL ACTIVITY

DYNAMIC METEOROLOGY

1. Research orientation

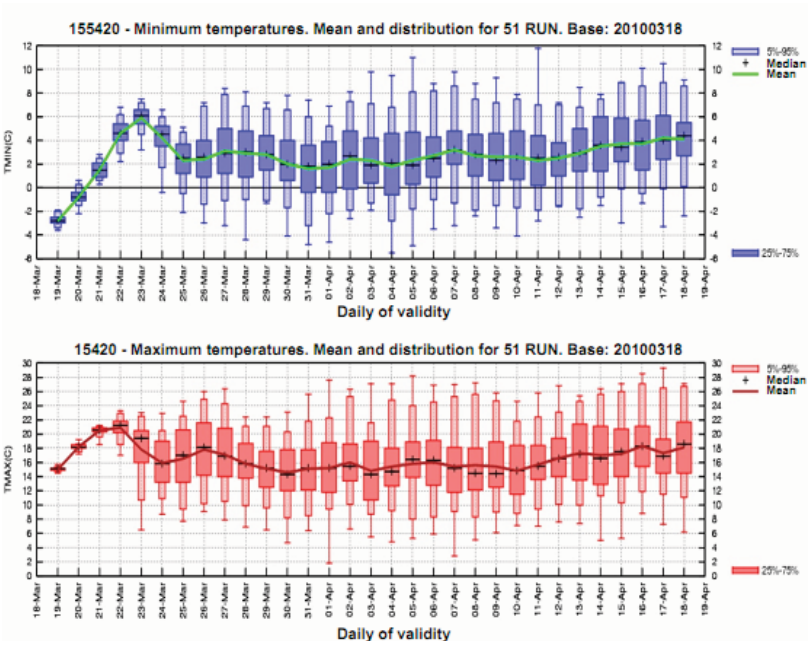
The research activity in meteorology developed the main activity domains: numerical atmospheric modelling and modelling of the pollutant transport, climatic modelling and studies (climate variability, climate change and climatic forecasting), studies on the physics of the atmosphere and of the ozone layer, studies based on satellite techniques, remote sensing and GIS, as well as studies of the climatic conditions impact on crops.

The results of the research activity were presented at internal and international scientific meetings and were published in specialized Romanian and international journals.

1.2. The forecast of local scale meteorological parameters using statistical models

During the statistical post-processing of numerical weather forecasts, there were operatively implemented MOS_EPS models for 15-day and 32-day, respectively, anticipations. Results were disseminated as follows:

- groups of maps with mean values and related standard deviation;
- graphs of related quantile distributions by region.



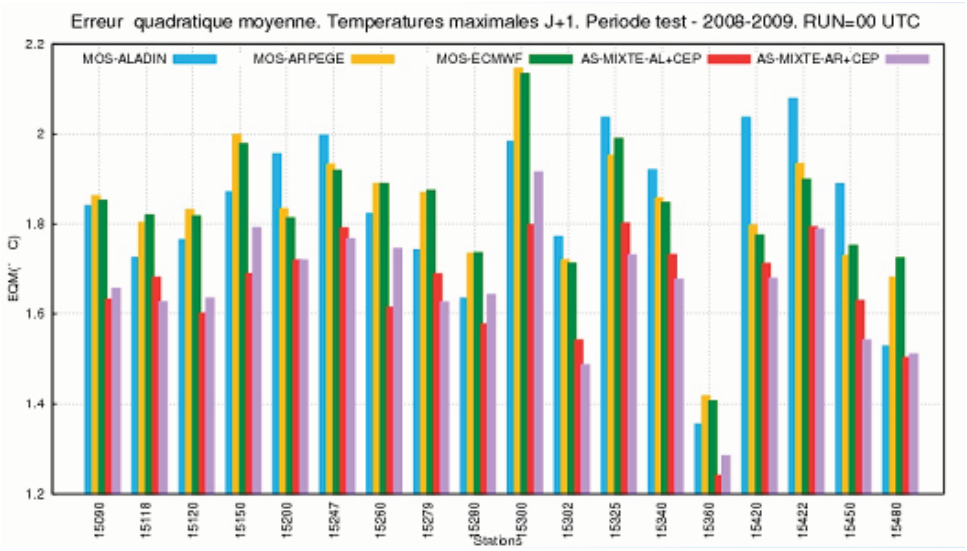
MOS_EPS display of a monthly high/low temperature forecast at a weather station

A bilateral collaboration between Meteo-France and the National Meteorological Administration resulted in the following accomplishments:

– it was developed a MOS statistical temperature-forecasting model at 1-hour resolution using barycentric regression; this model was implemented at the ECMWF while dissemination was assumed by the National Meteorological Administration;

– MOS_ARPEGE was developed for each of the four numerical model RUNs;

– tests on using a MOS_MIXT system to forecast ext reme temperatures. Composite models MOS-ARPEGE-ECMWF and MOS-ALADIN-ECMWF, respectively, proved to be better than individual models; consequently, these procedures will be also implemented in the operative flow.



Mean Squared Error; Maximum temperature for day J+1; Intercomparisons of MOS models for a 1-year test interval. Reference: 00 UTC.

1.3. Weather forecasts verification

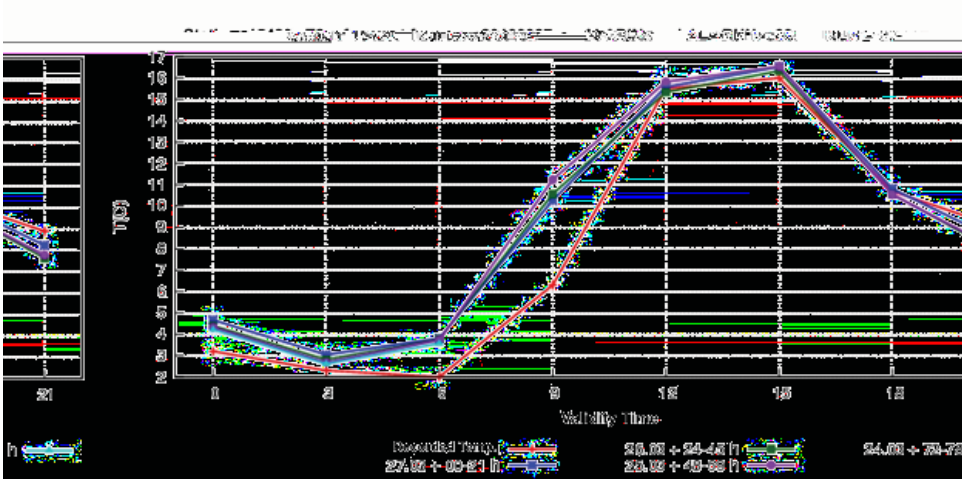
Verification of the weather forecast is operationally performed both for the one issued by numerical models and for those released daily by the forecaster at the NWFC.

Regarding the verification of weather forecasts, our efforts were focused on modernizing the objective numerical model verification system that grew more and more complex. The above-mentioned verification system's architecture was designed to meet scientific as well as administrative requirements. Its main modular components include functions such as:

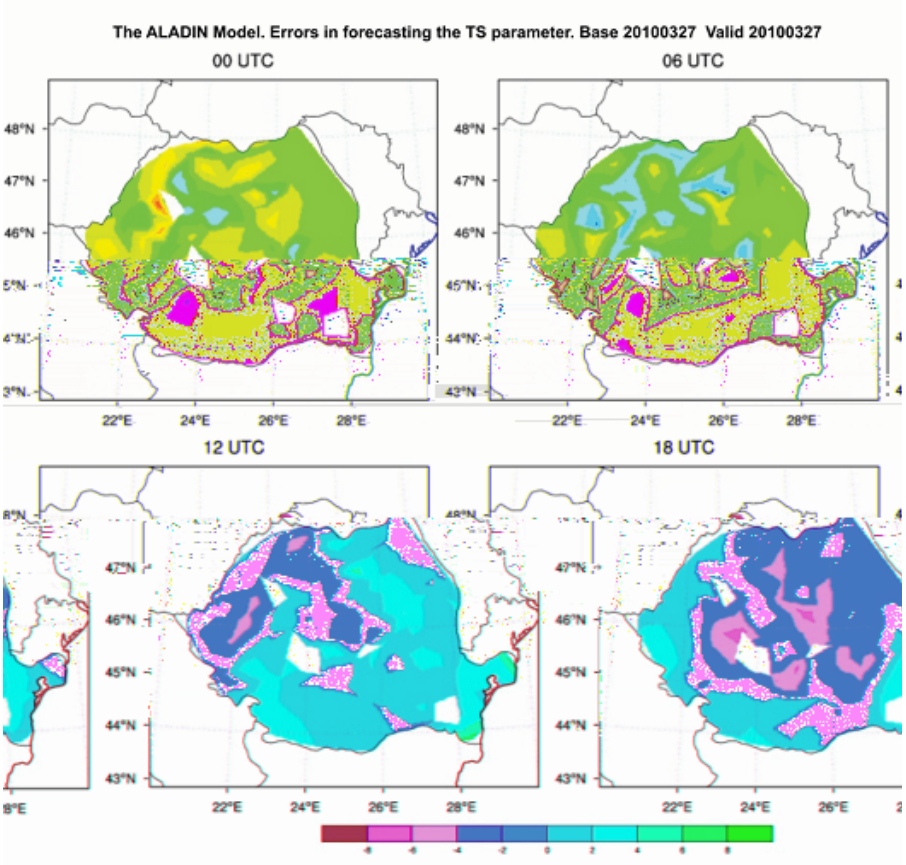
– numerical forecast and observation data preparation and control;
– score calculations;
– verification sets/arrays (stratification, composition etc.);
– graphic representation and dissemination;

Descriptive diagrams were made for a number of weather stations and there was figured the evolution of monthly scores for each weather parameter subjected to verification. This system can also provide a comparative display of scores for every model in the operative flow. A daily ALADIN verification procedure has been operative since summer 2009. Graphs and maps like the following ones are available daily on the website. At present,

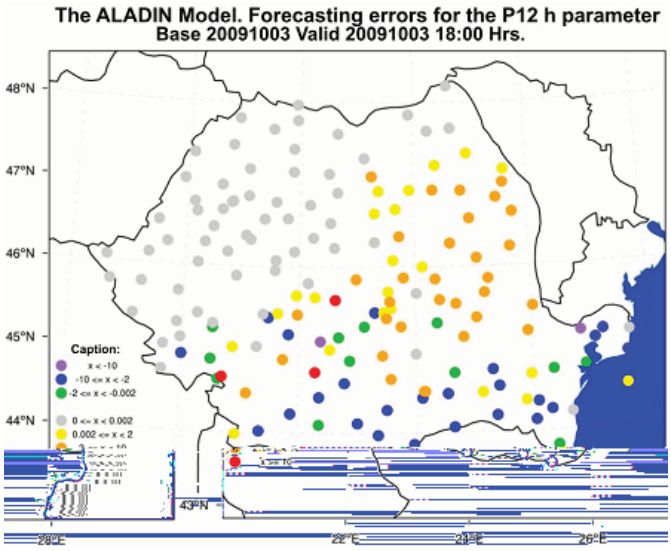
efforts are made to implement a verification procedure to compare precipitation amounts with weather station-recorded data. The display is similar to that shown below.



ALADIN-forecasted temperatures (4-day anticipation) and values recorded
at the Bucharest- Băneasa Station, 27 March 2009. Reference time: 0000 UTC



Spatial distribution of temperature forecast errors at 6-hour resolution,
ALADIN Model, 27.03.2009, 0000 UTC



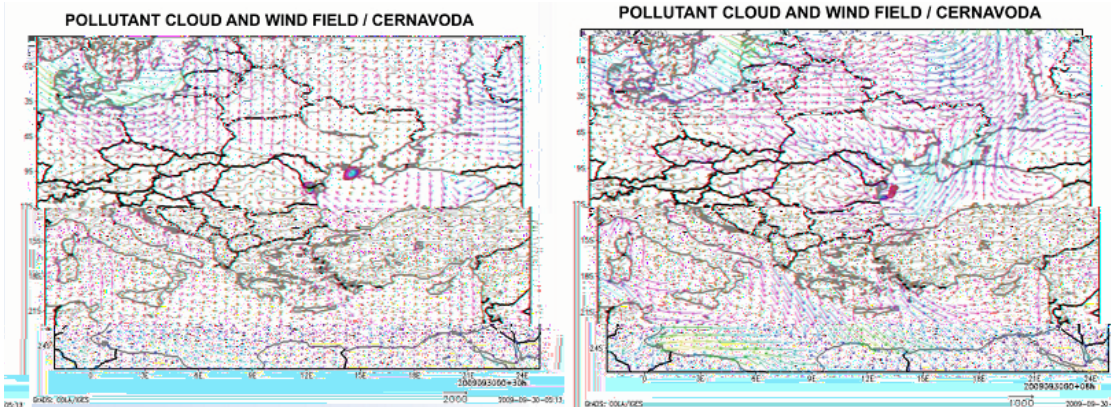
Spatial distribution of 12-hour Cumulated Precipitation forecast errors,
ALADIN Model, 03.10.2009, 0000 UTC

1.3. Chemistry and transport pollutant modelling

Two modelling chains were developed for pollutant dispersion and quality air forecast at urban scale.

Polutant dispersion

The system is based on the INPUFF, a Gaussian model able to simulate dispersion of certain substances emitted by punctual continuous, intermittent or instantaneous sources in a variable wind field provided by the HRM model. Three possible pollution sources are daily monitored on operative basis: Cernavodă, Turnu Măgurele and Kozlodui. As well an automatic procedure to integrate the model in case of accident was developed. Whenever such an event occurs, after introducing the geographical position of the pollutant source the model simulates pollutant dispersion on wind grid.

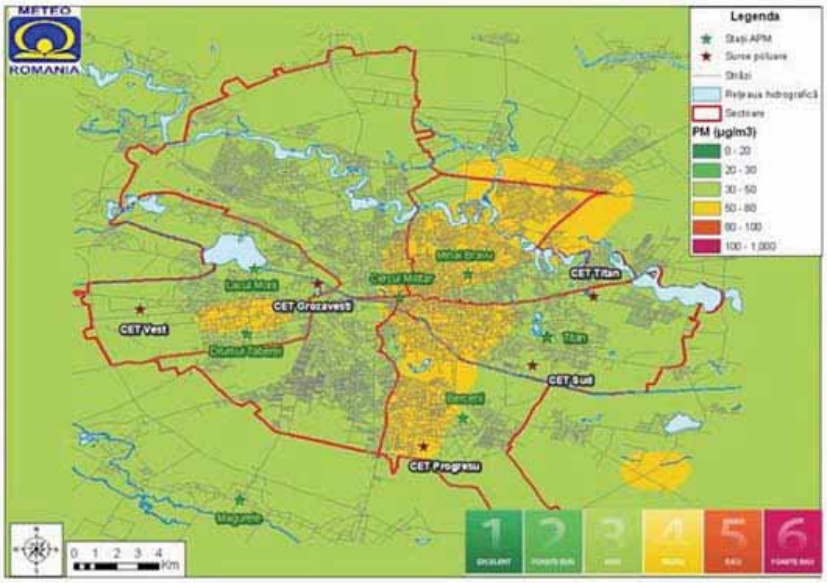


Pollutant-dispersion forecasts for Cernavodă an operatively-monitored location

Air quality forecast at urban scale

For the air quality system there are used two pollutant models: OML at urban scale and OSPM at street street modeling. This chain has meteorological and radiation input, the ALADIN forecast from the 1.5 km atmospheric chain (see 1.1 a). The background pollution concentration are those measured at the peri-rban background station for OML while the concentrations forecasted by OML are input for the OSPM model. Street canion pollution forecast is performed for 6 main traffic nodes in Bucharest.

Daily emissions are provided by 31 pointwise sources (thermal power plants and economic agents) and traffic emissions are provided by a statistical model (week day variation) based on: measurements along the year, vehicles parc parameters and traffic fluxes. The traffic emission model covers Bucharest area with a regular grid at 2 km. resolution. Simplified chemistry is used for NOx, No2 and O3. A fully operational emission data acquisition, validation and processing was implemented.



48-hour air pollution forecast with PM at urban scale, for Bucharest, in Open GIS

2. Participation of the Romanian specialists in international projects or programs

- The international **ALADIN** project (**A**ire **L**imitée **A**daptation dynamique **D**éveloppement **I**nter**N**ational; http://www.cnrm.meteo.fr/aladin/)
- The international **ALATNET** project (**ALA**DIN **T**raining **NET**work; http://www.cnrm.meteo.fr/alatnet/)
- The international **RC-LACE** project (**R**egional **C**ooperation for **L**imited **A**rea modelling in **C**entral **E**urope; http://www.rclace.eu/)
- The international COSMO project (Consortium for Small Scale Modelling); http://www.cosmo-model.org
- The European FP7 project **MACC** (Monitoring Atmospheric Composition and Climate)
- **HYDRATE** (Hydrometorological Data Resources and Technologies for effective flash flood forecasting)

- The LIFE project **AIR-AWARE** (AIR Pollution ImpAct Surveillance and WArning System for URban Environment)"
- **RODOS -** Decision support for nuclear emergency management
- **QUANTIFY -** "Quantifying the Climate Impact of Global and European Transport Systems", an Integrated Project
- **MedCLIVAR**
- The European FP6 project **ASCABOS** (**A S**upporting Programme for **CA**pacity **B**uilding in the Black Sea Region towards **O**perational **S**tatus of Oceanographic Services; http://www.ascabos.io-bas.bg/)

3. Organization of national and international scientific conferences

- Annual Scientific Session of NMA
- The 6th ALADIN PAC (Policy Advisory Committee), June 3-4, 2010, Bucharest Romania

4. Participation of the Romanian specialists in the international symposiums and conferences

- Annual EWGLAM / SRNWP Meetings (2007, 2008, 2010)
- Annual ALADIN Workshops and HIRLAM All Staf Meeting (2007-2010)
- Annual COSMO General Meeting (2007-2010)
- Annual COSMO User Seminar (2007-2010)
- EGU General Assembly, April 14-18, 2008, Vienna, Austria
- NetFAM Workshop on Moist Processes in Future High Resolution NWP Models, June 15-17, 2009 in Norrköping, Sweden
- ALARO-1 Working Days, February 16-19, 2010, Budapest, Hungary

6. Publications

Papers in reviewed journals

Dierer, S. Arpagaus, M. Seifert, A. Avgoustoglou, E., Dumitrache, R. Grazzini, F. Mercogliano, P. Mielli, M. Starosta, K. : 2010 Deficiencies in quantitative precipitation forecasts: sensitivity studies using the COSMO model. *Meteorologische Zeitschrift. Vol 18., No.6, 631-645*

Gerard, L., J.-M. Piriou, R. Brožkova, J.-F. Geleyn, D. Banciu, 2009: Cloud and precipitation parameterization in a meso-gamma scale operational weather rediction model , *Monthly Weather Review, Volume 137 Issue 11, pp 3960-3977*

Georgescu F., Tascu S., Caian M. and Banciu D**.,** 2009: A severe blizzard event in Romania – a case study, *Nat. Hazards Earth Syst. Sci., 9, 623–634*

Georgescu, F, S. Tascu and D. Banciu**,** 2008, Tropical air mass advection and frontal instability in severe weather events – a case study*, Reports in Physics*, *Vol. 61, No. 1, 129–138*

Proceedings at conferences and other publications

Banciu, D., 2010: LAM activities in Romania, *32th EWGLAM&17th SRNWP Meetings - MetOffice, EXETER, 4th to 8th October, http://srnwp.met.hu/Annual_Meetings/2010/download/monday/posters/Poster_EWGLAM2010_v1.pdf*

Banciu, D., 2007: LAM activities in Romania, *29th EWGLAM&14th SRNWP Meetings, DHMZ, Dubrovnik, 8th to 11th October (poster) http://meteo.hr/EWGLAM07/posters/Romania.pdf*

Caian, M., R. Radu, R. Dumitrache and S. Taşcu, 2007: A short range multi-model ensemble system at NMA, *The 3rd SRNWP Workshop on Short Range Ensemble Prediction Systems, 10-11 December 2007, Rome, Italy*. ???

Dumitrache, R.C., I.V.Pescaru, L. Velea, C. D. Barbu: 2008: Romanian Contribution in Quantitative Precipitation Forecast Project**,** *COSMO Newsletter No. 7*
http://www.cosmo-model.org/content/model/documentation/newsLetters/newsLetter07/cnl7_dumitrache.pdf

Georgescu, F., Taşcu, D. Banciu and S. Stefan, 2008: Atmospheric instability features associated to the dislocation of tropical air mass over Romania - a case study, poster, *EGU General Assembly, Vienna, Austria, 14-18 April, Geophysical Research Abstracts, Vol. 10, EGU2008-A-06221,* SRef-ID: 1607-7962/gra/EGU2008-A-06221

Niculae, M., R. Bojariu, A. Enculescu, M. Caian, 2009: Seasonality of SST influence on regional precipitation. *Poster EGU General Assembly, 20-24 April, Geophysical Research Abstracts, Vol. 11, EGU2009-12432, 2009*

Oprea, I. C., Taşcu and A. Antonescu, 2008: The Tecuci, Eastern Romania, flash flood of 5 September 2007, poster, *EGU General Assembly, Vienna, Austria, 14-18 April, Geophysical Research Abstracts, Vol. 10, EGU2008-A-05979, 2008, SRef-ID: 1607-7962/gra/EGU2008-A-05979*

Oprea, I. C., Gh. Stancalie, G. Tiron and Taşcu, 2009: A Study of Two Heavy Precipitation Events in the North-Eastern Romania*, poster EGU General Assembly, Vienna, Austria, 20-24 April, Geophysical Research Abstracts, Vol. 11, EGU2009-7407-1, 2009*

Pescaru, I., V., 2008: LAM activities in Romania, *30th EWGLAM&15th SRNWP Meetings, Meteorological State Agency of Spain, MADRID, 6th to 9th October*
http://srnwp.met.hu/Annual_Meetings/2008/download/oct6/afternoon/Poster/Romania.pdf

Pescaru, I., V., R. C. Dumitrache, C. D. Barbu, A. Lupascu , I. Ibanescu, 2009: Atmospherical Modelling Used in National *Meteorological* Administration in Romania**,** *Proceedings of the worksop on Air Management System in Meteorology and Environement RTP 32367 , Pitesti, Romania, 3-4 March*

Stefanescu S., D. Banciu and Taşcu, 2007: Operational modelling activities for the Black Sea in Romania*, Proceedings of NATO Advanced Research Workshop Challenges for the Black Sea operational oceanography to increase the regional environmental security, 25-27 September 2007, Balchik, Bulgaria*

Taşcu, S., M. Caian, F. Georgescu and D. Banciu, 2008: A severe weather event in Romania during winter - a case study, *EGU General Assembly, Vienna, Austria, 14-18 April,* Geophysical Research Abstracts, Vol. 10, EGU2008-A-09085, SRef-ID: 1607-7962/gra/EGU2008-A-09085

Wang, Y. and Taşcu, 2010: The challenge of LAMEPS on Quantitative Precipitation Forecast. *Proceedings of WMO 3rd international conference on QPE and QPF and Hydrology, 18-22 October 2010, Nanjing, China, pp 326-330*

Wang, Y., M. Bellus, E. Hagel, A. Horanyi, S. Ivatek-Sahdan, A. Kann, S. Kertesz, R. Mladek, R. Radu, Taşcu, C. Wittmann and F. Wimmer, 2007: ALADIN and LACE recent and ongoing development on LAMEPS, *29th EWGLAM and 14th SRNWP Meeting Newsletter,*
http://srnwp.met.hu/Annual_Meetings/2008/download/ oct8/morning/laef08ewglam_WANG.pdf

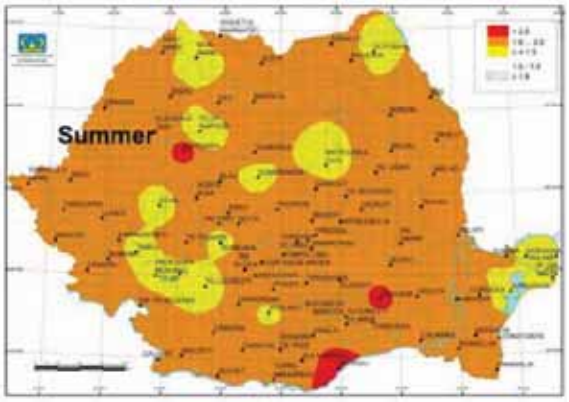
Wang, Y., C. Wittmann, A. Kann, M. Bellus, S. Ivatek-Sahdan, R. Mladek, Taşcu and E. Hagel, 2008: The Central European Limited Area Ensemble Forecasting system: ALADIN-LAEF, *Joint MAP D-PHASE Scientific Meeting - COST 731 mid-term seminar, 19-22 May 2008, Bologna, Italy, http://www.smr.arpa.emr.it/dphase-cost/?abstract_details&117*

CLIMATE

Climatological research activities are carried out by researchers within the National Meteorological Administration (NMA), the Department of Atmospheric Physics from the University of Bucharest, the Faculty of Physics, the Faculty of Geography, the Institute of Geography of the Romanian Academy, and the Academy of Agricultural and Forestry Sciences.

The research activity mainly consisted in computation of the various trends over the 1961-2007 period of the main climatic parameters (air temperature, precipitation, wind, and extreme events), thus explaining the mechanisms that control the climate variability in Romania, as well as making climatic scenarios for the 2001-2030 interval. Below are presented few of the main conclusions of the study.

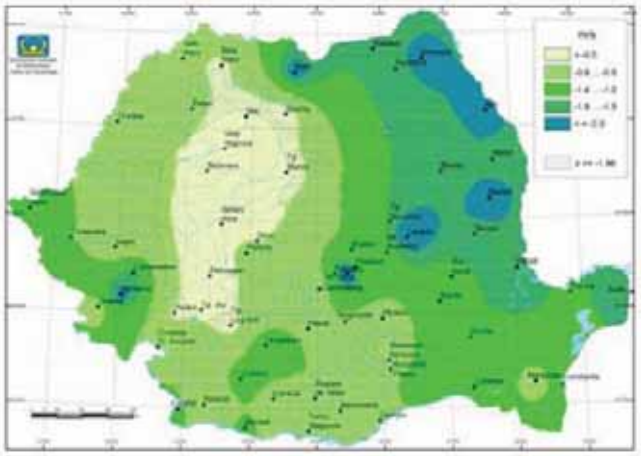
A significant warming of about 2˚ C all over the country in summer time was observed. The same increase in temperature was observed in the extra-Carpathian regions in winter time and during spring season, with the highest values exceeding 2˚ C during winter, and 1˚ C during spring. A slight cooling trend was observed for the whole country during the autumn. However, this is not statistically significant.



Summer mean temperature trend in Romania (˚C) over 1961-2007.
Hatched areas show the significant trends at the level of confidence of at least 95%

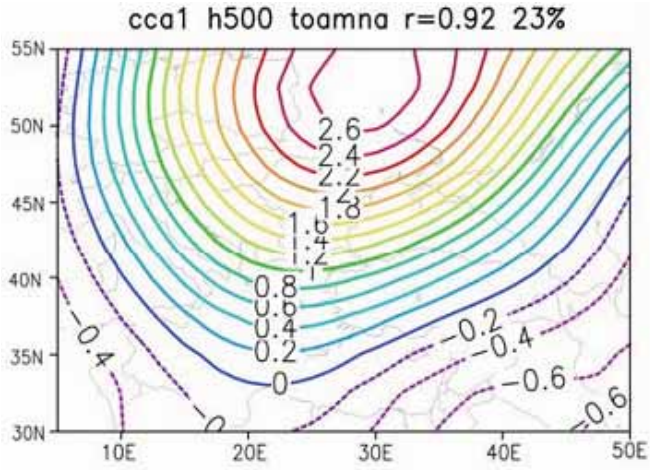
Autumn mean temperature trend in Romania (˚C) over 1961-2007. Hatched areas show the significant trends at the level of confidence of at least 95%

Regarding the precipitation amounts, decreasing trends were identified for winter and spring seasons, for the majority of the country's regions. Statistically significant changes were observed for the south and east during winter. Significant increasing trends of the precipitation amounts over wider areas (in the north-west, center and south-east) are observed in the autumn. No significant trends were observed for the summer.



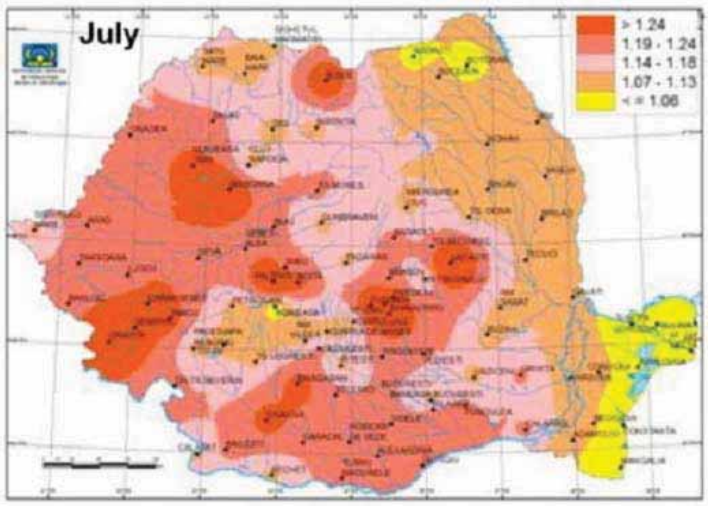
Spatial distribution of the trend of the number of days with precipitation ≥ 10 mm day^{-1}. Hatches are applied to those regions where the computed trend is significant at a confidence level of at least 90%.

Regarding the mechanisms that control the climate variability, during winter, spring and summer seasons, there has been an increase of the frequency and intensity of the upper air high pressure structures (H500 positive anomalies), centered over Romania, associated with the temperature increase at 850 mb, which has led to the air temperature increase in Romania, more markedly in wintertime. For the autumn the inverse process has been observed.



Configurations of the anomalies of the geopotential height at 500 mb (H500), maximum correlated with positive anomalies of the mean temperatures, for autumn.

Projections of the climatic regime changes in Romania (air temperature and precipitation) for the 2001-2030 period against the baseline, 1961-1990, were achieved through applying downscaling statistical models (SD) to certain global ocean-atmosphere climatic models (AOGCM), in the conditions of the A1B emission scenario of the IPCC.



Air temperature increase signal derived from the projections of the changes in the mean monthly air temperature at 94 weather stations, for the 2001-2030 period, performed with the SD models applied to the predictors simulated through three global climatic models (BCM2, INGV, FUB)

2. Participation of the Romanian specialists in international projects/ programs

European FP6 and FP7 Projects

- ENSEMBLES "ENSEMBLE-based Prediction of Climate Changes and their Impacts" (2007-2009)
- DYNAMITE "Understanding the Dynamics of the Coupled System" (2007-2008)
- CECILIA "Central and Eastern Europe Climate Change Impact and VulnerabiLIty Assessment" (2007-2009)
- EURO4M (2009-2010)

LIFE Projects

- AIR-AWARE "AIR Pollution ImpAct Surveillance and WArning System for URban Environment" (2007-2008)

Joint Research Projects

- Joint Research Project Italy-Romania "Changes in the characteristics of extreme climate events in southern and south-eastern Europe" (2007-2008)

COST Actions

- COST Action 733 «Harmonization and Applications of Weather Types Classifications for European Regions (2007-2010)
- COST Action 730 «Towards a universal thermal climate index UTCI for assessing the thermal environment of the human being" (2007-2009)

Mobility for research and as visiting scientist

3. Organization of national and international scientific conferences

- Annual Scientific Session of the Faculty of Physics, University of Bucharest
- Annual Scientific Session of the National Meteorological Administration

4. International workshops, conferences and symposiums (selection)

- European Conference on Applied Climatology (ECAC) (2007, 2009, 2010)
- European Geosciences Union General Assembly, Vienna Austria (2007-2010)

5. Others

- 1 Member in the Expert Team on Observing Requirements and Standards for Climate of the Commission for Climatology (CCI-XV) – WMO
- 3 Associate members (1-regular, 2 Seniors) at the ICTP, Trieste, Italy
- 2 lead authors of the IPCC WG1 for elaboration of the Four Assessment Report (AR4)
- 3 expert reviewers for the IPC AR4
- 2 expert evaluators for the FP6 UE proposals
- 1 INTAS evaluator for NIS-INTAS projects
- 4 reviewers for the international peer reviewed journals (Tellus, International Journal of Climatology, Theoretical and Applied Climatology, Climate Research, Water Resources Research)
- 1 Review Editor of the SYR AR4 – IPCC (2007)

6. Publications

Books and chapters of books

Busuioc, A., Caian, M., Cheval, S., Bojariu, R., Boroneant, C., Baciu, M., Dumitrescu, A, 2010: *Variability and climate change in Romania*, Ed. Pro Universitaria, ISBN: 978-973-129-549-7, Bucharest, 226 pp.

Dima M. and Sabina Stefan (2008) *Climate Change Physics* (In Romanian Language), Ed. Ars Docendi, 300pg. ISBN 978-973-558-379-8

Rimbu N. 2011: *Statistics and Elementary Graphs* (In Romanian Language). Ed. Ars Academica, Bucuresti, 150 pp.

Trenberth, K.E., Jones, P.D., Ambenje, P., Bojariu, R., Easterling, D., Klein Tank, A., Parker, D., Rahimzadeh, F., Renwick, J.A., Rusticucci, M., Soden, B. & Zhai, P. (2007) Observations: surface and atmospheric climate change. Climate Change 2007: The Physical Science Basis, Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (eds S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor & H.L. Miller). Cambridge University Press, Cambridge, UK and New York, NY.

Christensen JH, Hewitson B, Busuioc A, Chen A and others (2007) Regional climate projections. In: Solomon S, Qin D, Manning M, Chen Z, Marquis M, Averyt KB, Tignor M, Miller HL (eds) Climate change 2007: the physical science basis. Contribution of Working Group I to the 4th Assessment Report of the IPCC. Cambridge University Press, Cambridge, p 848–940

Papers in reviewed journals

Bojariu, R., R. Garcia-Herrera, L. Gimeno, T. Zhang, and O. W. Frauenfeld, 2008: Cryosphere-Atmosphere Interaction Related to Variability and Change of Northern Hemisphere Annular Mode. In L. Gimeno, R. García-Herrera, R. M. Trigo (eds.), Trends and Directions in Climate Research: Ann. N. Y. Acad. Sci. , 1146, pp. 50-59.

Hirschi M., Sonia I. Seneviratne, Vesselin Alexandrov, Fredrik Boberg, Constanta Boroneant, Ole B. Christensen, Herbert Formayer, Boris Orlowsky & Petr Stepanek, 2011, Observational evidence for soil-moisture impact on hot extremes in southeastern Europe. Nature Geoscience, Volume: 4, Pages: 17–21, DOI: doi:10.1038/ngeo1032.

A. Busuioc, F. Giorgi, X. Bi and M. Ionita, 2007: Comparison of regional climate model and statistical downscaling simulations of different winter precipitation change scenarios over Romania Theoretical and Applied Climatology Volume 86, Numbers 1-4, 101-123, DOI: 10.1007/s00704-005-0210-8

Cheval, S. and A. Dumitrescu, 2008: The July urban heat island of Bucharest as derived from modis images. Theoretical and Applied Climatology Volume 96, Numbers 1-2, 145-153, DOI: 10.1007/s00704-008-0019-3

Cheval, S., A. Dumitrescu, and A. Bell, 2009: The urban heat island of Bucharest during the extreme high temperatures of July 2007, Theoretical and Applied Climatology, vol. 97, no. 3-4, pp. 391–401, 2009.

Dima, M., and G. Lohmann, 2011: Hysteresis behavior of the Atlantic ocean circulation identified in observational data, , *Journal of Climate*, 24(2), 397-403.

Dima, M., and G. Lohmann, 2011: Evidence for two distinct modes of large-scale ocean circulation changes over the last century, *Journal of Climate*, 23, 5-16.

Felis, T., Suzuki,A., Kuhnert, H., Dima, M., Lohmann, G., and Kawahata, H, 2009: Subtropical coral reveals abrupt early- twentieth- century freshening in the western North Pacific Ocean, *Geology*, 37(6), 527-530.

Dima, M., and G. Lohmann, 2009: Conceptual model for millennial climate variability: a possible combined solar-thermohaline circulation origin for the ~1500-year cycle, *Climate Dynamics*, 32(2-3), 301-311.

McGregor, H. V., Dima, M., Fischer, H. W., and S. Mulitza, 2007: Rapid 20th Century increase in coastal upwelling off northwest Africa, *Science*, 315, 637-639.

Dima, M., and G. Lohmann, 2007: A mechanism for the Atlantic Multidecadal Oscillation, *Journal of Climate*, 20(11), 2706-2719.

Grosfeld, K., Lohmann, G., Rimbu, N., Lunkeit, F., Fraedrich, K,, and Lunkeit, F., 2007: Atmospheric multidecadal variations in the North Atlantic realm: proxy data, observations, and atmospheric circulation model studies. Climate of the Past 3, 39-50.

Kim, J.-H., Meggers, H., Rimbu, N., Lohmann, G., Freudenthal, T., Mueller, P.J., and Schneider, R.R., 2007: Impacts of the North Atlantic gyre circulation on Holocene climate off Northwest Africa, Geology 35: 387-390.

Rimbu, N., Lohmann, G., Grosfeld, K., 2007: Northern Hemisphere atmospheric blocking in ice core accumulation records from northern Greenland, Geophysical Research Letters, 34, L09704, doi:10.1029/2006GL029175 .

Grosfeld, K., Lohmann, G., and Rimbu, N., 2008:The impact of Atlantic and Pacific Ocean sea surface temperature anomalies on the North Atlantic multidecadal variability, Tellus, 60A(4), 728-741., doi:10.1111/j.1600-0870.2008.00304.x .

Ionita, M., Lohmann, G., and Rimbu, N, 2008: Prediction of spring Elbe discharge based on stable teleconnections with winter global temperature and precipitation, Journal of Climate., doi:10.1175/2008JCLI2248.1 .

Ionita, M., Lohmann, G., Rimbu, N., and Wiltshire, K., 2008: The influence of large-scale atmospheric circulation on the variability of salinity at Helgoland Roads station, Tellus A 60

Ionita, M., Rimbu, N., Lohmann, G., 2010: Decadal variability of the Elbe river streamflow. International Journal of Climatology. DOI: 10.1002/joc.2054 (in press)

Felis, T., A. Suzuki, H. Kuhnert, N. Rimbu, and H. Kawahata, Pacific Decadal Oscillation documented in a coral record of North Pacific winter temperature since 1873, *Geophysical Research Letters*, (in press)

Rimbu, N., Lohmann, G., 2010: Decadal variability in a central Greenland high-resolution deuterium record and its relationship to the frequency of daily atmospheric circulation patterns from the North Atlantic Region. J. Climate doi: 10.1175/2010JCLI3556.1 (in press)

Felis, T., and N. Rimbu, Mediterranean climate variability documented in oxygen isotope records from northern Red Sea corals – A review, *Global and Planetary Change*, *71*, 232-241, 2010

Ionita, M., G. Lohmann, N. Rimbu and S. Chelcea, 2011: Interannual to decadal summer drought variability over Europe and its relationship with global sea surface temperature. *Climate Dynamics (in press).*

Paraschivescu, M, Rimbu N, and Stefan S, 2011: Atmospheric circulations associated to the interannual variability of Cb cloud frequency in the southern part of Romania. *Int. Jour. Climatol. (in press)*

Bojariu, R. and M. Dinu, 2007: Snow variability and change in Romania. In: STRASSER, U. & VOGEL, M. (Eds.): Proceedings of the Alpine Snow Workshop (www.alpinesnowworkshop.org), 5-6 October 2006, Munich, Germany. Berchtesgaden National Park research report, No. 52, 34-38.

ATMOSPHERIC PHYSICS

A number of research studies were carried out in order to analyze certain atmospheric physical processes using the available data on solar radiation, electricity, total ozone and the chemical composition of air. The aerosol and air quality were the important subjects for study.

Today, the interest in aerosols is high mainly because of their effect on human health and their role in climate change. They have also a determining effect on visibility and contribute to the soiling of monuments.

The most important results are synthetically presented below.

Given that the Romanian radiometric network includes two systems measuring total solar radiation, it was necessary to elaborate a comparative study of the total solar radiation measurements on a horizontal surface in both standard and automatic regimes. To this aim, there were used the daily sums of total solar radiation on a horizontal surface provided by three radiometric stations from the national network equipped with both Kipp & Zonnen thermopiles and Robitzsch-type bimetallic actinographs. This data type was chosen as it is frequently used in studies on solar radiation climatology and is transmitted at low speed to the St. Petersburg Data Collecting Center. Analyzing the daily sums of total solar radiation on a horizontal surface provided by the standard and automatic systems shows the following:

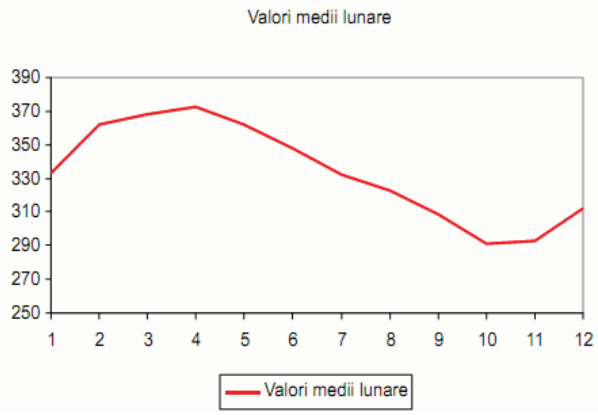
– The two systems, different in structure and operation, provide data within the same order of magnitude. We got the following mean correlation coefficients: 0.9712 at Galati, 0.9571 at Timisoara and 0.9547 at Cluj Napoca.

– The Robitzsch system, as against the automated one based on pyranometer, usually overestimates total solar radiation according to the measured values;

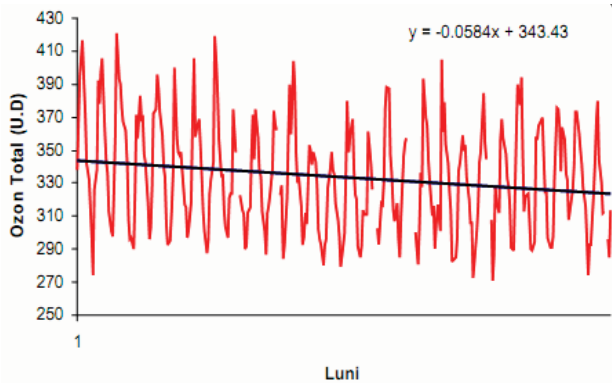
– Processing data also led to determining the S/R ratio (S-total radiation provided by the automated system, R-total radiation provided by the standard system), which is used to homogenize the existing total radiation data series.

The monitoring of total ozone went on and daily values were measured and transmitted to the World Ozone Data Center in Canada, where daily ozone maps are made in real time. This year's

total ozone deviations against the multi-annual values are negative excepting April, October and December, which proves that the stratospheric ozone depletion process is still going on. Monthly means show a kind of variability specific to mid-latitudes: marked maxima between January and April and minima in September and November. In September 2007 there were carried out no measurements on total ozone, as Romania participated to the GAW Spectrophotometer Intercomparison Session.



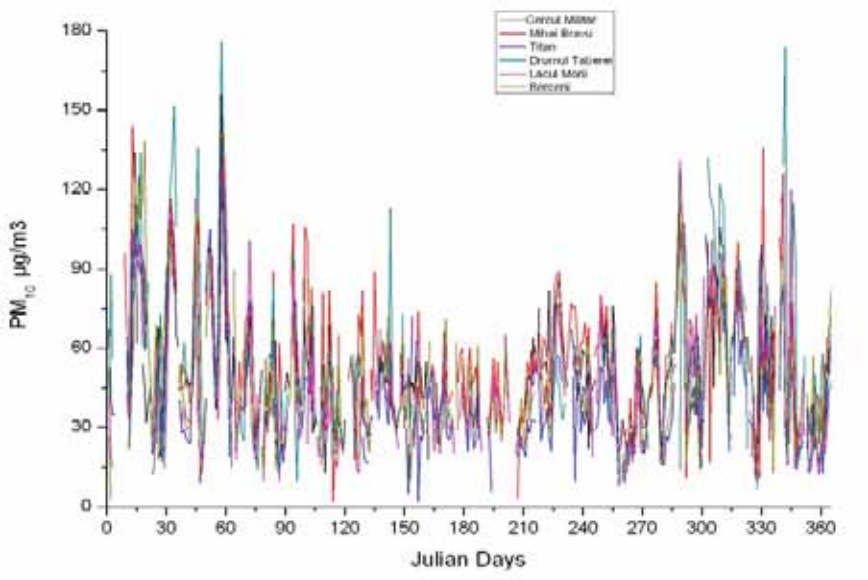
2007 monthly means at the Bucharest station



Monthly variation and tendency of total ozone in Bucharest over January 1980 – December 2007

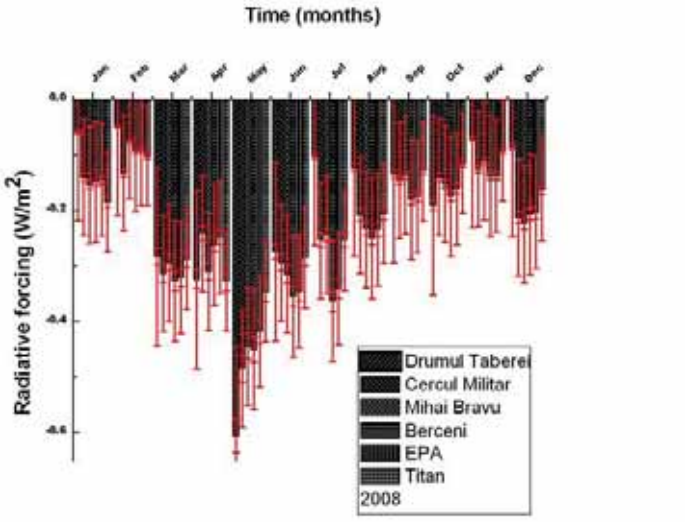
Air pollution is the principal cause of dangerous effects on the human health. It also influences the radiative forcing by its direct and indirect effects. In urban areas the greatest source of pollutants is vehicular traffic. Pollutant like NO_2, PM_{10}, O_3, and SO_2 are the relevant products of air pollution in such areas like Bucharest, where peculiar orographic and atmospheric conditions can lead to pollutant accumulation.

Studies of air quality in Bucharest using data from monitoring stations of Environment Protection Agency (http://www.apmn.ro) have shown a decreasing tendency of pollution for period 2007-2009 (not shown). In figure on can observe a few pollution episodes with PM10 in winter.



The PM10 concentration in 2008 at monitoring stations in Bucharest (Barladeanu et al., 2010)

Radiative forcing at surface in Bucharest has negative values and the largest values occurred in spring and summer (figure). These values emphasize the cooling effect of the aerosols



Monthly surface radiative forcing due to aerosols, in Bucharest in 2008 (Barladeanu et.al. 2010)

- Annual Scientific Session of the Faculty of Physics, University of Bucharest.
- ISWLA (International Students Workshop Laser Applications) 2010, May BRAN, ROMANIA

4. Selected References

Books

Sabina Stefan, Doina Nicolae and Mihaela Caian, 2008 *Secretele aerosolului atmosferic sub lumina laserilor* (***Secrets of Atmospheric Aerosol under Lasers Light***), Ed Ars Docendi, Bucharest, Romania, 350pg.

Papers in Journals with impact factors:

Raducan G., Stefan S, 2009: *Characterization of traffic-generated pollutants in Bucharest,* ATMOSFERA, VOL. 22 (1), pg.97-108.

Neamtu, S. Sabina Stefan, 2010: *Transfer and translocation of organochlorine pesticide residues in water-soil-crops in an agricultural area,* IJEWM International Jour. of Environment Waste and Management, Vol.5, no.1/2 2010, pg.114-124

Stefan, S., Cristian Necula and Florinela Georgescu, 2010: *Analysis of Long-Range transport of Particulate Matters in Connection with Air Circulation over Central and Eastern Part of Europe.*, Physics and Chemistry of the Earth, 35, 2010, pp 523-529.

Proceedings of National and International Conferences

Stefan, Cristina Raicu,*The Spatial and Temporal Variability of Pollutant Concentrations in Urban Area* Sabina AAAS2008 Advanced Atmospheric Aerosol Symposium 9-12 November, 2008 Naples, 4pg.

Laura Mihai, **Sabina Stefan**, Ioana Ungureanu *Determining of the aerosol radiative properties using the integrating nephelometer.*. Proceedings vol. 7475 Remote sensing of clouds and the atmosphere XIV ;DOI. 10.1117/12.830300;spie.org/x648.html?product_id=830300, 8pg.

Sabina Stefan, Raluca Barladeanu and Laura Mihai , 2009 Measurements of aerosol optical properties at urban sites to determine aerosol direct radiative effect, *Proceedings of EAC2009* Kalsruhe, Germany.

Ioana Ungureanu, Sabina Stefan. Study of cloudiness characteristics over Magurele using ceilometer CL-31. International Conference of Optoelectronics and Environment, Bucharest 1-3 Oct 2009, *Proceedings OTEM2009, Bucuresti pg.* 67-41.

Raluca Barladeanu, Sabina Stefan and Laura Mihai. Particulate Matter (PM_{10}) optical properties determined in a few sites of Bucharest. International Conference of Optoelectronics and Environment, Bucharest 1-3 Oct 2009, *Proceedings OTEM2009, Bucuresti pg.* 94-99.

Luminița Filip and Sabina Ştefan. A method for estimating the atmospheric content of sub-micrometer aerosol using direct-sun photometric data. International Conference of Optoelectronics and Environment, Bucharest 1-3 Oct 2009, *Proceedings OTEM2009, Bucuresti pg.* 120-126.

Luminita Filip, Sabina Stefan Study of correlation between PM10 mass concentration near the ground and Aerosol Optical Depth (AOD) *Proceedings of 25-th International Laser Radar Conference* Saint Petersburg 5-9 July, 2010.pg.

Sabina Stefan, Laura Mihai, Doina Nicolae and Andreea Boscornea, *Ångström Turbidity in the Lower Layers of the Troposphere,* International Conference of Optoelectronics and Environment, Cluj Oct 2010, *Proceedings OTEM2010 ,pg.*

Sabina Stefan, Luminita Filip, Anca Nemuc, 2011.A Study of the Aerosol Optical Properties at two AERONET Stations from Romania, International Conference of Optoelectronics and Environment, Cluj Oct 2010, *Proceedings OTEM2010,pg.*

Sabina Stefan, Florinela Georgescu, *Spectral analysis of total suspended particles in connection with circulation patterns in the central and eastern part of Europe.* Report of COST733- Harmonization and application of weather type Classification for. pg. 256-260.

Dobrovolschi, D., G.J. Steeneveld, A. Paci, O. Eiff, L. Lacaze, 2010: *Investigation of the vertical eddy flux of*

momentum under stable conditions in the surface boundary layer over land using CNRS-Toulouse stratified water flume, Proceedings of the HYDRALABIII joint transnational access user meeting, 2-4 February 2010, Hannover, Germany, 203-206 pp.

Dobrovolschi, D., Ristici, V., Ristici, A., Sandu, R., Rada, C., Nicodim, F., Lucaschi, B., 2010: *Boundary layer height estimation at night, at Bucharest-Baneasa.* Annual Scientific Conference of National Meteorological Administration, 10-11 November 2010, Bucharest, Romania.

Ifrimov, D., 2010: *Comparison between global solar radiation fluctuations measured at Bucharest and Constanta*, Annual Scientific Conference of National Meteorological Administration, 10-11 November 2010, Bucharest, Romania.

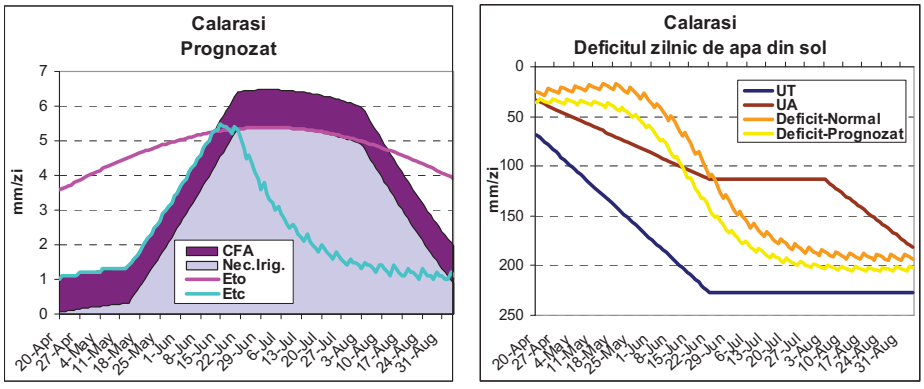
Miloş, I., 2010: *Operational Henri-Coanda Airport AMDAR data processing and analysis system.* Annual Scientific Conference of National Meteorological Administration, 10-11 November 2010, Bucharest, Romania.

AGROMETEOROLOGY

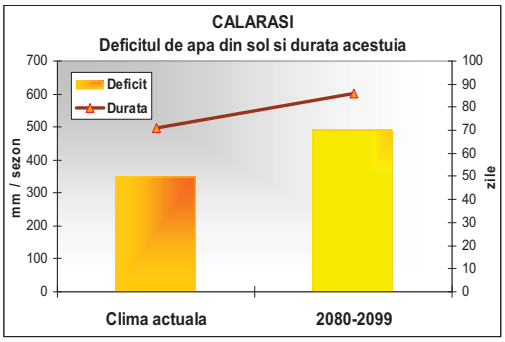
1. Research activity

The effects of climatic change and variability upon vegetal yields are the main objectives for impact studies at an ever increasing rate. These studies have shown that climate change is already present and is leaving its mark on every economic branch, particularly upon agriculture – which is mostly weather-dependent. As many other Southeast European countries, Romania was hit by climatic extremes (droughts, floods, heat waves, frost, diseases and pests etc.) with increased frequency and intensity over the last decades.

Research was mainly aimed to use seasonal forecasts and climatic scenarios in combination with the agrometeorological model CROPWAT for estimating the impact of climate change/variability upon agricultural yields and the main soil water balance components. Three procedures were started to this end, by running the CropWat model for maize crops in climatic conditions related to a normal year (using multi-annual means of climatic data over 1961-2000), in conditions estimated by the 2008 ECMWF seasonal forecast and in RegCM /2080-2099/SRES A1B scenario conditions.

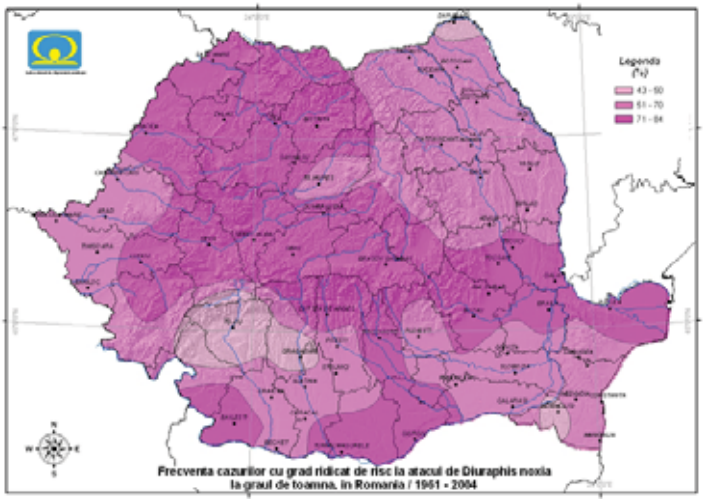


CROPWAT-simulated results for the 2008 maize vegetation season
in normal/forecast conditions – case study, Calarasi area.



Effects predicted by the regional climatic scenario RegCM 2080-2099/SRES A1B upon soil water deficit and its duration – case study, Calarasi area

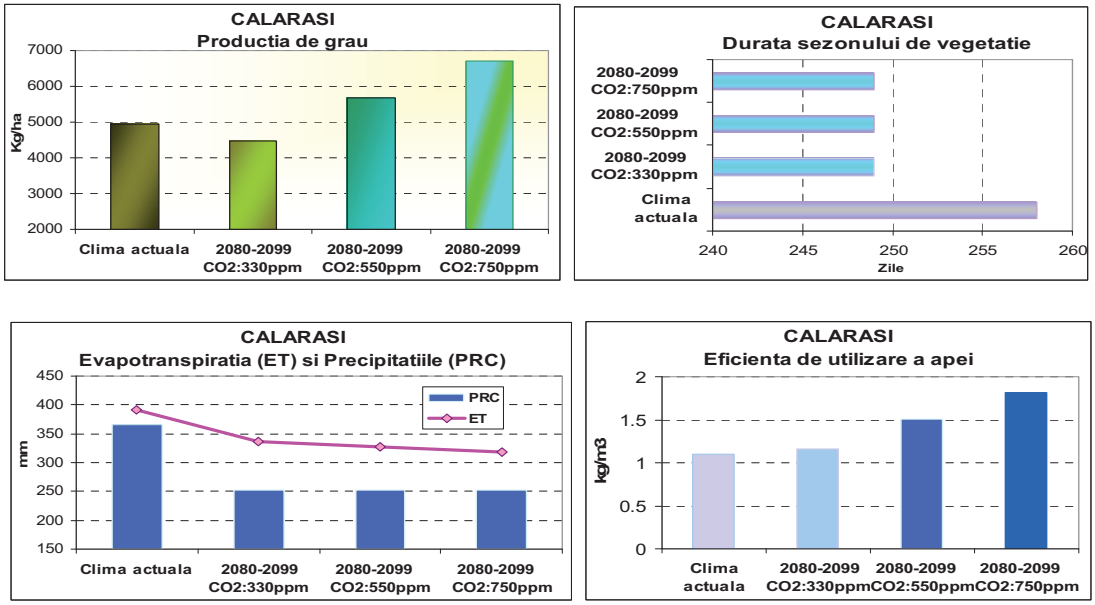
Another direction followed by researchers included a study called "*Integrated system to manage expected phytosanitary risks in Romania" - EMERISK*, Project BIOTECH 133/2006. This project was aimed to evaluate climatic variability and to quantify the vulnerability of regional conditions to "brown pollution" – new organisms such as *Gaeumannomyces graminis, Septoria nodorum and Diuraphis noxia* - phytopathogens responsible for significant yield losses in Romanian crops. The analysis is based on information concerning the origin of every harmful organism, areas where they were detected and the variety of affected plants. Every area of highest frequency of emergent phytosanitary risks was marked out on GIS maps in order to select the most vulnerable ones.



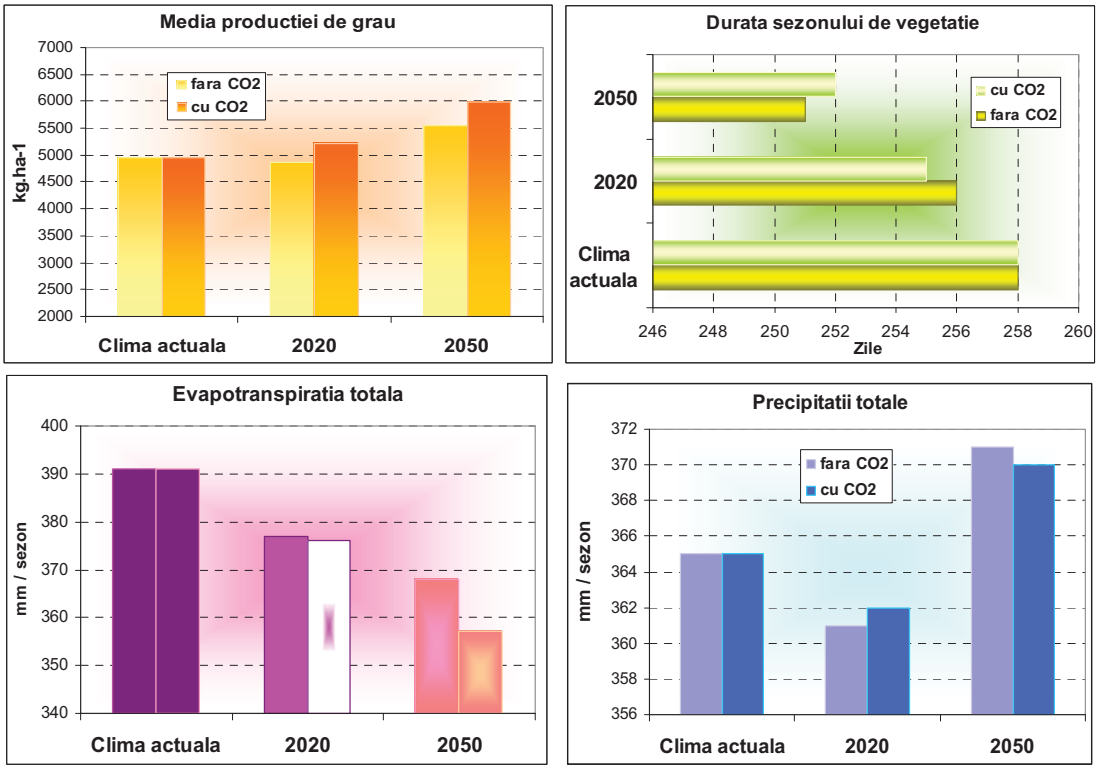
Frequency of high risk of Diuraphis noxia in winter wheat, 1961-2004

Several studies approached the impact of climatic change upon agriculture. Among them, the Project PNCDI-2, no. 51073/2007, Program 4 "Partnerships in foreground fields" – *Ways to mitigate the impact of climatic change on southern Romania wheat crops* – was mainly aimed to estimate the effects of climatic change upon winter wheat phenological development and yields, using the DSSAT v3.0 decision-making system. Over the year, the impact of climatic change on southern Romania winter wheat crops was evaluated and quantified by comparing results simulated for current climatic conditions as well as global and

regional scenarios (*RegCM/IPCC/2080-2099/ SRES A1B, RegCM/ICTP/2070-2100/ SRES A2*, HadCM3/decada 2020 and 2050/*SRES A2).*



CERES-Wheat results against the regional climatic scenario RegCM /IPCC /SRES A1B, 2080-2099 (with / without CO_2) - Calarasi Station



CERES-Wheat results for current conditions and the climatic scenario HadCM3/SRES A2, decades 2020 and 2050 (with and without CO_2) – Calarasi Station.

2. Participation at national and international symposiums

- COST 734 Action Meeting – Impacts of Climate Change and Variability on European Agriculture: CLIVAGRI, Vienna, Austria, 11-12 March 2010;
- International Workshop on addressing the livelihood crisis on farmers: weather and climate services, Belo Horizonte, Brazil, 12-21 July 2010;
- 1st Meeting of INTERREG IV C WATER CoRe/ WATER scarcity and droughts – Co-ordinated activities in European Regions" (2010-2013), Zaragoza, Spain, 26-27 April 2010;
- 2nd Meeting of INTERREG IV C WATER CoRe/ WATER scarcity and droughts – Co-ordinated activities in European Regions" (2010-2013), Szentendre, Ungary, 2-4 November 2010;
- International Conference on Scope and current limits of linking phenology and climatology in the context of COST 725 "Establishing a European Phenological Data Platform for Climatological Applications" and in cooperation with the German Weather Service (DWD), Geisenheim, Germania, 10-12.03.2009;
- 30th Session of IPCC on the 5th Global Report of Evaluation of Climatic Changes (AR5), Antalya, Turkey, 21-23 April 2009;
- Inter-Regional Workshop on Indices, and Early Warning Systems for Drought), Lincoln, Nebraska, USA 8-11 Decembrie 2009;
- COST 734 Action 2nd Meeting - Impacts of Climate Change and Variability on European Agriculture: CLIVAGRI, Florence, Italy, 21-23 February 2007;
- COST 734 Action 3rd Meeting - Impacts of Climate Change and Variability on European Agriculture: CLIVAGRI, Poznan, Poland, 20-22 May 2007;
- COST 725 Action 8th Meeting - Establishing a European Phenological Data Platform for Climatological Applications, Ivalo, Finland, 6- 10 June 2007;
- 7th EMS Annual Meeting / 8th European Conference on Applications of Meteorology, San Lorenzo de El Escorial, Spania, 1–5 October 2007;
- 5thMCM of Action COST 734 – Impacts of Climate Change and Variability on European Agriculture: CLIVAGRI, Larissa, GRECIA, 27 - 28.03.2008;
- International workshop and course for decision makers on the effective use of water in agricultural crop production, Jois, AUSTRIA, 6-8.10.2008;
- *2nd EIONET workshop on Climate Change Impacts, Vulnerability and Adaptation EEA*., Copenhaga, Danemarca, 08 - 10.10.2008;

3. Books

I. Sandu, Elena Mateescu, V. V. Vatamanu (2010) – *"Schimbari climatice in Romania si efectele asupra agriculturii"*, Editura SITECH Craiova, ISBN 978-606-11-0758-2, 392 pp

E. Chitu, Elena Mateescu, Andreea Petcu, Ioan Surdu, Dorin Sumedrea, Nicolae Tanasescu, Cristian Paltineanu, Viorica Chitu, Paulina Mladin, Mihail Coman, Madalina Butac, Victor Gubandru (2010) – *„Modele de estimare a favorabilitatii climatice pentru cultura pomilor in Romania"*, Editura INVEL Multimedia Bucuresti, ISBN 978-973-1886-52-7, 132 pp

4. Selected references

Elena Mateescu, D. Alexandru *(2010) – "Management recommendations and options to improve the crop systems and yields on South-East Romania in the context of regional climate change scenarios over 2020-2050",* Scientific Papers, Series A LIII - Agronomy, University of Agronomic Sciences and Veterinary Medicine of Bucharest, Faculty of Agriculture, ISSN 1222-5339, pp 328-334

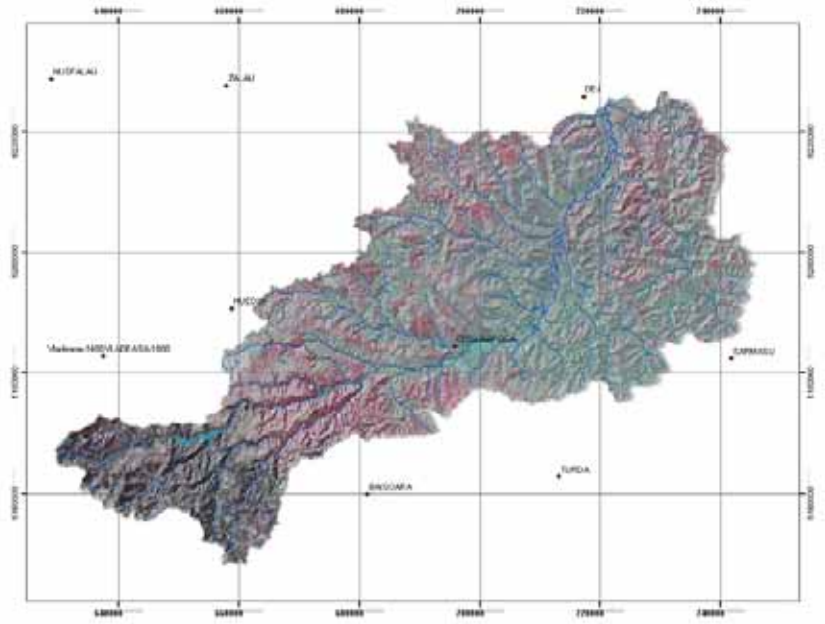
I. Sandu, Elena Mateescu (2010) – „*Monitoring soil drought in Romania and the impact on agriculture*", Proceeding of Inter-Regional Workshop on Indices and Early Warning Systems for Drought- World Meteorological Organization and National Meteorological Drought Center (NMDC-Nebraska USA), Lincoln, Nebraska, USA, 8-11 December 2009, pg. 78-95

REMOTE SENSING AND GIS RELATED ACTIVITIES

1. Research orientation

The operative and research activities carried out within the Remote Sensing and Geographic Information Systems Laboratory are presented in the following paragraphs.

One of the operative activities aimed to estimate snow melt water reserves for the following mountain river basins: Arges, Lotru, Bistrita, Doftana, Somesul Mic and Riul Mare. GIS-integrated high resolution satellite data and weather station data were used to this end. When processed, data were transmitted in due time to the National Institute of Hydrology and Water Management's Operative Department for Hydrological Forecasts.



Snow melt water reserve in the Somesul Mic hydrographic basin, 20 February 2008.

The Remote Sensing and GIS Laboratory also carried out several national and international projects during, as follows:

- *The HYDRATE* (Hydrometeorological data resources and technologies for effective flash flood forecasting) project is mainly aimed to improve the scientific ground of flash-flood forecasting through a better understanding of past flash floods, by developing and harmonizing a modern Europe-wide flash flood observation strategy as well as by building a coherent set of early warning technologies and instruments. HYDRATE has developed a European free-access flash flood database that provides the international scientific community with hydro -meteorological data. Its final objective is to improve the flash flood forecasting capacities across hydrographic basins that lack standard measurement and monitoring systems by using the

available information and a thorough understanding of triggering phenomena and processes.

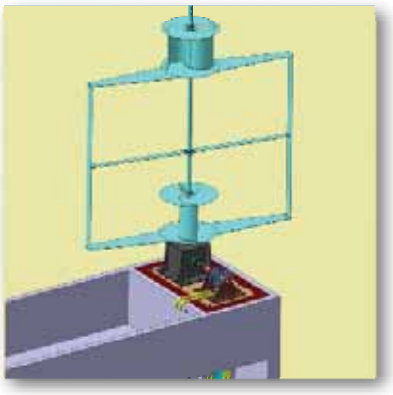
- *AIR-AWARE LIFE-ENV* Project *(*AIR Pollution ImpAct Surveillance and WArning System for URban Environment). Air quality is a vital part of our planet's life support system and for many years the EU has been actively working with Member States to help improve the quality of Europe's air. Such actions remain increasingly important as pressures from the likes of traffic-related pollution and expanding urban or industrial developments continue to adversely contaminate the air that we all rely so heavily on. Launched in 2005, as part of the country's EU membership process, this AIR-AWARE (Air Pollution Impact Surveillance and Warning System for Urban Environment) project amalgamated Bucharest's key environmental stakeholders and resulted in a highly successful sustainable development tool that continues to be used for monitoring, modeling and managing air quality in the Romanian capital. AIR-AWARE's system has now been fully operational since early 2009 (see image bellow). It uses data from the LIFE-funded monitoring equipment which scans and analyse air samples from different locations and altitudes to provide a 3D map of real-time emissions over the city. Eight fixed position monitoring units were included in the LIFE project and these are supported by several mobile emission monitoring stations that can be moved to analyse problems in particular hot-spot zones. All data is fed into a GIS platform which provides forecasts and dynamic mapping material for decision-makers in the municipal authorities. Users of the system welcome the improvements and note how the AIR-AWARE technology provides more detailed information which allows easier forecasting.

AIR-AWARE system – graphic visualisation aswering user-request options.

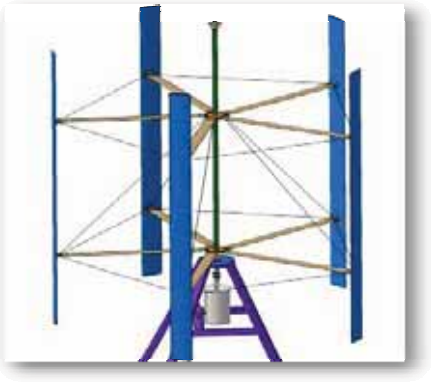
- The MACC (Monitoring atmospheric composition and climate) project is designed to meet the requirements that have been expressed for the pilot GMES Atmospheric Core Service. MACC prepares the core service in terms of implementation, sustained operation and availability. It will maintain and further develop the efficiency and resilience of the end-to-end pre-operational system, and will refine the scientific basis and quality of the products of the system. It will ensure that its service lines best meet both the requirements of downstream service providers and end users at the European, national and local levels,

and the requirements of the global scientific user community. The service lines cover air quality, climate forcing, stratospheric ozone and solar radiation. MACC Project delivers operational products and information that support the establishment and implementation of European policy and wider international programmes. It acquires and assimilates observational data to provide sustained real-time and retrospective global monitoring of greenhouse gases, aerosols and reactive gases such as tropospheric ozone and nitrogen dioxide. It provides daily global forecasts of atmospheric composition, detailed air-quality forecasts and assessments for Europe, and key information on long range transport of atmospheric pollutants. It provides comprehensive web-based graphical products and gridded data on which downstream services may be based.

- *CLEANWATER LIFE+ Project:* "Integrated system for protect and analyse the status and trends of water threatened by nitrogen pollution". The long – range objective of CLEANWATER Project is to contribute to the development of a modern Romanian water management system by elaboration of a completely integrated system as basis for the Barlad River Basin District Management Plan according to EU legislation (especially Water Framework Directive) and by gaining the knowledge and experience to be used later in management of other river basins of Romania.
- *The MIDMURES (*Mitigation Drought in Vulnerable Area of the Mures Basin) grant objectives are:
  - to develop a decision support model for the dissemination of drought-related bulletin to the farmers and appropriate methods for early warning information;
  - to assess the possibility to use the groundwater for crop irrigation for different water demand scenarios and different energy-based pumping systems and the impact of this use on the groundwater resources;
  - to optimize the irrigation methods (time, rates) using the rainfalls saving according to the plant needs and agro-climatic condition;
  - to development of technical project for a wind plant to combat desertification in Mures river basin;
  - making the installation of wind; there are proposed two projects of wind plant (see figures below);
  - to demonstrate the potential of water saving techniques for improving human and environmental conditions in the Mures River basin in Romania, using low-cost approaches based on remote sensing techniques.

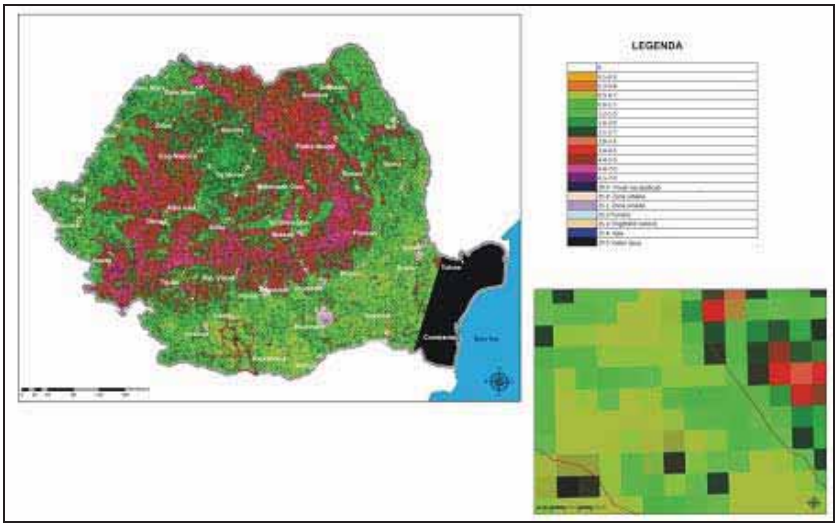


Eolian plant for crop irrigation without external energy consumption. The extracted water is achieved through a plant integrated pump and is stored in a collector tank which insures crop irrigation by gravitational means.



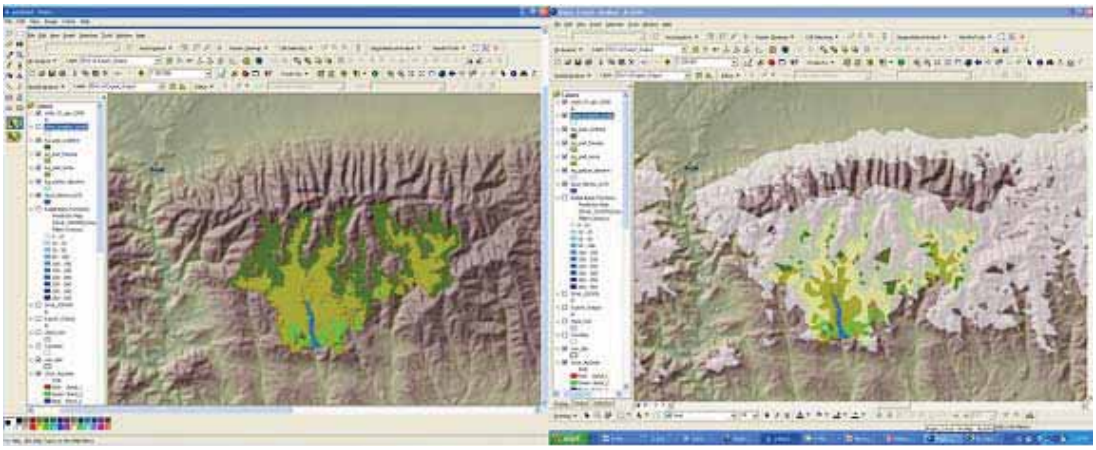
Eolian plant for electrical energy production. The generated energy is used for crop irrigation using an electric pump

- Project PNCDI 2/2007: Satellite Information-Based Service for Managing Emergency Situations. It is carried out in collaboration with the Romanian Space Agency, the Polytechnic University of Bucharest, the National Institute of Hydrology and Water Management, the Center for Advanced Studies and Research, and the Romanian Center for Remote Sensing in Agriculture. The project is aimed at organizing a national service to provide products mainly derived from processed satellite images, useful in the management of emergency situations.
- Project PNCDI-2/2007 RISCASAT: Developing new satellite data-derived products to meet user requests in the field of managing hydro-meteorological risk situations. It is carried out in collaboration with the Forest Research and Management Institute, the Romanian Space Agency, the University of Bucharest and the Transylvania University of Brasov. This project is mainly aimed to create new products by calibrating, validating, interpreting and analyzing standard satellite data-derived products (SPOT, IRS, RADARSAT, ERS,LANDSAT, QUICK-BIRD, EOS/AM, TERRA and EOS/PM AQUA, IKONOS, TERRASAR-X) tailored to the user requests for managing hydro-meteorological risk situations in Romania. A number of image products to be used in monitoring and evaluating agricultural vegetation, flood-affected areas, forest risks (windthrows, wildfires) and the quality of the Black Sea water were elaborated in 2009. To this aim, the equipment and instruments needed for measurements were procured and procedures were designed to determine every parameter used by calibration/validation algorithms:
  - determining Leaf Area Index (LAI) with a Delta-T SunScan SS1 system and by processing digital images with a specialized software (CAN-EYE developed in MATLAB);
  - using the S-WCA-M003 sensor to determine wind speed and direction an important factor related to windthrows;
  - using the S-LIA-M003 sensor to determine photosynthetic light intensity;
  - determining the location of GCP points by GPS ProXH and GPS GeoXM equipments;
  - measuring turbidity with a Hanna HI 98713 device;
  - measuring temperature, salinity etc. by the Hanna Multiparameter HI 9828.

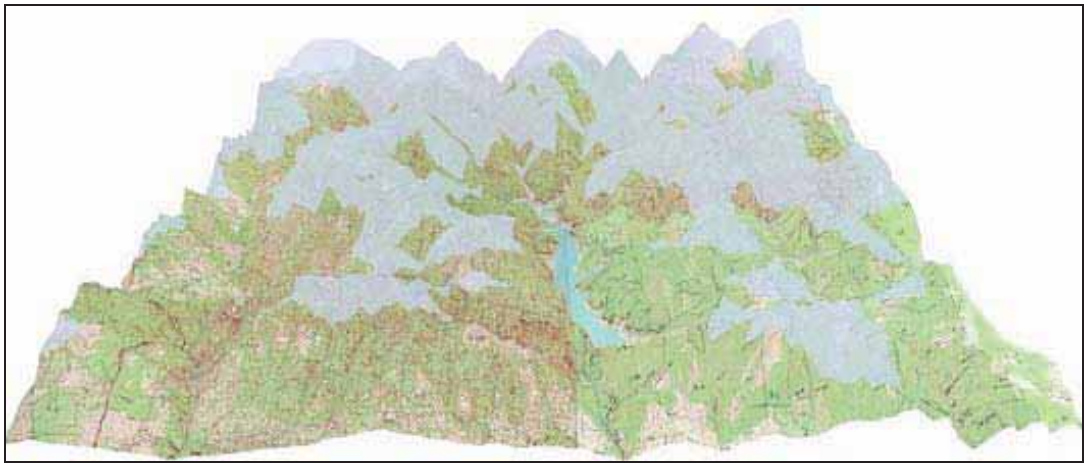


LAI map for Romania obtained from MODIS data, 05.07.2009

A number of dedicated MODIS products connected to the detection of snow-covered areas and snow albedo were elaborated and validated in order to monitor and evaluate the snow cover. The algorithm used in determining the extent of snow-covered areas is mainly based on a so-called snow index (Normalized Difference Snow Index NDSI): normalized difference of two bands, one in the visible and one in the near-infrared or short-wave infrared parts of the spectrum.



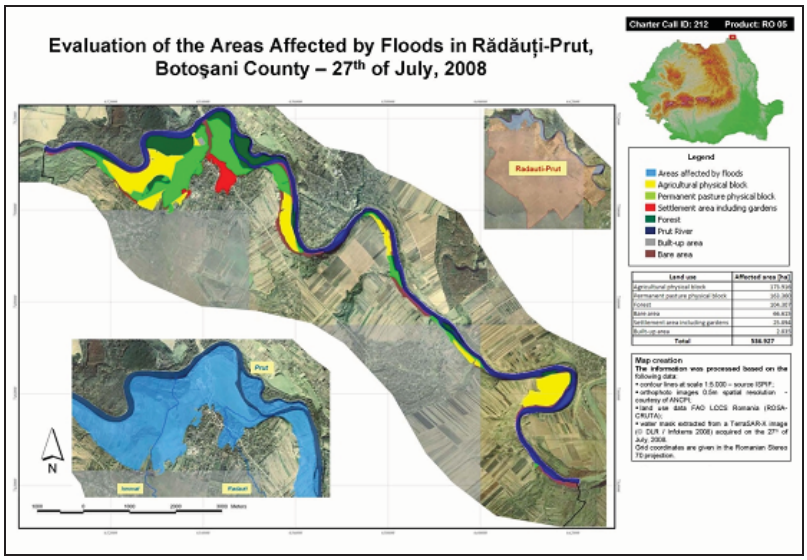
Forest areas within the Arges basin and the overlapping of snow-covered areas, 22 March 2009.



3D in the Arges area; topography and snow-covered areas on 22 March 2009 (the Global Mapper software was used)

A number of products derived from MODIS data validated by intercomparison with high-resolution satellite data (ASTER, TerraSAR-X) and GPS measurements were designed for flood monitoring. Such products include quasi-real time situation maps, maps of flooded areas and their classification, maps of flood evolution and damage-estimating products.

Water mask derived from a TerraSAR-X image (29 July 2008, 11:40 UTC)



Estimation of flood-affected areas within the Rădăuți-Prut area (Botoşani County), on 28 July, 2008

2. Research projects, working groups

- *SIGUR Project:* Satellite Based Emergency Response Services;
- *RISCASAT Project:* Satellite-derived products, risk management, hydro-meteorological factors, satellite image processing, geospatial data;
- *MUTER Project:* Services and applications for land monitoring using geospatial techniques;
- *SIAT Project:* Integrated system of early warning, monitoring and drought risk analysis for Romania;
- *CLEANWATER Project*: Integrated system for protect and analyse the status and trends of water threatened by nitrogen pollution
- *AIR-AWARE LIFE-ENV Project*: AIR Pollution ImpAct Surveillance and WArning System for URban Environment;
- *HYDRATE FP6 Project*: Hydrometeorological data resources and technologies for effective flash flood forecasting;
- *MACC FP7 Project:* Monitoring atmospheric composition & climate
- *CLEANWATER LIFE+ Project:* "Integrated system for protect and analyse the status and trends of water threatened by nitrogen pollution"
- *MIDMURES EC Grant:* „Mitigation Drought in Vulnerable Area of the Mures Basin"

AIR-AWARE LIFE Project has been selected and rewarded as one of the best LIFE Environment Project

3. Organization of national and international conferences

- HYDRATE FP6 STREP 037024, *Hydrometeorological data resources and technologies for effective flash flood forecasting* – 1st Midterm Meeting, Bucharest, 28-30 March, 2007;
- Technologies for the consolidation of the national spatial data infrastructure – International conference, Bucharest, 11-12 December 2007;
- AIR-AWARE LIFE Project, AIR Pollution ImpAct Surveillance and WArning System for URban Environment – International Workshop, Bucharest, 28 October 2008;
- Technologies for the consolidation of the national spatial data infrastructure – International conference, Bucharest, 11-12 December 2008;
- Technologies for the consolidation of the national spatial data infrastructure – International conference, Bucharest, 11-12 December 2009;

4. Participation of Romanian scientists at international symposia, courses and conferences Symposia and conferences

- 10th EMS Annual Meeting and 8th European Conference on Applied Climatology (ECAC), Zurich, Switzerland, 13-17 September 2010;
- Free and Open Source Software for Geospatial, Barcelona, Spain, 6-9 September 2010;
- INSPIRE Conference, Krakow, Poland, 23-25 June 2010;
- 3rd International Disaster and Risk Conference, Davos, Switzerland, 29 May-4 June 2010;
- 4th International Conference on Water Observation and Information System for Decision Support, Ohrid, Macedonia, 25-29 May 2010;
- European Geosciences Union General Assembly 2010, Vienna, Austria, 2-7 May 2010;

- Free and Open Source Software for Geospatial, Sydney, Australia, 20-23 October 2009;
- European Geosciences Union General Assembly 2009, Vienna, Austria, 19-24 April 2009;
- 33rd International Symposium on Remote Sensing of Environment, Stresa, Italy, 4-8 May 2009;
- Cartography and Geoinformatics for Early Warning and Emergency Management: Towards Better Solutions, Prague, Czech Republic, 19-23 January 2009;
- Free and Open Source Software for Geospatial, Cape Town, South Africa, 29 September-4 October 2008;
- The European Conference on Flood Risk Management, Research into Practice, 30 September-2 October 2008;
- European Geosciences Union General Assembly 2008, Vienna, Austria, 13-18 April 2008;
- NATO Workshop on "Natural Disasters and Water Security: Risk Assessment, Emergency Response and Environmental Management", Yerevan, Armenia, 18-22 October, 2007;
- International Conference on "Integrated catchments management for hazard mitigation", 24-26 September 2007, Trier, Germany;
- 2nd International Conference of GIS/RS in Hydrology, Water Resource and Environment, Guangzhou, China, 7-13 September 2007;
- European Geosciences Union General Assembly 2007, Vienna, Austria, 15-20 April 2007;

Courses

- Advanced Training Course on „Land Remote Sensing", 2-7 September 2007, Lisbon, Portugal;
- Understanding, processing and visualizing geospatial data with VTP software, 22-26 September 2008, Bucharest, Romania;
- Delft Object-oriented Radar Interferometric Software, 2-6 December 2008, Bucharest, Romania;
- Advanced Training Course on AnalystPlus, Bucharest, 26-30 January 2009;
- International Summer School on „Environmental Dynamics: Rain, Rivers and Turbulence", 12-19 June 2009, Venice, Italy;
- GEOSS Summer School on „Advancing Earth Observation Data Understanding", 3-5 September 2009, Sinaia, Romania;
- 2nd Advanced Trening Course on Ocean Remote Sensing, 28 September – 2 October 2009, Bergen, Norvegia;
- Radar Remote Sensing Course, 26-30 October 2009, Bucharest, Romania.

5. References

Books:

Stăncălie, G., Nerțan, A., and Toulios, L.,(2010) : *Satellite based methods for the estimation of Leaf Area Index*, publicat in cartea: Satellite Data Availability, Methods and Challenges for the Assessment of Climate Change and Variability Impacts on Agriculture**,** Edited by: Leonidas Toulios and Gheorghe Stăncălie

D. Nicolae, C, Talianu, cap. 1 "Atmospheric lidar and retrieval of aerosol optical characteristics" included in The book "Recent Advances in Atmospheric lidars", INOE Publishing House, Series: Optoelectronic Materials and Devices, ISSN 1584- 5508, December 2010

Papers in Journals with impact factor

Anca Nemuc, Robert L de Zafra, *Ozone profiles over the South Pole from ground-based retrievals and satellite data***,** Adv. Mater. **9**(11), pp 3533-3540, 2007, factor de impact

D. Nicolae, C. Talianu, E. Carstea, C. Radu, *Using classification to derive aerosol number density from lidar measurements*, J.Optoelectron. Adv. Mater. **9**(11), pp 3518-3521

Ioana Ionel, Sabin Ionel, Doina Nicolae, *Correlative comparison of two optoelectronic carbon monoxide measuring instruments*, J.Optoelectron. Adv. Mater. **9**(11), pp 3541-3545, 2007.

Camelia Talianu, Doina Nicolae, Jeni Ciuciu, Anca Nemuc, E. Carstea, L. Belegante, M. Ciobanu, *New Algorithm For The Retrieval Of Aerosol's Optical Parameters By Lidar Data Inversion*, ECMI Series Vol. 11, Springer, pp.55-62, 2007

Camelia Talianu, Anca Nemuc, Doina Nicolae, C.P. Cristescu, *Dust event detection from lidar measurements,* Scientific Bulletin Journal of "Politehnica" University of Bucharest, A Serie, vol 69, pp. 53-66, 2007

Nicolae, D; Talianu, C; Mamouri, RE, et al. Air mass modification processes over the Balkans area detected by aerosol lidar techniques , 2008 OPTOELECTRONICS AND ADVANCED MATERIALS-RAPID COMMUNICATIONS Volume: 2 Issue: 6 Pages: 394-402

Nicolae, D; Talianu, C; Nemuc, A, et al., 2008. Benefits and drawbacks of laser remote sensing in atmospheric research, UNIVERSITY POLITEHNICA OF BUCHAREST SCIENTIFIC BULLETIN-SERIES A-APPLIED MATHEMATICS AND PHYSICS Volume: 70 Issue: 4 Pages: 5-14

Vasilescu, J; Onciu, T; Jugaru, L, et al.Remote estimation of fluorescence marine components distribution,2009 ROMANIAN REPORTS IN PHYSICS Volume: 61 Issue: 4 Pages: 721-729

Nemuc, A; Nicolae, D; Talianu, C, et al. 2009 Dynamic of the lower troposphere from multiwavelength lidar measurements . ROMANIAN REPORTS IN PHYSICS Volume: 61 Issue: 2 Pages: 313-323

Pappalardo, G; Bosenberg, J; Amodeo, A, et al., 2009 EARLINET: the european aerosol research lidar network for the aerosol climatology on continental scale.CURRENT PROBLEMS IN ATMOSPHERIC RADIATION (IRS 2008) Volume: 1100 Pages: 189-192

Ioana Ungureanu, **Sabina Stefan** and Doina Nicolae, *Investigation of the cloud cover and Planetary Boundary Layer (PBL) characteristics using Ceilometer CL-31*, Romanian Reports in Physics, vol 62, nr. 2, 2010, pg. 396-404.

Vasilescu, GJ; Cristescu, CP; Belegante, L , 2010. Multifractal analysis of fluorescence lidar time series of Black Sea waters. JOURNAL OF OPTOELECTRONICS AND ADVANCED MATERIALS Volume: 12 Issue: 6 Pages: 1414-1420

Radu, C; Belegante, L; Talianu, C. 2010. Optimization of the multiwavelength raman lidar during earli 09 campaign. JOURNAL OF OPTOELECTRONICS AND ADVANCED MATERIALS Volume: 12 Issue: 1 Pages: 165-168

Vetres, I; Ionel, I; Popescu, F, et al. 2010., LIDAR system implementation and development for novel Romanian systems OPTOELECTRONICS AND ADVANCED MATERIALS-RAPID COMMUNICATIONS Volume: 4 Issue: 8 Pages: 1074-1077

Crăciunescu,V., Flueraru C. Stăncălie Gh., (2010): *The use of old cartographic datasets along with remote sensing data for better understand and map the 2005-2008 floods in Romania*, Acta Geodaetica et Geophysica Hungarica. vol 45(1), pp 112-119, DOI 10.1556/AGeod.45.2010.1.16, Index SCIE (Science Citation Index Expanded)

Crăciunescu, V., Gh. Stancalie, A. Diamandi, Rodica P. Mic (2007), Flood Monitoring Using On-Line Support System for Spatial Information Management, *Flood Risk Management: Hazards, Vulnerability*, Springer Netherlands, p. 127-137

Irimescu, A., Stăncălie, Gh., Crăciunescu V., Flueraru, C., Anderson, E. (2009), The use of Remote Sensing and GIS techniques in flood risk monitoring and damage assessment: A study case in Romania, Threats to global water security, editori: Jones, A., Vardanian, T., Hakopian, C., NATO Science for Peace and Security Series C: Environmental Security, Ed. Springer, ISBN 978-90-481-2343-8, pp. 167-177

Gaume, E., Bain, V., Bernardara, P., Newinger, O., Barbuc, M., Bateman, A., Blaskovicova, L., Bloschl, G., Borga, M., Dumitrescu, A., Daliakopoulos, I., Garcia, J., Irimescu, A., Kohnova, S., Koutroulis, A., Marchi, L., Mătreață, S., Medina, V., Preciso, E. , Sempere-Torres, D., Stăncălie, Gh., Szolgay, J., Tsanis, I., Velasco, D., Viglione, A. (2009), A compilation of data on European flash floods, Journal of Hydrology, Ed. Elsevier, vol . 367, 1-2, ISSN 0022-1694,DOI:10.1016/j.jhydrol.2008.12.028, pp. 70-78

Rus, I., C., Balint, V., Crăciunescu, S., Constantinescu, I., Ovejanu, and Zs. Bartos-Elekes (2010), Automated georeference of the 1: 20,000 Romanian maps under Lambert-Cholesky (1916-1959) projection system, *Acta Geodaetica et Geophysica Hungarica*, p. 105-111

Proceedings of National and International Conferences

D*etection of atmospheric boundary layer height from lidar measurements*. Sabina Stefan, Camelia Talianu, Doina Nicolae, Luminita Filip. Proceedings Conf. Nationala organizata de Programul AMCSIT-CEEX Brasov iulie 27-29, 2008, 8 pg. ISBN:

Methods of deriving atmospheric layering from lidar data, A. Nemuc, C. Talianu, E. Carstea, C. Radu, D. Nicolae, S. Stefan, Proceedings of 24th ILRC pp.324-327 , Boulder, USA, 2008

Bain, V., Newinger, O., Gaume, E.,Bernardara, P., Barbuc, M., Bateman, A.,Garcia, J., Medina, V., Sempere-Torres,D., Velasco, D., Blaškovicová, L., Blöschl,G., Viglione, A., Borga, M., Dumitrescu, A.,Irimescu, A., Stăncălie, Gh., Kohnova, S.,Szolgay, J., Koutroulis, A., Tsanis, I.,Marchi, L., Preciso, E. (2009), Europeanflash flood data collation and analisys, Flood Risk Management: Research and Practice, editori: Samuels P., Huntington, S., Al lsop, W. , Har rop, J. , Ed. Taylor&Francis Group, ISBN 978-0-415-48507-4, Londra, Anglia, pp. 1577-1585

Bartos-Elekes, Zs., I. Rus, S. Constantinescu, V. Crăciunescu, I. Ovejanu (2007), Topographic Maps of Romania Under Lambert-Cholesky Projection System (1916-1959), *Complexul Muzeal Bistrita Nasaud - Studii si Cercetari/Geology – Geography* Nr. 12, p. 161-167

Catană, S., Zaharia, L., Crăciunescu, V., (2010): Determination, analysis and updating of land use methods based on spatial information for the Teleajen River Basin, *National Meteorological Administration Annual Scientific Coneference*, Bucharest, 10-11 November, ISBN: 978-973-0-09341-4

Crăciunescu, V., Stăncălie, Gh., Toma, E., (2010): Infrastructuri de date spațiale pentru aplicații meteorologice, *National Meteorological Administration Annual Scientific Coneference*, Bucharest, 10-11 noiembrie, ISBN: 978-973-0-09341-4

Crăciunescu, V., Caian, M., Flueraru, C., Nerțan, A. (2009), On-line Air Quality Monitoring and Warning Support System for Bucharest Urban Area, Geographia Technica Nr. 1/2009, pp. 21-30

Crăciunescu V., Flueraru, C., Anderson, E., Nedelcu, I., Stăncălie, Gh., Irimescu, A. (2009), Mapping and monitoring the 2005-2008 floods in Romania, using remote sensing techniques, Studii şi Cercetări, Geology Geography, Bistrița, 14, Ed. Supergraph, ISSN 1582-5168, pp. 107-122

Crăciunescu, V., Flueraru, C., Stăncălie, Gh., Irimescu, A. (2009), Developing a rapid mapping and monitoring service for flood management using remote sensing techniques, Flood Risk Management: Research and Practice, editori: Samuels P., Huntington, S., Allsop, W., Harrop, J., Ed. Taylor & Francis Group, ISBN 978-0-415-48507-4, Londra, Anglia, pp. 237-243

Crăciunescu, V., Flueraru C., Anderson, E., Nedelcu, I., Stăncălie Gh., Irimescu, A. (2009), *Mapping and monitoring the 2005-2008 floods in Romania, using remote sensing techniques*, Complexul Muzeal Bistrița Năsăud "Studii şi Cercetări": Geology – Geography, Nr. 14, p. 107-122. Index ZR (Zoological Record)

Crăciunescu V., (2008), Free and Open Source Geospatial Software. A complete alternative to proprietary applications. *Proceedings of the International Workshop "Infrastructures and Engineering for Knowledge Society"*, Romanian Academy Library, p 136 – 141

Crăciunescu, V., S. Constantinescu (2008), Developing an Open Romanian Geoportal Using Free and Open Source Software, *Geographia Technica* Nr. 1/2008, p. 15-20

Flueraru, C., Gh. Stancalie, V. Crăciunescu, Elena Savin, (2007), A Validation of MODIS Snowcover Products in Romania: Challenges and Future Directions, *Transactions in GIS*, Vol. 11 Issue 6, Blackwell Publishing, p 927–941.

Irimescu, A., Crăciunescu, V., Stăncălie, Gh., Mihăilescu, D., Nerțan, A., Dana, I., Nedelcu I., Moise, C., Olteanu, V., (2010): June-July 2010 flood monitoring using Remote Sensing and GIS techniques, *National Meteorological Administration Annual Scientific Coneference*, Bucharest, 10-11 noiembrie, ISBN: 978-973-0-09341-4

Mihailescu, D. I.; Savin, E. L. & Poenaru, V. D. (2010). Contributions of the Remote Sensing Techniques for the Estimation of Thermal Field (2010). 0841-0843, *Annals of DAAAM for 2010 & Proceedings of the 21st International DAAAM Symposium*, ISBN 978-3-901509-73-5, ISSN 1726- 9679, pp 0421, Editor B. Katalinic, Published by DAAAM International, Vienna, Austria 2010

Nertan, A.; Stancalie, G; Mihailescu, D. I. (2010). A data assimilation method for improving the MODIS LAI time-series data products based on interpolation analysis. *International Disaster and Risk Conference,* Davos, Switzerland, May 30 - June 3

Poenaru, V. D.; Savin, E. L.; Mihailescu, D. I.; Cimpeanu, S. M.; Burghila, D. & Badea, A. (2010). Optical and Radar Image Processing for Vegetation Effects Monitoring (2010). 0573-0575, *Annals of DAAAM for 2010 & Proceedings of the 21st International DAAAM Symposium*, ISBN 978-3-901509-73-5, ISSN 1726-9679, pp 0287, Editor B. Katalinic, Published by DAAAM International, Vienna, Austria 2010

Poenaru, V. D.; Savin, E.; Mihailescu, D.; Badea, A. & Burghila, D., (2009). Integrated System for Monitoring and Drought Risk Analysis in Romania (2009). 1693-1695, *Annals of DAAAM for 2009 & Proceedings of the 20th International DAAAM Symposium*, ISBN 978-3-901509-70-4, ISSN 1726-9679, pp 847, Published by DAAAM International, Vienna, Austria 2009

Savin, E.; Poenaru, V.; Mihailescu, D. (2010). Integrated System of Early Warning, Monitoring and Drought Risk Analysis for Romania (2010). I*SPRS JOINT WORKSHOP on: "Core Spatial Databases - Updating, Maintenance and Services - from Theory to Practice*" 15-17 March, 2010 Haifa, Israel

Stăncălie, G., Nerțan, A., Danson, M. and Toulios, L., (2010) : *Combined Use of Remote Sensing Data and Crop Models for Enhanced Agrosystems Characterization*, publicat în cartea: Satellite Data Availability, Methods and Challenges for the Assessment of Climate Change and Variability Impacts on Agriculture**,** Edited by: Leonidas Toulios and Gheorghe Stăncălie

Stăncălie, G., Antonescu, B., Cheval, S., Irimescu, A., Dumitrescu, A., (2010), Synoptic and regional meteorological ingredients which induced severe flash floods in Romania, *International Disaster and Risk Conference*, Davos, Switzerland, 30 May – 3 June

Stăncălie, Gh., Crăciunescu, V., Irimescu, A.(2009), Spatial data integration foremergency services of flood management, Threats to global water security, editori: Jones, A., Vardanian, T., Hakopian, C., NATO Science for Peace and Security Series C: Environmental Security, Ed. Springer, ISBN 978-90-481-2343-8, pp. 155-165

Stăncălie, Gh., Antonescu, B., Oprea, C., Irimescu, A., Catană, S., Dumitrescu, A., Barbuc, M., Mătreață, S. (2009), Representative flash flood events in Romania, Case studies, Flood Risk Management: Research and Practice, editors: Samuels P., Huntington, S., Allsop, W., Harrop, J., Ed. Taylor & Francis Group, ISBN 978-0-415-48507-4, Londra, Anglia, pp. 1587-1596

Ştefănescu, V.E., Ştefan, S., Irimescu, A., (2010): *„Study and proposal related to extensive flooding in the Siret River area during the summer of 2008 in Romania"*, EGU, General Assembly, Viena, Austria, 2-7 May

Zoccatelli D., M. Borga, F. Zanon, B. Antonescu and G. Stancalie, 2010: Which rainfall spatial information for flash flood response modelling? A numerical investigation based on data from the Carpathian range, Romania. J. of Hydrology, 394 (1–2), 148–161

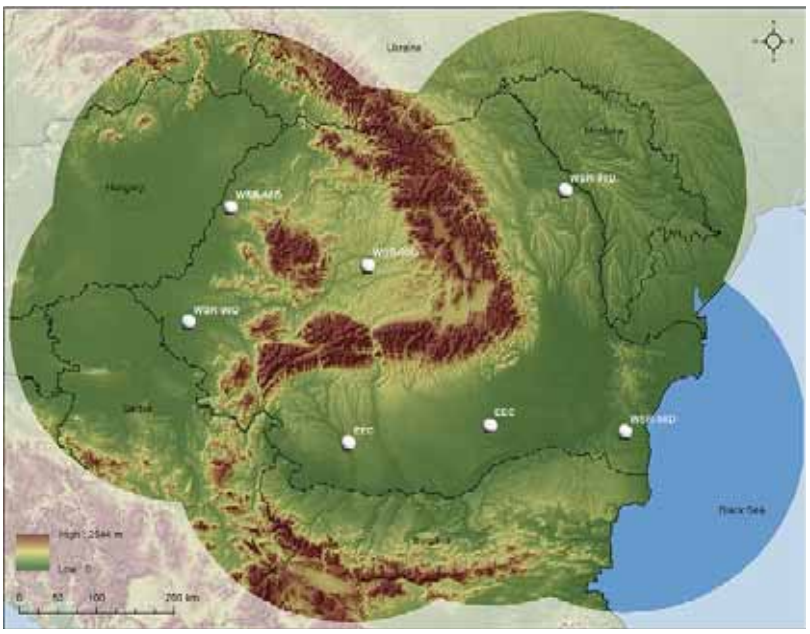
VERY SHORT RANGE FORECASTING – LABORATORY OF NOWCASTING TECHNIQUES

The main very short-range forecasting researches are developed at the Romanian National Meteorological Administration.

1. The main research area

a) Forecasting and monitoring of severe storms

The activity of Laboratory of Nowcasting Techniques, which is the main laboratory for very short range forecasting, also includes operational activities. The very short range forecasting is dedicated only to severe phenomena that occur in Romania. Using the Romanian Radar Network (3 C-band and 5 S-band D Doppler radars), Romanian Lightning Detection Network (8 SAFIR3000 sensors) and satellite imagery (MSG data), the nowcasting forecasters monitor the convective activity. A special attention is paid to the radar structures that can produce severe phenomena and which are associated with regional conceptual models.



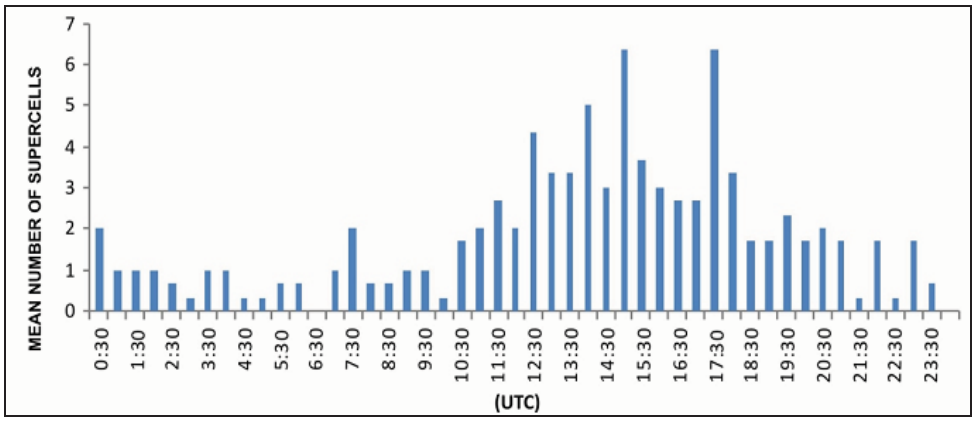
Area covered by the Romanian Doppler Weather Radar Network.

b) Climatology of supercells in Romania

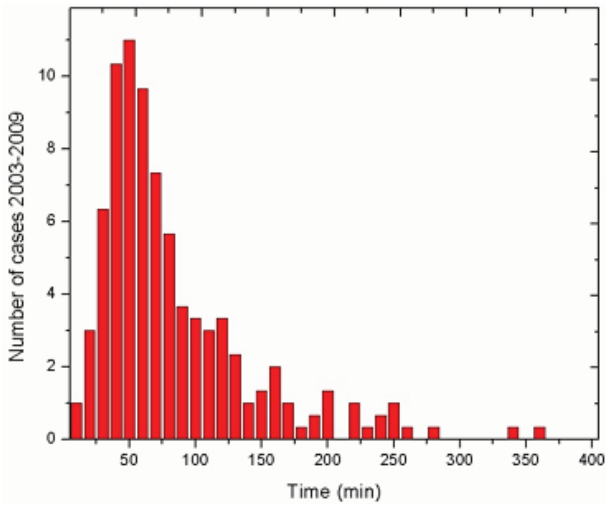
The mesoscale conditions causing supercellular storms in the south-east of Romania were analyzed. The first study of space and time characteristics of supercells, based on radar data, was made. The study was performed for the convective season (May-

September) 2003-2009, by using data provided by the WSR-98D radar placed in Medgidia. About 550 supercells were identified. A convective storm was considered a supercell when reflectivity exceeded 40 dBZ, and the mesocyclone was identified within the radial wind field. Then, coordinates of the supercell centroid were recorded every 6 minutes. The last radar scanning which proved the presence of the mesocyclone was considered the last point on the supercell trajectory.

The results proved that supercells have the highest frequency of occurrence in the interval 12:00-15:00 UTC, with a second maximum between 17:00 and 18:00 UTC. The mean life time duration of the analyzed supercells situated between 40 and 60 minutes.



Hourly mean number of supercells recorded in the south-eastern region of Romania between 2003 and 2009

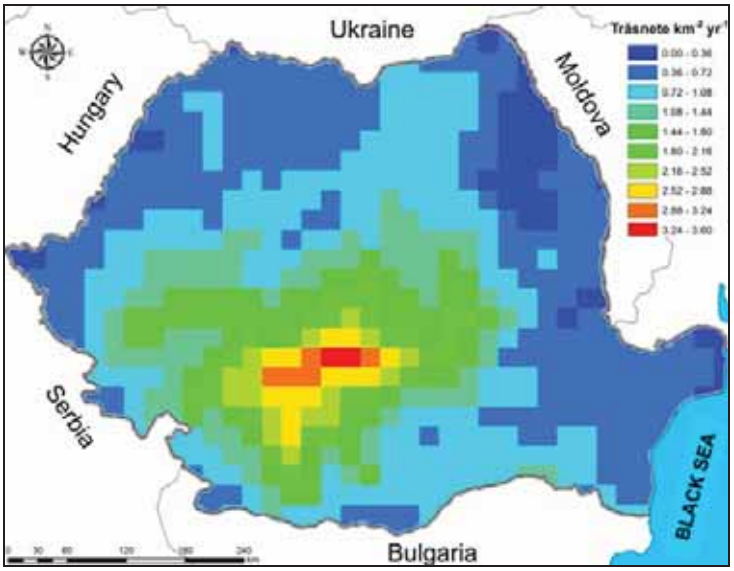


Mean lifetime duration of the supercells recorded in the south-eastern region of Romania between 2003 and 2009.

c) Lightning climatology

The study of the characteristics of cloud-to-ground (CG) lightning in Romania, based on the data recorded by the Romanian National Lightning Detection Network (RNLDN), was carried out. The data, more than 1.75 million CG flashes, covers the entirety of Romania and

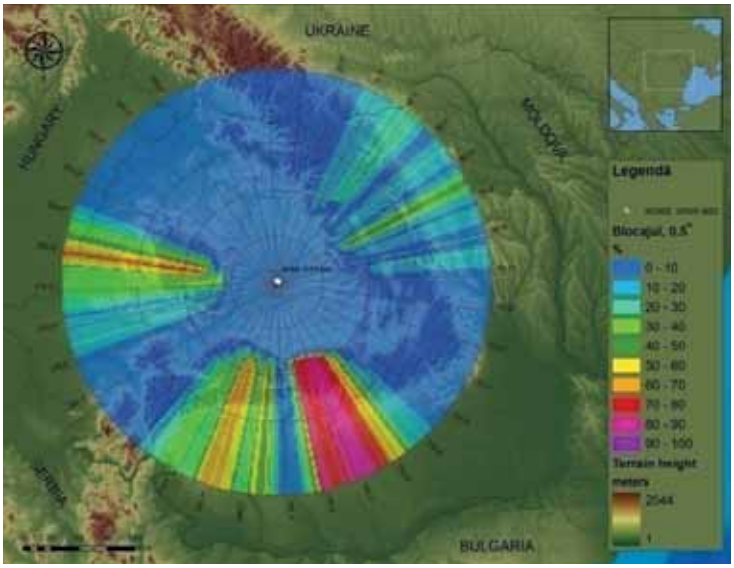
were recorded between January 2003 and December 2005 and January and December 2007. The spatial analyses (total and positive flash density, the percentage of positive flashes, and negative and positive peak currents) revealed the following results. The average spatial distribution shows a maximum (3.06 flashes km^{-2} yr^{-1}) over the south slopes of the central meridional Carpathians possibly associated with the Romanian Plain convergence zone. The mean monthly variation shows maximum CG lightning between May and September (98%) and minimum values in December and January. High values (>0.028 km^{-2} yr^{-1}) for positive CG lightning density are observed in southwestern and central Romania.



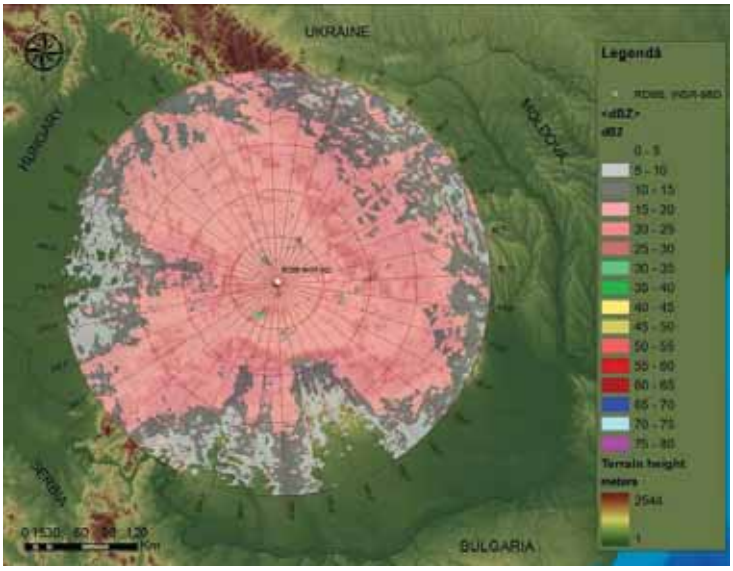
Total mean density of lightning (positive and negative) over the interval 2003 - 2007

d) Radar data quality for rainfall estimation

A study of assessment of data quality for rainfall estimation of the Romanian Weather Surveillance Radar – 98 Doppler (WSR–98D) systems was done. In addition, drop size distribution data provided by an optical laser disdrometer is used for the derivation of a new *Z-R* relation. Some of the radars operate in areas with complex topography and suffer from beam blockage caused by the presence of high terrain obstacles. The study presents the results for the Bobohalma (RDBB) radar site. A methodology for computing the radar beam blockage and its implications for radar rainfall estimation are presented. A GIS-based approach and digital elevation model (DEM) data are used for computing the beam blockage maps for the first four elevation angles. Using a three months actual volume radar data (Level II), theoretical power loss maps are compared with probability of detection of echoes and average reflectivity field maps. Also, our results are compared with the blockage and hybrid sectors maps currently used by WSR–98D NEXRAD system. The theoretical outputs are in very good agreement with the real measurements.



Beam blockage map for the Bobohalma WSR-98D radar system, for the 0.5˚ elevation angle



June-August 2009 average reflectivity map for the Bobohalma WSR-98D radar, for the 0.5˚ elevation angle

2. Participation of the Romanian specialists in working groups involved in international projects and programs

- HYDRATE FP6 Project Workshops and Meetings
- European Geosciences Union General Assembly 2008, Vienna, Austria, 13-18 April 2008;
- EUFAR Project

3. Organization of national and international scientific conferences and training courses

- Pre-ERAD2010 Nowcasting Course on Enhanced use of satellite and radar in Nowcasting, 30 August – 3 September 2010, Sibiu, Romania;
- Short Course on Dual-Polarization and Doppler Weather Radar : Fundamentals and Applications,
  4-5 September 2010, Sibiu, Romania;
- Pre-ERAD2010 RADMON (Radar Monitoring) Workshop, 5 September 2010, Sibiu, Romania
- Short Course on QPE, QPF and Hydrological Applications for students and experts, 3-5 September 2010, Sibiu, Romania;
- European Conference on Radar in Meteorology and Hydrology, ERAD 2010, 6-10 September 2010, Sibiu, Romania;
- International Training Course on Train the Thunderstorm Trainer, Constanta, Romania, 1-5 September 2008;
- International Training Course for South-East European NMHS's on Nowcasting Techniques, Bucharest, Romania, 26-30 November 2007;

4. Participation of Romanian scientists at international symposia, courses and conferences

- Training Course on Severe Convective Storm Nowcasting, China Meteorological Admibistration Training Centre (Beijing, PR China), 1-12 April 2007;
- Training Course on Weather Radars, WMO Regional Training Centre, Alanya, Turkey, 18-22 June 2007;
- Training Course on "Preventing and Mitigating Meteorological Natural Disasters by Means of Remote Sensing", WMO Regional Training Centre, Alanya, Turkey, 2-6 June 2008;
- "Train the Thunderstorm Trainer" International Course, Constanta, Romania, 1-5 September 2008;
- EGU General Assembly, Vienna, Austria, 14-18 April 2008;
- 5th European Conference on Radar in Meteorology and Hydrology, Helsinki, Finland, 30 June – 4 July 2008;
- Weather Radar Applications in Nowcasting for Weather Forecasters, Langen, February 2009;
- AMS 34th Conference on Radar Meteorology, Williamsburg, VA, 5-9 October 2009;
- European Conference on Severe Storms, Landshut, Germany, 12-16 October 2009;
- 6th European Conference on Radar in Meteorology and Hydrology, Sibiu, Romania, 6-10 September 2010;

5. Selected scientific papers

Antonescu, Bogdan, Sorin Burcea, 2010: A Cloud-to-Ground Lightning Climatology for Romania. *Mon. Wea. Rev.*, 138, 579–591

Antonescu B., Cărbunaru D. V., Sasu, M., Burcea, S., Bell, A.: *Climatology of supercells in Romania,* Proc. 6th European Conf. on Radar in Meteorology and Hydrology: Adv. in Radar Technology, Sibiu, România, ISBN 978-973-0-09057-4.

Bell, A.: *Mesoscale environment for tornadic supercells in SE Romania,* Proc. 6th European Conf. on Radar in Meteorology and Hydrology*:* Adv. in Radar Technology, Sibiu, Romania, ISBN 978-973-0-09057-4.

Bell, A.: *Sea breeze convergence zones and convective initiation in SE Romania,* Proc. 6th European Conf. on Radar in Meteorology and Hydrology: Adv. in Radar Technology, Sibiu, România, ISBN 978-973-0-09057-4.

Burcea, S., Antonescu, B., Bell, A., (2010): *Data quality of the Romanian WSR-98D weather radar systems*, Proc. 6th European Conf. on Radar in Meteorology and Hydrology: Adv. in Radar Technology, Sibiu, România, ISBN 978-973-0-09057-4.

Cărbunaru, D.V., Burcea, S., Sasu, M., Antonescu, B., Bell A.: T*hree Body Scatter Signature climatology in Romania*, Proc. 6th European Conf. on Radar in Meteorology and Hydrology: Adv. in Radar Technology, Sibiu, România, ISBN 978-973-0-09057-4.

Cheval, S., Burcea, S., Dumitrescu, A., Antonescu, B., Bell A., Breza, T.: *Comparison between radar estimations and rain gauge precipitations in the Moldavian Plateau* (Romania), Proc. 6th European Conf. on Radar in Meteorology and Hydrology: Adv. in Radar Technology, Sibiu, Romania, ISBN 978-973-0-09057-4.

Oprea, I.C., Bell, A., 2009, Meteorological environment of a tornado outbreak in Southern Romania, Nat. Hazards Earth Syst. Sci., 9, pp. 609-622;

AERONAUTICAL MET SERVICES

Taking into account that Romania was going to become a member of the EU, Romanian aeronautical MET services, completely separated from the national MET services, were constantly developed during this period, so as to meet the EU requirements and to prepare the meteorological services provider to be certified in accordance with the "Single European Sky" Regulations.

Consequently, almost all aeronautical MET stations in the 17 airports in Romania benefit by new AWOS systems, which increase the quality of observations and support new standards and recommended practices of ICAO Annex 3. At the same time, the new systems allow automated collection of data, being very useful to climatological programs at local and national level and to the case studies used in the training courses of the MET services personnel.

Meanwhile, the forecasting activity becomes centralized in one unique forecasting center, located in Bucharest. The center both has WMO tasks and prepares warnings and aerodrome nowcasting and forecasting activities for all 17 airports in Romania. The center has been modernized with flexible forecasting terminals and MESSIR facilities from COROBOR Systems – France.

The International Association for the Physical Sciences of the Oceans

REPORT
OF THE ROMANIAN NATIONAL IAPSO SECTION

Romanian marine sciences researches, relative to IAPSO topics, have been carried out in 2007 - 2010 period by several research institutes located both in Bucharest and Constanta. Most of these studies are focused on the western Black Sea Basin, its coastal zone and on its relationship with the River Danube. The main researches have been carried out in the framework of the National Research and Development Programs MENER, CERES, CEEX, PN II.

International or bilateral programs and projects represented also a very important support and framework of marine sciences development in Romania. These programmes are mainly in collaboration with the European Commission. Bilateral co-operation projects between Romanian and French, German, Italian, US, Russian, Ukrainian, Bulgarian, Greek and Turkish teams of scientists constituted also a good opportunity to develop the marine sciences in the Black Sea area.

The technical facilities and logistics available for the marine research has grown continuously as a consequence of the participation of Romanian scientists at national and international research projects.

As an example is the plan to create the **"International Centre for Advanced Studies "Danube – Danube Delta – Black Sea""**

The Action Plan of the European Strategy of the Danube River Region states that one of the priority objectives of the programme is the creation of an International Research Centre that should deal with the environmental problems of the Danube River Region. In order to answer this objective and place it in a larger framework the Romanian scientific community together with Romanian Government is promoting the creation "International Centre for Advanced Studies Danube – Danube Delta – Black Sea" aiming at:

Performance of fundamental and applied integrated and multi-disciplinary research on sustainable and adaptative management of wetlands and River – Sea Systems in the World

Support of several policies related to these fields. Activities will be carried out at regional level but their impact will be at European level.

The International Centre for Advanced Studies « Danube – Danube Delta – Black Sea » will represent one of the most important research structures in the EU for environmental and geonomic sciences oriented to modern, sustainable and adaptative management of River – Sea Systems. It will offer excellent research conditions for Romanian and European scientists for studying on the example of the Danube Delta the processes that influence the environmental state of wetlands, deltas and coastal zones.

The Centre will be a European focal point for continuous and top level education and training of young researchers from Romania, European Union and other countries in the mentioned domains of science.

The Centre will act for improving the level of local communities awareness and their involvement in the sustainable management of wetlands with direct application to the Danube Delta Biosphere Reserve.

The Centre will offer excellent conditions for international scientific cooperation that could improve the knowledge of processes governing the evolution and the environmental state of rivers, deltas and coastal zones.

Centre's activities will be performed within an integrated research programme complementary to the EU research Framework programme and national R&D programmes. The Centre's scientific programme will focus on the following subjects, the list being not restrictive:

- Assessment of Danube River - Black Sea system reference state of environment;
- Studies on climate changes and their consequences for the Danube River – Black Sea System;
- Studies on the ecosystem response to climate changes;
- Assessment of the effects of increasing human activities on the Danube River - Black Sea system;
- Assessment of changes in Societal Demand on the Danube River – Black Sea System;
- Provisions of improved knowledge and scientific tools for sustainable and adaptative management;
- Scientific Support for policy development in various fields;
- Contributions to Sustainable Development under Climate change; responses to socio-economic needs.

Advantages of proposed location

The Centre will be located at Murighiol in the neigbourhoud of the Danube Delta. The proposed location, selected from 10 other places, presents the following advantages:

Land availability: Murighiol Local Council approved 10 hectares area for the Centre;

Access facilities: by road and/or by the Danube River, immediate access to the Danube Delta, access to the Coastal Zone and the Coastal Sea, access to the Danube River before the delta apex (Ceatal Izmail – the first bifurcation of the Danube River at the delta entrance);

Early stage feasibility study.

Participants

The participants that will contribute and take part to the management and to the scientific programme of the Centre are the following (their interest is already declared):

Governmental level:

– Ministry of Education and Research, Youth and Sport – National Authority for Scientific Research

– Ministry of Regional Development and Tourism

– Ministry of Environment and Water Management

and other governmental institutions (ministries) from EU member states (in particular from Danube region) in charge with research, regional development, environment, etc.

Research and executive organisations:

– The Danube Delta Biosphere Reserve Authority

– National Institute of R&D for Marine Geology and Geo-ecology

– National Institute of Environment
– National Institute of Biology
– Universities
– EU based Research Organisations
– France – IFREMER
– Germany – Hamburg University
– Austria
– Switzerland – EAWAG
– Italy – ISMAR - Marine Geology Institute Bologna
– Bulgaria – Institute of Oceanography, etc.

Centre's activities will be performed within an integrated research program complementary to the EU research Framework programs and national R&D programs.

Taking into account the above mentioned arguments the International Centre for Advanced Studies Danube – Danube Delta – Black Sea will be an R&D infrastructure at European level extremely favorable for high level scientific activity, an ideal framework for environmental interdisciplinary research and development of international cooperation in wet lands, deltas and coastal zones. Knowledge acquired within this Centre will be applicable for other river-sea systems in the whole world.

RESEARCH INSTITUTIONS FOR ROMANIAN NATIONAL IAPSO SECTION

The National Institute of Hydrology and Water Management (INHGA)

The activity of the institute is characterized by a dynamics of the preoccupations permanently connected to the requests that have developed over the years, so that now we have a comprehensive experience that is the basis for approaching new issues occurred in the field of the sustainable water resources management and the correlation with the European legislation for Romania's integration into the European Union.

The National Institute of Hydrology and Water Management has also as attributions, services and research-development activities on large expertise areas that cover in practice all water management and hydrological fields (in natural and infrastructure development regime of waters).

The address of the INGHA is:
Sos. Bucuresti-Ploiesti 97 sector 1, Bucharest
Tel.: +40-21-318 1115; +40-21-318 1114; +40-21-317 9992
Fax: +40-21-318 1116

In the frame of the institute there are elaborated:
- hydrological, hydrogeological and water management studies and researches;
- diagnosis;
- warnings in case of dangerous hydrological phenomena;
- hydrological forecast of national and transboundary interest;

- synthesis, yearbooks and monographs;
- environmental studies and balances;
- eco-hydrological studies and researches.

Objectives:

Research activities and public operational services of national and international interest, for:

- *population and goods protection*
- *improvement of life quality*
- *environment protection*

Services & Products:

- Hydrological forecasts in order to underline the regime of reservoirs exploitation
- Hydrological yearbook of the surface waters
- Cadastre of the surface and underground waters
- Hydrological synthesis and regionalizations
- Hydrological studies regarding the hydrological parameters necessary for design and exploiting the engineering hydrotechnical structures related to water
- Hydrogeological studies for assessing the underground water resources and their rational utilization
- Infrastructures development plans of the hydrological basins
- Regional strategies of development in the water field
- Studies of flooding occurrence
- Impact and environmental balances studies
- Specifications for obtaining the water management licences
- Studies and projects for reconstructing/restoring the water courses

Advanced researches regarding the following issues:

- influence of the climatic changes upon the hydrological cycle
- occurrence and propagations of flash floods on water courses
- water resources management during droughts periods
- eco-technique of water courses
- displacement of pollution waves
- determination of flood vulnerability and afferent risks

National Projects

Starting with 2005, through the implementation of the DESWAT – Destructive Water Abatement and Control of Water Disasters, the field of hydrology and water management enters a new stage of development and modernization of the following systems:

- The monitoring of rivers, by installing automatic stations equipped with sensors measuring water, precipitation level, water and air temperature and also measuring the main parameters of water quality
- Short-term and medium-term hydrological forecasts, by acquiring performant forecast models, NWSRFS (USA), etc. and the integration of the Romanian forecast models VIDRA, CONSUL and UNDA in the decisional system of waters.

This project, extremely important for the management of floods and real time warning, is financed by the Romanian Government and it is implemented by the American company LOCKHEED MARTIN OVERSEAS CORPORATION has as primary objectives:

– the use of SIMIN project facilities (Integrated National Meteorological System);

– the evaluation of potential damages – costs, in the case of floods and their decrease;
– the elaboration of medium-term and long-term hydrological forecasts taking into consideration various scenarios of the meteorological situation evolution.

The DESWAT project will integrate the communication and radar system within the SIMIN project (Integrated National Meteorological System).

The Romanian Marine Research Institute (IRCM)

Romanian Marine Research Institute (RMRI) has been established in 1970 by unification of the existing marine research institutes from Romania, at that time. In 1999, it was reorganized as National Institute for Marine Research and Development „Grigore Antipa" (NIMRD), according to the Governmental Decision 686/ 23.08.1999.

The institute is the heritage of 80 years of institutional oceanology in Romania, starting with 1926 and 1932, moments of establishing of the first marine research institutes, created by prof. Ioan BORCEA and by prof. Grigore ANTIPA.

Nowadays, the institute is a representative national organization with a pluridisciplinary and interdisciplinary structure and functioning under the coordination of the Ministry of Environment and Water Management. NIMRD carries out basic, applied and technological research, crucial for the knowledge, protection and management of the coastal zone and marine environment, oceanography, marine and coastal engineering, also management of the marine living resources in the Black Sea and Planetary Ocean.

It is the support for solving the national and international problems regarding Romanian marine sector and the Black Sea Exclusive Economical Area, according to the Romania's tasks assumed within the international conventions regarding its activity. Also, NIMRD insure the national, regional and European marine strategies/ plans implementation.

According to the establishing legal document, NIMRD is the technical operator of the physic, chemical and biological national network for marine waters and for coastal erosion surveillance.

The RMRI address is: 300 Mamaia Boulevard, RO-900581, Constanta, Romania
Tel: +40-41-543 288
Fax: +40-41-831 274
E-mail: office@alpha.rmri.ro

RMRI is structured as follows:

- Laboratory of Oceanography
- Laboratory of Marine Ecology
- Laboratory for Ecological Reconstruction
- Laboratory of Fishery Resources
- Laboratory of Marine Technology
- Laboratory of Marine Biochemistry
- Nuclear Unit
- Computer Office

National Programs

- Scientifical and technological partnership for sustainable management of the Romanian marine fisheries – PSTPMR

- IMAGIS
- MACROEVAL
- CALCAN
- TENUME
- IMAGIS

Main International Programs

- Small Contract for Services: Local Consultants in Support of the GEF Black Sea Ecosystem Recovery Project Implementation Unit for: Pilot Monitoring of the Black Sea ,Phase 2 - Romania United Nations for Project Services (UNOPS)
- Southern European Seas : Assessing and Modelling Ecosystem Changes/SESAME Commission of the European Comunities
- CE / PC6: Black Sea Scientific Network (BLACK SEA SCENE)
- RO 2004/016-772.05.02.02 Coastal Zone and Maritime Spatial Planning "PLANCOAST"
- The development of an indicative ecologically cohent network of sub- tidal Marine Protected Areas(MPAs) in Bulgaria and Romania
- CE / PC5: A regional capacity building and networking programme to upgrade monitoring and forecasting activity in the Black Sea basin (ARENA)
- CE / PC 6: Supporting Programme for Capacity Building in the Black Sea Region towards Operational Status of Oceanographic Services (ASCABOS)
- CE / PC6: European lifestyles and marine ecosystems (ELME)
- CE / PC6: International action for sustainability of the Mediterranean and Black Sea environment (IASON)
- CE / PC6: Pan-European infrastructure for Ocean & Marine Data Management (SEADATANET)
- BBI / MATRA: The development of an indicative ecologically coherent network of sub-tidal marine protected area in Bulgaria and Romania
- ACCOBAMS: Assessment of the extent of current cetacean by-catch and stranding in the Romanian Black Sea area
- ESTROM: Evaluarea impactului antropic din lacul Tasaul si reabilitarea ecosistemului
- ECOOP: European Coastal-shelf sea Operational Observing and forecasting system
  Commission of the European Communities
- Improvement of the Scientific Background for Assuring Sustainable Development in the Black Sea Coastal Zone – pre-feasibility study
- Scientific and technologic collaboration for the study of sea – level changes and vertical crustal movements at the western Black Sea.

The National Institute for Marine Geology and Geoecology – GeoEcoMar

NIRD GeoEcoMar is a research and development institute of national interest, performing research in geology, geophysics and geoecology, with focus on aquatic, marine, deltaic and fluvial environments.

NIRD GeoEcoMar represents an excellence pole in the marine research, working as a European and national center for studies of sea-delta-fluvial macrosystems. A modern research infrastructure, based mainly on marine and fluvial research vessels, enables Geoecomar to undertake complex, multidisciplinary studies in national and international programs.

The National National Institute for Research and Development of Marine Geology and Geoecology – **GeoEcoMar** was founded in 1993 as the Romanian Centre of Marine Geology and Geoecology, under the co-ordination of the Ministry of Scientific Research. Due to its technical capabilities and scientific performance achieved in a short period of time, the centre has become in 1996 an "institute of national interest", its main research goal being the complex study of the Danube River-Danube Delta-Black Sea macro-geosystem. Results obtained within the research projects, accomplished with Romanian and international partners, **NIRD GeoEcoMar** helped with the obtaining of the statute of "**European Center of Excellence (Euro-EcoGeoCentre Romania)**" in the 5th Framework Programme.

Since 1996, NIRD GeoEcoMar has been authorized by the Ministry of Environment and Forests to elaborate environmental impact and assessment studies. Starting with 2006, the institute has implemented a Quality Management System applied to geology, geoecology and geophysics. This quality system has been authorized by Lloyd's Register Quality Assurance (Romania), according to **ISO 9001:2008** and **SR EN ISO 9001:2008**.

NIRD GeoEcoMar has known a continuous scientific and financial growth, being recognized at national and international levels.

The GeoEcoMar's addresses are:

Headquarters: 23-25 Dimitrie Onciul Street,
RO-024053
Phone: +40-21-252.55.12
+40-21-252.55.12
Phone./Fax: +40-21-252.25.94
E-mail: headquarter@geoecomar.ro

Constanta Branch: 304 Mamaia Blv.,
RO-900581
Phone: +40-241-51.01.15
+40-241-51.01.15
Phone./Fax: +40-241-69.03.66
E-mail: branch.constanta@geoecomar.ro

The structure of GeoEcoMar corresponds to its main scientific aims. GeEcoMar has many scientific departments (laboratories), a technical and navigational department and an operational-financial-administrative one. The departments of the institute are:

- Marine Geology and Sedimentology
- Seismo-Acoustic, Digital Cartography, GIS, Data Base
- Geophysical Methods of Deep Investigation
- Geochemical, Geoecological and Sedimentological Analysis
- Maintenance and Management of Scientific Equipment
- Coastal Zone Research and Management
- Project Management and Marketing
- Quality and Safety Management
- Environmental Quality Investigation

GeoEcoMar in the present has a multidisciplinary marine research vessel and is a converted Atlantic II-type trawler ("***MARE NIGRUM***" - 3,000 t displacement, 82 m length) and it is operational since 2003.

The institute has also a research vessel (R/V **"*ISTROS*"**, 32-m length)

and a floating laboratory **("*HALMYRIS*"**, for 22 researchers) for research campaigns within the Danube River and its Delta.

For more information regarding the GeoEcoMar's structure, main scientific objectives, equipment and other capabilities, visit the web site: www.geoecomar.ro

Main National Projects

- Water and sediments circulation on the Romanian costal zone: measurements with modern technologies mathematical modeling
- Protected areas: the evaluation of the environment quality to use the natural resources and to have a sustainable development
- The evaluation of the petroleum pollutants impact over the aquatic ecosystems

Main International Projects

- Network for environmental assessment and remediation in the aquatic system: Environmental curriculum and training at the postgraduate level
- International action for sustainability of the Mediterranean and Black Sea environment
- EU GEOCAPACITY- Assessing European capacity for geological storage of carbon dioxide
- CO2 capture and storage networking extension to new member states
- Black Sea scientific network
- Southern European Seas: Assesing and Modelling Ecosystem changes
- Concepts and science for coastal erosion management
- Bridging the gap between adaptation strategies of climate change impacts and European water policies
- Evolution du litoral danubien: vulnerabilite et prevention

Romanian Navy's Maritime Hydrographic Directorate (DHM)

Significant contribution to the physical oceanography, mainly in the field of bathymetry, have been brought by the Romanian Navy's Maritime Hydrographic Directorate (DHM) whose address is:

1 Fulgerului Street 8700 Constanta, Romania
Tel: +40-41-651 040
Fax: +40-41-513 065
E-mail:dhm@tomrad.ro;
carto@gmb.ro

The structure of the Romanian Maritime Hydrographic Directorate is as follows:

- The Hydrographic Branch;
- The Nautical Cartographic Branch;
- The Oceanography and Meteorology Branch;
- The Maritime Aids to Navigation Branch;
- The Navigation Equipments Maintenance Branch.

MHD operates the hydrographic vessel **"Eugen Stihi"** and the hydrographic launch **"Oltina"** to perform hydrographic and oceanographic surveys.

MAIN OBJECTIVES OF THE ROMANIAN IAPSO SCIENTIFIC RESEARCH

Most of the Romanian geoscientists contributions concerning the physical sciences of the oceans during the past four years has been carried out both within the national program for interdisciplinary scientific research and several international programs financed mainly by the UN, EEC and NATO organizations. The weight of the international co-operation programs on the Romanian scientific research budget was grown each year during the analyzed period.

Although the scientific contribution of the Romanian scientists covers a wide palette of subjects, these may be gathered into the following main topics: the physical sciences of the Geosphere and the physical sciences of the Hydrosphere. Therefore, the classification of research subjects, related to physical sciences of the oceans, included in this brief report will be issued from the above mentioned major topics.

SELECTED REFERENCES

Behr, O., Gutknecht, D., Bondar, C. (1999) First international study on the morphological changes of the Danube river down-stream. "*Anniversary Scientific Conference" 50 years, Faculty of Hydrotechnics, vol. I, Hydrology, Hydraulics and Water Economy. Sofia*

Bondar, C. (1999) Modelisation mathematique de la biomasse planctonique et bentonique du Danube a l'entrée dans le Delta. *GeoEcoMarina, v. 3*

Brustur, T. (1999) On an animal activity structure produced by Cicindela (Coleoptera) in the sand of the Sf. Gheorghe beach (Danube Delta), *GeoEcoMarina, v. 3*

Brustur, T., Anghel, S., Malageanu, M. (1999) Petrographic and microfacial studies on the bulding stones from archeological site of Argamum Fort, (North Dobrogea), *Scientific annals of the ICPDD, vol. VII/3*

Dimitriu, R. G. (1999) Some particularities of the gravity surveys performed within the continent-sea transition zones. An application in the Southern Danube Delta. *GeoEcoMarina, v. 3*

Dimitriu, R. G., Sava, C. S., Oaie, Gh., Anghel, S. (1999) Deep geological structure of Danube Delta area as deduced by 3D interpretation of geopjysical data. *Romanian Journal of Tectonics and Regional Geology. Vol. 77. Suppl. 1*

Flood, R. D., Ryan, W. B. F., Panin, N., Lericolais, G., Berne, S., Dinu, C., Shimkus, K. M. (1999) Deep Sea Drilling Programme in the Black Sea: climate change and sedimentation in the Black Sea region in response to Pleistocene climtic cycles, a letter of intent. *CIESIM Workshop Series. Mediterranean Scientific Drilling Perspectives*

Gomoiu, M.T., Secrieru, D., Oaie, Gh., Cristescu, M., Nicolescu, N., Marinescu, V. (1999) Ecological state of River Danube ecosystems in 1995. *GeoEcoMarina, v. 3*

Jamil, A., Lajtha, K., Radan, S., Ruzsa, C., Cristofor, S., Postolache, C. (1999) Mussels as bioindicators of trace metal pollution in the Danube Delta of Romania. *Hydrobiologia, vol. 392, p. 143-158. Kluwer Academic Publishers (Netherlands)*

Miller, K. G., Sugarman, P., Browning, J.V., Olsson, R. K., Georgescu, M. D., Cramer, B. M., Metzger, K. T. (1999) Ancora Site Report (ODP Leg 174A). *Proceedings of the Ocean Drillings Program, v. 174, p. 1-61. Government the United States*

Oaie, Gh., Brustur, T. (1999) Deep marine sedimentation of the Histria Formation, Central Dobrogea (Romania). *Romanian Journal of Tectonics and Regional Geology. Vol. 77. Suppl.1*

Oaie, Gh., Szobotka, St., Stanica, A., Grosu, A., Fulga, C., Opreanu, G., Ruzsa, G., Pestrea, S. (1999) Environmental asseessment of the River Danube between 1995 and 1997. *GeoEcoMarina, v. 3*

Panin, N., Jipa, D. (1999) Danube River sediment input and its interaction with the northwestern Black Sea: results of EROS-2000 and EROS-21 projects. *GeoEcoMarina, v. 3*

Secrieru, D., Secrieru, A. (1999) Effects of oil drilling activities on Ba concentrations in superficial sediments from the Black Sea Romanian shelf. *GeoEcoMarina, v. 3*

Secrieru, D., Secrieru, A. (1999) Preliminary geochemical data for sediment samples from IAEA 1998 "Radeux" Cruise in the Black Sea. *GeoEcoMarina, v. 3*

Amza-Prein, M.E., Jonson, A., Dimitriu, R., Sava, C., Nicolescu, A. (2000) OASIS montage TM data processing and analyses (DPA) software for geoscietists – An example using geophysical data for Constantza area of Romania*, Romanian Geophysics, vol. 7, suppl., p. 202-205.*

Behr, O., Gutknecht, D., Modev, S., Bondar, C., Prohaska, S. (2000) Danube river morphology: a common initiative was taken, Danube Programme Coordination Unit, *Viena International Center, p. 6-8.*

Bondar, C. (2000) Hydromorphological processes on the lower Danube riverbed, *Romanian Geophysics, vol. 7, suppl., p. 428-431.*

Bondar, C. (2000) The phisical degradation of the Danube riverbed in the low reaches, Abstracts *volume (3rd International Conference of Balkan Environmental Association – B.E.N.A.), p. 142-143.*

Bondar, C., Blendea, V., Dobrin, E. (2000) Dates concerning the hydromorphological processes from coastal zone of Mamaia, Annual Session of Scientific Communications of INMH, *Abstracts Volume, p. 38-39.*

Bondar, C., Borcia, C. (2000) Data on longitudinally water flow velocity pulses and on the water turbulence from the Lower Danube riverbed, *Annual Session of Scientific Communications of INMH, Abstracts Volume, p. 103.*

Bondar, C., Borcia, C., Stanica, A., (2000) Hydrologic, sedimentologic and morphologic processes in the Sulina mouth area, *Proceedings of the IUG – Comission of the Coastal zones, p. 19-25.*

Bondar, C., Sava, C., Dimitriu, R., Ion, G., Ion, E., Anghel., S. (2000) A new monitoring methodology of the riverbed morphological changes, applied on the lower course of the river Danube*, Romanian Geophysics, vol. 7, suppl., p. 427-428.*

Budanov, V.G., Pascho, V.F., Atakov, A.I., Lokshin, B.S., Sava, C., Dimitriu, R. (2000) Usage of high precision on-board gravimetry for the studies on main structures of ocean bottom, *Romanian Geophysics, vol. 7, suppl., p. 110-113.*

Budanov, V.G., SavaC.S., Dimitriu R.G., Marin, O. (2000) Increased precision in marine on-board gravity acquisition: new possibilities in prospecting and monitoring of shelf oil-gas reservoirs, *25th General Assembly of European Geophysical Society, p. 1.*

Caraivan, G., Donici, A., Opreanu, G. (2000) Morphometrical characterictics of the beach rudites (Agigea – Eforie South Area), *Scientific Session PONTICA 2000, Abstracts volume, p. 94.*

Davis, P., Berle, H., Miroshnichenko, V., Vladimirov, V., Kalinkin, I., Musin, O., Aliaoutdinov, a., Panin, N., Ion, G., Ion, E., Mamaev, V., Iaban, C. (2000) Black Sea web – new internet technology for querying heterogenous distributed database, *Romanian Geophysics, vol. 7, suppl., p. 206-209.*

Dimitriu, R., Seghedi, A., Sava, C., Oaie, Gh. (2000) Geotectonic frame outlined by 3D interpretation of geophysical data in Danube Delta region, *Romanian Geophysics, vol. 7, suppl., p. 114-117.*

Donici, A., Paun, F., (2000) Preliminary data on the bottom sediments grain size, *Annals of INCDDD, vol 7, p. 299-303.*

Fulga, C., Fulga, V. (2000) Coastal zones – terrigenous minerals in the sediments of the littoral and Black Sea inner shelf zone, *Annals of INCDDD, vol. 8*

Fulga, C., Fulga, V. (2000) Heavy minerals – source area indicators in the Danube-Danube Delta- Black Sea system, *Annals of INCDDD*

Gomoiu, M.T. (2000) Naval taransport development and marine ecosystems disturbance. Transboundary pollution – *Abstracts volume (3rd International Conference of Balkan Environmental Association – B.E.N.A.) p. 80-81*

Gomoiu, M.T. (2000) Possible risk concerning the protection of the natural resources from the protected areas*, The ecological bases for an sustainable management of the Natural Resources (Constantza), p. 14.*

Gomoiu, M.T. (2000) The noxes from the Black Sea, *Yacht Magazine, p. 55*

Gomoiu, M.T., Secrieru, D., Oaie, Gh., Cristescu, M., Nicolescu, N., Marinescu, V. (2000) Ecological state of the river Danube ecosystems in 1995*, Geo-Eco-Marina, vol. 3, p. 37-88*.

Gomoiu, M.T., Van Deventer, M.A., Pitu, V., Moraru, V. (2000) Lake Techirghiol, Constantza county, *Second World Water Forum, p. 17-22.*

Grosu, A. (2000) Anthropogenic influence upon the water quality of the river Danube tributaries between 1995-2000, *Abstracts volume (3rd International Conference of Balkan Environmental Association – B.E.N.A.), p. 144-145.*

Grosu, A.(2000) Assessment of aquatic environment quality of the Danube between 1995- 2000, *Abstracts volume (3rd International Conference of Balkan Environmental Association – B.E.N.A.), p. 143-144.*

Ion, G. (2000) New insights sedimentary structures of the Okhosk using very high resolution seismo-acoustic data, *GEOECOMAR report.*

Lericolais, G., Panin, N., Ryan, W., Guichsrd, F., Berne, S., Popescu, I., Ion, G. and BLASON scientific crew (2000) Danube and Dniepr paleovalleys:a new discoveries during BLASON survey on the north western Black Seashelf, *Abstracts volume, 31st International Geological Congress, 1p.*

Opreanu, P. (2000) Preliminary data on the present states of meiobental populations from several lakes from the Danube Delta, *Annals of INCDDD, vol7, p. 34-39.*

Opreanu, P.A. (2000) Contributions to the knowledge of recent Ostracoda fauna from some Danube Delta lakes, *Scientific Session PONTICA 2000, Abstracts volume, p. 102-103*.

Panin, N. (2000) Romanian coastal zone: Evolution, present-day state and integrated management of the fragile Danube Delta coastal zone, *MEDCOAST 2000-Proceedings of the international Conference on the Black Sea coastal zone management (Mamaia, Romania)*

Panin, N. (2000) The river Danube – a river of life, *Proceedings of the 3rd Symposium Science, Religion and Environment.*

Paun, F., Donici, A., (2000) Computer program for sedimentological studies – example from the Danube Delta, *vol. 7, p. 491-497*

Popescu, I., Lericolais, G., Panin, N., Wong, H.K., Droz, L. (2000) Late Quaternary channel avulsion on the Danube deep sea fan*, Marine Geology No. 167*

Radan, S., (2000) Lateritic paleoweathering crusts in Central and North Dobrogea, *Studies and Researches, Geology Series.*

Radan, S., Ganciu, A., Olariu, C., (2000) Emission of biogenic gases in the Danube Delta – anthropogenic influence and environmental implications, *Abstracts volume (3rd International Conference of Balkan Environmental Association – B.E.N.A.), p. 43.*

Radan, S., Ganciu, A., Strechie, C., (2000) Overview of the long term ecological research performed by7 GEOECOMAR in the Danube Delta, *Proceedings of the ILTER Regional Workshop, p.101-112.*

Radan, S., Ganciu, A., Strechie, C., Grosu, D., Berghes, F., Radan, S. C., Ruzsa, Gy., (2000) The Danube Delta – tendencies in pollutant dispersal and environmental state of the aquatic ecosystems (1995-1999), *Abstracts volume (3rd International Conference of Balkan Environmental Association – B.E.N.A.), p. 86-87*

Radan, S.C., Radan, M., Radan, S., (2000) Rock magnetic and thermomineralogic integrated study of baked clays of Jilt area (Dacic Basin), *Studies and Researches, Geology Series*.

Sava, C., Dimitriu, R. (2000) New data regarding the deep structure of western Black Sea continental margin by gravity and magnetic modeling, *Geophysical Journal, vol. 22, p. 123-124.*

Sava, C., Dimitriu, R., Morosanu, I. (2000) Western Black Sea continental margin as inferred from 2 D modeling of gravity and magnetic data, *Romanian Geophysics, vol. 7, suppl., p. 106-109.*

Secrieru, D., Secrieru, A. (2000) Effects of oil drilling activities on Ba concentrations in superficial sediments from Black Sea Romanian shelf*, Geo-Eco-Marina, vol. 3, p. 143-148.*

Secrieru, D., Secrieru, A. (2000) Preliminary geochemical data for sediment samples from IAEA 1998 RADEUX cruise in the Black Sea, *Geo-Eco-Marina, vol. 3, p. 139-142.*

Stanica, A., Ungureanu, Gh., Opreanu, G. (2000) Erosional phenomena along the Romanian Black Sea coastal zone, *Abstracts volume (3rd International Conference of Balkan Environmental Association – B.E.N.A.), p.146.*

Ungureanu, Gh., Stanica, A. (2000) Impact of human activities on the evolution of the Romanian Black Sea beaches, Lakes and reservoires: *Research and management, vol. 5, p. 111-115*

Winguth, C., Wong, H.K., Panin, N., Dinu, C., Georgescu, P., Ungureanu, Gh. (2000) Upper Quaternary water level history and sedimentation in the Northwestern Black Sea*, Marine Geology No. 167, p. 127-146.*

Yanev, S., Popa, M., Seghedi, A., Oaie, Gh. (2000) The continental Permian in Balkans, Moesia, South Carpathians and Apuseni Mountains; a comparison*, Proceedings of Natural Sciences Museum of Brescia (Italy), p. 15.*

Anghel, S. (2001) Current aspects of the geophisical research in archeological fields. *Rev. Dacia, nr. 4. Bucuresti*

Bellaiche, G., ioncke, L., Gaullier, V., Mascle, J., Courp, T., Moreau, A., Radan, S., Sardou, O., (2001) Le cone sous marin du Nil et son reseau de chenoux profond: nouveaux resultats (Campagne FANIL). *C.R. Acad. Sci., 333. P. 399-404*. Paris

Bellaiche, G., Ioncke, L., Gaullier, V., Mascle, J., Courtp, T., Moreau, A., Radan, S., Sardou, O., (2001) The nil deep sea fan: main results of FANIL cruise (rezumat). EUG XI Meeting. Strasbourg

Bondar, C. (2001) A global mathematical model of the annual captures of the fishes in Danube Delta (rezumat*). Al IX-lea simpozion al INCDDD "Delte si zone umede". Tulcea*

Bondar, C. (2001) Longitudinal pulsation of the flow velocity and water turbulence from the lower Danube River. *GEOECOMARINA, nr. 4*

Bondar, C. (2001) The Danube riverbed. *Marea noastra no. 2 (39), p. 34-37. Constanta*

Bondar, C. (2001) The natural enclosure to the Black Sea of the Musura Golf and its effects. *Marea noastra no. 3 (40), p. 19-29. Constanta*

Bondar, C., Blendea, V. (2001) The long variation of the annual energetical components of the wind of Sulina on 1941-1998 years. *11th National Conference of Socoety for promotion of Renewable, Inexhaustible and New Energies (abstract*). Bucharest

Friedrich, J, Dinckel, Ch., Grieder, E., Radan, S., Secrieru, D., (2001) Nutrient retention in Danube Delta lakes. *Freshwater biology. p. 37*

Gaullier, V., Lancke, L., Mascle, J., Bellaiche, G., Vendeville, B., Courp, T., Moreau, A, Radan, S., Sardou, O., (2001) Combined thin-skinner and thc-skinned tectonics in the Eastern Nile deep sea fan, Eastern Mediterranean*: Results from the recent FANIL survey (rezumat). EUG XI Meeting. Strasbourg*

Ghitau, V., Savulescu, C., Sava, C. S., (2001) Present state and future outline for modernisation of the national geodating networks in Romania. *Workshop "Perspectives of geodesy in Southeastern Europe". 22 p., Dubrovnik*

Gomoiu, M.T., Secrieru, D. (2001) Readings of eutrophication. *Near 2 wokshop B: Nutrient dynamics and eutrophication in river, lakes and marine systems, 70 p. Varna*

Ion, G. (2001) Integrated approach of GIS management and valorisation of marine geological-geophysical data*. Computers & Geosciences, 15 p.*

Oaie, Gh., Secrieru, D., Szobotka, St., Stanica, A., Soare, R., (2001) Pollution state of sediments dredged from the Sulina Distributary and their influence to the Danube Delta Front area. 6 p. *GEOECOMARINA 4*. Bucharest

Oaie, Gh., Szobotka, St., Stanica, A., Soare, R. (2001) Pollutant imput from the sediments dredged from the Sulina Distributary (Danube River) onto the Black sea shelf (abstract). *Treatment 2000 Symposium and exhibition, Istambul (Turkey)*

Panin, N., Jipa, D. (2001) Danube river sediment input and its interaction with the Northwestern Black Sea. Estuarine*, Coastal and Shelf Science. London*

Popescu, I., Lericolais, G., Panin, N., Wong, H. K., Droz, L. (2001) Late Quaternary channel avulsions on the Danube deep sea fan. *Marine geology, 179, 25-37*

Rizescu, C., Georgescu, Gh., Duliu, O., Szobotka, St. (2001) 3 D gamma-ray computer axial tomography of polymetallic nodules. *Deep-sea Research, I 48, p. 2529-2540*

Secrieru, D., Secrieru, A. (2001) Geochemical data for sediment samples from the international cruise Black Sea sediment fluxes. *GEOECOMARINA, nr. 4*

Seghedi, A., Oaie, Gh., Iordan, M., Vaida, M. (2001) correlation of Vendian Basins along the Southern Margin of Baltica. *Joint Meeting of EUROPROBE, TESZ, TIMPEBAR, URALIDE & SW IBERIA. Abstracts volume, 2 p. Ankara (Turkey)*

Seghedi, A., Oaie, Gh., Teleman, C., Ciulavu, M. (2001) The Paleozoic basement of the North Dobrogea Orogen and Pre-Dobrogea Depression: comparative Variscan history based on the sedimentary and magmatic record. *EUROPROBE Devonian- Triassic "Time-Slice" Symposium- Variscides- Craton-Uralides: linkage between and intraplate processes. 2 p. Moskow (Rusia)*

Strechie, C. (2001) Magnetic minerals as indicator of major environmental changes in Holocene Black Sea sediments: Preliminary results. *Physics and Chemistry of the Earth (in print)*

Velev, G., Sava, C. S., Heitzinger, D. (2001) Application of a new technology in the surveying and mapping of Danube river. *Workshop "Perspectives of geodesy in Southeastern Europe. 22 p., Dubrovnik*

Melinte M.C., Lamolda M. A., (2003) "Correlation of the Coniacian/Santonian boundary interval in Romania and other European areas", London, 56/2, p: 22-34, *Cretaceous Research*

Melinte M.C., Brustur T., Szobotka S., Furtună, C., Pavel A., Şiţaru G., (2003) „Dâmbovicioara-Rucăr-Bran, a Geopark in the heart of the Romanian Carpathians", Bratislava, p: 7-11, *Geologica Carpathica*

Wong H.K., Ludmann T., Baranov B.V., Karp B.Ya., Konerding P., Ion G., (2003) "Bottom current-controlled sedimentation and mass wasting in the northwestern Sea of Okhotsk", 201/2003, *Marine Geology*

Friedrich J., Dinkel Ch., Grieder E., Radan S.;, Secrieru D., Steingruber S.,Wehrli B., (2003) "Nutrient uptake and benthic regeneration in Danube Delta Lakes", 64, p: 373-398, *Biogeochemistry*

Seghedi A., Oaie Gh., Maruntiu M., Iancu V., (2003) "Late Proterozoic-Early Cambrian Terranes in the Basement of Moesia and Surrounding Alpine Belts", Abstracts with Programs, Cordilleran Section, vol. 35, nr. 4, p. 11, *Geological Society of America Convention*

Melinte M.C. (2003) "Biostratigraphical signals across the Barremian/Aptian boundary interval", *Geological Society of America Annual Meeting and Exposition Abstracts, Seattle, 2-5 November 2003*

Lericolais G.I., Popescu I., Panin N., Guichard F., Popescu S., (2003) "Was the last rapid sea change in the Black Sea linked to a catastrophic event recorded by mankind?", p. 406, *Geological Society of America Annual Meeting and Exposition Abstracts, Seattle, 2-5 November 2003*

Arz H.; Dehning K.; Klann M.; Lamy F.; Okay N.; Schäffer R., Scheurle C., Secrieru D., Seiter Ch., Wienberg C., (2003) "Paleoclimate Studies", p. 4-10 – 4-13, *In: Hemleben, C.; K. Hoernle; B. B. Jørgensen und W. Roether (Eds):, Ostatlantik - Mittelmeer - Schwarzes Meer Cruise No. 51, 12 September - 28 December 2001, Meteor Berichte 03-01, Universität Hamburg*

Bötcher M. E., Jørgensen B. B., Kallmeyer J., Neumann K., Okay N., Secrieru D., Theune A., Wehausen R., (2003) "Pore Water Geochemistry and Stable Isotope Geochemistry", p. 4-24 – 4-27, *In: Hemleben, C.; K. Hoernle; B. B. Jørgensen und W. Roether (Eds):, Ostatlantik - Mittelmeer - Schwarzes Meer Cruise No. 51, 12 September - 28 December 2001, Meteor Berichte 03-01, Universität Hamburg*

Secrieru, **D**. (**2003)** "Major, Minor and Trace Element Distribution in Marmara and Black Sea Sediments", p. 4-30 – 4-31, *In: Hemleben, C.; K. Hoernle; B. B. Jørgensen und W. Roether (Eds):, Ostatlantik - Mittelmeer - Schwarzes Meer Cruise No. 51, 12 September - 28 December 2001, Meteor Berichte 03-01, Universität Hamburg*

Jipa D., Melinte M.C., **(2003)** "Turonian-Coniacian red beds in the East Carpathians (Romania)", Volume of abtracts, p: 32-33, *Meeting of the IGCP463 (Upper Cretaceous Oceanic Red Beds), Bartin –Turkey*

Melinte M.C. (2003) " Is the deposition of the CORB related to biostratigraphical significant changes?", Volume of abtracts, p: 26-28, *Meeting of the IGCP463 (Upper Cretaceous Oceanic Red Beds), Bartin – Turkey*

Bondar C., Sava C., (2003) "An enhanced monitoring methodology of the riverbed morphological changes, applied on the lower course of the Danube River", Abstract, *XXII I.U.G.G. General Assembly, Sapporo, Japan*

Dimitriu R.G., Seghedi A., (2003) "Western Black Sea shear margin: Regional tectonics as inferred from geological modeling", *Workshop on „Tectonic events and evolution of the Black Sea", MEBE Programme, Kiev, U-kraine, February 18-25, 2003*

Dimitriu R.G., Seghedi A. Oaie Gh., Ioane D., (2003) "Deep structure of the foreland in the East Carpathian bend zone and the geological evolution of the Danube Delta basement", *Workshop on „Tectonic events and evolution of the Black Sea", MEBE Programme, Kiev, U-kraine, February 18-25, 2003*

Lamolda M.A., Melinte M.C., Kunio K., (2004) "Extinction and survivorship across the K/T Boundary of Caravaca (SW Spain)", v. 44., *Palaeogeography, Palaeoclimatology, Palaeoecology*

Melinte M.C., Jipa D., (2004) „Uppermost Cretaceous pelagic/hemipelagic red beds in the Bend Area of the Romanian Carpathians", vol. 20, *Cretaceous Research*

Stanica A., Feas J., (2004) „Present evolution and future predictions for the Black Sea coastal zone between the Sulina and Sf. Gheorghe Danube River mouths (Danube Delta). A theoretical view of sustainable shoreline management issues.", *Ocean & Coastal Management*

Papanikolaou, D., Barghati, H., Dabovski, C., Dimitriu, R.G., EL-HAWAT H., Ioane D., Kranis H., Obeidi A., Oaie Gh., Seghedi A., Zagorchev, I., (2004) "The TransMed Atlas: The Mediterranean Region from Crust to Mantle - Transect VII: East European Craton – Scythian Platform – Dobrogea – Balkanides – Rhodope Massif – Hellenides – East Mediterranean – Cyrenaica. (Editors: Cavazza, W., Roure, F., Spakman, W., Stampfli, G.M., Ziegler, A.), p: 114-119, CD-ROM, *Springer – Verlag (Berlin, Heidelberg)*

Starostenko V., Buryanov V., Makarenko I., Rusakov O., Stephenson R., Nikishin A., Georgiev G., Gerasimov M., Dimitriu R., Legostaeva O., Pchelarov, V., Sava C., (2004) "Topography of the crust-mantle boundary beneath the Black Sea basin", v. 381, n. 1-4, p. 211-233, Tectonophysics

Seghedi A., Oaie Gh., Dimitriu R., (2004) "The TRANSMED Atlas – The Mediterranean Region from crust to mantle. Geological and geophysical framework of the Mediterranean and the surrounding areas – Transect VII – East European Craton – Dobrogea – Cyrenaica", *Springer – Verlag (Berlin, Heidelberg)*

Popescu I., Lericolais G., Panin N., Normand A., Dinu C., LeDrezen E., (2004) "The Danube subaqueous canyon (Black Sea): morphology and sedimentary processes", v. 206 (1-4), p: 249-265, *Marine Geology*

Seghedi A., Stephenson R.A., Neaga V., Dimitriu R., Ioane D., Stovba S., (2004) "The Scythian Platform north of Dobrogea (Romania, Moldova and Ukraine), *Tectonics*

Bondar C. Sava C., (2004) "Enhanced Monitoring Methodology of the Riverbed Morphological Changesapplied on the Lower Course of the Danube River", *XXII-th IUGG.General Assembly, Sapporo, Japan*

Seghedi A., Oaie Gh., Vaida M., Debacker T. N., Sintubin M., (2004) "Paleozoic formations in North Dobrogea: sedimentation, deformation and metamorphism", p: 1 – 3, *Avalonia – Moesia Symposyum & Workshop, Ghent (Belgium)*

Oaie Gh., Seghedi A., Radan S., Vaida M., (2004) „Sedimentology and source areas for the Neoproterozoic - Lower Cambrian turbidites from East Moesia", p: 23 – 24, *Avalonia – Moesia Symposyum & Workshop, Ghent (Belgium)*

Rădan S.C., Rădan S., (2004) "Magnetic susceptibility identification of environmental impact of the anthropogenic activities in aquatic ecosystems. A case study in the Danube Delta (Romania)", vol. 34, Special issue, p: 114 –116, *9th Castle Meeting, Palaeo, Rock and Environmental Magnetism, Tatranská Javorina, Slovak Republic, June 27 – July 3, 2004, Contributions to Geophysics and Geodesy*

Rădan S.C., Rădan S., Oaie Gh., Szobotka Ş., (2004) "Magnetic susceptibility as a sensitive proxy parameter for differentiating deltaic (lacustrine and fluvial) sedimentary environments; inferences from the Danube Delta (Romania)" ", vol. 34, Special issue, p: 117 – 119, *9th Castle Meeting, Palaeo, Rock and Environmental Magnetism, Tatranská Javorina, Slovak Republic, June 27 – July 3, 2004, Contributions to Geophysics and Geodesy*

Secrieru, D., Gulin, S., Osvath, I., (2004) "Chronology of Metal Pollution Offshore Coruh Mouth, Eastern Black Sea", poster, *Aquatic Forum 2004, Monaco*

Gallemi J., Melinte M.C. (2004) "Echinoid levels and ages of Betic Cordilleraa (S and SE Spain)", Volume of abstracts, p: 12-13, *Meeting of the Spanish Palaeontological Society, Granada 2004*

Lamolda M., Melinte M.C., Wan X., (2004) "Integrated micropaleontological study of the Chuangde section, Southern Tibet", Volume of Abstracts, p: 6-9, *Symposium of the Geology of Asia, Hanoi*

Oaie Gh., (2004) "Romanian Marine RT&D priorities", poster, *Galway (Ireland)*

Panin N., (2004) "Euro-EcoGeoCentre Romania", Abstract book, p: 116-117, *EUROCEAN 2004, European Conference, Marine Science & Ocean Technology, Galway, Ireland, May 10-13*

Lericolais G., Popescu S., Guichard F., Wong H.K., Panin N., Dinu C., Dimitrov P., Stanev E., Staneva J., Martinez-Ruiz F., Morigi C., (2004) "Holocene Black Sea sedimentary system – ASSEMBLAGE)", Abstract book, p: 143-144, *EUROCEAN 2004, European Conference, Marine Science & Ocean Technology, Galway, Ireland, May 10-13*

Lericolais G, Popescu I., Panin N., Guichard F., (2004) "Questions on the sea level fluctuations in the Black Sea since the Last Glacial Maximum ASSEMBLAGE Project", p. 123, *Fourth International Congress on Environmental Micropalaeontology, Microbiology and Meiobenthology, Program and Extended Abstracts (September 13-18, 2004, Isparta, Turkey), V. Yanko-Hombach, M. Görmüs, A. Ertunç, M. McGann, R. Martin, J. Jacob and S. Ishman eds.*

Stanica A., Bonardi M., (2004) "Proposal for a sustainable shoreline management", TR ISMAR-Ve No. 126/2004, p. 17, *Proceedings of the China-Italy Bilateral Seminar on Monitoring and management of coastal areas in relation to natural and man induced environment impact, climate change and mean sea level variations, June 28- July 2, 2004, Qingdao (China)*

Stanica A., Bonardi M., (2004) "Identification of most acceptable methods for the environmental rehabilitation of the Guanabara Bay (Brasil)", TR ISMAR-Ve No. 126/2004, p: 55-56, *Proceedings of the China-Italy Bilateral Seminar on Monitoring and management of coastal areas in relation to natural and man induced environment impact, climate change and mean sea level variations, June 28- July 2, 2004, Qingdao (China)*

Radan S., (2004) „Emissions de gaz à effet de serre dans le Delta du Danube", *Les séminares de l'UMR 6143 à CAEN – Institut de Morphodynamique continentale et cotière, Caen France, 17 Mars 2004*

Radan S., (2004) „Le géosystème hydrosédimentaire Danube – Delta du Danube – Mer Noire. Genèse, évolution, influences anthropique", *Conférence à l'Université de Perpignan – Laboratoire d'Etude des Géo-Environnements Marins, 22 Mars 2004*

Radan S., (2004) „Sédimentation argileuse actuelle dans le hydrosystème Danube – Delta du Danube – Mer Noire", *Conférence à l'Université de Perpignan – Laboratoire d'Etude des Géo-Environnements Marins, 23 Mars 2004*

Radan S., (2004) „Delta du Danube – impact des apports fluviatiles sur l'évolution des écosystèmes aquatiques. Évaluation des influences sur la qualité des milieux aquatiques sédimentaires et biologiques", *Conférence à l'Université de Perpignan – Laboratoire d'Etude des Géo-Environnements Marins, 30 Mars 2004*

Radan S., (2004) „Emissions de gaz à effet de serre dans le Delta du Danube", *Conférence à l'Université de Perpignan – Laboratoire d'Etude des Géo-Environnements Marins, 31 Mars 2004*

Stoica M., Ungureanu V.Gh., Radan S., (2004) „Fossils response to paleoenvironmental change in Danube Delta", *Varna Workshop, 23 - 26 October 2004, Varna, Bulgaria*

Strechie C., Fontugne M., Guichard F., (2004) „Carbon Isotope Ratio in Black Sea Sediments: Geochemical and Geochronological Aspects", *Varna Workshop, 23 - 26 October 2004, Varna, Bulgaria*

Jelinowska, A. Louchet, Strechie C., Meynadier L., Guichard F., Tucholka P., (2004) "Magnetic properties of NW Black Sea sediments : results of BLASON II cruise", *Varna Workshop, 23 - 26 October 2004, Varna, Bulgaria*

Oaie Gh., (2004) "Project RER / 2 / 003 – Marine Environmental Assessment of the Black Sea Region. Regional Technical Co-operation", *IAEA, Vienna, Austria*

Secrieru D., Gulin S., Osvath I., (2004) "Chronology of Metal Pollution Offshore Coruh Mouth, Eastern Black Sea", p: 608-609, *Book of Extended Synopses, International Conference on Isotopes in Environmental Studies - Aquatic Forum 2004. IAEA-CN-118, Vienna*

Bondar C., (2004) "The state and tendency of the hydromorphological processes of the Danube and Danube Delta", Volume of Abstracts, *Euro-EcoGeoCentre – Romania – Workshop 1: "Environmental problems of the Lower Danube, including the Danube Delta, and new ideas for an Integrated Observing and*

Forecasting System in the Lower Danube, Danube Delta and the Black Sea", Bucharest, 19 - 22 January 2004

Dimitriu R., **(2004)** "An integrated geo-ecological study of the Razelm-Sinoe Lagoon System", Volume of Abstracts, *Euro-EcoGeoCentre – Romania – Workshop 1 – "Environmental problems of the Lower Danube, including the Danube Delta, and new ideas for an Integrated Observing and Forecasting System in the Lower Danube, Danube Delta and the Black Sea", Bucharest, 19 - 22 January 2004*

Oaie Gh., (2004) „General presentation of the main issues regarding the sustainable management of the Danube River", Abstracts volume, *Euro-EcoGeoCentre – Romania – Workshop 1: "Environmental problems of the Lower Danube, including the Danube Delta, and new ideas for an Integrated Observing and Forecasting System in the Lower Danube, Danube Delta and the Black Sea", Bucharest, 19-22 January 2004*

Rădan S., (2004) „The evolution of clay mineral associations in the sediments of the Danube – Danube Delta – Black Sea geosystem", Abstracts volume, *Euro-EcoGeoCentre – Romania – Workshop 1 – "Environmental problems of the Lower Danube, including the Danube Delta, and new ideas for an Integrated Observing and Forecasting System in the Lower Danube, Danube Delta and the Black Sea", Bucharest, 19 - 22 January 2004*

Szobotka Ş., (2004) "Bathymetrical and sedimentological research along the Romanian section of the Danube River", Abstracts volume, *Euro-EcoGeoCentre – Romania – Workshop 1 – "Environmental problems of the Lower Danube, including the Danube Delta and new ideas for an Integrated Observing and Forecasting System in the Lower Danube, Danube Delta and the Black Sea", Bucharest, 19 - 22 January 2004*

Secrieru, D., Oaie Gh., (2004) "Geochemical and sedimentological characteristics of the NW Black Sea Shelf". Abstracts volume, *Euro-EcoGeoCentre – Romania – Symposium 1: "The Pollutant Influxes into the semi-enclosed marine basins – Comparison between the European River–Seas Systems of the Baltic Sea, the Mediterranean Sea and Black Sea", Bucharest, 22-24 April 2004*

Dincă, D., Stobie, V., Zaharia, D., Secrieru D., Gomoiu, M.T., (2004) „Some results of the studies carried out on the effect of thermal discharge from NPP Cernavoda on the Danube River ecosystem – zone of influence", Volume of Abstracts, *Euro-EcoGeoCentre – Romania – Symposium 1: "The Pollutant Influxes into the semi-enclosed marine basins – Comparison between the European River–Seas Systems of the Baltic Sea, the Mediterranean Sea and Black Sea", Bucharest, 22-24 April 2004*

Bondar C., Sava C., **(2004)** "Study on morphological changes in a riverbed pilot reach of the Lower Danube", Volume of Abstracts, *EuroEcoGeoCentre –Romania Symposium 1: "The Pollutant Influxes into the semi-enclosed marine basins – Comparison between the European River–Seas Systems of the Baltic Sea, the Mediterranean Sea and Black Sea", Bucharest, 22-24 April 2004*

Panin N., Bondar C., Jipa D., (2004) „The River Danube – Black Sea Geosystem. Birth and development. Hydrologic and sedimentologic characteristics", Abstracts volume*, Euro-EcoGeoCentre – Romania – Symposium 1: "The Pollutant Influxes into the semi-enclosed marine basins – Comparison between the European River–Seas Systems of the Baltic Sea, the Mediterranean Sea and Black Sea", Bucharest, 22-24 April 2004*

Rădan S., Ganciu A., Strechie C., Grosu A., Berghes F., Rădan S.C., Secrieru D., Bălan S., Grosu D, (2004) „Trends in Pollutant Inflow and Dispersal in Danube Delta – Effects on Aquatic Ecosystem Quality", Abstracts volume, *Euro-EcoGeoCentre – Romania – Symposium 1: "The Pollutant Influxes into the semi-enclosed marine basins – Comparison between the European River–Seas Systems of the Baltic Sea, the Mediterranean Sea and Black Sea", Bucharest, 22-24 April 2004*

Ungureanu V., Stanica A., Dan S., Panin N., Maximov G., Simescu D., Bondar C., (2004) "Mamaia Bay - Morphodynamics and possible solutions against erosional phenomena", *Euro-EcoGeoCentre – Romania – Symposium 1: "The Pollutant Influxes into the semi-enclosed marine basins – Comparison between the European River–Seas Systems of the Baltic Sea, the Mediterranean Sea and Black Sea", Bucharest, 22-24 April 2004*

Ungureanu V., Stanica A., Dan S., Panin N., Maximov G., Simescu D., Bondar C., (2004) "Researches regarding the beaches from the southern part of the romanian littoral – South of Constanta Harbor", *Euro-EcoGeoCentre – Romania – Symposium 1: "The Pollutant Influxes into the semi-enclosed marine basins – Comparison between the European River–Seas Systems of the Baltic Sea, the Mediterranean Sea and Black Sea", Bucharest, 22-24 April 2004*

Angheluță C., Jipa D., (2004) "Environmental risk assessment from hydrocarbon contamination in the coastal zone: Case study – OIL Terminal S.A. – Constanța Area", Volume of Abstracts, *Euro-EcoGeoCentre –*

Romania– Workshop 2 – "Environmental disequilibria in the NW Black Sea coastal system: causes, consequences, correctives", Danube Delta, 25-29 August 2004

Bondar C., (2004) „The possible influence of the Bystroe Canal on the Danube Delta hydrology", Abstracts volume, *Euro-EcoGeoCentre – Romania – Workshop 2 – "Environmental disequilibria in the NW Black Sea coastal system: causes, consequences, correctives", Danube Delta, 25-29 August 2004*

Panin N., Bondar C., Stănică A., Dan S., (2004) "The Danube Delta and the coastal zone-Evolution and environmental changes", Abstracts volume, *Euro-EcoGeoCentre – Romania – Workshop 2 – "Environmental disequilibria in the NW Black Sea coastal system: causes, consequences, correctives", Danube Delta, 25-29 August 2004*

Rădan S., Ganciu A., Olariu C., Pavel A., Klaver G., (2004) „Emissions of greenhouse gases in the Danube Delta", Abstracts volume, *Euro-EcoGeoCentre – Romania Workshop 2 – "Environmental disequilibria in the NW Black Sea coastal system: causes, consequences, correctives", Danube Delta, 25-29 August 2004*

Panin N., Stănică A., Bondar C., Fulga C., Dan S., Maximov G., Ungureanu Ghe., Simescu Ctin., Simescu D., Constantinescu M., (2004) "Complex researches for the coastal protection against erosional phenomena in order to provide the basis for the Integrated Coastal Zone Management. Case Study: Cape Midia – Cape Singol Constanta (Navodari and Mamaia beaches)", *International Simposium "Black Sea Coastal – Air – Sea Interaction / Phenomena and Related Impacts and Application", 13 – 15 Mai 2004, Constanța – Mamaia*

Melinte M.C., Jipa, D.C. (2005) "Campanian-Maastrictian marine red beds in Romania: biostratigraphic and genetic significance." Elsevier, Oxford, G.B, vol 26/1 p: 49-56., *Cretaceous Research*

Iovea M., Oaie Gh., Ricman C., Mateiasi G., Neagu M., Szobotka S., Duliu O.G., (2005) "Dual energy X-ray computer axial tomography and digital radiography investigation of cores and other objects of geological interest", p. 14, *Springer – Environmental Geology*

Lamolda, M.A., Melinte M.C., Kaiho, K., (2005) "Nannofloral extinction and survivorship across the K/T boundary at Caravaca, southeastern Spain", London, 224 (1-3), p: 27-52, *Palaeogeography, Palaeoclimatology, Palaeoecology*

Clauzon, G., Suc. J-P., Popescu, S.-M., Mărunțeanu, M. Rubino, J.-L., Marinescu. F, Melinte M.C., (2005) "Influence of the Mediterranean sea-level changes on the Dacic Basin (Eastern Paratethys) during the Late Neogene: the Mediterranean Lago Mare Facies deciphered", 17 (3), p: 437-462, *Basin Research*

Popescu I, Lericolais G, Panin N, Normand A, Dinu C, Le Drezen E., (2005) "The Danube Submarine Canyon (Black Sea): morphology and sedimentary processes", 206 (1-4), p: 249-65, *Marine Geology*

Oaie Gh., Seghedi A., Radan S., Vaida M., (2005) "Sedimentology and source areas for the Neoproterozoic-Lower Cambrian turbidites from East Moesia",vol. 8, nr. 4, p: 78-98, *Geologica Belgica*

Seghedi A., Berza T., Iancu V., Maruntiu M., Oaie Gh., (2005) "Neoproterozoic terranes in the Moesian basement and in the Alpine Danubian nappes of the South Carpathians", vol. 8, nr. 4, p: 4-19, *Geologica Belgica*

Gomoiu M.T., (2005) "Non-indigenous species in the Romanian Black Sea litoral zone: *Mya arenaria, Rapana venosa* and others", p: 163 – 183, *"NEAR curriculum in natural environmental sciences" Editors: Janusz Dominik et al.*

Gomoiu M.T., (2005) "New approaches in the assesment of the Black Sea ecosystems"**,** p: 20 – 26, EC/Joint Research Centre /Black Sea Commission/ Helsinki Commission, Joint Workshop on *Marine Assessment and Monitoring with emphasis on eutrophication, Istanbul - Outcome of the Joint EC-JRC / HELCOM / BSC Workshop. HELCOM DPS in folder: MONAS / EC-JRC HELCOM BSC Workshop.*

Iovea M., Oaie Gh., Neagu M., Ricman C., Mateiasi G., Szobotka St., Duliu O., (2005) "Dual energy and radiographical investigation of sedimentary cores and some methamorphic rocks samples", Abstract CD ROM, *32-nd International Geological Congress, Florence (Italy)*

Oaie Gh., Seghedi A., Brustur T., Gheuca I., (2005) "Geosites from Romania under threat of anthropic activities", Abstracts, Section-T17.02 "Cities at risk geotourism-geoparks, confict of economy and ecology", *32-nd International Geological Congress, Florence (Italy)*

Strechie C., Jelinowska A, Colin C, Guichard F, Tucholka P,Fontugne M, Lericolais G, Panin N., (2005) „Tracing Black Sea level since the Last Glacial Maximum", p. 352, *32-nd International Geological Congress, Florence (Italy)*

Oaie Gh., Secrieru D., (2005) "Sedimentological and geochemical characteristics of the Danube Delta front and Danube prodelta", *32-nd International Geological Congress, Florence (Italy)*

Seghedi A., Oaie Gh., (2005) "Neoproterozoic evolution of the Moesian crust", Abstract CD ROM, *32-nd International Geological Congress, Florence (Italy)*

Scott R., Hu X., Malata E., Melinte M.C., Scherbinina E., Wagrecih M., (2005) "Timing and rates of deposition of Cretaceous Oceanic Beds", *32-nd International Geological Congress, Florence (Italy)*

Melinte M.C., Jipa D. (2005) "Arid and humid climates during the Cenomanian-Maastrichtian interval in the Romanian Carpathians", *32-nd International Geological Congress, Florence (Italy)*

Lericolais G, Popescu I, Panin N, Guichard F., (2005) "Questions on the sea level fluctuations in the Black Sea since the Last Glacial Maximum ASSEMBLAGE Project", *International Symposium on Earth System, Istanbul (Turkey); In: Alemdaroglu K, Barla MC, Mater B, editors*

Popescu I, Lericolais G, De Batist M, Panin N., (2005) "Submarine Canyon Evolution and Controls in the NW Black Sea: Evidence from the Danube Canyon", *International Symposium on Earth System, Istanbul (Turkey); In: Alemdaroglu K, Barla MC, Mater B, editors*

Iovea M., Oaie Gh., Duliu O.G., Bodale M., Mateiasi G. , Neagu M., (2005) "Single and dual-energy X-ray computer tomography and digital radiography study of sedimentary cores", *MEDCOAST 05, Kuşadasi ,Turkey*

Oaie Gh., (2005) " Romanian Marine RT&D priorities", poster, *EUROCEAN – EXHIBITION ESF.CREST, Galway, Ireland*

Melinte M.C., Bojar A. V. (2005) "Biostratigraphical and biogeochemical signals: proxies for the generation of anoxic oceanic events", *The 7th International Cretaceous Symposium, Neuchâtel*

Melinte M.C., Lamolda M. A., Kaiho K., Bernandez E. (2005) "The Response of the Calcareous Nannofossils at the Oceanic Anoxic Event 2 (OAE2) in the Arobes section, N. Spain", *The 7th International Cretaceous Symposium, Neuchâtel*

Melinte, M.C., Bubik, M. (2005) "Paleoceanographic significance of Upper Cretaceous red bed sediments. Case Study: the Eastern Carpathians", *The 7th International Cretaceous Symposium, Neuchâtel*

Barbu V., Melinte M.C. (2005) "Late Valanginian Anoxic Event in the Bucegi Mountains area (Romania)", *The 7th International Cretaceous Symposium, Neuchâtel*

Melinte M.C. **(2005)** "Calcareous nannofloral character from the Romanian Black Sea cretaceous onshore and offshore sediments" , Volume of Abstracts, p. 76, *In Nakoman et al. (eds.), International Earth Science Colloquium on Aegean Regions, Izmir, Turkey, October 4-7, 2005*

Melinte M.C., Popescu, S.-M., Suc, J.-P., Clauzon, G., Çatagay, N. (2005) " Messinian-Zanclean nannofloras from the Aegean Region Intepe Section (NW Turkey)", Volume of Abstracts, p. 77, *In Nakoman et al. (eds.), International Earth Science Colloquium on Aegean Regions, Izmir, Turkey, October 4-7, 2005*

Oaie Gh., Melinte M.C. **(2005)** "Upper Holocene sedimentation in the NW and SE Black Sea Basin", Volume of Abstracts, p. 87-88, *In Nakoman et al. (eds.), International Earth Science Colloquium on Aegean Regions, Izmir, Turkey, October 4-7, 2005*

Seghedi A., Oaie Gh., Vaida M., (2005) "Paleozoic evolution of the Moesian Platform (Romania) – an overview", Volume of Abstracts, p: 106-107, *In Nakoman et al. (eds.), International Earth Science Colloquium on Aegean Regions, Izmir, Turkey, October 4-7, 2005*

Oaie Gh., Florescu S., (2005) "R/V Mare Nigrum – New equipments on-board", Lisbon (Portugal), *European Research Vessels Operators (ERVO)*

Oaie Gh., (2005) "Environmental Sciences and Policy for the Future – Romanian position for the FP 7", *EU Meeting Bratislava (Slovakia)*

Ioane D., Oaie Gh., (2005) "Mining activities in Rosia Montana (Romania) in the Roman times", *COST – Action 27, Napoli (Italy)*

Bondar C., (2005) "Variations in the Black Sea level due to river-sea interactions", Volume of Abstracts, p. 4, *Euro-EcoGeoCentre International symposium "Semi-enclosed European Seas-Interactions between Major Compartments" April 08-10, 2005, Snagov*

Gomoiu M.T., (2005) "State of biotic communities at NW Black Sea sediment-water interface", Volume of Abstracts, p. 9, *Euro-EcoGeoCentre International symposium "Semi-enclosed European Seas-Interactions between Major Compartments" April 08-10, 2005, Snagov*

Melinte M.C., (2005) "Mesozoic-Cenozoic Paleoclimatic changes revealed by calcareous nannofloras of the Romanian Black Sea onshore and offshore", Volume of Abstracts, p. 18, *Euro-EcoGeoCentre International symposium "Semi-enclosed European Seas-Interactions between Major Compartments" April 08-10, 2005, Snagov*

Radan S., Klaver G., Ganciu A., (2005) "Danube Delta – a Wetland source of greenhouse gases: Natural trends and anthropogenic influences", Volume of Abstracts, p: 30-32, *Euro-EcoGeoCentre International symposium "Semi-enclosed European Seas-Interactions between Major Compartments" April 08-10, 2005, Snagov*

Radan S. C., Radan S., (2005) "Environmental magnetic studies in the Danube Delta: Evidences of natural changes and anthropogenic pressure on sedimentary processes", Volume of Abstracts, p: 26-29, *Euro-EcoGeoCentre International symposium "Semi-enclosed European Seas-Interactions between Major Compartments" April 08-10, 2005, Snagov*

Oaie Gh., Secrieru D., Szobotka St., Fulga C., Stanica A., **(2005)** "Danube River: sedimentology, mineralogical and geochemical characteristics of the bottom sediments", Volume of Abstracts, p: 19-21, *Euro-EcoGeoCentre International symposium "Semi-enclosed European Seas-Interactions between Major Compartments" April 08-10, 2005, Snagov*

Ungureanu V., Panin N., Stanica A., Bondar C., Simescu D., Dan S., Maximov G., (2005) "Mamaia Bay-Morphodynamics and Possible Solutions against Erosional Phenomena", Volume of Abstracts, p: 34-35, *Euro-EcoGeoCentre International symposium "Semi-enclosed European Seas-Interactions between Major Compartments" April 08-10, 2005, Bucharest*

Simescu D., Stanica A., Panin N., Bondar C., Dan S., Maximov G., Simbotin A., Diaconeasa D., Ungureanu V., (2005) "Researches regarding Romanian Littoral Beaches at South of Constantza Port, carried out in the Frame of the MENER Program", Volume of Abstracts, p. 33, *Euro-EcoGeoCentre International symposium "Semi-enclosed European Seas-Interactions between Major Compartments" April 08-10, 2005, Bucharest*

Olteanu, R., Jipa, D., (2005) "Dacian semi-inclosed Paratethyan basin. Environmental evolution during the Upper Neogene", Volume of Abstracts, p. 15, *Euro-EcoGeoCentre International symposium "Semi-enclosed European Seas-Interactions between Major Compartments" April 08-10, 2005, Bucharest*

Olariu C., Ungureanu G.V., Stanica A., (2005) "Variation of the Sf. Gheorghe river effluent plume using remote sensing, Danube Delta - Black Sea", *4th Congress of the Balkan Geophysical Society "RSG-BGS / EAGE & SEG / EGU & AGU Bucharest 2005" October, 2005, Bucharest*

Jipa, D., Olteanu, R., (2005) "Birth development and closure of the Dacian Basin (Upper Neogene, Romania)", Conference volume, Supplement to Jour, Balkan Geophys. Soc. vol. 8 p. 72-75, *4th Congress of the Balkan Geophysical Society, 2005, Bucharest*

Opreanu P., (2005) "Preliminary data concerning some quantitative and qualitative changes in the Ostracoda (Crustacea) populations in the north-western Black Sea", Volume of abstracts , p. 13, *Euro-EcoGeoCentre Workshop "Change in the structure and functioning of the open sea ecosystems", October 27-29, 2005, Snagov*

Gomoiu M. T., Secrieru D., Oaie Gh., Opreanu P., Paraschiv G.M., Begun T., Teaca A., Sosnovschi E., (2005) "GeoEcoMar contributions to the understanding of the NW Black Sea Ecosystems", Volume of abstracts, p. 7, *Euro-EcoGeoCentre Workshop "Change in the structure and functioning of the open sea ecosystems", October 27-29, 2005, Snagov*

Banaru D., Harmelin-Vivien M., Gomoiu M.T., (2005) „Use of stable isotopes signature (δ13C & δ15N) of water, sediment and some organism from the Black Sea Danubian Area – New approach for understanding the influence of terrestrial discharge upon the marine ecosystem", Volume of abstracts, p. 3, *Euro-EcoGeoCentre Workshop "Change in the structure and functioning of the open sea ecosystems", October 27-29, 2005, Snagov*

Bondar C. (2005) "On water and salinity paleobalance of the Black Sea Basin", Volume of abstracts, p. 4, *Euro-EcoGeoCentre Workshop "Change in the structure and functioning of the open sea ecosystems", October 27-29, 2005, Snagov*

Ion G., Ion E., (2005) „Gas hydrates and fluids – factors in the evolution of sedimentary structures", Volume of abstracts, p. 8, *Euro-EcoGeoCentre Workshop "Change in the structure and functioning of the open sea ecosystems", October 27-29, 2005, Snagov*

Jipa D., Panin N., (2005) „Mechanisms of sandy sediment accumulation in the Black Sea Abyssal Zone (Quaternary)", Volume of abstracts, p. 10, *Euro-EcoGeoCentre Workshop "Change in the structure and functioning of the open sea ecosystems", October 27-29, 2005, Snagov*

Melinte M.C., (2005) „Biological response of calcareous nannoplankton to climatic changes and sea-level fluctuations", Volume of abstracts, p. 11, *Euro-EcoGeoCentre Workshop "Change in the structure and functioning of the open sea ecosystems", October 27-29, 2005, Snagov*

Melinte M.C., Suc J.-P., Clauzon G., Cagatay N., Popescu S., (2005) „Changes in the functioning of marine ecosystems. Case study: The Messinian-Zanclean of NW Turkey", Volume of abstracts, p. 12, *Euro-EcoGeoCentre Workshop "Change in the structure and functioning of the open sea ecosystems", October 27-29, 2005, Snagov*

Panin N., Strechie C., (2005) „The Black Sea development and consequent environmental changes in the last ~ 100.000 years", Volume of abstracts, p. 14, *Euro-EcoGeoCentre Workshop "Change in the structure and functioning of the open sea ecosystems", October 27-29, 2005, Snagov*

Jipa D., Olteanu R., (2005) „Dacian Basin during Sarmatian time: open sea or marine bay?", Volume of abstracts, p.9, *Euro-EcoGeoCentre Workshop "Change in the structure and functioning of the open sea ecosystems", October 27-29, 2005, Snagov*

Gomoiu M.T., **(2005)** "Fascination of shells, fascination of snails. Conchology – malacology at the Black Sea", Abstracts volume, *International Congress of Malacology, Sibiu*

Gomoiu M.T., **Begun T., Paraschiv G., Opreanu P., Sosnovschi E., (2005)** "Contributions to the knowledge of the Mollusk populations in the Razelm - Sinoe lagoonal complex", Abstracts volume, *International Congress of Malacology, Sibiu*

Teaca A., Gomoiu M.T., **(2005)** "Contributions to the knowledge of the mollusk populations on the shallow hard bottom of the Romanian Black Sea Coast"**,** p: 72-75, *International Congress of Malacology, Sibiu*

Jugaru, L., Provansal, M., Panin, N., Dussouillez, P., 2006. Apports des Systemes d'Information Geographiques a la perception des changements morphodynamiques (1970-2000) dans le delta du Danube. Le cas du bras de Saint-George. GEO-ECO-MARINA, 12 : 29-42.

Melinte M.C., **(2007)** "Latest Jurassic to Earliest Cretaceous Paleoenvironmental Changes in the Southern Carpathians (Romania): Regional Record of the Late Valanginian Nutrification Event" *(in press), London, Cretaceous Research*

Melinte M.C., (2007) Bojar. A.-V., "Biostratigraphic and isotopic record of the Cenomanian-Turonian deposits in the Ohaba-Ponor section (SW Haţeg, Romania)" *(in press), London, Cretaceous Research*

Melinte M.C., (2007) Lamolda M., "Coniacian-Santonian boundary in Romania and comparison with other European areas", 56, *(in press), London, Cretaceous Research*

Melinte M.C., Lamolda M., (2007) "Calcareous nannofossil biostratigraphy of the Coniacian/Santonian boundary interval in Romania and comparison with other European regions", *(in press), London, Cretaceous Research*

Popescu M.S., Melinte M.C., Suc J.-P., Clauzon G., Quillevéré F., Sütö-Szentai M., (2007) "Earliest Zanclean age for the Colombacci and uppermost Di Tetto formations of the "latest Messinian"northern Apennines: New palaeoenvironmental data from the Maccarone section (Marche Province, Italy)" *(in press), Géobios*

Duque-Bolero, F., Maurrasse, F., Melinte M.C., (2007) "Cyclic sedimentation from the Cenomanian/Turonian of NE Mexico: its relationship to Milankovitch and solar cycles" *(in press), London, Earth and Planetary Science Letters*

Panin N., Popescu I., (2007) "Research in the Western Sector. The northwestern Black Sea: climatic and sea-level changes in the Late Quaternary", p: 387-404, *"The Black Sea Flood Question: Changes in Coastline, Climate and Human Settlement", Ed. by Valentina Yanko-Hombach, Allan S. Gilbert, Nicolae Panin, Pavel M. Dolukhanov, Published by Springer, P.O. Box 17, 3300 AA Dordrecht, The Netherlands*

Dan, S., Stive, M.J.F., Walstra, D.J.R., Panin, N., 2009. Wave climate, coastal sediment budget and shoreline changes for the Danube Delta. Marine Geology, 262 (1-4): 39-49.

Jugaru Tiron, L., Le Coz, J., Provansal, M., Panin, N., Raccasi, G., Dramais, G., Dussouillez, 2009. Flow and sediment processes in a cutoff meander of the Danube Delta during episodic flooding. Geomorphology, 106 (3-4): 186-197.

Stănică, A., Pan in, N., 2009. Present evolution and future predictions for the deltaic coastal zone between the Sulina and Sf. Gheorghe Danube river mouths (Romania). Geomorphology, 107, (1-2): 41-46.

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ROMANIAN NATIONAL COMMITTEE OF GEODESY AND GEOPHYSICS

NATIONAL REPORT ON GEODETIC AND GEOPHYSICAL ACTIVITIES IN ROMANIA

2007-2010

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NATIONAL REPORT IN SEISMOLOGY AND PHYSICS OF THE EARTH'S INTERIOR

IASPEI ACTIVITIES IN ROMANIA
2007-2010

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Secretary:
Dr. Iren-Adelina Moldovan [1)] iren@infp.ro

1) National Institute for Earth Physics
12, Calugareni Street, P.O. Box MG-2, RO-077125
Magurele, Ilfov, Romania
Tel: +40-21-4050670; Fax: +40-21-4050673

2) Institute of Geodynamics "Sabba S. Stefanescu"
19-21 Jean-Louis Calderon, RO- 020032
Bucharest 37, Romania
Tel: +40-21-317 21 26; Fax: +40-21-317 21 20

Involved Institutions
National Institute for Earth Physics
Institute of Geodynamics "Sabba S. Stefanescu"
University of Bucharest, Faculty of Geology and Geophysics
University of Bucharest, Faculty of Physics

FOREWORD

The present report describes the activities carried out in Romania, under the supervision of the "Seismology and Physics of the Earth's" section of the National Romanian Committee of Geodesy and Geophysics, organized in four main domains: Seismology, Structure of the Lithosphere, Engineering Seismology and Heat Flow Studies.

Romania is characterized by moderate-to-high seismic activity, experiencing 3-4 destroying earthquakes per century, located at the Carpathian Arc Bend, in the Vrancea region, in a particularly confined focal volume at intermediate depths. The strong earthquakes generated here are significantly affecting extended areas in Europe. From time to time, earthquakes in the 5-6 magnitude range are generated in the crustal domain, as well, mostly in the regions of contact between platform and orogen zones.

Since Seismology is a data-driven science, special efforts were made in the last decade to develop and improve the data management, including acquisition, processing and rapid exchange of seismic information. The National Institute for Earth Physics is operating now a network of 21 seismic stations connected in real time to the National Data Centre in Bucharest. Part of the stations belongs to GEOFON network (one station), VEBSN network (6 stations) and AFTAC (one array) and is continuously exchanging data with other seismological centres. This network is designed first to monitor natural and induced seismicity, and to rapid disseminate high-level information in case of large earthquakes. At the same time, a strong motion network of 46 high quality digital accelerometers has been recently installed in the framework of the Romanian-German co-operation.

In the field of **Seismological Research**, important achievements were obtained during 2003-2006 period in the following domains:

* monitoring of seismicity;
* seismic source physics;
* wave propagation;
* seismotectonics;
* seismic hazard of Romania by probabilistic and deterministic approaches;
* earthquake prediction;
* geotechnical investigations for site evaluation;

In the field of **Engineering seismology** significant efforts were made to predict the peak values and spectral characteristics of the strong motion in large urban areas, like Bucharest. At the same time, important efforts were made to determine the site effects and microzonation maps for most of the cities from Romania.

In the field of **Lithosphere Structure** the most significant results are referring to the deep structure of the lithosphere, determined from seismic data correlated with the available geological and geophysical data.

In the frame of **Heat Flow Studies**, the geothermal structure and evolution of the lithosphere in various tectonic units, as well as problems of borehole climatology, such as inversion of borehole temperature data and air-soil heat transfer, were tackled.

Prof. Dr. Dumitru ENESCU Dr. Mircea RADULIAN

PART I: SEISMOLOGY

The National Institute for Earth Physics (NIEP, http://www.infp.ro) is the leading institution for seismology in Romania, responsible for the earthquake monitoring of the territory and basic and applied researches in seismology. It was established in 1977 as an organization for research and development in Earth sciences. Now is coordinated by the Romanian Ministry for Education and Research, being mainly financed by contracts from public sources. Structure of the NIEP is 6 departments, 34 researchers (18 PhD), 56 technical people and 16 PhD students. It has a wide background in earth sciences research, with focus on seismic source and seismotectonics, lithosphere structure and dynamics, seismic hazard assessment, site effects and microzonation, engineering seismology, assessment and mitigation of seismic risk.

The seismological research in Romania during the 2007-2010 time interval has been focused on seven main directions:

1) **historical seismology and macroseismology**
2) **monitoring of natural and induced seismicity**
3) **seismic source physics**
4) **wave propagation**
5) **seismotectonics**
6) **seismic hazard**
7) **earthquake prediction**

Since Romania is an earthquake prone area, it is of crucial importance to obtain quantitative information needed for seismic risk mitigation and related public policies and seismic safety measures. The most damaging earthquakes in Romania concentrate in Vrancea region, located at the sharp bend of the Eastern Carpathians chain, in a well-confined focal volume at intermediate depths (60 to 200 km). The extremely peculiar seismotectonics and geodynamic processes in this area focused the attention of numerous seismologists. At the same time, taking into consideration the dramatic social and economical implications of the Vrancea earthquakes, major efforts have been made to seismic hazard assessment and seismic microzonation of the large urban areas affected by these earthquakes, and first of all of Bucharest, for long-term protection against earthquakes.

Historical seismology and macroseismology

Contemporary seismology must respond to the new necessity for security of modern and important constructions (N.P.P., dams etc.). This desideratum is possible through ample study of historical earthquakes and their physical characteristics. Recently, within the historical seismology field there was made a significant step which implied the collecting of a large amount of historical records regarding the occurrence of many of the major Romanian earthquakes. The research was made, mainly to improve the data on the strongest earthquakes on the Romanian territory, as they are mostly responsible for maximum observed intensities and have great importance for seismic hazard assessment and implicitly for anti-seismic design. Also a great attention was paid to those earthquakes of which we didn't have enough information. New records were found in some archives which have not been investigated until now. Some of the discovered information indicated the occurrence of seismic events unknown so far. All the historical information have been evaluated and reevaluated

(Constantin et al., 2009: http://www.nipne.ro/rjp/2009_54_1-2/0239_0249.pdf, Constantin et al., 2011: http://www.nipne.ro/rjp/accpaps/074-Constab76413f49de894eb9cdc.pdf). Different magnitude and depth estimations were calibrated against observation data. These results were obtained in the framework of the project "Fundamental Research of Historical Seismology and Paleoseismology needed for the assessment of long-term seismicity and seismic hazard" (2007-2013 National Strategic Plan for Research, Development and Innovation II) with the participation of two partners (ICM and GIR). Through this project we've succeeded the achievement of a database as complete as possible with the purpose of a more real seismic hazard assessment, which may lead to a significant reducing of the seismic risk.

In order to set the basis of some rigorous standards and norms of anti-seismic design, capable of assuring maximum security to buildings, in accordance with the idea of promoting and developing a national system, compatible with the European standardizing systems, we initiated a very large research activity especially of reevaluating and harmonizing of the macroseismic maps of the significant earthquakes occurred on the Romanian territory (see Pantea & Constantin, 2011: http://www.nipne.ro/rjp/accpaps/026-Pantea822732945cd813aa3d46.pdf). Taking this into consideration, we obtained important results, in the field of macroseismology, in the framework of the project "Seismic macrozoning of the territory of Romania, based on revalued macroseismic intensities corroborated with complex geological and geophysical data" (2007-2013 National Strategic Plan for Research, Development and Innovation II) with the participation of two partners (GIR and UB-FGG).

Monitoring of natural and induced seismicity

The National Institute for Earth Physics (NIEP) operates a real-time seismic network designed to monitor the seismic activity on the Romanian territory, dominated by the Vrancea intermediate-depth (60-200 km) earthquakes.

The reduction of earthquakes impact on society is conditioned by the existence of a large number of high-quality observational data. The development in the last few years of the seismic network and of an advanced acquisition system are essential factors to achieve this goal.

Starting with 2002 the modernization of Romanian seismic network was based on the installation of new seismic stations acquired in real time. This network consists of digital seismic stations equipped with acceleration sensors (EpiSensor) and velocity sensors (broadband – STS2, CMG3ESP, KS2000, CMG40-T or short period – MP, SH-1, S13, Mark Product, etc).

The real-time digital seismic network consists of 82 seismic stations with three components and 2 arrays: BURAR with 12 elements and PLOR with 7 elements. All data recorded by this network are transmitted in real time at NIEP for automatic data processing, analysis and dissemination. The seismic stations locations and equipment characteristics for the real-time Romanian Seismic Network are shown in Table 1.

Table 1. Real-time stations existing in Romania

Station Code	Latitude (^{0}N)	Longitude (^{0}E)	Elevation (m)	Recording equipment type	Data Transfer mode
ARCR	47.085	24.353	385	Q330+MARMOT, STS2 + Episensor	Real Time
ARR	45.365	24.633	871	Q330, CMG3ESP + Episensor	Real Time

Station Code	Latitude (^{0}N)	Longitude (^{0}E)	Elevation (m)	Recording equipment type	Data Transfer mode
AMRR	44.610	27.335	67	Q330+MARMOT S13, SH1 + Episensor	Real Time
BANR	45.382	21.137	80	Q330+MARMOT, KS200 + Episensor	Real Time
BAPR	44.405	26.119	103	K2 Digitizer, Mark + Episensor	Real Time
BMR	47.672	23.496	294	Q330, CMG40T+ Episensor	Real Time
BSTR	44.445	26.098	125	K2 Digitizer, Mark + Episensor	Real Time
BTMR	44.437	26.106	140	K2 Digitizer, S13, SH1 + Episensor	Real Time
BUC	44.410	26.093	82	K2 Digitizer, Mark + Episensor	Real Time
BUC1	44.347	26.028	77	K2 Digitizer, Mark + Episensor	Real Time
BURAR	47.644	25.200	1216	9 SP - GS21, 1 BB - KS5400, 5 CMG40T	Real Time
BVCR	44.430	26.101	112	K2 Digitizer ,Mark + Episensor	Real Time
BZS	45.618	21.640	260	Q330, STS2 + Episensor	Real Time
CFR	45.178	28.136	52	Q330+MARMOT, CMG40T + Episensor	Real Time
CIOR	44.448	25.879	138	Q330+MARMOT, Mark + Episensor	Real Time
CJR	46.713	23.598	750	Q330+MARMOT, CMG3ESP+ Episensor	Real Time
CNCR	44,.43	26,.61	105	K2 Digitizer ,+ Episensor	Real Time
CRAR	44.325	23.799	125	Q330, CMG3ESP + Episensor	Real Time
CVD	44.351	28.039	153	Q330, Mark + Episensor	Real Time
CVD1	44.320	28.062	50	Q330, CMG40T + Episensor	Real Time
DEV	45.887	22.898	250	Q330, CMG40T + Episensor	Real Time
DOPR	45.967	25.388	526	Q330+MARMOT, STS2 + Episensor	Real Time
DRGR	46,.791	22.711	921	Q330, KS2000 + Episensor	Real Time
EFOR	44.075	28.632	103	Q330+MARMOT, Ranger + Episensor	Real Time
GIUM	45.485	28.208	106	K2 Digitizer ,CMG40T + Episensor	Real Time
GRER	45.380	26.974	276	Q330+MARMOT, S13, SH1 + Episensor	Real Time
GHRR	46.060	27.408	212	Q330+MARMOT, CMG3ESP + Episensor	Real Time
GOLR	44.843	24.981	301	Q330+MARMOT, S13, SH1 + Episensor	Real Time
GZR	45.393	22.776	850	Q330+MARMOT, STS2 + Episensor	Real Time
HARR	44.689	27.930	118	Q330+MARMOT, S13 + Episensor	Real Time
HUMR	44.528	24.980	247	Q330+MARMOT, CMG40T + Episensor	Real Time
IAS	47.193	27.553	160	Q330+MARMOT, KS2000 + Episensor	Real Time
INCR	44.441	26.161	88	Q330, MARK + Episensor	Real Time
ISR	45.118	26.543	750	Q330+MARMOT, CMG3ESP + Episensor	Real Time
KIS	46.997	28.817	185	Q330, CMG40T + Episensor	Real Time
LEOM	46.473	28.246	52	K2 Digitizer ,CMG40T + Episensor	Real Time
LOT	45.446	23.769	1240	Q330+MARMOT, STS2 + Episensor	Real Time
MANR	43.816	28.587	71.9	Q330+MARMOT, MARK + Episensor	Real Time
MDB	46.149	24.376	375	K2 Digitizer , MARK+ Episensor	Real Time
MLR	45.490	25.945	1360	Q330, STS2 + Episensor	Real Time
MSAB	44.089	27.826	124	Q330, CMG40T + Episensor	Real Time
MTUR	45.234	25.073	1018	Q330+MARMOT, S13 + Episensor	Real Time
ODBI	45.763	27.055	181	Q330, RANGER + Episensor	Real Time
PETR	45.723	27.231	86	K2 Digitizer, KS2000+ Episensor	Real Time
PGOR	44.919	26.976	98	Q330+MARMOT, S13, SH1 + Episensor	Real Time
PLAR	44.914	26.027	146	Q330+MARMOT, MARK + Episensor	Real Time
PLSP4	45.851	26.649	672	Q330, GS21	Real Time
PLOR	45.851	26.649	657	Q330, STS2, 6 CMG40T + 4 Episensor	Real Time
PRAR	47.361	26.227	451	Q330+MARMOT, MARK + Episensor	Real Time
RMGR	44.662	22.692	113	Q330+MARMOT, MARK + Episensor	Real Time
RMVG	45.036	24.284	260	K2 Digitizer ,MARK + Episensor	Real Time
SECR	45.035	26.067	417	K2 Digitizer , S13, SH1 + Episensor	Real Time
SIRR	46.265	21.663	480	Q330+MARMOT, CMG40T + Episensor	Real Time
SIBR	45.809	24.175	463	Q330, S13 + Episensor	Real Time
SRE	44.660	23.203	335	Q330+MARMOT, MARK + Episensor	Real Time
SORM	48.135	28.351	64	Q330, CMG40T + Episensor	Real Time
SULR	44.677	26.252	73	Q330, KS2000 + Episensor	Real Time
TESR	46.511	26.648	372	Q330+MARMOT, STS2 + Episensor	Real Time
TIM	45.736	21.221	88	K2 Digitizer ,S13, SH1 + Episensor	Real Time
TLB	44.585	28.041	60	Q330, CMG40T + Episensor	Real Time

Station Code	Latitude (^{0}N)	Longitude (^{0}E)	Elevation (m)	Recording equipment type	Data Transfer mode
TNR	45.652	24.273	519	Q330, S13	Real Time
TIRR	44.458	28.412	77	PS6-24, STS2 + Episensor	Real Time
TLCR	45.186	28.815	73	Q330+MARMOT, MARK + Episensor	Real Time
VOIR	45.437	25.049	969	Q330, STS2 + Episensor	Real Time
VRI	45.865	26.727	472	Q330, STS2 + Episensor	Real Time
ZIMR	43.657	25.365	74	Q330, Ranger + Episensor	Real Time

The remote seismological stations have three-component seismometers for weak motions and three-component accelerometers for strong motion.

In cooperation with the Institute of Geophysics and Seismology Kishinev, Republic of Moldova, we installed three seismic stations in Republic of Moldova. The seismic stations were installed at Leova (LEOM), Giurgiulesti (GIUM) and Milestii Mici (MILM). Also in collaboration with the same institute two more seismic stations were installed in Kishinev (KIS) and Soroca (SORM). All the data from the seismic stations installed on the Republic of Moldova territory are received in real time at NIEP Data Centre using seedlink connection.

The primary goal of the real-time seismic network is to provide earthquakes parameters from more broadband stations with high dynamic range in order to compute more rapidly and with better accuracy the location and magnitude of the earthquakes. Seedlink and Antelope^{TM} program packages are used for real-time (RT) acquisition and data exchange.

The real-time digital seismic network developed by NIEP is represented in Figure 1. Near-future strategy includes installing additional broad band stations in the central and western part of Romania and other 40 strong motion stations in Bucharest city.

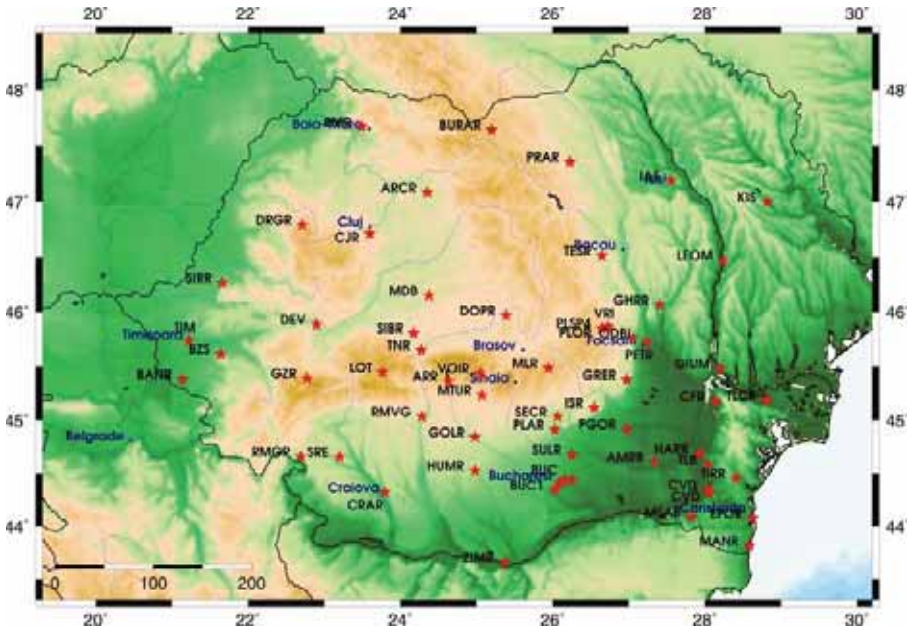
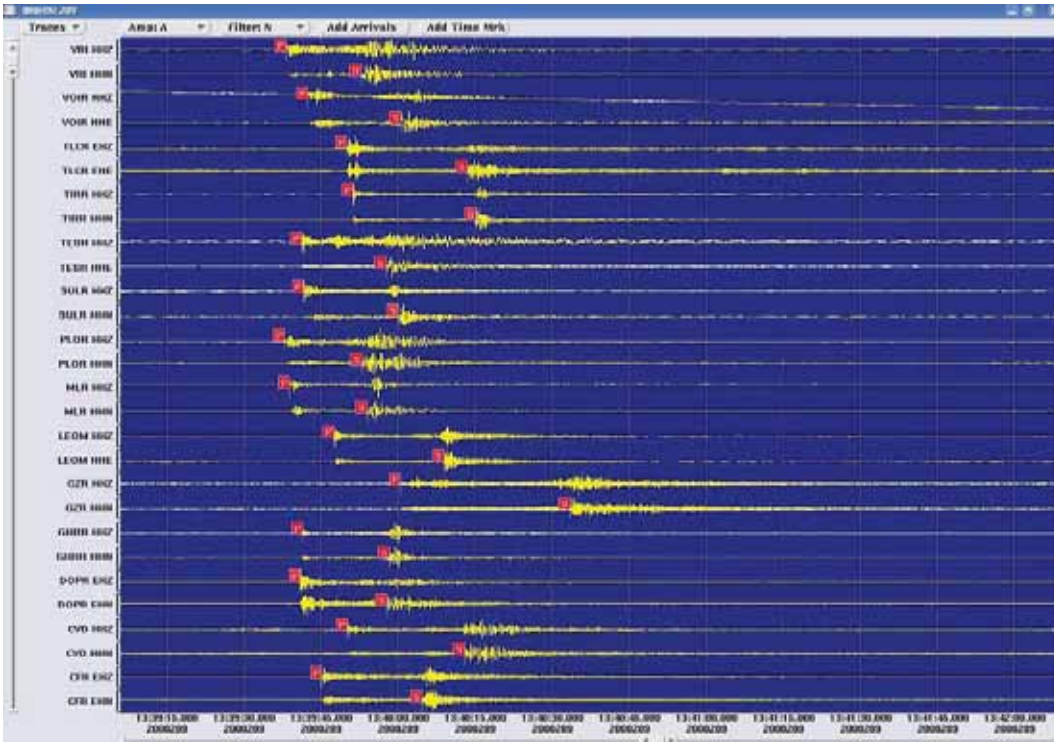


Figure 1. Real Time Seismic Network of Romania

A completely automated seismological system Antelope (developed by BRTT) (Fig. 2) runs at the Data Center in Magurele. The Antelope^{TM} data acquisition and processing software run on two workstations for real-time and post processing. The Antelope real-time system provides automatic event detection, arrival picking, event location and magnitude calculation. It provides graphical display and automatic location within near real-time after a local, regional or teleseismic event occurred (Neagoe and Ionescu, 2009).



Figures 2. Example of manual data processing with Antelope software

SeisComP 3, another automated system, run at NIEP providing the following features: data acquisition, data quality control, real-time data exchange, network status monitoring, real-time data processing, issuing event alerts, waveform archiving, waveform data distribution, automatic event detection and location, easy access to relevant information about stations, waveform and recent earthquakes (Fig. 3).

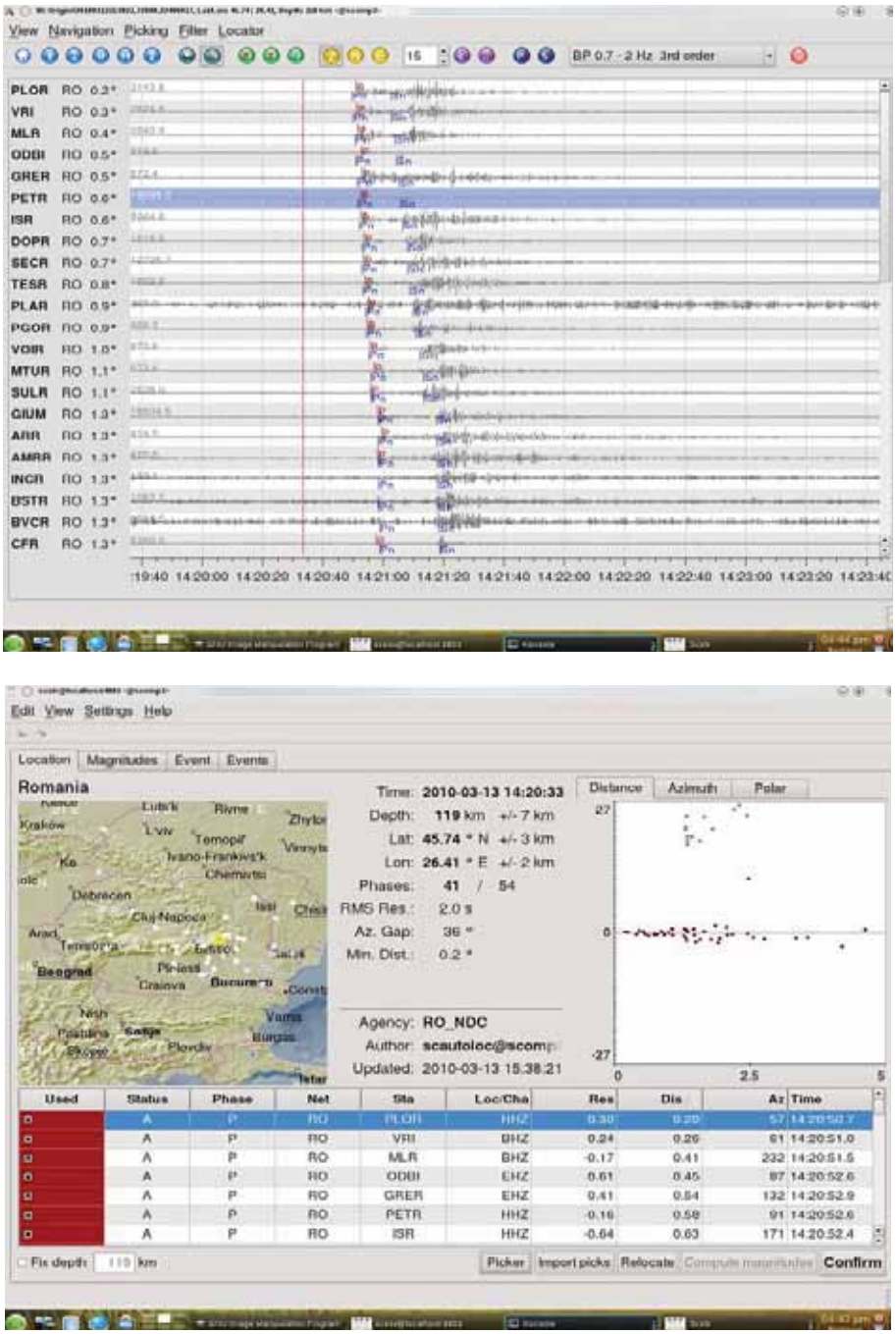


Figure 3. – Automatic detection (up) and seismic data processing (down) using SeiscomP 3 Software

The Romanian Seismic Network exchanges data with international organizations like ORFEUS and IRIS and with data centers from other European countries via Internet. The provided data consist in near real-time waveform data from 6 broadband stations: Iasi (IAS), Dragan (DRGR), Craiova (CRAR), Bucharest (BUC1), Vrincioaia (VRI), Muntele Rosu (MLR) and Bucovina (BURAR) array (Fig. 4).

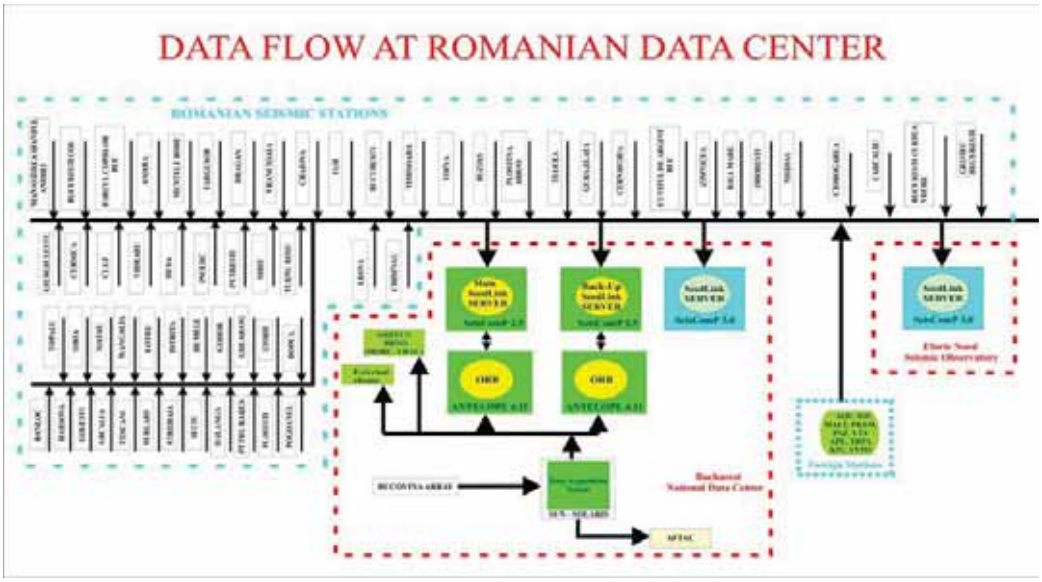


Figure 4. Data Flow at Romania Data Center

For automated data acquisition from seismic stations at NDC two servers are used, one main server which use Antelope 4.11 software and the second one with Seiscomp 3 program, considered as back-up. For data acquisition at seismic stations we use for 34 stations Antelope 8.0.2 program who runs on a pc light called Marmot and for other 48 stations a seedlink server is used from the SeisComP 2.1 package. For data acquisition from the seismic stations we use seedlink protocol from Seiscomp 2.5 package with chain pluggin or orb pluggin.

Both systems produced information about local and global parameters of earthquakes. In addition, Antelope is used for manual processing (association events, magnitude computation, database, sending seismic bulletins, calculation of PGA and PGV, etc.), generating ShakeMap products and interacts with international data centers.

In order to make all this information easily available across the Web and also lay the grounds for a more modular and flexible development environment the National Data Center developed tools to enable centralizing of seismological data from software such Antelope

Because Antelope is using a dedicated database system (Datascope, a database system based on text files) we moved the data to a more general-purpose database , Mysql, which acts like a hub between different acquisition systems used in the data center. Mysql database also provides better connectivity at no expense in security (Fig. 5).

Mirroring certain data to MySQL also allows the National Data Center to easily share information to the public via the new application which is being developed and also mix in data collected from the public (e.g. information about the damages observed after an earthquake which internally is being used to produce macroseismic intensity indices which are then stored in the database and also made available via the web application). For internal usage there is also a web application which uses data stored in the database and displays earthquake information like location, magnitude and depth in semi-real-time.

Another usage of the data collected is to create and maintain contact lists to which the data center sends notifications (SMS and emails) based on the earthquake parameters.

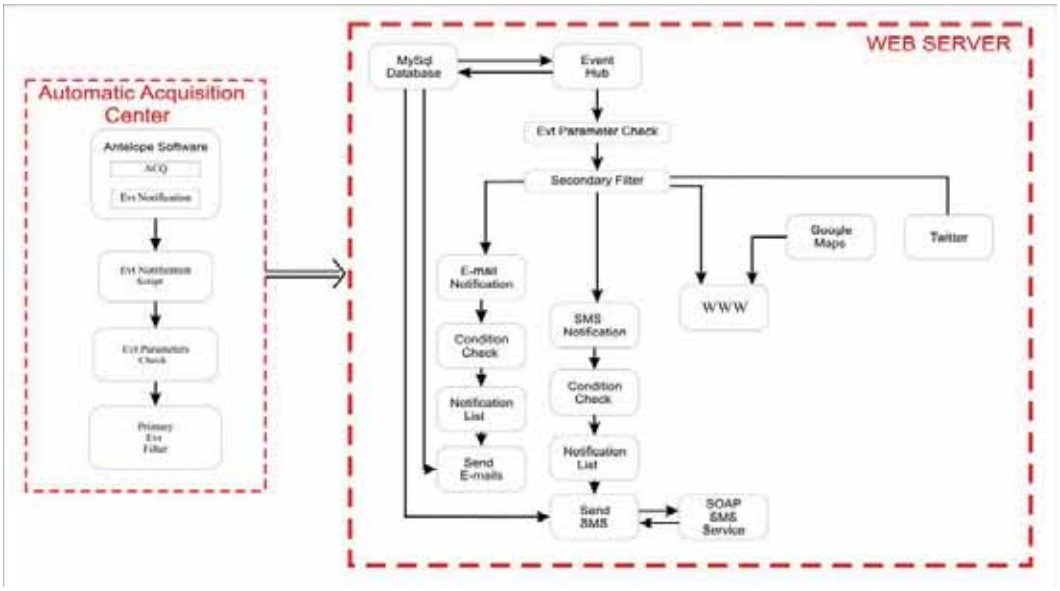


Figure 5. Web Server Configuration

NIEP has more than 25 years of experience in global seismological monitoring in support of the Comprehensive Nuclear-Test-Ban Treaty (CTBT). It is participating to the international verification activities with the seismic station Muntele Rosu, which was included in the auxiliary seismic network of the International Monitoring System, and with the operation of the Romania's National Data Centre (NDC). In order to ensure Romania's technical contribution to CTBT at the operational standards required by the Treaty, since 1999 an important upgrade has been under development both at the seismic station Muntele Roşu and at the NDC, involving both technical cooperation with the Government of Japan and technical assistance from the CTBT Organization. Hence, in the fall of 2001 a new seismic monitoring system was installed and is now fully operational, by recording continuous earth motion data at Muntele Rosu site and transmitting these data in real-time to the facilities in Bucharest, in the framework of the Japan International Cooperation Agency project „Technical Cooperation for Seismic Monitoring System in Romania".

Among the most significant achievements in the past years we mention:

- A fully automated and networked system dedicated to digital acquisition and real-time processing of seismological data, as well as to rapid exchange of earthquake information has been implemented. At present, NIEP participates with 6 BB stations to the Virtual European Broadband Network and is ready to significantly increase its contribution to the objectives of the research infrastructures integrating activity, one of the main domain of the Structuring the European Research Area.
- The Romanian Earthquake catalogue (ROMPLUS) comprises updated, complete, user-friendly and rapidly accessible earthquake information. The catalog refers to earthquakes occurred on Romanian territory and in the neighbour boundaries since 984 up to present, including information related to locations and other source parameters, as well as links to waveforms of strong earthquakes. Seismicity analysis is continuously performed implying updating of the earthquake catalogue, spatial-temporal-magnitude patterns in different seismic regions of Romania, earthquake sequences [16]. Interpretation and reconsidering of historical data constitutes an important issue for the seismic hazard investigation.

- Field investigations of microearthquakes and earthquake sequences;
- Research on natural and induced seismicity.

Future Developments of the Romanian Monitoring Network

The Romanian Seismic Network will be enlarged by the installation of new stations that will provide seismic data in real-time to the data center. The upgraded network will provide new data for site effects studies and microzonation purposes and will be used for developing and evaluations of the Shakemaps for all country and in the Bucharest area.

For future development, amongst others, the data center plans to compare the locations provided by Antelope 4.11 and Seiscomp3 using the same velocity global model.

Seismic source physics

Modelling the earthquake source is one of the main tasks with the long-term goal to construct a quantitative physical model for the entire earthquake process, including tectonic stress accumulation, nucleation of rupture, and the dynamics of the rupture propagation and cessation. Integration of the multiple aspects of the earthquake phenomena, from the small scale (dynamic rupture) to large-scale (plate boundary tectonics) processes is becoming of increasing interest for many researchers.

The increase of the seismic network of the NIEP after 2007 in number and quality of instruments, the integration in the European virtual network have contributed to a better covering of the Romania territory and provided higher-quality database for seismic source studies. Besides the Vrancea intermediate-depth focus, where the most damaging earthquakes of Romania are generated, systematic investigations have been carried out in other seismogenic zones on the territory. A special focus has been drawn to cross-border integration data in the framework of a few European projects (CEI projects no. 1202.001-07, 1202.136-07, 1202.038-09; SHARE project no. 226967; DACEA project no. 2 (1I) – MIS ETC 636).

Waveform inversion for small to large earthquakes have been applied using local and teleseismic recordings in order to retrieve source parameters and focal mechanism. The recent advance in both observations and computer simulations has strongly increased our performance in constraining the source parameters over a broad magnitude range. Instrumental recordings from historical events have been digitized and corrected to be used in re-assessing the source parameters of historical significant earthquakes. This kind of recovery of information from the past can be crucial for seismic hazard evaluation and seismic cycle analysis.

Another approach to understand the way the seismic cycle in the Vrancea region evolves has been the stress transfer modelling. Apparently, the major Vrancea earthquakes are generated alternatively in two separated segments on depth and this behaviour would be in favour of a stress coupling among these segments. Stress transfer plays a major role also in generating aftershock sequences.

Seismic source scaling properties, seismicity clustering and geometrical alignments have been investigated in correlation with the tectonics, geodynamics and other geophysical properties. Possible coupling between the Vrancea subcrustal seismic activity and shallow seismicity in the overlying crust has been explored in a few studies. A lot of discussion has been addressed to issues related to the geotectonical models in order to explain the particular seismic activity at the South-Eastern Carpathians arc bend: oceanic slab detachment, continental delamination, deep instable gravitational root, etc., and their consequences on crustal movements, orogen features, magmatism, subsidence, heat flow and gravity.

As concerns the seismicity in the crust, many investigations have been carried out in order to define potentially active faults and their geometric and dynamic parameters. These parameters constitute basic input data for seismic hazard evaluation. Numerical techniques have been proposed to simulate earthquake process in the Vrancea seismic source and to generate synthetic earthquake catalogues.

One of the main targets of the NIEP is to model the influence of the seismic source on seismic hazard distribution and to simulate the strong ground motion characteristics in dense-populated areas of Romania, and first of all in Bucharest. The relative deconvolution methods, like spectral ratios or empirical Green's function deconvolution were applied to retrieve the source parameters. Implications of the source directivity and focal depth effects upon the strong ground motion distribution have been analyzed as well.

Wave propagation

The seismic wave propagation is the main factor which controls the shape and amplitude of the ground motion as recorded at the Earth's surface. Modelling the propagation of seismic waves through complex three-dimensional structures is one of the most difficult challenges in seismology.

The lateral inhomogeneities in the lithosphere and the local geology beneath the site are critical in shaping the ground motion distribution and subsequently in mapping the seismic hazard.

The analysis of travel times for different body wave phases provides the basic information related to the seismic wave path trajectory and velocity of propagation from the earthquake focus to the observation point. Relative techniques are applied as well, using double-differences and waveform cross-correlation for large sets of earthquake recorded data. S to P converted waves, as recorded by the Romanian seismic network, were investigated to determine the crustal thickness in the SE Carpathians arc bend area.

Seismic tomography using local body wave travel times was carried out to determine three-dimensional velocity structure beneath Romania territory. Of special interest was the tomography imaging for of the Vrancea subducting zone and its neighbourhood. P- and S-wave tomography illuminates a well-defined high-velocity body dipping almost vertically, where intermediate-depth earthquakes are generated. However, the extension of investigation to the west and north shows possible deep lithospheric roots in the South-Eastern Carpathians back-arc region as well. They were tentatively put into correspondence with magmatic activities which are still active there.

The seismic wave attenuation has been investigated using modal summation technique to model the complete synthetic waveforms. This technique has been developed within the Department for Earth Sciences of Trieste for one-dimensional and two-dimensional structural models. The spectral-ratio method has been applied as well to determine lateral variations in seismic wave attenuation.

The data recorded during long-range seismic experiments in Romania along different refraction profiles or by other temporary networks provide important additional information on specific wave propagation. They were designed mostly to investigate the Vrancea region but extended also recently to the west, in the Carpatho-Pannonian region (South Carpathian Project, in cooperation with the University of Leeds).

The receiver functions technique is a tool frequently used to determine the crust and upper mantle structure at regional and global scale. P- and S-wave receiver functions are computed at the broadband stations of the Romania network to estimate vertical structure in the crust and upper mantle.

Anisotropy properties in the seismic wave propagation provides important new information and constraints in the seismotectonic modeling of the Vrancea region (subduction, flow pattern in the upper mantle, slab delamination etc.). Shear-wave splitting is a powerful diagnostic of anisotropy that has been used to detect mantle fabric and flow beneath Vrancea seismic region. This kind of investigation is fundamental for understanding thermal structure in the upper mantle, slab dehydration, melt generation and transport, and slab dynamics. Both SKS and SKKS broadband teleseismic shear waves were analyzed in order to investigate mantle and crust anisotropy properties over country territory. Shear wave splitting let to delay times up to 2 s and is highly variable with a marked change of the fast direction from perpendicular to the Carpathians Arc in the foredeep region to a parallel direction in the Vrancea epicentral area. It was assumed that the anisotropy is caused by specific flows induced by the particular geometry of the lithosphere body descending in the upper mantle.

Another approach to investigate the crustal seismic-velocity structure that has been applied in the last years is the use of surface wave dispersion and the ambient-noise cross-correlation. For pairs of stations the Green's function is computed by cross-correlating long and multiple time series currently recorded by the seismic network. The method takes advantage of avoiding the often highly nonuniform and sporadic distribution of earthquakes and of the increased density of stations after the recent seismic network improving.

Seismotectonics

Several new models of the seismotectonics in the Vrancea seismic region were proposed in the last years. Other studies were focused on the correlation between seismotectonics, earthquake focal mechanism, structure of the deep crust in the seismic active zones of the Carpathians foredeep, Dobrudja and Southern part of the Transylvanian depression.

Focal mechanism solutions were analysed in order to determine the stress field and to correlate with the seismicity.

Implications of paleomagnetic research on seismotectonics in the Carpathians region were studied.

Seismic hazard

The seismic hazard assessment is a crucial step towards mitigation of urban earthquake risk and improvement of disaster prevention management. Vrancea earthquakes are documented for a millennium (since 984 a.c.) and represent very peculiar characteristics. They are a permanent threat for urban areas on the Romanian territory and extended areas in Europe. Bucharest is among the megacities mostly affected by destructive earthquakes. Extensive studies concentrate on the characterisation of the macroseismic field of Romanian earthquakes, such as Vrancea intermediate-depth events, Fagaras and Banat crustal earthquakes.

An essential step was the collecting of seismicity and geotechnical data, including information on historical seismology. Different magnitude estimations were calibrated against observation data. An important parameter necessary to define the seismic hazard evaluation is the maximum magnitude. On the basis of these data, the seismic zoning map of the Romanian territory has been obtained. Finally, the seismic hazard was evaluated by probabilistic and deterministic approaches.

To apply the probabilistic approach, attenuation laws corresponding to Vrancea earthquakes were empirically determined in terms of macroseismic intensity and peak ground acceleration and a maximum magnitude value was prescribed. In parallel, attenuation

relationships for quarry blasts were studied. The seismic hazard assessment in dense-populated geographical regions and subsequently the design of the strategic objectives (dams, nuclear power plants, etc.) are based on the knowledge of the seismicity parameters of the seismogenic sources which can generate ground motion amplitudes above the minimum level considered risky at the specific site and the way the seismic waves propagate between the focus and the site. Extremely vulnerable objectives, like large cities, hidroenergetic dams or nuclear power plants, are present all arround Romania, and not only in the Vrancea intermediate earthquakes action zone. The best example is the western part of Romania, that is not affected by Vrancea intemediate earthquakes and where the crustal seismicity is high. In this part of the country are cities like Timisoara, Arad and Oradea and the "Portile de fier I and II" hidroenergetic dams.

The studies have provided a complete set of information required for a probabilistic assessment of the seismic hazard in Romania relative to the crustal sources: (1) geometrical definition of all seismic sources affecting Romania - Figure 1, (2) estimation of the maximum possible magnitude, (3) estimation of the frequency magnitude relationship, (4) estimation of the attenuation law and, finally, (5) computing PSH with the algorithm of McGuire – Figure 2 (Moldovan.I.A, et. al, 2008 - http://www.nipne.ro/rjp/2008_53_3-4/0575_0592.pdf)

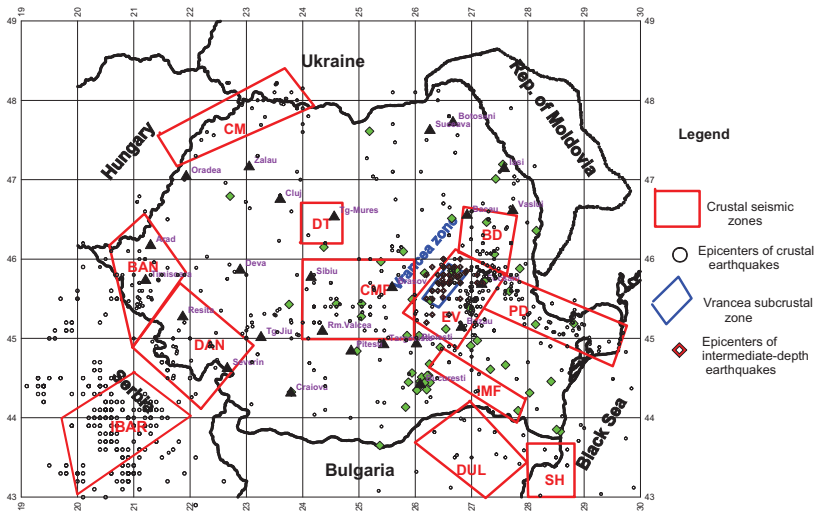


Figure 1. Seismic crustal and intermediate active zones in Romania and adjacent areas and their characteristics

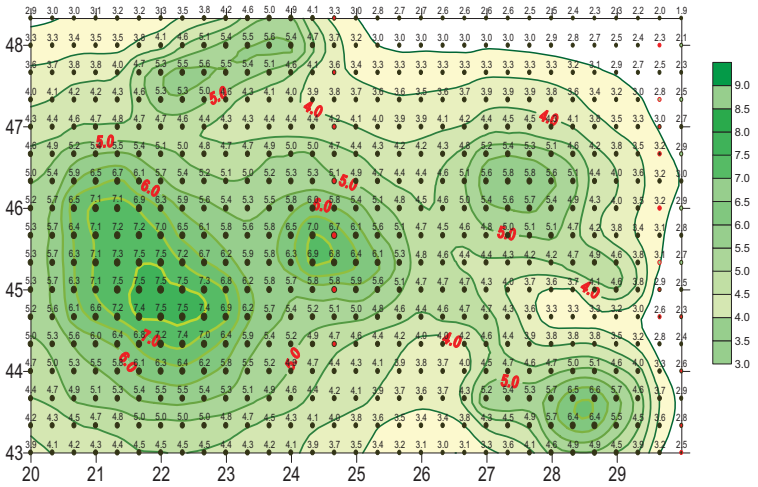


Figure 2. Hazard map for Romanian crustal sources and return periods of 100 years

Recent advances in computer technology make possible the use of the deterministic numerical synthesis of ground motion for seismic hazard calculations. The deterministic approach is completely different and complementary to the probabilistic approach. It addresses some issues largely overlooked in the probabilistic approach: (a) the effect of crustal properties on attenuation are not neglected; (b) the ground motion parameters are derived from synthetic time histories and not from overly simplified attenuation "functions"; (c) the resulting maps are in terms of design parameters directly, and do not require the adaptation of probabilistic maps to design ground motions; (d) such maps address the issue of the deterministic definition of ground motion in a way which permits the generalization to locations in which there is little seismic history.

Earthquake prediction

The failure in predicting the recent strong earthquakes of Northridge, California (1994), Kobe, Japan (1995) and Sahalin (1995) drew attention on the serious limitations of the standard earthquake prediction methods and at the same time provoked seismologists to look for new approaches of this extremely complex problem.

Vrancea seismogenic zone is a conspicuous active area in terms of its extraordinary seismotectonic features, outstanding persistent and highly recurrent seismicity displaying a remarkable regularity in occurrence of large events and manifestation of a plethora of geophysical precursors and severe socio-economic impact with a huge felt area.

Extensive analyses in order to detect premonitory changes in seismicity patterns as possible precursors of the Vrancea strong shocks were performed for past and future earthquakes. Analysis and discussions of a variety of precursory seismicity patterns belonging to all temporal developmental stages of the preparatory geophysical process leading to the major Vrancea earthquake of August 30, 1986 were performed and documented, clearly proving that the earthquake would not has been unexpected .

Different algorithms, like CN and the geostatistical method were applied to predict the strong Vrancea earthquakes. The CN algorithm (Keilis-Borok&Rotwain, 1990) has been initially created for the retrospective analysis of the seismicity patterns which precede the strong earthquakes within California-Nevada regions. The algorithm has been modified so that

it can be applied, without any parameters adjustment, for all the seismic regions in the world. The method consists in analysis of a set of precursory phenomena reflected in the temporal evolution of the seismicity recorded in the earthquake catalogue. Although it was firstly conceived for crustal events, the CN algorithm can be also applied for prognosis of the intermediate earthquakes. The results are different depending on the seismic region which is under study. Thus, in case of Vrancea and Sicily regions where the paleosubduction is one of the possible interpretations, the results are positive (in case of Vrancea the strong earthquakes from 1977, 1986 and 1990 have been predicted), while for intermediate earthquakes within the regions where the subduction is still active, the algorithm can not be applied.

It has been recently experimented the electromagnetic and infrasonic methods to predict Vrancea intermediate-depth earthquakes and look for seismo-electromagnetic and infrasonic precursors. NIEP operates a real-time geomagnetic, electric, electromagnetic VLF/LF and infrasonic network (named The Romanian Electromagnetic Field and Infrasound Monitoring Network - MEMFIS) consisting of 6 stations, 4 of them centered in the Vrancea seismic zone and 2 of them outside the seismogenic zone (Fig. 1).

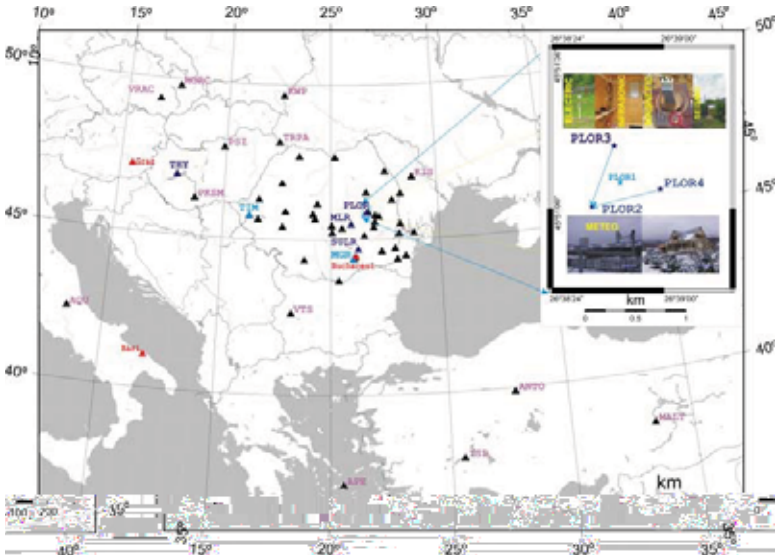


Figure 1. The Romanian seismic (black triangles) and geophysical network (blue and light blue triangles). On the figure are also marked the seismic stations that assures the real time seismic international data exchange and the THY Intermagnet station. In the upper right corner is presented the new Plostina geophysical network comprising seismic, magnetic, electric and infrasonic sensors

The geophysical data (geomagnetic, electric and infrasonic data) are transmitted in an ASCII format, from the stations to the data center, using the TCP/IP protocol. The time resolution is given by the chosen sampling rate, and the accuracy is of +/- 1μs; the measurement resolution is of 24 bits. The data transfer rate is minimum 0.5 Mbits/s. The Romanian data center collects geomagnetic data from all stations of the real-time INTERMAGNET network.

The Romanian Electromagnetic Field and Infrasound Monitoring Network (Table 1 - http://www.infp.ro/cercetare/laboratoare/studii-magnetotelurice-si-bioseismice) is equipped with 4 triaxial fluxgate magnetometers (Bartington – Fig. 2), with seismic sensors in each monitoring site, with 3 infrasound stations – MBAZEL2007 (Fig. 2) and 1 Chaparral Infrasound sensor (Fig. 3), 1 electrometer measuring the vertical atmospheric electric field -

Boltek EFM100 (Fig. 2) and one meteorological station – La Crosse WS-3600 (Fig. 4).

Table 1. The geophysical observatories from the Romanian Electromagnetic Field and Infrasound Monitoring network

Observatory Code	Equipment	Latitude	Longitude	Altitude (m)
MLR	Seismic/magnetic	45.49N	25.95E	1360
SURL (SRL)	Seismic/magnetic	44.68N	26.25E	97
PLOR2	Seismic/magnetic +/- 100uT /infras+/-50PA	45.8502N	26.6438E	694
PLOR3	Seismic/magnetic +/- 100uT /infras+/-50PA	45.8539N	26.6455E	708
PLOR4	Seismic/vertical electric +/-20kV/m Boltek/infras MBAZEL2007+/-50PA / infras Chaparal/meteo	45.8512N	26.6499E	656
AZEL	VLF-LF/ meteo/ infras +/-50PA	44.3548N	26.0282E	76
Dobrudj Observatory	VLF-LF/meteo/vertical elctric Boltek	44.0750N	26.6325E	23

The monitoring sites are located in Vrancea seismic zone (Fig.1) and one of them is located near Bucharest, outside the epicentral area. The geophysical database consists in more than 10 years of geomagnetic recordings at Muntele Rosu Observatory and in one year of multiple geophysical recordings (magnetic, electric and infrasonic) at Plostina Observatory - PLO2, PLO3 and PLO4.

Figure 2. An outer image of PLO3 site and some of the equipments that are involved.in the monitoring process: Data Acquisition System, Microbarometer MBAZEL2007, Triaxial Fluxgate Magnetometer MAG-03MS. However, the Electric Field Monitor EFM-100 is installed at PLO4, in the vicinity of the Weather Station WS-3600.

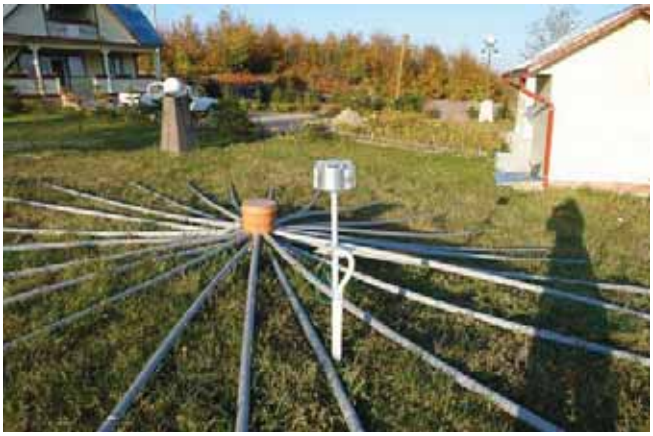


Figure 3. The Chaparal infrasound sensor located at Plostina main building (PLO4)

Figure 4. A part of the meteorological station installed at PLO4

Starting with March 2009 the **Romanian Electromagnetic Field and Infrasound Monitoring Network** was enhanced with VLF and LF antennas (Fig. 5) and one Elettronika receiver (offered by Prof. P.F.Biagi- Department of Physics, University of Bari - http://beta.fisica.uniba.it/infrep/GroupsEU/ROM/Research.aspx) and is operating in the Dobruja Observatory (Table 1). The amplitude and phase data are collected with a 60 s sampling interval.

Figure 5. Magnetic VLF and LF antennas installed on the roof of the Dobrudja Observatory

Participation of the Romanian specialists in national and international projects or programmes

In the past four years the Romanian seismology has been actively contributing to:

(1) *world-wide interdisciplinary international research programs*, such as:

Romania's technical participation in support of the Comprehensive Nuclear-Test-Ban Treaty (CTBT). The National Institute for Earth Physics hosts the Romania's National Data Centre (NDC), with operates the seismic station Cheia-Muntele Rosu (MLR) for its uninterrupted participation to the global monitoring network of the verification system, and co-operates with national and international organizations for upgrading and maintaining. NDC receives and analyzed the data coming from MLR station and from the International Monitoring System, as well the products of the International Data Centre (IDC) from Vienna, Austria.

- "International Lithosphere Program" (ICL) of the Inter-Union Commission for the Lithosphere.
- CERGOP: "The Central European Regional Geodynamics Project".
- NATO Science for Peace Project 981882 (2006 - 2008): "**Site-effect analyses for the earthquake-endangered metropolis Bucharest, Romania"**

The main objective is earthquake risk mitigation and better seismic safety of Bucharest, the capital of Romania. As there is a major gap in knowledge concerning seismic and geotechnical parameters in the shallow (< 100 m), unconsolidated soil and sediment layers, we shall to drill 8 boreholes. By conducting seismic measurements at the boreholes and geotechnical analysis of the core samples, the dynamic parameters of soils and rocks will be determined. These dynamic parameters will be used as input for linear and non-linear waveform modelling to estimate the seismic amplitude amplification at specific sites in Bucharest. These modelled waveforms will be compared and calibrated with observations from seismic stations in the city. The results from the site-effect analysis will be gathered in an updated seismic microzonation map of Bucharest which will be disseminated to the public and especially to the end-users who will introduce our results in the future city planning.

- European Commission Project, FP6-2005-GlOBAL-4, contract no. 036935: **"Seismic Early Warning for Europe"** (SAFER), 2006-2009.

The main goal of the project is to mitigate the seismic risk in Europe. The project puts Europe at the level of the non-European leading countries in this area.
Objectives:

- Development of improved algorithms for fast determination of earthquake source parameters (real time event detection and –location, real-time fault mapping as well as new approaches for fast magnitude/moment determinations based on strong motion data, modern seismic array technology or the concept of energy magnitude)
- Further elaboration of new concepts, including the virtual seismologist, for providing in an evolutionary process real-time alert maps and predicted shake maps within seconds and minutes as well as measured shake maps within a few minutes.
- Development of fast algorithms for damage scenario simulations and improvement of the existing methods for real-time simulation and prediction of earthquake triggered secondary landslides and related losses.

- Deployment of real-time structural control mechanisms for immediate protection of endangered structures and devices.
- Improvement of the reliability of assessments of the aftershock hazard in real-time.
- Applications to selected test cities (Istanbul, Bucharest, Atens, Napoli, Cairo)

• European Commission Project, FP6-2004-infrastructures-5, contract no. 026130 - **"Network of Research Infrastructures for European Seismology"** (NERIES), 2006-2009 (http://www.orfeus-eu.org/neries/neries.htm).

The project involves a consortium of 25 institutes form different countries of Europe.
Objectives:
- Foster the construction of a pan-European-Mediterranean cyber-infrastructure to serve the needs of the scientific seismological community and facilitate future research
- Network the main partners in seismology from the users and infrastructures communities to facilitate cross-disciplinary fertilizations and a wider sharing of knowledge
- Facilitate the expansion of the geographical availability of seismological data and the quality control of the data
- Develop synergies and complementary capabilities among operators of similar seismological infrastructures in order to offer an improved access to researchers
- Develop a single portal to provide remote access to all classes of seismological data to the wider research community, delivering a unified service to the whole community
- Enhance and facilitate the access to and utilization of key specialized seismological facilities
- Foster the development of the next generation of tools for future instrumental observations
- Reduce the fragmentation of the research community and foster an increase of the critical mass to work effectively on large-scale issues
- Network archives of data of high significance for seismic hazard assessment: historical instrumental records, earthquake damage intensity data, strong-ground motion recordings
- Invest in capacity building and technology transfer to ensure the access to modern technologies for infrastructures and the larger scientific community in the Euro-Med region
- Develop strategies and tools for long-term sustainable access to seismological infrastructures

- **Central European Initiative (CEI) projects**

There were three CEI projects focused on integrating data and procedures to assess seismic zonation and seismic hazard in the countries of the Balkan area.

No. 1202.001-07: ***Progress on seismic and geotectonic modeling across CEI territory and implications on preventing and mitigating seismic risk***, 2007.

No. 1202.136-07-08 ***Deterministic seismic hazard analysis and zoning of the territory of Romania, Bulgaria and Serbia*****,** 2007-2008.

No. 1202.038-09: ***Unified seismic hazard mapping for the territory of Romania, Bulgaria, Serbia and Republic of Macedonia*****,** 2009-2010.

In all three cases the project leader was Romania (dr. M. Radulian). The partners were from Italy, Bulgaria, FYR Macedonia, Serbia and Hungary. Experts from Germany and Republic of Moldova were invited as well. The participants benefited from the training and software support available at CEI University Network and ICTP-SAND research group, Trieste. Preliminary maps of isoseismal curves for six strong Vrancea earthquakes have been prepared after integrating and homogenizing the data gathered from Bulgaria, Hungary, Republic of Moldova, Romania, Serbia, FYR Macedonia, Republics of Ukraine, Belarus and Estonia. Results of the common/joint work where disseminated through papers and presentations at/in scientific meetings.

- **Seismic Hazard Harmonization in Europe - SHARE**
  FP7 Collaborative project No. 226967/2008
  2009-2011

The project is coordinated by Switzerland (Prof. D. Giardini) and involves 18 partner institutes from Belgium, France, Germany, Greece, Italy, Norway, Portugal, Romania, Serbia, Switzerland, Turkey, United Kingdom. The main objectives is to build up an integrated hazard map at European scale, harmonizing and standardizing data and procedures across borders. The seismic source analysis and parameterization are essential inputs for the seismic hazard evaluation.

- **Danube Alert System for Earthquakes**
  Cross-border project No. 2 (1I) – MIS ETC 636
  2010-2012

A common Romania – Bulgaria project related to implement and operate an early earthquake system for the Danube cross-border area. A primary objective is to build and update a common, integrated data base and to characterize the seismogenic zones which affect the target area.

- **South Carpathian Project**

Project funded by the UK Natural Environment Research Council, aimed at determining the lithospheric structure and geodynamical evolution of the South Carpathian orogen.

NERC Grant NE/G005931/1, 2009-2011

A network of 55 seismographs is temporarily deployed in cooperation with the University of Leeds in the western part of Romania, Hungary and north-eastern part of Serbia. The network covers the South Carpathians, the western part of the Moesian block and the eastern part of the Pannonian Basin.

- **The enhancement of the station Bucovina (BURAR) for signal detection and seismic phase identification at regional and teleseismic monitoring**
  Bilateral project sponsored by Air Force Research Laboratory (USA)
  Contract number: FA8718-06-C-0064, 2006 - 2007

The project is focused on the problem of inhomogeneous lithosphere structure beneath Vrancea region and its implications on seismotectonics, geodynamics and seismic wave attenuation.

• **Network of Research Infrastructures for European Seismology – NERIES**
FP6 Support for Research Infrastructures No. 026130/2006
2006-2009

The project involves a consortium of 25 institutes form different countries of Europe. One important component of the project involving the participation of NIEP was the build up and implementation of a European reference model for the crust.

• **Crustal Deformation in Balkanic Area**
NATO Science for Peace Project, Contract: ESP.EAP.SfPP 981881
Duration: 2007-2009

The general objective was the monitoring of the crustal deformation in the Balkan area using the Global Monitoring and Positioning System.

Participants: 1.National Observatory of Athens, Greece
2. Bulgarian Academy of Science, Lab.of Geodesy, Sofia
3. National Institute for Earth Physics, Bucharest
4. Aristotel Univ.of Thessaloniki, Greece
5. Metrisys Ltd.Sofia, Bulgaria

• **Seismic Hazard Harmonization in Europe - SHARE**
FP7 Collaborative project No. 226967/2008
2009-2011

The project is coordinated by Switzerland (Prof. D. Giardini) and involves 18 partner institutes from Belgium, France, Germany, Greece, Italy, Norway, Portugal, Romania, Serbia, Switzerland, Turkey, United Kingdom. The main objectives is to build up an integrated hazard map at European scale, harmonizing and standardizing data and procedures across borders. The wave propagation effects are essential inputs for the seismic hazard evaluation.

• **Danube Alert System for Earthquakes**
Cross-border project No. 2 (1I) – MIS ETC 636
2010-2012

A common Romania – Bulgaria project related to implement and operate an early earthquake system for the Danube cross-border area. A primary objective is to build and update a common, integrated data base and to characterize the seismogenic zones which affect the target area, the geological structure in the cross-border region and the attenuation of the seismic waves for seismic hazard and risk assessment.

(2) *bilateral cooperation:*

• A long-term bilateral program on **"Strong Earthquakes: a Challenge for Geosciences and Civil Engineering"** with the Collaborative Research Center 461 of University of Karlsruhe (Germany) has been active since 1996 (Informații: http://www-sfb461.physik.uni-karlsruhe.de/). The project implies extended interdisciplinary works focused on strong ground motion seismology and seismic hazard and risk due to Vrancea earthquakes. The seismology research objectives are approached within two subprojects: (1) Seismic Tomography of the Carpathian Arc and (2) Seismogenic Potential of the Vrancea Subduction Zone - Quantification of Source and Site Effects from Strong Earthquakes.

Several important subprojects were dealing with seismic hazard and microzonation subjects:

- Assessment resulting seismic hazard mapping of Romania using a probabilistic approach (Ardeleanu et al., 2005).
- Implementation of an early warning system in Bucharest for the Vrancea intermediate-depth earthquakes (Wenzel et al., 2001).
- Urban Seismology: A broad band experiment in the City of Bucharest, Romania. Monitoring of Bucharest City to get Shake Map/2003-2004 (Ritter et al., 2005).

The German partner has assisted the NIEP in installing and maintaining the digital accelerometer network on the Romanian territory. Romanian seismologists have been participating in research working groups as applied training or visiting scientists in several common working stages at the Institute of Geophysics of Karlsruhe for seismic profile data interpretation, tomography using local data, seismic source studies, early warning system, shakemap, hazard and microzonation.

• The bilateral project on "Seismic microzoning of Bucharest" with the University of Trieste (Italy) has the goal to estimate the ground motion parameters due to waves coming from complex seismic sources and propagating in highly realistic structural models to mitigate the seismic risk in Bucharest metropolitan area.

During several stays as visiting scientists at ICTP and DES - University of Trieste, a group of researchers from NIEP worked within different NATO and EC projects focused on Vrancea earthquakes and their implications to the seismic hazard using the deterministic method developed at DES – Trieste. Complex research on microzonation, seismic source and earthquake prediction (CN method) was carried out on this occasion.

• The scientific co-operation between Romania and Switzerland (project SCOPES nr. 7SUPJ062404, 2000-2003) **"CALIXTO - Seismic Tomography in the Vrancea Region, Romania"** was focused on seismic tomography studies using the data achieved during the CALIXTO'99 experiment in Romania.

• The bilateral project with the National Science foundation (project EAR-0230336, 2004 – 2006) **"Seismic Attenuation and Anisotropy in the Carpathians and Adjacent Basins: Upper Mantle Role in the Last Stages of Tethyan Closure"** focused on the problem of inhomogeneous lithosphere structure beneath Vrancea region and its implications on seismotectonics, geodynamics and seismic waves attenuation.

• A bilateral cooperation between the National Institute for Earth Physics (NIEP) and the Air Force Technical Applications Center (AFTAC) of the United States of America started in 1999 aiming at installing and operating a seismic array in the northern part of Romania (Bucovina array). The array consists of 9 short-period stations and 1 broadband station and started to be fully operational in July 2002. Another bilateral cooperation (NIEP and the Geoforschungszentrum Potsdam - GFZ) has been active since 1999 for the operation of the broad-band station Cheia - Muntele Rosu (belonging to the GEOPHON network). An important upgrade of the Cheia – Muntele Rosu station, as well as of the National Data Centre in Bucharest has been done since 1999, involving both technical cooperation with the Government of Japan and technical assistance from the CTBT Organization. Hence, in the fall of 2001 a new seismic monitoring system was installed and is now fully operational, by recording continuous earth motion data at Muntele Rosu site and transmitting these data in real-time to the facilities in Bucharest, in the framework of the Japan International Cooperation Agency project „Technical Cooperation for Seismic Monitoring System in Romania". Also, during 2001-2002, the CTBT Organization has supported the site preparation works at the seismic station Muntele Roşu and supplied equipment for establishing reliable

data communications links between the seismic station, the NDC and the International Data Centre from Vienna.

(3) *national programs and projects for research and developement*:

Program RELANSIN-AMCSIT

Technology for diagnosing stability of hydrotechnical dams
Period: 2008 - 2009
Project manager: C. Paunescu/ L. Munteanu

Monitoring and warning system of landslide risk in areas of geostrategic importance
Period: 2008 - 2009
Project manager: S.G. Dimitriu/ L. Munteanu

Program NUCLEU

Advanced research on disaster management generated by Romanian earthquakes / CAPMAG
Period: 2006 - 2008
Project manager: Marmureanu Gheorghe

CEEX

Advanced research on nonlinear effects and development of concept of nonlinear seismology in the study of seismic phenomena
Period: 2006 - 2008
Project manager: Apostol Bogdan

Advanced seismic monitoring system for high risk industrial zones. Case study: NPP Cernavoda site
Period: 2006 - 2008
Project manager: Ionescu Constantin

Complex modelling of the lithosphere based on analysis of waveforms from earthquakes and geophysical fields in order to mitigate seismic risk in Romania
Period: 2006 - 2008
Project manager: Popa Mihaela

Models to evaluate crustal deformation by interferometry satellite data, RADAR, ASTER and GPS for seismic risk prediction in Vrancea region
Period: 2006 - 2008
Project manager: Mateciuc Doru
Geotectonic and dynamic models of seismogenic areas in the Carpathians and their foreland
Period: 2006 - 2008
Project manager: Radulescu Florin

Correlation of crustal seismicity and stress field associated with the active fault systems - the primary element in evaluation and mitigation of seismic risk in Romania
Period: 2006 - 2008
Project manager: Raileanu Victor

System for seismic vulnerability mitigation applied to installations and technological processes in the nuclear field
Period: 2006 - 2008
Project manager: Ionescu Constantin

Earth physics complex research to achieve the final seismic hazard map of Romania by deterministic and probabilistic, linear and nonlinear methods
Period: 2006 - 2008
Project manager: Marmureanu Gheorghe

Basic research concerning dams rating in seismic risk categories. Probabilistic and deterministic approach for dams situated in the Moesian Platform
Period: 2006 - 2008
Project manager: Moldovan Iren-Adelina

Complex multidisciplinary research system on precursory phenomena associated with strong intermediate-depth Vrancea earthquakes, according to up-to-date international approaches
Period: 2006 - 2008
Project manager: Moldovan Iren-Adelina

Automatic generation and release of macroseismic intensity maps using information networks
Period: 2006 - 2008
Project manager: Ionescu Constantin

Complex monitoring and processing system using modern techniques for precursory factors in case of major earthquakes
Period: 2006 - 2008
Project manager: Ionescu Constantin

Seismotectonics models of lithosphere in Vrancea, Dobrogea and Moesian Platform seismic regions for estimating the dynamic behavior of the local geological structure in case of major earthquake
Period: 2006 - 2008
Project manager: Diaconescu Mihail

Attenuation properties of the seismic waves in lithosphere for the seismic hazard assessment in Romania
Period: 2006 - 2008
Project manager: Ardeleanu Luminita

Pilot system for seismic alarm in case of hydroelectric plants. Case Study - Hydroelectric plant of Vidraru
Period: 2006 - 2008
Project manager: Vasiliu A/Ionescu Constantin

Integrated research on the genesis of intermediate-depth intracontinental earthquakes in the Vrancea zone
Period: 2006 - 2008
Project manager: Besutiu Lucian/Radulian Mircea

Multidisciplinary research for natural hazards. Case Study: Tsunami phenomenon in

the Black Sea
Period: 2006 - 2008
Project manager: Diaconescu Mihail

3D determination of displacement at hydrotechnical dams by satellite methods
Period: 2006 - 2008
Project manager: V. Mocanu /L. Munteanu

Subsidence of lands affected by mining exploitation. Case study of Petrosani mining basin
Period: 2006 - 2008
Project manager: V. Mocanu / L. Munteanu

Earth surface relief response to current tectonic processes in the continental collision of Vrancea area
Period: 2006 - 2008
Project manager: V. Mocanu / L. Munteanu

Research on national mapping of Radon (in the crust and in different environmental factors) to protect the population in accordance with international standards and EU requirements
Period: 2006 - 2008
Project manager: Purghel L./Moldovan Iren Adelina

System for mitigation of vulnerability to the seismic action upon installation systems and technological processes in the nuclear field
Period: 2005 - 2008
Project manager: Ionescu Constantin

Advanced research on local seismic hazard for cities situated in extra Carpathians zone: Case Study: Iasi, Bacau, Buzau and Craiova
Period: 2005 - 2008
Project manager: Marmureanu Gheorghe

Correlation of crustal seismicity and associated stress field with the active fault systems - basic element in assessing and reducing seismic risk
Period: 2005 - 2008
Project manager: Raileanu Victor

Prediction of strong earthquakes by studying precursory factors in parallel with the seismic activity
Period: 2005 - 2008
Project manager: Enescu Dumitru

Program SPACE and SECURITY

Research on implementation of a system for early and in real time warning of authorities in case of Vrancea earthquakes
Period: 2005 - 2007
Project manager: Marmureanu Gheorghe

Methods and models to detect natural and artificial events using infrasonic emission monitoring systems

Period: 2005 - 2007
Project manager: Moldovan Iren

PNII/C1

Modeling of seismic sources in eastern Romania for seismic hazard assessment
Period: 2007 - 2010
Project manager: M. Diaconescu

Multidisciplinary Evaluation of the Seismic Site effects for Bucharest area microzonation
Period: 2007 – 2010
Project manager: A. Bala

Modeling of local site effects induced by crustal earthquakes occurred in Tulcea, Galati-Tecuci, Campulung, Banat zones and seismic risk assessment for these regions
Period: 2007 - 2010
Project manager: F.S. Balan

Seismic risk mitigation by avoiding the soil-structure resonance seismic and by isolating the structure basement. Applicability in Bucharest metropolitan area
Period: 2007 - 2010
Project manager: G. Marmureanu

Seismic macrozonation of Romanian territory, based on reviewed macroseismic intensities in conjunction with complex geological and geophysical data
Period: 2007 - 2010
Project manager: A. Pantea

Fundamental research of historical seismology and paleoseismology, needed to assess long-term seismicity and seismic hazard
Period: 2007 - 2010
Project manager: Constantin Angela

System for real-time monitoring of safety and structural integrity of emergency hospitals and alarm system in case of earthquake. Case Study - St. Pantelimon hospital
Period: 2007 - 2010
Project manager: Vasiliu O./Ionescu C.

Advanced earthquake monitoring system for high-risk industrial areas. Case study-NPP Cernavoda site
Period: 2007 - 2010
Project manager: Ionescu Constantin

Multidisciplinary research for natural hazards. Case Study: Tsunami phenomenon in the Black Sea
Period: 2007 - 2010
Project manager: Oaie Gheorghe/M. Diaconescu

Multihazard and vulnerability in the Bucharest city environment
Period: 2007 - 2010
Project manager: Armas Iuliana/Radulian Mircea

Algorithm to simulate numerically seismic cycles in order to identify precursory

elements
Period: 2007 - 2010
Project manager: Carbunar Octavian/Radulian Mircea

Innovative techniques and methodologies for assessing natural hazard risk (earthquakes and landslides).
Period: 2007 – 2010/Project manager: Stanica Dumitru/Raileanu Victor

PNII/C2

Innovative devices and systems for building security in case of strong earthquakes.
Period: 2008 – 2011/Project manager: Daniela Ghica

Complex exploration and surveillance of geophysical environment using advanced monitoring techniques and multiparametric analysis to detect precursory anomalies for crustal and subcrustal earthquakes
Period: 2008 – 2011/Project manager: Moldovan Iren

Program IDEI-CNCSIS

Study of local seismic effects by interdisciplinary research using equivalent linear and nonlinear modeling
Period: 2008 – 2011/Project manager: Marmureanu Gheorghe

Network of Research Infrastructures for European Seismology
Period: 2006 – 2010/Project manager: Ionescu Constantin

Seismic early warning for Europe
Period: 2006 – 2009/Project manager: Marmureanu Gheorghe

Realistic modeling of Vrancea area by numerical simulation of seismic cycles
Period: 2007 – 2010/Project manager: Radulian Mircea

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PART II: ENGINEERING SEISMOLOGY

The evaluation and mitigation of the seismic risk is one of the permanent and urgent problems facing the Romanian society, equally implying work of seismologists, geologists and engineers. Significant efforts were made to predict the peak values and spectral characteristics of the strong motion in large urban areas, like Bucharest. At the same time,

important efforts were made to determine the site effects and microzonation maps for the same city.

Every damaging earthquake demonstrates the importance of the local site effects and their worsening of the damage and economic losses. Another open problem is the correct definition of the local site effect and the possibility to control it to a certain degree. The experience gained of some recent earthquakes (Kobe, Loma Prieta, Mexico, etc.) shows the importance of quantifying the physical parameters of the local site and other local conditions which can affect the severity of ground shaking that a site may experience and the potential for locally induced effects, such as landslides, liquefaction, floods, fires, etc.

A number of studies have significantly contributed to the establishing of the response spectra to be used in connection with the large intermediate-depth earthquakes generated by the Vrancea region of Romania and the existing European Building Code Eurocode 8 was critically reviewed and improvements were suggested to orient it to the Carpatho-Balkan region.

The modal summation method and finite differences technique were applied to calculate the expected ground motion in Bucharest due to large intermediate-depth Vrancea earthquakes. The results outlined that the presence of alluvial sediments and the possible variation of the event scenario require the use of all three components of motion for a reliable determination of the seismic input.

Study of dynamic parameters of soils by using resonant columns and geophysical methods, realistic modelling of seismic input taking into account source, wave path propagation and local site effects have been permanent tasks for Romanian seismologists and important outcomes for seismological engineers. Laboratory analyses were made also to determine the attenuation effects for surface layers and its dependence on the strain level induced by large earthquakes.

The role of the non-linear effects in the local site response has been the subject of several studies outlining their important contribution to the strong motion in Bucharest area. This will be a challenge for seismological research in the next years.

Engineering Seismology

Two main (interrelated) topics were dealt within this frame:

- characterization of ground motion severity at a definite location;
- summarizing the outcome of analysis of accelerographic records obtaned during recent strong Vrancea earthquakes.

The concern for the characterization of ground motion severity was due to the direct experience of the destructive earthquake of 1977.03.04. The survey of earthquake effects, combined with the data provided by the strong motion record of Bucharest – INCERC, raised the need to consider intensity not only globally, but also as related to various spectral bands. A system of intensity quantification based on accelerographic data was developed and applied to the analysis of numerous ground motion records. An application forwarded to the NATO Office, Brussels, was accepted and NATO provided the Collaborative Linkage Grant No. 981619 for the Project *QUANTIFICATION OF EARTHQUAKE ACTION ON STRUCTURES*. The cooperative activities in this framework, in which researchers from Bucharest, Moscow and Chişinău were involved, lasted from 2005 to 2008. They included meetings in Bucharest, Chişinău and Moscow and led to the drafting of some joint papers. Finally, the NATO Office agreed to provide support for the publication of a volume with the same title. The main participants in these activities were the authors of this volume. Several publications on this

subject were drafted and some of them were presented at the European Conferences on Earthquake Engineering of 2006 and 2010 and at the World Conference on Earthquake Engineering of 2008. A summary publication on this subject was represented by the volume *Quantification of seismic action on structures (studies related to a project sponsored by NATO in the frame of the Program Science for Peace).* (Program Director & Editor: H. Sandi. Co-authors: F. Aptikaev, I. S. Borcia, O. Erteleva, V. Alcaz). AGIR Publishing House, Bucharest, 2010.

An invited lecture on related topics, by H. Sandi: "Seismic intensity and hazard quantifications, versus some earthquake engineering requirements" (slides) was prepared, for. *Proc. Advanced Conference on "Seismic Risk Mitigation and Sustainable Development".* Trieste, 10 – 14 May 2010, Abdus Salam International Centre for Theoretical Physics.

The activities devoted to summarizing the outcome of analysis of accelerographic records obtaned during recent strong Vrancea earthquakes relied on the infomation provided by the numerous valuable strong motion records obtained during the strong Vrancea earthquakes of 1977.03.04, 1986.08.30, 1990.05.30 and 1990.05.31.

The most relevant findings related to the features of the radiation pattern put to evidence are:

- the variability of directivity from one event to the other;
- in some cases, the variability of directivity, for a same event, from one spectral band to the other.

The features of the radiation pattern were evaluated also in relation to the variability of the spectral contents of ground motion, put to evidence by the ensemble of response spectra presented. As a most striking example, the results obtained show that, for a large area, the longer period ordinates of response spectra were unexpectedly low in case of the event of 1990.05.30. They also show that the source mechanism was of a nature that led to diferent directivities of radiation for different spectral bands. The challenge for a joint study of source mechanisms and of response spectra becomes obvious.

The most relevant findings related to the spectral contents made obvious by instrumental data and response spectra are related to the cases of stability and of variability respectively, of spectral contents of ground motion. The importance of the existence at relatively small depth of an interface characterized by a strong contrast of *S* wave propagation velocity for the adjacent layers, in order to provide a strong and stable influence of local conditions upon the ground motion characteristics must be emphasized again. Otherwise, the need to examine the characteristics of deep geological profiles is necessary.

The importance of these aspects for the predictability of ground motion features and for microzonation studies is obvious.

Earthquake Engineering

The main directions of work in this field were:

- studies on the seismic vulnerability of structures;
- modernization of design codes;
- studies on base isolation;
- earthquake protection principles.

The vulnerability studies were carried out essentially in analytical terms. Two main subjects were dealt with:

- analysis of evolutionary vulnerability, mainly as a consequence of the cumulative effects of successive earthquakes;
- Vulnerability and risk analysis of multi-location systems, like lifelines, railway networks etc.

The studies on modernization of codes were intended mainly to adapt the codes for practice to the outcome of more consistent techniques of control of structural safety.

The studies on base isolation were oriented towards the analysis of specific criteria under the seismic conditions of Romania. An international symposium on this subject was organized in Bucharest in 2008. The papers presented were published in a volume, I. Lad, H. Sandi, U. Sannino, A. Martelli: *"Modern systems for mitigation of seismic action"*. AGIR Publishing House, Bucharest, 2009.

The studies on earthquake protection principles were devoted mainly to a critical analysis of the specific obstacles to the control and mitigation of seismic risk to structures.

Examples of achievements related to microzonation, hazard and shake maps are given below:

NATIONAL PROJECTS

CEEX PROGRAM 2005-2008: Advanced studies on local seismic hazard (microzonation) for important cities located outside of the Carpathians Belt. Case studies for Iasi, Bacau, Buzau and Craiova .

Partners : University of Bucharest- Faculty of Geology and Geography, INCERC and Romanian Academy – Solid Mechanics Institute.

The objective of this project is knowledge accumulation on the competitive base at the European and international level, to obtain results and experience in the Earth physics and to transfer them to the economic and social activities from Romania. The proposal is correlated with the S/T thematic area, concerning natural hazards, observation and evaluation of the Earth and especially the earthquake research (deterministic and probabilistic analyses, linear and nonlinear wave propagation). Results of this project will consist of the local seismic hazard maps (microzonation) for the Iasi, Bacau, Buzau and Craiova cities and of data base for Romania SHAKE MAP performance. On the international level knowledge in this field were focused on the shallow earthquake which are numerous and notorious at the international scale. In case of our country the most important are the intermediate–depth Vrancea earthquakes which affect seriously the extra-Carpathian territory and partially neighbouring country (Bulgaria, Moldavia, and Ukraine). The main goal of this project is to mitigate the effects of these earthquakes. Edification of a culture of the prevention is not a facile work, the costs of prevention are made at the present, their benefits appear in the future (Kofi Anan).

Consortium formed by NIEP, Geological and Geophysics Faculty, INCERC and Institute of Solid Mechanics of Romanian Academy allows an optimal valorisation of the scientific potential from Romania and a real involvement in FP6 and FP7 European Projects and increases the Romanian capacity to supply experts for the international scientific and technical collaborative programs.

CEEX- 144/2006 – 2009: Earth Physics complex researches for final seismic Hazard map of Romania by probabilistic and deterministic approaches, linear and nonlinear methods/HHRO

Partners : University of Bucharest- Faculty of Geology and Geography, INCERC and Romanian Academy – Solid Mechanics Institute, University of Iassy – Faculty of

Mathematics.

The seismicity of Romania comes from the released energy of **crustal** earthquakes, which have a depth not more than 60 km, and by the **intermediate** earthquakes coming from Vrancea region (the only European case) with a depth between 60 and 200 km. Vrancea earthquakes, the main ones in Romania, are belonging to the biggest calamities that take place around the world.

The objective of this project is knowledge and experience gaining, at European and global level, in the field of fundamental research of Earth physics, in general, of seismology, in principal, based on competition, and transferring them to economic and social environments of Romania, in order to increase its ability, national security, in order to protect the population against Romanian destructive earthquake. The proposal belongs to the thematic areas (code 6.1) regarding "natural disasters" generated by Romanian earthquakes from Vrancea, Banat or South Dobrogea areas, but because it is an Earth physics project, we used fundamental sciences (code 11) "like mathematics and physics" to solve the complex problem of evaluating the seismic hazard on Romanian territory, by using probabilistic and deterministic methods, linear and nonlinear analysis, and the wave propagation phenomena in viscoelastic nonlinear layers, on the path from focus-bedrock-free surface, of studied area. The result of this project is mainly the Romanian hazard seismic map. The consortium composed by INCDFP, Faculty of Geology and Geophysics, University of Bucharest, INCERC, Mathematics Faculty-Iasi University A.I.Cuza, Solid Mechanics Institute belonging to Romanian Academy allows an optimal valuation of the scientifically Romanian potential and a real commitment in the European project FP6 and FP7. The project belongs to the national politics in the field(HG 372/2004-"Seismic Risk National Management Programme")

INERNATIONAL PROJECTS

NATO Science for Peace Project 981882 (2006 - 2008): "Site-effect analyses for the earthquake-endangered metropolis Bucharest, Romania" in cooperation with Karlsruhe University, Germany.

The main objective is earthquake risk mitigation and better seismic safety of Bucharest, the capital of Romania. As there is a major gap in knowledge concerning seismic and geotechnical parameters in the shallow (< 100 m), unconsolidated soil and sediment layers, we shall to drill 8 boreholes. By conducting seismic measurements in the boreholes and geotechnical analysis of the core samples, the dynamic parameters of soils and rocks will be determined. These dynamic parameters will be used as input for linear and non-linear waveform modelling to estimate the seismic amplitude amplification at specific sites in Bucharest. The results from the site-effect analysis will be gathered in an updated seismic microzonation map of Bucharest which is disseminated to the public and especially to the end-users who will introduce our results in the future city planning.

SAFER (Seismic Early Warning for Europe) - project funded by the European Commission in the context of Framework Program 6 under the Theme Sustainable Development, Global Change and Ecosystems. The SAFER Project was carried out between July 2006 and June 2009 by a Consortium formed by 20 institutes from 11 European and Mediterranean countries (Germany, Italy, Greece, Romania, Switzerland, Norway, France, the Netherlands, Iceland, Turkey and Egypt), and one each from Japan, Taiwan and U.S.A. The Consortium includes universities, governmental and non-governmental research institutes and private companies. The Consortium was led by Jochen Zschau, GFZ German Research Centre for Geosciences, Potsdam, Germany, assisted by a Steering Committee formed by Paolo Gasparini, AMRA Scarl, Napoli, Italy and Gerassimos Papadopoulos, National Observatory

of Athens, Greece.

It has the general objective to develop tools and knowledge for increasing the capability of effective earthquake early warning (EEW) in Europe and to implement and test these tools in selected European cities: Athens, Bucharest, Cairo, Istanbul and Naples. The combined population of these cities is about 40 million inhabitants, and all have experienced severe earthquakes in recent years.

The main progress brought by SAFER to the early warning and disaster management capability of the Bucharest city concerns the rapid magnitude determination of Vrancea earthquakes, the development of a new azimuth dependent attenuation law to fit the geology of the region, and the integration, in an early warning approach, of alert-, shake- and damage maps. The EEW system generates also a preliminary shake/alert map for Bucharest within 4-5 seconds after the earthquake has been detected in the epicentral area (Vrancea). This alert map is improved and converted step by step to a measured shake map as the real-time data from accelerometers installed in the Bucharest area become available**.** In order to make a rapid assessment of the possible damage, these data will be further combined in the EEW-System with vulnerability information. Main results/achievements from this project were published in a special volume.

Central European Initiative (CEI) projects

No. 1202.136-07-08 "**Deterministic seismic hazard analysis and zoning of the territory of Romania, Bulgaria and Serbia, 2007-2008"**

1202.038-09: **"Unified seismic hazard mapping for the territory of Romania, Bulgaria, Serbia and Republic of Macedonia", 2009-2010**.

Project leader: PhD Radulian (Romania), Partner leaders: Prof. G.F. Panza (Italy), Prof. PhD Eng. I.Paskaleva (Bulgaria), PhD Dr.Dojcinovski (FYR Macedonia), PhDS. Radovanovich (Serbia). Prof. P.Varga (Hungary) supported the projects from the very beginning.

The main objectives of these projects were to upgrade the existing seismic zonation maps and to harmonize the seismic hazard and/or risk estimates in the different partner countries within a common framework provided by the software support available at CEI University Network and ICTP-SAND research group, Trieste.

The projects have brought together advanced scientific personalities with their innovative and expertise knowledge from the participating countries and other professional volunteers from Hungary and Republic of Moldova in fruitful brainstorming discussions.

Preliminary maps of isoseismal curves for six strong Vrancea earthquakes have been prepared after integrating and homogenizing the data gathered from Bulgaria, Hungary, Republic of Moldova, Romania, Serbia, FYR Macedonia, Republics of Ukraine, Belarus and Estonia. Results of the common/joint work where disseminated through papers and presentations at/in scientific meetings.

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PART III: STRUCTURE OF THE LITHOSPHERE

Research activities regarding the lithosphere studies are carried out by the National Institute for Earth Physics, Department for Lithosphere structure.

MAIN RESEARCH DIRECTIONS IN THE FIELD OF LITHOSPHERE STRUCTURE

The department for Lithosphere structure and dynamics is working since the INCDFP foundation, in 1994, and it has as principal goal the research of the lithosphere structure and dynamics at regional and local scale, employing seismic and seismologic methods. Subjects as

dynamics of the lithosphere are also followed and study of the movements of the crust using GPS and satellite methods.

Main research directions of the department are:

- Lithosphere structure at regional and local scale;
- Dynamics of the lithosphere by complex interpretation of the actual movements of the crust;
- New models at the geologic and tectonic scale, having elements of the physical properties of the rocks, with direct application in seismic hazard assessment;
- Studies of the crustal seismicity and seismotectonics and assessement of the dynamic properties of the crust in the case of a major earthquake.

In the last years several studies about the natural hazard at a local and regional scale were performed:

- Microzonation studies (local seismic hazard) of densely populated areas, with special view to the Bucharest area.
- The seismic tomography of the main hydropower dams.
- Studies about hydropower dams employing satellite methods and subsidence of the mining areas.

NATIONAL RESEARCH PROJECTS LEAD BY DEPARTMENT SCIENTIFIC RESEARCHERS

Projects in the frame of PNCDI National Programme 2007 – 2011

- **Project EMMESLAB/2007**

Multidisciplinary Evaluation of the Seismic Site-effect upon the seismic zonation of the earthquake-endangered Bucharest Metropolitan area.
Project director : dr. ing. *Andrei BALA*, senior research geophysicist.

- **Project SURIZO/2**

Modelling of the seismic sources from eastern part of the Romanian territory for the evaluation of the seismic hazard.
Project director : Drd. *Mihai Diaconescu*, research geophyisicist.

- **Proiect TEMERISC/2007(partner)**

INOVATIVE TECHNIQUES AND METHODOLOGIES TO EVALUATE THE NATURAL RISK HAZARD (EARTHQUAKES AND LANDSLIDES)
Project director: dr. Dumitru Stanica, GEODIN.
Project responsible: dr. ing. *Raileanu Victor*, senior research geophysicist, NIEP.

Project VELOROM/2008 (partner)
Geonomic characterization of the major tectonic units in Romania. Models of the distribution of the seismic waves velocities.
Project coordinator : University of Bucharest.
Project responsible from NIEP: dr. ing. *Raileanu Victor*, senior research geophysicist, NIEP. More information can be found at www.infp.ro.

Participation of the Department in International Projects and Programmes

1. Collaborative Research Center 461: "Strong Earthquakes: A challenge for

Geosciences and Civil Engineering", University of Karlsruhe, Germany

The Collaborative Research Center 461: "Strong Earthquakes: A challenge for Geosciences and Civil Engineering", at the University of Karlsruhe, Germany, and the "Romanian Group for Strong Vrancea Earthquakes", Bucharest, collaborate since 1996 in a multidisciplinary attempt towards understanding Vrancea seismicity and mitigating seismic risk in Romania.

More details about projects within the Collaborative Research Center (CRC) 461 related to lithosphere study can be found in the Final Report printed in 2008 at the University of Karlsruhe, Germany:

(http://uvka.ubka.uni-karlsruhe.de/shop/product_info.php/info/p12448_Abschlussbericht-f--r-die-Jahre-1996---2007-mit-Berichtsband-f--r-die-Jahre-2005---2007--mit-CD-.html).

SUBPROJECT A1: DEEP SEISMIC SOUNDING OF THE VRANCEA ZONE

Project leaders: Dr. J.R.R. Ritter, dr. T. Forbriger, Geophysical Institute, Karlsruhe University.

Romanian partners: dr. Andrei Bala; dr. Stefan Balan, National Institute for Earth Physics, Bucharest, Romania.

Participation of Romanian researchers in the Subproject A1 was acknowledged in the Final Report of the Collaborative Research Center 461, printed at the Karlsruhe University, Germany, pag.38-50.

(http://www-sfb461.ipf.uni-karlsruhe.de/publications/readpdf.php?id=983).

SUBPROJECT B6: GEOTECHNICAL AND SEISMIC MICROZONATION OF BUCHAREST CITY.

Project leaders: prof. dr. Heinz Hotzl; dr. Joachim Rohn, Geophysical Institute, Karlsruhe University

Romanian partners: dr. Andrei Bala; dr. Stefan Balan, National Institute for Earth Physics, Bucharest, Romania. Dr. Viorica Ciugudean, Metroul S.A.

Participation of Romanian researchers in the Subproject B6 was acknowledged in the Final Report of the Collaborative Research Center 461, printed at the Karlsruhe University, Germany, pag.215-271.

(http://www-sfb461.ipf.uni-karlsruhe.de/publications/readpdf.php?id=990).

In the end of the Collaborative Research Center 461 in Oct. 2007 in Bucharest took place *The International Symposium on Strong Vrancea Earthquake and risk mitigation,* Oct. 4 – 6, 2007 with a large participation of research institutions from Bucharest, Romania and Germany. During the international symposium there were presented 4 papers in the field of lithosphere structure

(http://www.ubka.uni-karlsruhe.de/volltexte/beilagen/1/proceedings/index.html).

2. NATO Science for Peace Project 981882
Site-effect analyses for the earthquake-endangered metropolis Bucharest, Romania
2006 - 2009

Project Co-Directors:

Dr. Andrei Bala –

Dr. Stefan Florin Balan (PPD) –

National Institute for Earth Physics, Bucharest, Romania
PD Dr. Joachim Ritter (NPD)
University Karlsruhe (TH), Germany
Prof. Dr. Joachim Rohn
University of Erlangen, Germany
Principal investigators:
Prof. Dr. Gerhard Huber –
University of Karlsruhe, Institute of Soil and Rock Mechanics, Karlsruhe, Germany
Dr. Dieter Hannich –
University of Karlsruhe, Dept. of Applied Geology,
Karlsruhe, Germany

FINAL REPORT FOR THE NATO SFP PROJECT 981882
LIST OF ABBREVIATIONS

AGK	Department of Applied Geology, Universität Karlsruhe (TH)
CRC461	Collaborative Research Center 461 "Strong Earthquakes" at the Universität Karlsruhe (TH)
GPI-KA	Geophysical Institute, Universität Karlsruhe (TH)
K2-network	Kinemetrics acceleration measurement network
NIEP	National Institute for Earth Physics, Bucharest
NPD	NATO Country Project Director
PPD	Partner Country Project Director
UKA	Universität Karlsruhe (KA)
URS	URban Seismology (seismological project at Bucharest 2003/2004)
UTCB	Technical University of Civil Engineering Bucharest (third party for drilling operations etc.)

1. Introduction

Bucharest, the capital of Romania (Fig. 1), with more than 2 million inhabitants, is considered after Istanbul the second-most earthquake-endangered metropolis in Europe. It is identified as a natural disaster hotspot by a global study of the World Bank and the Columbia University (Dilley et al., 2005). Four major earthquakes with moment-magnitudes between 6.9 and 7.7 hit Bucharest in the last 65 years (Fig. 1). The most recent destructive earthquake of 4th March 1977, with a moment magnitude of 7.4, caused about 1.500 casualties in the capital alone. All disastrous earthquakes are generated within a small epicentral area – the Vrancea region - about 150 km northeast of Bucharest. Thick unconsolidated sedimentary layers in the area of Bucharest amplify the arriving seismic shear-waves causing severe destruction. Thus, disaster prevention and mitigation of earthquake effects is an issue of highest priority for Bucharest and its population.

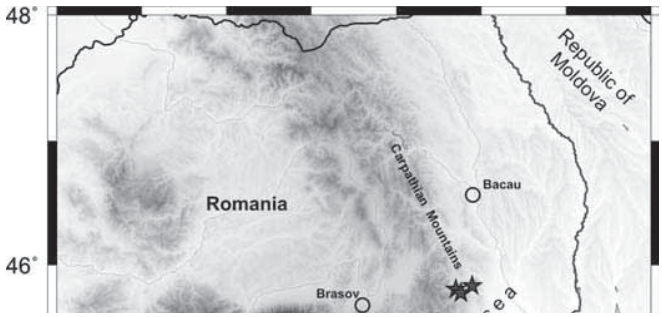

Figure 1. Map with greater region of interest. The Vrancea earthquakes occur underneath the bend of the Carpathian Mountains (stars indicate the epicentres of the last four major events in 1940, 1977, 1986 and 1990). Bucharest in the foreland is built on poorly consolidated sedimentary rocks at a distance of about 150 km.

Several national and international research programs were done in the past to understand the causes for the Vrancea seismicity, to study the seismic wave propagation in the region and to assess seismic hazard for Bucharest and other communities. A major programme was the Collaborative Research Centre (CRC461) "Strong Earthquakes" at the Universität Karlsruhe (TH), Germany that involved a very close cooperation with the National Institute of Earth Physics, Bucharest, Romania. As part of this programme jointed seismological experiments were conducted in Romania. For a summary see Sonderforschungsbereich 461 (2008).

Especially in Bucharest high-quality seismic data were acquired during the URS (URban Seismology) Project from October 2003 to August 2004. Within this project 32 state-of-the-art broadband stations were continuously recording in the metropolitan area of Bucharest (Ritter et al., 2005). This unique dataset provides important information on the seismic amplitude variation across the area. Additionally there is a modern ground acceleration observation network (K2-network) which has been upgraded in the last years by the Universität Karlsruhe (TH) and NIEP and which is run by NIEP. From this network there is a database with strong motion recordings. Engineering geology and modelling of wave propagation in near-surface layers (consolidated and non-consolidated material) was also studied. However, we found out that there is an urgent need for a homogeneous dataset on the geotechnical parameters of the soils and rocks of the uppermost layers underneath Bucharest. These are partly responsible for local ground motion amplification and thus important for hazard assessment. To fill this gap of knowledge and to improve the knowledge in this respect we jointly applied for this Science for Peace Project.

b. Scope and objectives of the project

The scope of our project is earthquake risk mitigation and better seismic safety of Bucharest, the capital of Romania. Since future earthquakes cannot be avoided, nor predicted within a reasonable time frame, our goal is to mitigate the impact of earthquake waves onto the city. One important component of earthquake engineering seismology is to evaluate the role of the near-surface soil layers. These layers, on which buildings and other constructions are set, can have a wide range of influences on the ground shaking. For example loose soils or sediments can amplify the ground motion or water-saturated sediments can produce soil liquefaction. These phenomena can then cause complete yielding of the ground during earthquake shaking with the result of catastrophic collapse of building. Strong stiffness contrasts of layered material at depth can further lead to resonance effects in the underground which can further amplify the ground motion or which can prolong the time of shaking.

Bucharest is built on young, partly unconsolidated and water-saturated sediments of the Dambovita and Colentina river systems and their surrounding plains. This underground is especially prone to strong shaking and even amplification of earthquake waves including ground liquefaction.

The specific overall goal of the project was to derive an improved microzonation map of Bucharest which is based on a homogeneous dataset of geotechnical and geophysical data. As there is a major gap in knowledge concerning seismic and geotechnical parameters in the shallow (< 100 m), unconsolidated soil and sediment layers, we concentrated on these layers.

The available geotechnical and geophysical data on the near surface layers underneath Bucharest are by far not enough for a well founded microzonation of the whole city area. This is due to large spatial gaps of data, partly old data and differently applied methods. Thus we wanted to acquire basic data for these layers in a homogeneous way by specifically selected 8 boreholes (10 were realised in the end). In and at these boreholes we wanted to conduct seismic measurements and geotechnical analysis of the core samples. From these we wanted to determine representative dynamic parameters of the soils and rocks. These dynamic parameters can be used as input for linear and non-linear waveform modelling to estimate the seismic amplitude amplification at specific sites in Bucharest. These modelled waveforms can now be compared and calibrated with observations from seismic stations in the city. The results from the site-effect analysis will be gathered in an updated seismic microzonation map of Bucharest which will be disseminated to the public and especially to the end-users who will introduce our results in the future city planning.

At NIEP and UKA young scientists were involved in the project and hence trained for this kind of geophysical and earthquake engineering research. Visits at the UKA were used for training in new non-linear modelling techniques. As the funding of this project was mainly for data acquisition such as drilling operations, there was no significant enhancement of scientific infrastructure. The money used for travelling and training improved the international co-operation between the German and Romanian partners as well as initiated new links with other European scientists.

c. Realisation of the project

The project was organised in five parts:

- Careful planning of the field experiments
- Performance of the field measurements
- Analysis of the newly acquired data and existing data
- Modelling of site responses
- Administration

These work packets and their management were distributed between the partners according their experience and actual location. The planning of the field experiments was jointly done between NIEP and UKA. The decision on the location of the boreholes was the most important step. Potential drill sites were selected based on the scientific aspects such as gaps of knowledge, proximity to seismological stations and relevance for expected sampled layers. The colleagues at NIEP then asked for the necessary permissions to get access to the sites on private and public ground. They also cleared all logistical problems and negotiated with companies to conduct the drillings. The field operations were also supervised by NIEP. Borehole core samples were partly analysed in the rock mechanic laboratory of NIEP. The analysis of the new data from the borehole sites was done in large parts at NIEP. During visits in Karlsruhe or in Bucharest the partners evaluated the achieved results and discussed the next steps. The analysis and modelling of existing seismological data, mainly from the URS experiment was pursued mainly at UKA. Modelling of site response spectra was conducted at NIEP. The administration of the project and communication with NATO was done mostly at UKA.

Participating institutions/industries: By far most of the work involved in the project was conducted by NIEP and UKA. Further assistance came from the UTCB which was hired as contractor for the drilling operations and VSP measurements.

d. Scientific results

The main results can be summarized as:

- 10 new boreholes including complete lithological profiles and about 250 recovered core samples for geotechnical analysis
- 10 downhole measurements for *vp* and *vs* profiles
- 400 geotechnical analyses of samples from 6 Quaternary layers
- Spectral amplification curves for the 10 sites
- Improved *vs30* map
- Investigation of seismological measurements across the city.

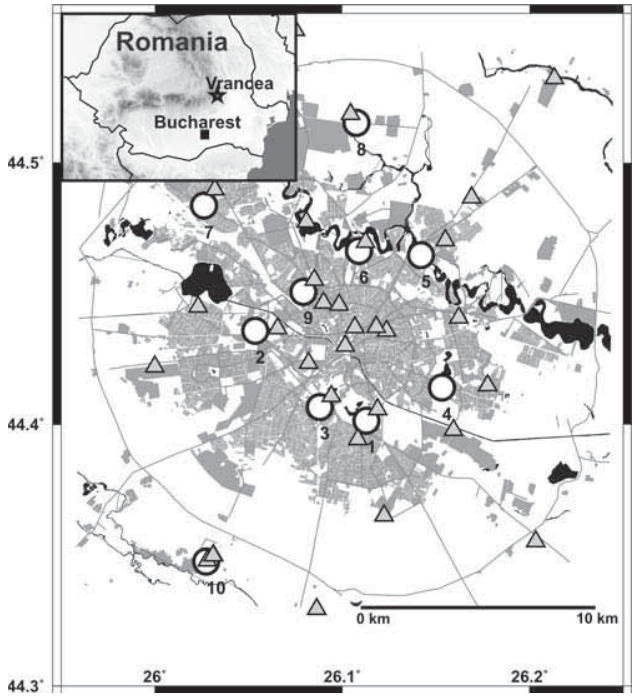

Figure 2. Map with area under investigation. The metropolitan region of Bucharest, Romania, is mainly inside the characteristic ring road with a diameter of about 20 km. Residential and industrial areas are indicated in grey; lakes, channels and rivers in black. The ten borehole sites are shown as circles and numbers. Sites with broadband instruments during the URS experiment (Ritter *et al*., 2005) are indicated with triangles.

3. European project NERIES

National Institute for Earth Physics (NIEP) was one of 26 partners of the FP6 European Project **NERIES** (EUROPEAN NETWORK FOR RESEARCH INFRASTUCTURE IN SEISMOLOGY) developed in the 2006-2010 years. NIEP has activated in the JRA1 section regarding the European Seismological Reference Model along with the INGV Bologna Italy, (leader of section), ETHZ Zürich, Switzerland, University of Utrecht (UU), Netherlands, IPGP Paris, France and GFZ Potsdam, Germany. The main task of NIEP was to collect, process and provide information of crustal structure in Europe based on seismic refraction and reflection data. Final model was assembled by INGV Bologna. It can be consulted at : http://www.bo.ingv.it/eurorem/view/index.html

Acknowledgements. This report has been prepared by Dr. Andrei Bala and Dr. Victor Raileanu.

PART IV: HEAT FLOW STUDIES

The main heat flow research activities in Romania were carried out by the Institute of Geodynamics of the Romanian Academy and by the Geological Institute of Romania, in close correlation with programmes of the International Heat Flow Commission of IASPEI. Dr. Crisan Demetrescu served in this commission between 2007-2011.

A. GEOTHERMAL MODELING

The geothermal regime in the Earth's lithosphere is given mainly by the transport to the surface of heat from the mantle and of heat that is generated by the decay of radioactive isotopes in the rocks. The main mechanisms of heat transfer are conduction and convection by moving fluids.

The thermal regime of the lithosphere in the East Carpathian bend and its foreland was analyzed, based on geothermal measurements performed in 41 boreholes (Demetrescu et al., 2007). The time-dependent heat budget, thermal evolution and rheology of the lithosphere in the last 13Myr, along a 120 km long profile in the foreland of the Eastern Carpathians bend is presented. The study area, a complex tectonic environment in the vicinity of the wellknown intermediate-depth seismogenic Vrancea zone, includes the deepest sedimentary basin in Romania (~18 km), with a recent rapid evolution in the last 13Myr (8 km of sediments).

Detailed high-resolution temperature logs in the depth ranges from 0–700 m to 0–2400 m in eight thermally stabilized boreholes, together with logging and geological information on structure, lithology and time evolution of the sedimentary pile have been used to model the thermal evolution by means of a 2-D finite element model which includes sedimentation history, sediment compaction, lateral and vertical variation of thermal properties of sediments and consolidated crust. Modelling results have been compared to measured temperatures, corrected for palaeoclimate effects, in a trial and error iterative approach. Sedimentation, palaeoclimate, undercompaction and heat refraction effects on one hand, and the heat generated in the upper crust, on the other, combine to explain the observed subsurface temperature field and in particular the pronounced curvature of the vertical temperature profiles. The Neogene-Quaternary sedimentation resulted in a rather uniform deficit of the surface heat flux of about 12 mW m^{-2} in the study area, in spite of the marked lateral variation of the sedimentary pile thickness. The palaeoclimate effect is responsible for a surface heat flux depression of 7–8 mW m^{-2}, uniform along the study profile. Unlike older sedimentary basins, in the study area transient sedimentation thermal effects add to palaeoclimate effects in establishing the temperature field in the depth range of geothermal measurements. The lateral variation of the palaeoclimatically corrected surface heat flux from the centre of the Focsani Depression (40 mW m^{-2}) to its margin and the foreland platform (70 mW m^{-2}) is mainly the result of the lateral variation of the heat produced in the upper crust where thickness varies from 7 to 21 km, respectively. A heat production of 2.3 μWm^{-3} for the southeastern end of the profile and of 2.15 μWm^{-3} for the rest of it has been modelled.

As a result of the sedimentation process, temperature variations as large as 70–100°C occurred in the pre-Neogene sediments and the crystalline crust immediately under the sedimentary pile, with consequences on the metamorphic state and rheological behaviour of the foreland lithosphere. Progressively smaller variations were present to 40–50 km depth. Unlike flexural modelling, which indicate effective elastic thickness values of 10–15 km, our rheological analysis based on the derived temperature field indicates time-dependent lateral variations between 26–39 km, possibly favouring the recent evolution of the foredeep, characterized by depo-centre migration and basin expansion.

A re-evaluation of the tectonic evolution models for the lithosphere in the main tectonic units in the extra-Carpathian area (the Central Moesian Platform, Black Sea Block and East-European Platform) and a minimization of the uncertainties in the spatial distribution of the parameters required in thermal modelling by assimilation of the information supplied by tomographic seismic data, using a conversion procedure of seismic wave velocity to temperature was performed (Tumanian, 2008). Profiles of the temperature distribution with depth, for the crust and mantle, have been obtained and the rheological behaviour of the rocks in compressive regime was analysed. The rheological structure of the lithosphere has been interpreted in correlation with the characteristics of the seismic wave propagation process (quality factor of the medium Q). The thermal effects of the generation of magmas in the Neogene volcanic area on the temperature field have also been assessed by means of a numerical 2-D finite-element model which took into account the processes of subsidence/sedimentation, uplift/erosion and generation of magmas.

B. PAST CLIMATE CHANGES INFERRED FROM GEOTHERMAL MEASUREMENTS

Temperature data from nine boreholes in the Carpathian orogen in Romania have been used to obtain information on the ground surface temperature history (GSTH) in the last 250 years (Demetrescu et al., 2011). Long-term air temperature records available from the

Romanian weather station network have been used as a comparison term for the first 100-150 years of the GSTH, and as a forcing function in a POM-SAT model that combines borehole temperature profiles and meteorological time series to produce information on the so-called pre-observational mean (POM). Results from a global circulation model for the Romanian area have been used in the discussion as well.

C. HEAT TRANSFER AT THE AIR-SOIL INTERFACE

100-150 years years-long temperature and precipitation records from 14 Romanian stations and century-long temperature records from other 21 European stations were analyzed to reveal long-term characteristics of the surface climatic regime (Dobrica et al., 2009; Dobrica et al., 2010).

Temperature data recorded in 2002 and 2003 at 10 stations out of the 70 available in the Romanian automatic weather stations network are presented and analyzed in terms of the heat transfer from air to underground (Demetrescu et al., 2007). The air temperature at 2 m, the soil temperatures at 0, 5, 10, 20, 50 and 100 cm below the surface as well as rain fall and snow cover thickness have been monitored. The selected locations sample various climate environments in Romania. Preliminary analytical modelling shows that soil temperatures track air temperature variations at certain locations and, consequently, the heat transfer is by conduction, while at other stations processes such as soil freezing and/or solar radiation heating play an important part in the heat flux balance at the air/soil interface. However, the propagation of the annual thermal signal in the uppermost one meter of soil is mainly by conduction; the inferred thermal diffusivity for 8 stations with continuous time series at all depth levels ranges from 3 to 10×10^{-7} m^2 s^{-1}.

Acknowledgements. This report was prepared by Dr. Crisan Demetrescu and Dr. Venera Dobrica

PARTICIPATION OF THE ROMANIAN SPECIALISTS IN THE NATIONAL AND INTERNATIONAL SYMPOSIUMS AND CONFERENCES

Many of the results obtained by the Romanian seismologists in the past four years have been presented at a series of national and international meetings as follows:

2007

Symposium "Thirty years from the Romanian earthquake of 4 March 1977", Bucharest, 1-3 March 2007

A. Bala, I. Zihan, V. Ciugudean, V. Raileanu, B. Grecu, Physical and dynamic properties of the Quaternary sedimentary LAYERS in and around Bucharest City

G. Mărmureanu, M. Radulian, C. Ionescu, A. Mărmureanu, The Modern Romanian Seismology after March 4, 1977 Vrancea Earthquake

F. Wenzel, J. Bartlakowski, J. R.R. Ritter, M. Radulian, Urban Shakemap Methodology for Bucharest

B. Grecu, M. Radulian, N. Mandrescu, G. F. Panza, Application of H/V spectral ratios technique to noise data and strong ground motion characteristics in the particular case of Vrancea earthquakes and their effects in the Bucharest city area

N. Mândrescu, M. Radulian, G. Mărmureanu, B. Grecu, Seismic Microzonation of Bucharest Urban Area

Balan S.F., Cioflan C. O., Apostol B., Tataru D., Ritter J. R. R., Urban Seismology Research in the Area of Bucharest City

Moldovan I.A., Popescu E., Plăcintă A.O., Dam's rating in seismic risk classess. Part I: dam's from Transylvania and the central part of Romania

Oros E. Macroseismic and instrumental seismicity of the Banat Region and its significance on the seismic hazard and risk

A. Bala, B. Grecu, V. Raileanu, Physical and dynamic properties of the Quaternary sedimentary layers in and around Bucharest City II.

M. Diaconescu, Z. Malita, F. Radulescu, Seismotectonics of the Banat region (Romania)

M. Diaconescu, F. Radulescu, Z. Malita, Vrancea crustal seismogenic area (Romania)

F. Radulescu , M. Diaconescu, , Z. Malita, Seismotectonics of the Banat region

UNESCO Meeting,
March 2007, Athens, Greece

A. Bala, M. Radulian, National Institute for Earth Physics, Bucharest, Romania: Research directions, objectives, international cooperation

Workshop CDRF geohazard map,
April 2007, Ohrid, Macedonia

N. Mandrescu, B. Grecu, M. Radulian, Present status of the geohazards in Romania

General Assembly of the European Geoscience Union,
15 – 20 April 2007, Vienna, Austria

M. Popa, N. Cadichian, L.L. Romashkova, M. Radulian, D. Stănica, V.G. Kossobokov, Seismic monitoring aimed at intermediate-term prediction of strong earthquakes in the Vrancea region (invitată)

S.F Balan, C.O. Cioflan, B. Apostol, D. Tataru, J.R.R. Ritter, Urban Seismology Research in the Metropolitan Area of Bucharest

A. Bala, S. Balan, D. Hannich, J.R. R. Ritter, J. Rohn, Local site effects based on in situ seismic measurements in Bucharest city, Romania

V. Raileanu, M. Radulian, C. Ionescu, M. Popa, D. Tataru, Geological settings and crustal models for the seismological stations within the eastern part of Romania

V. Răileanu, C. Dinu, M. Radulian, A. Bălă, V. Diaconescu, E. Popescu, M. Popa, Crustal seismicity and the active fault systems in the SW of Romania

A. Oth, F. Wenzel, M. Radulian, Source scaling for intermediate-depth Vrancea (Romania) earthquakes with empirical Green's functions

O. Carbunar, M. Radulian, Numerical simulation method applied for Vrancea (Romania) intermediate-depth earthquakes

F. Borleanu, M. Popa, D. Ghica, M. Radulian Enhancement of monitoring for local and regional earthquakes using array techniques and calibration at BURAR (northern Romania) station

I.A. Moldovan, D. Enescu, A. S. Moldovan, Results obtained through the geomagnetic method for short-term prediction of Vrancea (Romania) earthquakes

I. A. Moldovan, A. S. Moldovan, C. G. Panaiotu, M. M. Echim, The geomagnetic method on precursory phenomena associated with 2004 Significant intermediate Vrancea seismic activity

A.S. Moldovan, S. Ersen, I. Dane, I.A. Moldovan, A. Ersen, A Romanian Infrasound Monitoring Array at Plostina - Vrancea. An evolving project on earth's whispers

I.A. Moldovan, E. Popescu, A.O. Placinta, T. Moldoveanu, Dam's rating in seismic risk classess in the North-Eastern part of Romania

A. Tugui, M. Popa, M. Craiu, M. Radulian, Earthquake scenarios for Vrancea source and implication on shake-maps

E. Popescu, M. Radulian, A.O. Plăcintă, M. Popa, I.A. Moldovan, B. Grecu, High-frequency spectral shape of acceleration data recorded in case of Vrancea (Romania) intermediate-depth earthquakes

V. Sokolov, K.-P. Bonjer, F. Wenzel, M. Radulian, B. Grecu, Attenuation relations for the intermediate depth Vrancea (Romania) earthquakes based on Fourier amplitude spectra

Radulescu F., Malita Z., Placinta A. O., Seismological information about the recent dynamics of the North-Dobrogean Orogen (Romania)

International Symposium on Seismic Risk Reduction,
The JICA Technical Cooperation Project in Romania,
26 – 27 April 2007, Bucharest, Romania.

L. Ardeleanu, G. Leydecker, K.-P. Bonjer, H. Busche, T. Schmitt, D. Kaiser, Probabilistic seismic hazard map of Romania in terms of macroseismic intensities

L. Ardeleanu, Attenuation properties of seismic waves in the crust in the Vrancea region (Romania)

A. Bala, J.R.R. Ritter, D. Hannich, S.F. Balan, C. Arion, Local site effects based on in situ measurements in Bucharest city, Romania in the frame of NATO SfP project 981882.

A. Bala, I. Zihan, V. Ciugudean, V. Raileanu, B. Grecu, Physical and dynamic properties of the Quaternary sedimentary layers in and around Bucharest city.

V. Raileanu, C. Dinu, M. Radulian, V. Diaconescu, A. Bala, E. Popescu, M. Popa, Crustal seismicity and active fault systems in the SE of Romania

5th International Conference on Seismology and Earthquake Engineering,
Teheran, mai 2007

F. Wenzel, J. Bartlakowski, M. Radulian, J. R. R. Ritter, A New Shakemap Methodology – Application to Bucharest, Romania

AGU 2007 Joint Assembly,
Acapulco, 22-25 mai 2007

F. Borleanu, M. Popa, D. Ghica, M. Radulian, Enhancement of monitoring for local and regional earthquakes using array techniques and calibration at BURAR (northern Romania) station

National Symposium of Geology and Geophysics "GEO2007",
Bucharest, 25-26 May 2007

A. Bala, J.R.R. Ritter, D. Hannich, S.F. Balan, C. Arion C., Seismic site effects based on in situ measurements in boreholes in Bucharest city, Romania in the frame of NATO SfP project 981882.

Raileanu, V., Bala, A., Radulian, M., Dinu, C., Diaconescu, V., Popescu, E., Mateciuc, D., Popa, M., A correlation of the crustal seismicity with deep structure in and in the front of SE Carpathians

M. Diaconescu, Z. Malita, Craiu G, Seismotectonics features of the Central and South Dobrogea.

Annual Scientific Conference of the Faculty of Physics,
Bucharest, 1-2 iunie 2007

A. Tugui, M. Craiu, M. Popa, M. Radulian, Characteristics of the ground motion distribution for different Vrancea earthquakes scenarios

M. Rogozea, B. Enescu, O. Bazacliu, M. Popa, M. Radulian, Seismicity characteristics of the Vrancea (Romania) intermediate-depth earthquakes

B. Grecu , M. Radulian, A. Bala, N. Mandrescu, B. Zaharia, Local response in Bucharest urban area inferred from moderate-size to Vrancea earthquakes

F. Borleanu , D. Ghica, M. Popa , B. Grecu , M. Radulian, Lateral structure in the Mediterranean Region as revealed by azimuth and slowness deviations detected by array-type systems

IUGG XXIV 2007, 2-13 iulie 2007,
Perugia, Italia

Demetrescu, C., Tumanian, M., Dobrica, V., Time-dependent thermal state in the Carpatho-Pannonian area. A review based on heat flow data and modeling, *XXIV IUGG General Assembly, Perugia, Italy, July 2-14, 2007.*

Dobrica, V., Wilhelm, H., Heat and groundwater flow modeling in the litosphere of the Eastern Carpathians bend, *XXIV IUGG General Assembly, Perugia, Italy, July 2-14, 2007.*

M. Rogozea, M. Popa and M. Radulian, Time-dependent seismic hazard assessment on the basis of monitoring seismicity behaviour in Vrancea region, Romania

I.A. Moldovan, D. Enescu, A. S. Moldovan, Possible association between some geomagnetic anomalies and Vrancea (Romania) significant earthquakes occurred in the years 2004-2007

A. Moldovan, I.A. Moldovan, C. Ionescu, S. Ersen, A. Ersen, MEMFIS - Multiple Electromagnetic Field and Infrasound Monitoring Array at Plostina - Vrancea. An attempt to guess what's cooking

I.A. Moldovan, E. Popescu, E. Oros, Dam's rating in seismic risk classess in Banat region- Romania

I.A. Moldovan, E. Popescu, A. Constantin, Probabilistic seismic hazard assessment In Romania: Application for crustal seismic active zones

M. Radulian, E. Popescu, A.O. Placinta, M. Popa, I.A. Moldovan, Source-site characterization for Vrancea (Romania) intermediate-depth earthquakes

E. Popescu, I.A. Moldovan, A.O. Placinta, C.O. Cioflan, M. Radulian, Attenuation relations for maximum acceleration produced by Vrancea intermediate, moderate earthquakes

L. Ardeleanu, V. Raileanu, The focal mechanism of small earthquakes in relation with the active fault systems of Vrancea region (Romania)

L. Ardeleanu, F. Borleanu, Q-models for deterministic seismic hazard assessment in Romania

F. Borleanu, O. Bazacliu Detailed investigation of the intermediate depth seismicity of the Vrancea region (Romania) during the last decade

A. Tugui, B. Grecu, M. Popa, M. Radulian and N. Mandrescu, Shake Map analysis for Vrancea (Romania) intermediate-depth earthquakes and implication on disaster management strategy.

F. Radulescu, Z. Malita, A. Placinta, M. Diaconescu, Seismicity and seismotectonics of eastern part of the Pannonian Depression (Romania)

Tumanian, M., Temperature estimates of the lithosphere on the Romanian territory constrained by seismic velocity data, XXIV IUGG General Assembly, Perugia, Italy, July 2-14, 2007.

E2C2-GIACS Advanced School on 'Extreme Events: Nonlinear Dynamics and Time Series Analysis',
Comorova, Romania, 3-11 septembrie 2007

M. Radulian, Earthquakes in Vrancea

International Symposium on Strong Vrancea Earthquakes and Risk Mitigation,
4-6 Octombrie 2007, Bucuresti, Romania.

M. Radulian, K.P. Bonjer, M. Popa, E. Popescu, Seismicity patterns in SE Carpathians at crustal and subcrustal domains: tectonic and geodynamic implications

Moldovan I.A., Popescu E., Placinta A.O., Moldoveanu T., Moldavian dam's rating in seismic risk classess - A probabilistic approach

Popescu E., Cioflan C.O., Radulian M., Placinta A.O., Moldovan I.A., Attenuation relations for the seismic ground motion induced by Vrancea intermediate-depth earthquakes

A. Bala, S.F. Balan, J.R.R. Ritter, D. Hannich, G. Huber, J. Rohn, Seismic site effects based on in situ borehole measurements in Bucharest, Romania.

A. Bala, B. Grecu, D. Hannich, D. Ehret, V. Raileanu, Methods to assess the site effects based on in situ measurements in Bucharest city.

L. Ardeleanu, G. Leydecker, K.-P. Bonjer, H. Busche, D. Kaiser, T. Schmitt, Map of probabilistic seismic hazard assessment for Romania as a basis for a new building code

B. Zaharia, B. Grecu, M. Radulian, M. Popa, D. Paulescu, H/V spectral ratio technique application for Bucharest area.

F. Borleanu , M. Popa, B. Grecu, M. Radulian , D. Paulescu, Structure inhomogeneity in the Mediterranean region and its influence upon azimuth and slowness corrections at BURAR (Romania) seismic array

S.F. Bălan, J.R.R. Ritter, D. Hannich, G. Huber, J. Rohn J., Geotechnical Laboratory Tests for the Microzonation of Bucharest.

S.F. Bălan, J. Bartlakowski, T. Diehl, T. Forbinger, J. Groos, B. Jaskolla, J. Rhon, J.R.R. Ritter, O. Sebe, H. Sudhaus, F. Wenzel, J. Ziehm, Results from the Urban Seismology (URS) Project in Bucharest, Romania.

V. Raileanu, A. Bala, C. Dinu, M. Radulian, E. Popescu, V. Diaconescu, D. Mateciuc, M. Popa, Crustal seismicity and deep structure in the SE Carpathians and its foreland.

Raileanu, V., Hauser, F., Bala, A., Fielitz, W., Prodehl, C., Dinu, C., Landes, M., Deep seismic sounding across the Vrancea region.

D. Ghica, J. Schweitzer, Automatic Data Processing at BURAR Seismic Station

3nd International conference on Science and Technology for Safe Development of Lifeline Systems - Natural risks: Progress on seismic and geotectonic modeling across CEI territory and implications on preventing and mitigating seismic risk, Bucureşti, 24-27 octombrie 2007

L. Ardeleanu, A method to estimate depth-dependent Q-models for the determistic seismic hazard assessment in Romania

M. Diaconescu, G. Oaie, Z. Malița, Seismogenetic areas in the Black Sea in the Black Sea areal

Oros E. Review of the historical seismicity in the western and southwestern territory of Romania (Banat Seismic Region)

Oros E. Defining the seismic hazard sources for Banat Region (the western and southwestern territory of Romania)

B. Zaharia, M. Radulian, M. Popa, B. Grecu, D. Tataru, The estimation of the local response in Bucharest area using Nakamura's method

F. Borleanu, M. Popa, M. Radulian, C. Panaiotu, Evidence of strong lateral inhomogeneous structure beneath SE Carpathians and specific mantle flow patterns

S.F. Bălan, C.O. Cioflan, B.F. Apostol, D. Tătaru, B.B. Grecu, The resonance of the surface waves. The H/V ratio in the metropolitan area of Bucharest

V. Raileanu, C. Dinu, E. Popescu, V. Diaconescu, B. Grecu, Crustal seismicity and associated tectonics in the W and NW of Romania.

CIEM, 22-23 noiembrie 2007, Bucharest, România.

L. Ardeleanu, M. Tumanian, Attenuation properties of the seismic waves in lithosphere for the seismic hazard assessment in Romania

1st International Workshop *"Advances in understanding crustal deformation in Southern Europe using the Global Positioning System"*, December 3-5, 2007, Sofia, Bulgaria

V. Mocanu, L. Munteanu, Crustal kinematics in Romania by satellite geodesy

M. Radulian, Seismicity of Romania and geodynamic implications

AGU Fall Meeting, San Francisco, 10-14 December, 2007

C. Ionescu, G. Marmureanu, A. Marmureanu, A. Grigore, Vrancea earthquake early warning system development in Romania

C. Ionescu, A. Danet, M.B. Sorensen, B. Zaharia, D. Stromeyer, G. Grunthal, Implementation of the near real time shakemap system in Romania

M.B. Sorensen, D. Stromeyer, G. Grunthal, A. Danet, C. Ionescu, Attenuation of macroseismic intensity - New relations for different parts of Europe

G. Marmureanu, C. Ionescu, A. Marmureanu, B. Grecu, C. Cioflan, The Early Warning System (EWS) as first stage to generate and develop Shake Map for Bucharest to deep Vrancea earthquakes.

V. Mocanu, L. Munteanu, Geodynamics of the Carpathian Bend Zone: interconnection between surface and deep processes

2008

European Geosciences Union General Assembly, 12-18 aprilie 2008, Viena

Apostol B. F., Bălan S. F., Cioflan C. O., Short-Term Seismic Activity. Next-Earthquake Time-Magnitude Distributions

Bălă A., Bălan F.S., Ritter J.R.R., Hannich D., Rohn J., Linear modelling of seismic site effects in Bucharest City, Romania

Bălan F.S., Apostol F.B., Bălă A., Ritter J.R.R., Huber G., New geotechnical tests in the Bucharest metropolitan area

Constantin A., Pântea A., Stoica R., New data about historical earthquakes occurred on the Romanian territory

Demetrescu, C., Tumanian, M., Thermal and rheological models of the Carpathians foreland on the Romanian territory, constrained by seismic velocity data, EUG General Assembly, Vienna, Austria, April 13-19, 2008.

Dobrica, V., Tumanian, M., Improved model simulating the Neogene volcanic process in Harghita Mountains (East Carpathians), EUG General Assembly, Vienna, Austria, April 13-19, 2008.

Diaconescu M., Plăcintă A.O., Moldovan I.A., Constantin P.A., Craiu M., Sesimological features of the Central and South Dobrogea

Diaconescu M., Plăcintă A.O., Moldovan I.A., Constantin P.A., Lazăr D., Characterization of the seismic sources from Black Sea areal

Ionescu C., Mărmureanu A., Mărmureanu G., The first European early warning system (EWS) for deep strong Vrancea earthquakes is working

Moldovan A., Ionescu C., Moldovan I.A., Ersen S., Ersen A., Recent results regarding the development of an infrasound monitoring array at Plostina-Vrancea

Moldovan I.A., Moldovan A.S., Panaiotu C.G., Plăcintă A.O., Significant amplitude geomagnetic anomalies prior the occurrence of Vrancea October 27th, 2007, Mw=6.0 earthquake

Moldovan I.A., Plăcintă A.O., Popescu E., Moldoveanu T., Probabilistic seismic hazard assessment in Romania used for dam's rating in seismic risk classes

Popescu E., Plăcintă A.O., Moldovan I.A., Radulian M., Source characteristics for Vrancea (Romania) intermediate-depth earthquakes

Popescu E., Plăcintă A.O., Moldovan I.A., Cioflan C.O., Radulian M., Attenuation model for the seismic ground motion induced by Vrancea intermediate-depth earthquakes

Purghel L., Georgescu M., Gheorghiu D., Moldovan I.A., Plăcintă A.O., Diaconescu M., Popescu E., Measurement of radon emanation along three surface faults from Dobrogea (Eastern – Romania)

Rădulescu F., Malița Z., Plăcintă A., Subcrustal earthquakes of Romania (without Vrancea)

F. Rădulescu, Z. Malița, A. Plăcintă, Seismological information about the recent dynamics of the North-Dobrogea orogen (Romania)

Răileanu V., Ardeleanu L., Bălă A., Popescu E., Deep structure and seismicity in the SE Carpathians and Focsani depression

Răileanu V., Ionescu C., Tătaru D., Crustal models in Romania based on seismic data

2008 Annual Meeting Of The Seismological Society Of America,
16-18 Aprilie 2008, Santa Fe

Cărbunar F.O., Radulian M., Earthquake Simulation Algorithm And Cycle Characteristics In The Vrancea (Romania) Area

Radulian M., Enescu B., Popa M., Zaharia B., Grecu B., Detailed Seismicity Analysis In Vrancea (Romania) To Provide Well-Constrained Parameters For Seismic Cycle Behavior

Scientific Conference GeoCAD' 08

9-10 mai 2008, Alba Iulia. University "1 Decembrie 1918" from Alba Iulia, Faculty of Sciences, University of West Hungary, Faculty of Geoinformatics, Székesfehérvár

Grecea C., Bălă A., Oros E., Studies and geodetic solutions for future evolutions and monitoring earthquakes in Banat county

International workshop on seismic hazard and seismic risk reduction
in the countries influenced by Vrancea earthquakes,
20 mai 2008, Chisinau, Moldova,
Organized in the framework of the research project NATO SfP-980468, http://igg.asm.md/sfp/

Bonjer K.-P., Ionescu C., Sokolov V., Radulian M., Grecu B., Popa M., Popescu E., Ground motion pattern of intermediate depth Vrancea earthquakes: The October 27, 2004 event

Grecu B., Radulian M., Mândrescu N., Panza G., Relevance of H/V spectral ratios technique in case of Bucharest city

National Symposium of Geology and Geophysics "GEO2008",
Bucharest, 23 - 24 May 2008

Bălă A., Bălan S.F., Ritter J.R.R., Hannich D., Arion C., Seismic in situ measurements in boreholes in Bucharest City, Romania

Bălă A., Grecu B., Hannich D., Răileanu V. Methods to assess the site effects based on in situ measurements in Bucharest city

Diaconescu M., Malița Z., Craiu G. M., Oros E., Seismological features of the areal situated between Curtea de Arges and Comarnic

Muntean A., Munteanu L., Mocanu V., Paunescu C., Andrei G., Herebei O., Veres I., Dima N., Filip L., Stability analysis of over-exploited mining areas by satellite geodesy

Munteanu L., Muntean A., Mocanu V., Andrei G., Paunescu C., Geodynamics of the Vrancea seismogenic zone by satellite geodesy

Munteanu L, Muntean A., Pauneacu C., Mocanu V., Andrei G., Calinoiu C., Analysis of Vidraru dam stability by satellite geodesy

Oros E., Site effects in the city of Timisoara – the resonance frequencies of the uppermost sedimentary layers

Rădulescu F., Malița Z., Plăcintă A., Mocanu V., Andrei G., On the seismotectonics of the Banat seismogenic zone

Răileanu V., Bălă A., Grecu B., Tătaru D., Crustal models in Romania based on seismic data

Annual Scientific Conference of the Faculty of Physics,
Bucharest, 6 June 2008

Borleanu F., Neagoe C., Popa M., Radulian M., Schwaitzer J., Slowness and azimuth determination for Bucovina array (BURAR) applying multiple signal techniques

Moldovan I.A., Moldovan A.S., Plăcintă A.O., Enescu D., Short-term prediction of Vrancea (Romania) earthquakes using the geomagnetic method

Neagoe C., Ionescu C., Grigore A., Dăneț A., Toward a dense real-time seismic network in Romania

Paulescu D., Ionescu C., Scanning, digitization and vectorization of historical seismograms

Popescu E., Tugui A., Plăcintă A.O., Moldovan I.A., Radulian M., Attenuation relations for maximum accekeration produced by Romanian crustal and subcrustal earthquakes

Popescu E., Plăcintă A.O., Popa M., Moldovan I.A., Radulian M., Seismic source characteristics and geodynamical features in the Vrancea region, Romania

Rogozea M., Popa M., Radulian M., Detailed seismicity analysis in the Vrancea area and implications for the seismic cycle evolution

Tătaru D., Răileanu V., Receiver functions technique – a new tool for investigation of the Romanian crust.

Tugui A., Craiu M., Rogozea M., Popa M., Radulian M., Seismotectonics of Vrancea (Romania) zone: the case of crustal seismicity in the foredeep area

Tugui A., Necula C., Panaiotu C., Preliminary rock magnetic properties of Quaternary basalts from the Persani Mts. (Romania).

Zaharia B., Radulian M., Popa M., Enescu B., Koulakov I., Tomographical research regarding Vrancea seismic zone.

The meeting commemorating the centenary
of Messina Reggio 1908 earthquake (MERCEA08), Reggio Calabria,
Italia, July 7-12 2008.

Bălan S. F., Cioflan C. O., Apostol B. F., Tătaru D., Grecu B., The Resonance of the Surface Waves. The H/V Ratio in the Metropolitan Area of Bucharest

Panza G.F., Kouteva-Guentcheva M., Cioflan C.O., Paskaleva I., Vaccari F., Romanelli F., Radulian M., Marmureanu G., Recent achievements in the neo-deterministic seismic hazard assessment in the CEI region

CEEX-MENER 2008,
27-29 Iulie 2008, Brasov

Munteanu L., Muntean A., Mocanu V., Paunescu C., Andrei G., Calinoiu C., Stability of artificial dams by satellite geodesy. Case study: Vidraru, Romania

International Seminar on Natural Hazards in the Marine Area,
28-29 July 2008, Bucharest, Romania

Diaconescu M., Malița Z., Characterization of the potential tsunamo-genetic seismic sources around Black Sea areal

Diaconescu M., Malița Z., Characterization of the tsunamogenetic potential of the seisimic sources located around the black sea area

The 33rd International Geological Congres,
6-14 August 2008, Oslo

Demetrescu, C., Tumanian, M., Seismic constrained thermal and rheological models for the Intra-Carpathian area (Romania), 33rd International Geological Congres, Oslo, Norway, August 6-14, 2008.

Dobrica, V., Tumanian M., An attempt to infer the anelastic attenuation on the Romanian territory from thermal models for the lithosphere, 33rd International Geological Congres, Oslo, Norway, August 6-14, 2008.

Radulian M., Grecu B., Mândrescu N., Criteria and methodology for geohazard assessment and mapping

Popa M., Mândrescu N., Radulian M., Seismic cycle behavior in a continental convergence area and implications on time-dependent seismic hazard evaluation

Beşuțiu L., Atanasiu L., Mitrofan H., Zlăgnean L., Radulian M., Popa M., Rogozea M., Sabău G., Negulescu M., Baltres A., Rus T., Danciu V., Moldoveanu C., Neuner J., New insights on the structure and dynamics of the intermediate-depth seismic zone located in the bending area of East Carpathians: INDEGEN project

Mândrescu N., Radulian M., Mărmureanu G., Grecu B., Integrated study of the geological, geophysical and seismological data for earthquake response evaluation

Ticleanu M., Pântea A., Constantin A., Ticleanu N., Nicolescu R., Hypothesis on the paleodynamic (paleoseismic) origin of the trovants ("Sandsteinkonkretionen")

Plăcintă A.O., Rădulescu F., Malița Z., Romania seismicity in the last two decades (1986-2007)

Muco B., Alexiev G., Aliaj S., Elezi Z., Grecu B., Mândrescu N., Milutinovic Z., Radulian M., Ranguelov B., Shkupi D., Geohazards map and assessment of some Balkan countries

Seminar NORSAR,
12 August 2008, 10:15 – 15:00,

M. Popa, M. Radulian, Presentation of the Romanian NDC

International Disaster and Risk Conference, IDRC Davos,
25-29 august 2008, p.15-20, Elveția

Mărmureanu G., Ionescu C., Mărmureanu A. Early Warning System, Shake Map and Disaster Maps for Deep Vrancea Earthquakes Developed in Romania as Parts of Disaster Reduction and Risk Management

NATO ARW Workshop "Coupled site and soil-structure interaction effects
with application to seismic risk mitigation"
31 August – 3 Sept. 2008, Borovets, Bulgaria.

Bălă A., Bălan S.F., Ritter J.R.R., Hannich D., Rohn J., Seismic site effects based on in situ borehole measurements in Bucharest, Romania

31rd General Assembly of the European Seismological Commission,
7-12 Septembrie 2008, Hersonissos, Creta

Ardeleanu L., Depth-dependent Q-models in the crust and upper mantle in the Vrancea region and surroundings

Ardeleanu L., Răileanu V., Sileny J., The seismic moment tensor of the crustal earthquakes from the Eastern Carpathians bending zone and surroundings

Bazacliu O., Ghica D., Ardeleanu L., Time evolution of seismic activity parameters in relation with the

occurrence of the strong earthquakes of the Vrancea region

Bălan S. F., Ritter J. R. R., Bălă A., Huber G., Geotechnical investigations at core samples from the Bucharest metropolitan area

Bălă A., Bălan F.S., Ritter J.R.R., Hannich D., Rohn J., Seismic site effect modelling based on *in situ* borehole measurements in Bucharest, Romania

Bălă A., Aldea A., Hannich D., Ehret D., Răileanu V., Methods to assess the site effects absed on in situ measurements in Bucharest city, Romania

Bălă A., Radulian M., Grecu B., Popescu E., Source effect vs. site effect of Vrancea earthquakes in Bucharest city, Romania

Borleanu F., Popa M., Radulian M., Slowness and azimuth determination for Bucovina Array (BURAR) applying multiple signal

Constantin A., Pântea A., Stoica R., Historical records of some Romanian earthquakes

Craiu M., Paulescu D., Tugui A., Reevaluating the magnitudes for intermediate-depth Vrancea earthquakes using analogues and digital recordings from the seismic observatory of Bucharest

Ghica D. V., Calibration of slowness estimations using Bucovina Romanian Seismic Array

Ghica D. V., Popa M., Radulian M., Bucovina Romanian Seismic Array (BURAR) – Contributions to the on-line seismic monitoring in South-Eastern Europe

Grecu B., Mândrescu N., Radulian M., New mapping of geohazards in Romania

Moldovan A.I., Popescu E., Constantin A., Cioflan C.O., Seismic hazard assessement in the Western part of the Moesian Plarform-Romania

Moldovan I. A., Moldovan A. S., Plăcintă A. O., Panaiotu C. G., Anomalous magnetic phenomena - possible precursors for Vrancea (Romania) intermediate earthquakes

Muco B., Alexiev G., Aliaj S., Elezi Z., Grecu B., Mândrescu N., Milutinovic Z., Radulian M., Ranguelov B., Shkupi D., Geohazards map and assessment of some Balkan countries

Oros E**.,** Paulescu D., Popa M., The M6.4, 26th January, 1916 earthquake under review: new data on the seismicity of Fagaras Seismogenic Region (Romania)

Oros E., Oros V., The study of the 20th century strong Romanian earthquakes using historical instrumental data - a success of EUROSEISMOS 2002-2006 Project

Oros E., Seismic sequences in the western part of Romania: time-spatial and size distributions

Oros E., Defining the seismic hazard sources on the south-eastern border of Pannonian Depression (the western and southwestern territory of Romania)

Pântea A., Constantin A. P., Isoseismal map of the October 27, 2004 Vrancea (Romania) earthquake

Pântea A., Constantin A. P., Revised isoseismal map for the August 30, 1986 Vrancea (Romania) strong earthquake

Popescu E., Plăcintă A., Popa M., Moldovan I. A., Radulian M., Source characteristics of the Vrancea (Romania) subcrustal earthquakes: Variability test of the source time function using a small-aperture array

Rădulescu F., Malița Z., Plăcintă A., Subcrustal lithosphere dynamics of the Carpathian area of Romania

Răileanu V., Bălă A., Ardeleanu L., Popescu E., Crustal seismicity vs. deep structure in Focsani Basin (Romania)

Răileanu V., Bălă A., Ionescu C., Tătaru D., Crustal models in Romania from seismic data

Rogozea M., Popa M., Radulian M., Analysis of the aftershock sequences of the most recent strong events generated in the Vrancea area

Tugui A., Craiu M., Popa M., Seismotectonics features in the Vrancea (Romania) zone: as revealed by the earthquake sequences in the Râmnicu Sărat area

Zaharia B., Enescu B., Radulian M., Popa M., Koulakov I., Tomography image in Vrancea seismic zone using local data

11th Castle Meeting „Paleo, Rock and Environmental Magnetism”,
2008, Bojnice, Slovacia

Tugui A., Panaiotu C., Paleomagnetic and rock magnetic properties of Quaternary basalts from the Persani Mts.

National Conference in Physics,
10-13 September 2008, Magurele

Borleanu F., Popa M., Radulian M., Determination of lithosphere inhomogeneities for the Bucovina (Romania)region using specific array techniques

Călin M.R., Ionescu C., Grigore A., The measurement of atmospherical Radon in seismic monitoring applications

Craiu M., Paulescu D., Tugui A., Tătaru D., Recalculation of the intermediate-depth Vrancea earthquakes magnitudes using historical seismograms

Grecu B., Răileanu V., Tătaru D., Bălă A., Analysis of site response characteristics in Romania using S and coda waves.

Tătaru D., Răileanu V.- Crustal thickness and Vp/Vs variations from analysis of teleseismic receiver functions

Zaharia B., Enescu B., Radulian M., Popa M., Koulakov I., Parolai S., Tomographical image for Vrancea area using local data

27th ECGS Workshop „Seismicity patterns in the Euro-Med region”,
17-19 septembrie 2008, Luxembourg

Apostol B.-F., Bălan S.F. Statistical distribution of earthquakes and urban seismology in Romania

Bălă A., Radulian M., Grecu B., Popescu E., Source effect vs. site effect of Vrancea earthquakes recorded in Bucharest City, Romania

Popa M., Radulian M., Mândrescu N., Paulescu D., Seismicity patterns in Vrancea region as revealed by revised historical and instrumental catalogues

Răileanu V., Dinu C., Bălă A., Ardeleanu L., Popescu E., Crustal seismicity and associated fault fields in Romania

Rogozea M., Popa M., Zaharia B., Radulian M., Vrancea (Romania) seismic cycle modelling on the basis of characteristic space-time-size earthquake distributions

ESF-FWF Conference on “New Challenges in earthquake dynamics:
observing and modelling a multi-scale system”
18-23 octombrie 2008, University Centre Obergurgl, Austria

Grecu B., Popa M., Radulian M., Seismicity patterns in Vrancea area and implications on seismic cycle evolution

Technical – Scientific International Symposium 2008 “Modern Systems for Mitigation of Seismic Action”
(organized to honor the memory of Prof. Eng. Dan Ghiocel), 31 octombrie 2008 (AGIR, 118 Calea Victoriei, Bucharest, sect 1).

Panza G.F. , Cioflan C.O., Vrancea Earthquakes: A Special Challenge for Seismic Isolation in Bucharest

AGU Fall Meeting
15-19 decembrie 2008, San Francisco, California

Cărbunar O.F., D. von Seggern, Radulian M., Ivan M., Space-time seismicity patterns identification in Vrancea (Romania) seismic region using high-resolution revised catalog data

2009

Seminar NOA – Institute of Geodynamics, Athens, on 20/3/2009,
HemusNET project: SfP-981881(www.hemus-net.org)

B. Grecu, M. Radulian, Seismic Ground Motion Characteristics in the Bucharest Area

National Symposium of Geology and Geophysics "GEO2009",
Bucharest, 22-23 May 2009

M. Diaconescu, Z. Malita, E. Popescu, Câmpulung and Sinaia seismological areas. Geo-tectonic and seismological correlations

M. Diaconescu, Z. Malita, Some aspects concerning the seismicity of the Romanian territory

European Geosciences Union, General Assembly
19 – 24 April 2009, Vienna, Austria

A. Bălă, A. Aldea, J.R.R. Ritter, D. Hannich, Methods to Assess the Site Effects Based on in situ Measurements in large urban Areas. Application in Bucharest City, Romania

A. Bălă, J.R.R. Ritter, D. Hannich, S.F. Bălan, SHAKE modelling of seismic site effects based on data recorded in Bucharest City, Romania

S.F. Bălan, C.O. Cioflan, B.F. Apostol, Local Seismic Effects Induced by the Crustal Lithosphere Zone of Tulcea, Romania

D. Ghica, L. Manea, Short-period seismic noise conditions at the BURAR seismic array

D. Ghica, A. Grigore, C. Ionescu. Protective system for civil buildings and industrial structures subjected to the seismic risk

D. Ghica, M. Popa, V. Oancea, Romanian contribution to the CTBT monitoring during 2004 – 2008

I. Ilieş, C. Ionescu, A.G. Grigore, The development of the Moldova digital seismic network

C. Ionescu, A.S. Moldovan, I.A. Moldovan, A.G. Grigore, The development of the Romanian infrasound network array

A. Mărmureanu, C. Ionescu, Gh. Mărmureanu, Benchmark of Romanian Early Warning System

Gh. Mărmureanu, C.O. Cioflan, A. Mărmureanu,New seismic hazard map of Romania in MMI intensities by using probabilistic and deterministic approaches, linear and nonlinear methods

V. Mocanu, L. Munteanu, C. Paunescu, G. Andrei, A. Muntean, Monitoring non-tectonic surface deformations by space and classic geodesy techniques. Applications for arc dams

I.A. Moldovan, A.O. Placinta, A.P. Constantin, A.S. Moldovan, The 1998-2009 geomagnetic data and significant amplitude geomagnetic anomalies (re)analysis in correlation with earthquake occurrence and magnetic storms

I.A. Moldovan, A.P. Constantin, E. Popescu, A.O. Placinta, T. Moldoveanu, Earthquake Risk Classes for dams situated in the Romanian Moesian Platform and Loss Estimates Scenario due to Ramnicu Valcea Dam collapse

A.S. Moldovan, I.A. Moldovan, C. Ionescu, C.G. Panaiotu, Electromagnetic and Infrasound Monitoring Network in Romania – First data, first results

C. Neagoe, C. Ionescu, The improved broadband Real-Time Seismic Network in Romania

C. Neagoe, F. Borleanu, M. Popa, C. Ionescu, M. Radulian, Calibration of Local Magnitude in case of crustal Earthquakes for Romania Territory Using data from broadband stations

C.G. Panaiotu, T. Merezeanu, A. Tugui, C. Corban, C. Necula, A. Panaiotu, Paleomagnetism of the Pliocene-Quaternary volcanic rocks of the Eastern Carpathians

A. Pantea, A. Constantin, The revision of the macroseismic maps for the Vrancea (Romania) subcrustal earthquakes, occurred on the 30th and 31st of May 1990

M. Picozzi and the SAFER and EDIM working groups Team, The Self-Organising Seismic EarlyWarning Information Network

Zaharia B., Enescu B., Radulian M., Popa M., Koulakov I., Parolai S., Determination of the lithospheric structure in the South-Eastern Carpathians Arc bend area using local data

M. Zoran, D. Mateciuc, Use of geospatial information and in situ monitoring data for seismic hazard assessment in Vrancea area, Romania

National Symposium of Geology and Geophysics "GEO2009",
Bucharest, 22-23 May 2009

Ardeleanu L. , Depth-dependent Q-models by high frequency waveform modelling

Ardeleanu L., Răileanu V., The focal mechanism of small earthquakes from the bending of the Eastern Carpathians and surroundings

Bălan S.F., Ioane D., Cioflan C.O., Characteristics of crustal lithosphere zone of Tulcea

Diaconescu M., Malita Z., Some aspects concerning the seismicity of the romanian territory.

Diaconescu M., Malita Z., Popescu E., Campulung and Sinaia seismological areas. Geo-tectonic and seismological correllations.

Răileanu V., Dinu C., Ardeleanu L., Diaconescu V., Popescu E., Munteanu I., Bălă A., Crustal seismicity vs active fault systems in Romania

Tătaru D., Răileanu V. - Receiver function structure beneath three Romanian seismic broadband stations

The Annual Symposium of the Institute of Solid Mechanics,
Bucharest, 2009

Bratosin D., Bălan S. F., Cioflan C. O., On natural periods of the systems with nonlinear materials

Annual Scientific Conference of Faculty of Physics,
5 June 2009

Moldovan I.A., Constantin A.P., Popescu E., Plăcintă A.O., Earthquake risk classes for dams situated in the Romanian Moesian Platform

Neagoe C., Popa M., Radulian M., A possible deep lithospheric root beneath the Sinaia area

Popescu E., Radulian M., Ghica D., Rogozea M., Source parameters and directivity in the case of Vrancea intermediate-depth earthquake of 15th April 2009

Rogozea M., Popa M., Radulian M., Statistical investigation of the time-space-size fluctuations in the Vrancea intermediate-depth earthquake catalog

Tătaru D. ,Imaging the Romanian crust using Ps converted waves

International Scientific Studies Conference (ISS09),
10-12 iunie, 2009, Viena

Ghica D. , Popa M., Oancea V., Analysis of system perfor-mance applied to the territory of Romania (2004 - 2008)

Workshop on Seismic Tomography, July 2-3, 2009, University of Utrecht, Netherlands

Morelli A., Boschi L., Kind R., Montagner J.-P., Raileanu V., Trampert J., Towards a European seismo-logical reference model

4th International Conference on Sciences and Technology for Safe Development of Lifeline Systems- Natural Risks, Investigations in Earth Sciences and Protection of Environment in CEI Countries, 30 August – 1 September 2009, Skopje/ Ohrid, Republic of Macedonia

Bălan S. F., Apostol, F. B., Local seismic effects induced by crustal lithosphere zone of Galati and Tecuci, Romania

Neagoe C., Popa M., Radulian M.,A subcrustal earthquake source outside the Vrancea nest, beneath Sinaia area, Romania

Popa M., Radulian M., Seismicity fluctuations in the Vrancea region: how far are they influencing the seismic activity in the neighbourhood areas?

SHARE – Meeting of Work Package 3 "Earthquake sources and activity rates", INGV, Rome, 14-16 September, 2009

Radulian M., Report on the status of the input parameters for seismic hazard assessment in Romania

Joint NERIES NA4, SHARE Task 3.1
Workshop on "The Making of the European-Mediterranean Earthquake Catalogue", Thessaloniki, Greece, 12-14 October 2009

Radulian M., Re-evaluation of depth and magnitude of Vrancea earthquakes using macroseismic data

The 95th Journées Luxembourgeoises de Géodynamique (JLG95), Echternach, Luxembourg, 9-11 November, 2009, http://www.ecgs.lu/jlg95-abstracts/

Bălă, A., S.F. Bălan, J.R.R. Ritter, D. Hannich, Modeling of seismic site amplification based on in situ borehole measurements in Bucharest, Romania,

Central European Initiative
Unified seismic hazard mapping for the territory of Romania, Bulgaria, Serbia and Republic Macedonia - Project 1202.038-09, ICTP Trieste, 17-18 November 2009

Cioflan C. O. , Deterministic seismic hazard analysis in Romania

Radulian M., General presentation on the state-of-the-art of CEI project

International Experts Meeting on Carpathian Geodynamic Network, 19-21 November 2009, Bucharest

Zaharia B., Neagoe C., Koulakov I.,Enescu B., Radulian M., Popa M., Geodynamics features in the Carpathian-Pannonian area from new seismicity and earthquake tomography data

Second International Workshop on "Advances in understanding crustal deformation in Southern Europe using the Global Positioning System", 20-21 November 2009, Nevrokopi, Greece

Munteanu L., Mocanu V., Radulian M. , Ten years of GPS observations in Romania

SHARE Meeting of Work Package 3 on Historical Data and Catalogues, Bucuresti 3-4 Decembrie, 2009

Oros E., Historical data from Banat Seismic Region.

4-th National Conference on Seismic Engineering 2009

Bălă A., Radulian M., Grecu B., Popescu E., Source effects vs. site effects of Vrancea earthquakes recorded in the Bucharest city, Romania

Bălă A., Arion, C., Neagu, C., Balan, S.F., In situ Borehole Measurements in Bucharest, Romania as a Tool for

Assessment of the Seismic site

Bratosin D., Bălan F. S., Cioflan C. O., On dominant site period evaluation

I.A. Moldovan, A.P. Constantin, E. Popescu, A.O. Plăcintă, T. Moldoveanu, Incadrarea in clase de risc seismic a barajelor situate in Platforma Moesica

Oros E., Oros V., New and updated information about the local hazard seismicsources in the Banat Seismic Region.

2010

EGU General Assembly 2010, Vienna

Bălan S. F., Apostol B., Chitea F., Anghelache M. A., Cioflan C. O., Serban A., Scenarios for local seismic effects of Tulcea (Romania) crustal earthquakes, preliminary approach for the seismic microzoning of Tulcea city, Geophysical Research Abstracts, Vol. 12, EGU2010-15456, 2010

Bălan S. F., Ritter J., Bălă A., Rohn J., New geophysical and geotechnical data on Quaternary layers in the metropolitan area of Bucharest

K.-P. Bonjer, R. Glavcheva, A. Drumea, I. Paskaleva, M. Radulian, S. Radovanovic, K. Gribovscki, W. Weisbrich, Destructive Vrancea (Romania) intermediate-depth earthquakes: intensity distribution and isoseismals, Geophysical Research Abstracts, Vol. 12, EGU2010-0, 2010

Borleanu F., Tibuleac I., Single-array location and magnitude estimation for the Korean nuclear tests (9 October 2006 and 25 May 2009) at BURAR (Romania), Geophysical Research Abstracts, Vol. 12, EGU2010-12959, 2010

Ghica D., Popa M., Radulian M., Observation of the regional and distant seismicity with BURAR seismic array, Geophysical Research Abstracts, Vol. 12, EGU2010-0, 2010

Grecu B., Tătaru D., Neagoe C., Panza G. F., Răileanu V., Radulian M., Popa M., Ionescu C., Ambient seismic noise cross-correlations at Romanian broadband stations, Geophysical Research Abstracts, Vol. 12, EGU2010-117645, 2010

Ioane D., Stancicu M., Chitea F., Diaconescu M., Active fault systems and their significance for urban planning in Bucharest, Romania, Geophysical Research Abstracts, Vol. 12, EGU2010-15505-3, 2010

C. Ionescu, A.-S. Moldovan, I.-A. Moldovan, D. Ghica, Seismo-acoustic array installed in Vrancea seismogenic area, Geophysical Research Abstracts, Vol. 12, EGU2010-12931, 2010

Mărmureanu G., Cioflan C.O., Mărmureanu A., Strong nonlinear dependence of the spectral amplification factors of deep Vrancea earthquakes magnitude, Geophysical Research Abstracts, Vol. 12, EGU2010-0, 2010

Mărmureanu G., Ionescu C., Mărmureanu A., Rapid magnitude determination in maximum 5 seconds for Vrancea early warning system. Testing of EEWS software

Molinari I., Morelli A., Răileanu V., Tătaru D., The crustal structure of South-Eastern Europe in the new European Plate reference model,Geophysical Research Abstracts, Vol. 12, EGU2010-8366, 2010

Iren-Adelina Moldovan, Anca Otilia Placinta, Angela Petruta Constantin, Adrian Septimiu Moldovan, The correlation of the geomagnetic anomalies recorded at Muntele Rosu (Romania) Seismic Observatory with earthquake occurrence and solar magnetic storms (2000 – 2009), Geophysical Research Abstracts, Vol. 12, EGU2010-1332, 2010, EGU General Assembly 2010

Adrian Moldovan, Iren-Adelina Moldovan, Anica Otilia Placinta, Pier Francesco Biagi, The Romanian VLF/LF monitoring system as a part of the INFREP international network, Geophysical Research Abstracts Vol. 12, EGU2010-1205-2, 2010 EGU General Assembly 2010

T. Maggipinto, P. F. Biagi, L. Castellana, A. Ermini, M. E. Contadakis, I. A. Moldovan, A. S. Moldovan, A. Buyuksarac And M. Fiore, Present status and preliminary results of the VLF/LF radio recording European network installed in 2009, Geophysical Research Abstracts Vol. 12, EGU2010-2497, 2010 EGU General Assembly 2010 EGU General Assembly 2010

Nitoiu, D., Dobrica, V., Demetrescu, C., On the decadal variability of atmospheric large-scale modes: teleconnections with observational data from Romania, *EGU General Assembly, Vienna, Austria, May 2-7, 2010.*

C. Negoe, L. Manea, C. Ionescu, Romanian complex data center for dense seismic network, Geophysical Research Abstracts, Vol. 12, EGU2010-0, 2010

Pântea A., Constantin A., Reevaluated macroseismic map of the strongest Vrancea (Romania) earthquake occurred in 20th century, Geophysical Research Abstracts, Vol. 12, **EGU2010-1873**, 2010

V. Raileanu, L. Ardeleanu, E. Popescu, Seismic evidences of the crustal faults at bottom of the Focsani basin (Romania), Geophysical Research Abstracts, Vol. 12, EGU2010-0, 2010

V Raileanu, B. Grecu, D. Tataru, A. Bala, C. Ionescu, A synthesis of old and new seismic crustal data in the Romanian sector of the Moesian Platform, Geophysical Research Abstracts, Vol. 12, EGU2010-3885, 2010

National Symposium of Geology and Geophysics "GEO2010",
Bucharest, 21 mai 2010

Bălan S. F., Ioane D., Apostol B., Cioflan C., Panea I., Chitea F., Local seismic effects induced by crustal earthquakes from Tulcea zone, Romania

Bălă A., Ritter J. R. R., Bălan S. F., Hannich D., Modelling of seismic site amplification based on *in situ* borehole measurements in Bucharest, Romania

I.A. Moldovan, A.O. Placinta, A.P. Constantin, A.S. Moldovan, The correlation of geomagnetic anomalies recorded at Muntele Rosu seismic observatory (Romania) with earthquakes' occurrences and solar magnetic storms, Expanded Abstract GEO-2010

Tătaru D., Grecu B., Răileanu V. , Joint inversion of receiver function and surface wave dispersion curves for S-velocity structure at the Romanian broad-band stations

International Disaster and Risk Conference (IDRC) –
Davos, 30 May-03 June 2010

Mărmureanu G., Mărmureanu A., Ionescu C., Romanian early warning system part of seismic hazard/risk mitigation mechanisms

Annual Scientific Conference of the Faculty of Physics,
Bucharest, 18 iunie 2010

Borleanu F., Zaharia B., Manea L., Popa M., Diaconescu M., Radulian M., Baher S. Preliminary P-wave velocity model in case of Dobrogea (Romania) and surrounding regions as revealed by 3 D tomography inversions

A. Craiu, C. Panaiotu, Paleomagnetic study of the Quaternary Racos volcanic structure

M.Craiu, A. Craiu, C. Ionescu Calibrating the local magnitude formula ML using modified Richter formula, reported with the MD magnitude

I.-A. Moldovan, A. Moldovan, A. O. Placinta, P. F. Biagi Preliminary results of the INFREP European VLF/LF radio monitoring network installed in 2009: the Romanian contribution

C. Neagoe, C. Ionescu, A. Danet, B. Grecu A strong motion network in Romania: detection capabilities and analysis

E. Popescu, M. Radulian, F. Borleanu, Maria Rogozea Source parameters of the crustal moderate earthquakes occurred between 2007 and 2009, in the south-eastern part of Romania

M. Rogozea, M. Popa, M. Radulian Analysis of the 1838 Vrancea earthquake

Tătaru D., Grecu B., Răileanu V.Receiver function studies in Romania

14-th European Conferenceon Earthquake Engineering,
27 Aug. – 1 Sep. 2010, Skopje-Ohrid (Rep. Macedonia) (www.14ecee.mk)

Mărmureanu G., Cioflan C.O., Mărmureanu A., New seismic hazard map of Romania by probabilistic and deterministic approaches, linear and nonlinear analyses

C. Neagoe, C. Ionescu, B. Grecu, The development of the real-time strong motion network in Bucharest area for engineering purposes

Panza, G.F., Radulian, M., Kronrod, T, Paskaleva, I., Radovanovic, Sl., Popa, M., Drumea, A., Gribovski, K., Dojchinovski, D., Kouteva, M., Varga, P., Pekevski, L., Integrated Unified Mapping of the Vrancea Macroseismic Data for the CEI Region

ESC, 6-10 sep. 2010, Montpellier (www.esc.eu)

Bălan S. F., Cioflan C. O., Apostol B., Local seismic effects induced by crustal lithosphere zone of Câmpulung-Muscel, Romania, SH4/P13/ID20

Bălă A., Aldea A., Arion C., Bălan S. F., In situ borehole measurements in Bucharest, Romania as a tool for assessment of the seismic site effects, SH4/P10/ID17

F. Borleanu, M. Popa, M. Radulian, S. Baher, Contribution of the BURAR (Romania) array to monitoring seismicity in the region of Balkans and Middle Asia, ES10/P5/ID39

O. Cărbunar, M. Radulian, Earthquake cycle simulation in the Vrancea (Romania) subcrustal source by a 2-D algorithm with characteristic discretization, ES6/P10/ID213

O. Cărbunar, M. Radulian, M. Ivan, Vrancea (Romania) intermediate-depth seismicity nest: geometrical constrains and implications on seismic cycle evolution, ES6/P9/ID212.

A. Constantin, A. Pântea, R. Stoica, A preliminary investigation of some major Vrancea (Romania) historical earthquakes: new sources.

I. Moldovan, A. Constantin, E. Popescu, A. Plăcintă, T. Moldoveanu, Earthquake risk classes for dams situated in the Oltenia (Romania) zone.

C. Neagoe, L. Manea, C. Ionescu, M. Drăgoicea, Real-time estimation of macroseismic intensity in Romania

Oros E., Oros V., Estimating magnitude and location of Romanian crustal earthquakes using intensiy data, SD4/P6/ID66

A. Pântea, A. Constantin, Relocation of the historical earthquakes occurred on the Romanian territory.

E. Popescu, M. Radulian, F. Borleanu, A. Plăcintă, I. Moldovan, Source characteristics of the recent crustal earthquakes occurred in the south-eastern part of Romania, ES5/P12/ID115

M. Radulian, M. Rogozea, M. Popa, R. Glavcheva, B. Nilay, O. Nurcan, Contribution to intensity data base and catalogue compiling for earthquakes in Romania and neighboring countries, SD4/P14/ID74

Zaharia, B., Oros, E., Popa, M., Radulian, M., Tomography research in Banat area (western Romania) using local earthquake data, SW3/P3/ID188

The National Conference in Physics,
Iasi, 23-25 sep. 2010

F. Borleanu, Popa M., Radulian M., Improvement of automat detections for different seismic phases in case of BURAR (Bucovina) seismic array (invited)

Craiu M, Craiu A., Ionescu C., Local magnitude revaluation for Vrancea intermediate depth earthquakes

Ghica D., Rău C. D., Ionescu C., Grigore A., Antiseismic protection system for dangerous installations

B. Grecu, D. Tataru, C. Ionescu, C. Neagoe, A. Danet, M. Popa, New development and research applications of the Romanian Real-Time Digital Seismic Network

Iren-Adelina Moldovan, Angela Constantin, Emilia Popescu, Anica Placinta, Earthquake Risk Classes for dams situated in the Western part of Romania

Iren-Adelina Moldovan, Adrian Moldovan, Anica Placinta, Pier Francesco Biagi, The INFREP European VLF/LF radio monitoring network - Present status and preliminary results of the Romanian monitoring system

Muntean A., Munteanu L., Stability analysis of over-exploited mining areas by satellite geodesy

D. Paulescu, G. Mărmureanu, Database of historical seismograms in Romania

Rogozea M., Popa M., Radulian M., Re-evaluation of the catalogue for the historical earthquakes in Romania

Zaharia B., Oros E., Popa M., Radulian M., Banat seismic area tomography from local data

The XIX Congress of the Carpathian Balkan Geological Association (CBGA 2010), 23-26 September 2010, Thessaloniki, Greece, www.cbga2010.org

Popa M., Radulian M., Szakacs A., Seghedi I., Zaharia B., Seismicity in the southern part of the Harghita Mountains and its possible correlation with recent volcanic activity

Tătaru D., Grecu B., Raileanu V., New insights into the lithosphere beneath the Romanian seismic network from Rayleigh wave dispersion and receiver function analysis

2nd Symposium of International Geo-Hazards Research Society "Scientific approach to Geo-Hazard: a window to the future", Rosignano, Italy, 27-29 Sept. 2010

Bălan S. F., Cioflan C. O., Bălă, The influence of crustal earthquakes on the geo-hazard of the seismogenic zone of Făgăraş-Câmpulung, Romania.

***The 2-nd Symphosium of IGRS (*International Geo-Hazards Research Society)- Rosignano, Italia, 26.09 - 02.10.2010**

Bălă A., Radulian M., Bălan S. F., Popescu E., Variable Site Effects of Vrancea Earthquakes recorded In Bucharest City, Romania,

REFERENCES 2007-2010

2007

Ardeleanu L.A., Leydecker G., Schmitt T., Bonjer K.-P., Busche H., Kaiser D., Simenova S.D., Solakov D.E. (2007). Probabilistic seismic hazard maps in terms of intensities for Romania and Bulgaria, Proc. CRC-461 International Symposium on Strong Vrancea Earthquakes and Risk Mitigation, MATRIX ROM, Bucharest, p.128-132, 2007.

Bălan S.F., J.R.R. Ritter, D. Hannich, G. Huber, J. Rohn, Geotechnical Laboratory Tests for the Microzonation of Bucharest, International Symposium on Strong Vrancea Earthquakes and Risk Mitigation, Oct. 4 – 6, 2007, Bucharest, Romania. (244-247 p.) ISBN 978-973-755-247-1, 2007.

Bălan S.F., J. Bartlakowski, T. Diehl, T. Forbinger, J. Groos, B. Jaskolla, J. Rhon, J.R.R. Ritter, O. Sebe, H. Sudhaus, F. Wenzel, J. Ziehm J., Results from the Urban Seismology (URS) Project in Bucharest, Romania International Symposium on Strong Vrancea Earthquakes and Risk Mitigation, Oct. 4 – 6 , 2007, Bucharest, Romania. (277-283 p.) ISBN 978-973-755-247-1, 2007.

Bălan S.F., Bălă A., Ritter, J.R.R., Hannich, D., Huber G., Rohn J., Geotechnical laboratory tests for the microzonation of Bucharest, Proc. CRC-461 International Symposium on Strong Vrancea Earthquakes and Risk Mitigation, MATRIX ROM, Bucharest, p.244-248, 2007.

Bălă A., Zihan I., Ciugudean V., Răileanu V., Grecu B., Physical and dynamic properties of the Quaternary sedimentary layers in and around Bucharest city, Proceedings of the International Symposium on Seismic Risk reduction, Paper 07, 359-366, Ed Orizonturi Universitare Timisoara, 2007.

Bălă A., Ritter J.R.R., Hannich D., Bălan S.F., Arion C., Local site effects based on in situ measurements in

Bucharest city Romania, in the frame of NATO SfP Project 981882, Proceedings of the International Symposium on Seismic Risk reduction, Paper 06, 367-374, Ed Orizonturi Universitare Timisoara, 2007.

Bălă A., S.F. Bălan , J.R.R. Ritter, D. Hannich, G. Huber, J. Rohn, Seismic site effects based on in situ borehole measurements in Bucharest, Romania, Proceedings of the International Symposium on Strong Vrancea Earthquake and Risk Mitigation, Oct. 4 – 6, Bucharest, Romania, 190 – 204, 2007.

Bălă A., B. Grecu, D. Hannich, D. Ehret, V. Răileanu, Methods to assess the site effects based on in situ measurements in Bucharest city, Proceedings of the International Symposium on Strong Vrancea Earthquake and risk mitigation, Oct. 4 – 6, Bucharest, Romania, 248 – 252, 2007.

Borleanu F., M. Popa, B. Grecu, M. Radulian, D. Paulescu, Structure inhomogeneity in the Mediterranean region and its influence upon azimuth and slowness corrections at BURAR (Romania) seismic array, Proc. CRC-461 International Symposium on Strong Vrancea Earthquakes and Risk Mitigation, MATRIX ROM, Bucharest, p.170-173, 2007.

Böse M., Ionescu C., Wenzel F., Earthquake early warning for Bucharest, Romania: Novel and revised scaling relations, Geophysical Research Letters, 34, L07302, 6p., 2007.

Böse M., Wenzel F., Erdik M., Mărmureanu G., Earthquake early warning for Bucharest and Istanbul, Proc. CRC-461 International Symposium on Strong Vrancea Earthquakes and Risk Mitigation, MATRIX ROM, Bucharest, p.148-152, 2007.

Bratosin D., Bălan S. F., Cioflan C. O., Soils non-linearity evaluation for site seismic microzonation, Proceedings of the Romanian Academy, 8, 3, 235-242, 2007.

Cioflan C. O., Romanelli F., Grecu B., Popa M., Mândrescu N., Răileanu V., Bălă A., Panza G.F. (2007). General Mapping of the strong ground motion in Bucharest area and related hazard/risk scenarios, in *Impact of Vrancea Earthquakes on the Security of Bucharest and other Adjacent Areas* Ed. G.F. Panza, M. Radulian, I. Kuznetsov, 93-99, 2007.

Demetrescu, C., Nitoiu, D., Boroneant, C., Marica, A., Lucaschi, B., 2007, Thermal signal propagation in soils in Romania: conductive and non-conductive processes, *Clim. Past, 3, 637-645*.

Demetrescu, C., Wilhelm, H., Tumanian, M., Damian, A., Dobrica, V., Ene, M., 2007, Time dependent thermal state of the lithosphere in the foreland of the Eastern Carpathians bend. Insights from new geothermal measurements and modeling results, *Geophys. J. International, 170, 896-912*.

Diaconescu M., Malita Z., Surse seismice in zona Marii Negre, in 'Hazarde Naturale: Evenimente Tsunami in Marea Neagra' (editor G.Oaie), 2007 Bucuresti, ISBN 978-973-0-05181-0, pg. 71-80, 2007.

Enescu D., Enescu B.D., A procedure for assessing seismic hazard generated by Vrancea earthquakes and its application. iii. A method for developing isoseismal and isoacceleration maps. Applications, Romanian Reports in Physics, Vol. 59, 113-126, 2007.

Enescu B., Mori J., Miyazawa M., Quantifying early aftershock activity of the 2004 mid-Niigata Prefecture earthquake (Mw 6.6), J. Geophys. Res. 112, DI 10.1029/2006JB004629, 2007.

Ghica D., Schweitzer J., Automatic Data Processing at BURAR Seismic Station, Proceedings of International Symposium on Strong Vrancea Earthquakes and Risk Mitigation, Oct. 4-6, 2007, Bucharest, p. 164-169, 2007.

Grecu V., Mateciuc D., Seismic forecast using geostatistics, Rom. Rep. Phys. 59, 871-917, 2007.

Grecu B., Radulian M., Mandrescu N., Panza G. F., H/V spectral ratios technique application in the city of Bucharest: can we get rid of source effects, *Journal of Seismology and Earthquake Engineering*, vol. 9, 1-14, 2007.

Hauser F., Răileanu V., Fielitz W., Dinu C., Landes M., Bălă A., Prodehl C., Seismic crustal structure between the Transylvanian Basin and the Black Sea, Romania, Tectonophysics 430, 1–25, 2007.

Ionescu C., Mărmureanu A., Grigore A., Popa M., Moldovan I.A., System for mitigation of seismic vulnerability of nuclear installations and technological processes, Proceedings of International Symposium on Strong Vrancea Earthquakes and Risk Mitigation, pp. 119-128, 4-6 octombrie 2007, Bucuresti, Romania, 2007.

Ionescu C., Böse M., Wenzel F., Mărmureanu A., Grigore A., Mărmureanu G., An early warning system for deep Vrancea (Romania) earthquakes, Proceedings of the Workshop on Seismic Early Warning for European Cities (Eds. P. Gasparini, G. Manfredi, J. Zschau), Naples, Sep. 23-25, 2004, 343-349, 2007.

Mândrescu N., Radulian M., Mărmureanu G., Geological, geophysical and seismological criteria for local response evaluation in Bucharest urban area, Soil Dynamics and Earthquake Engineering 27, 367-393, 2007.

Mândrescu N., Radulian M., Mărmureanu G., B. Grecu, Large Vrancea intermediate depth earthquakes and seismic microzonation of Bucharest urban area, Rom. Journ. Phys. 52, 171-188, 2007.

Mândrescu N., Radulian M., Mărmureanu G., B. Grecu, Local geological conditions and their influence on the building behavior during the large Vrancea intermediate depth earthquakes. Case study: Bucharest urban area, Proc. CRC-461 International Symposium on Strong Vrancea Earthquakes and Risk Mitigation, MATRIX ROM, Bucharest, p.273-277, 2007.

Mărmureanu G., Ionescu C., Mărmureanu A., Early warning system and shake map for deep Vrancea Earthquakes (Romania) and place of them in seismic risk management, Proceedings of the International Disaster Reduction Conference (IDRC 2007), Harbin, China (Eds. S. Y. Wang, G. J. Tang, J. Y. Zhang, W. Song, J. Ammann, C. Kux), Aug. 21-25, 20-24, 2007.

Moldovan I.A., Popescu E., Plăcintă A.O., Moldoveanu T., Moldavian dam's rating in seismic risk classess - A probabilistic approach, Proc. CRC-461 International Symposium on Strong Vrancea Earthquakes and Risk Mitigation, MATRIX ROM, Bucharest, p.383-388, 2007.

Nanjo K. Z., Enescu B., Shcherbakov R., Turcotte D. L., Iwata T., Ogata Y., Decay of aftershock activity for Japanese earthquakes, J. Geophys. Res. 112, DI 10.1029/2006JB004754, 2007.

Oros E., Macroseismic and instrumental seismicity of the Banat Region and its significance on the seismic hazard and risk. Vol. editat in format electronic CD International Symposium "Thirty Years from the Romania Earthquake of March 4, 1977", 10 pp. Bucuresti, 1-3 martie 2007.

Oros E., Ioan Curea, founder of the Seismological Observatory in Timisoara and pioneer of the modern Romanian Seismology, in vol. "In memoriam, Prof. Dr. Doc., The First Rector of the University of Timisoara", eds. M. Bocsa and M. Megan, Universitatea de Vest din Timisoara, Biblioteca documentara, Timisoara, pp. 100-104 (in Romanian), 2007.

Oth A., Wenzel F., Radulian M., Source parameters of intermediate-depth Vrancea (Romania) earthquakes from empirical Green's functions Modeling, Tectonophyiscs 438, 33-56, 2007.

Oth A., Wenzel F., Radulian M., Source scaling for intermediate-depth Vrancea earthquakes with empirical Green's functions, Proc. CRC-461 International Symposium on Strong Vrancea Earthquakes and Risk Mitigation, MATRIX ROM, Bucharest, p.103-119, 2007.

Popescu E., Radulian M., Popa M., Plăcintă A.O., Ghica D., Moldovan I.A., Vrancea seismic source calibration using a small-aperture array, Romanian Reports in Physics 59, 147-164, 2007.

Popescu E., Radulian M., Popa M., Plăcintă A.O., Grecu B., Source of Vrancea (Romania) intermediate-depth earthquakes: parameter variability test using a small-aperture array, Rev. Roum Geophys. 51, 15-34, 2007.

Popescu E., Cioflan C.O., Radulian M., Plăcintă A.O., Moldovan I.A., Attenuation relations for the seismic ground motion induced by Vrancea intermediate-depth earthquakes, Proc. CRC-461 International Symposium on Strong Vrancea Earthquakes and Risk Mitigation, MATRIX ROM, Bucharest, p.152-156, 2007.

Radulian M., Bonjer K.-P., Popescu E., Popa M., Ionescu C., Grecu B., The October 27th, 2004 Vrancea (Romania) earthquake, ORFEUS Newsletter, vol. 1, nr. 7, January 2007.

Radulian M., Bonjer K.-P., Popa M., Popescu E., Seismicity patterns in SE Carpathians at crustal and subcrustal domains: tectonic and geodynamic implications, Proc. CRC-461 International Symposium on Strong Vrancea Earthquakes and Risk Mitigation, MATRIX ROM, Bucharest, p.93-102, 2007.

Răileanu V., Bălă A., Grecu B., Local seismic effects in sites located in the south and central part of Transylvania based on spectral ratios, Romanian Reports in Physics 59, 165-178, 2007.

Răileanu V., Dinu C., Radulian M., Diaconescu V., Bălă A., Popescu E., Popa M., Crustal seismicity and active fault systems in the SE of Romania, Proceedings of the International Symposium on Seismic Risk reduction, Paper 14, Ed. Orizonturi Universitare Timisoara, 269-276, 2007.

Răileanu V., Bălă, A., Dinu, C., Radulian, M., Popescu, E., Diaconescu, V., Mateciuc, D., Popa, M., Crustal seismicity and deep structure in the SE Carpathians and its foreland. Proc. CRC-461 International

Symposium on Strong Vrancea Earthquakes and Risk Mitigation, MATRIX ROM, Bucharest, p.86-89, 2007.

Răileanu V., Hauser F., Bălă A., Fielitz W., Prodehl C., Dinu C., Landes M., Deep seismic sounding across the Vrancea region, Proc. CRC-461 International Symposium on Strong Vrancea Earthquakes and Risk Mitigation, MATRIX ROM, Bucharest, p.80-85, 2007.

Rogozea M., Enescu B., Bazacliu O., Popa M., Radulian M., Seismicity characteristics in the particular case of Vrancea (Romania) intermediate-depth earthquakes, Proc. CRC-461 International Symposium on Strong Vrancea Earthquakes and Risk Mitigation, MATRIX ROM, Bucharest, p.156-160, 2007.

Sandi, H.,: "Some current challenges to the development of the regulatory basis of earthquake resistant design". Proc. Symp. "Thirty years from the Romania Earthquake of March 4 1977" UTCB, 2007.

Sandi, H.,, E. S. Georgescu, I. S. Borcia: "A view on the experience, impact and implications of the 4 March 1977 earthquake, after 30 years" (invited lecture). Proc. Symp. "Thirty years from the Romania Earthquake of March 4 1977" UTCB, 2007.

Sandi, H.,, A. Pomonis, S. Francis, E. S. Georgescu, R. Mohindra, I. S. Borcia: "Development of a nation wide seismic vulnerability estimation system". Proc. Symp. "Thirty years from the Romania Earthquake of March 4 1977" UTCB, 2007.

Sandi, H.,: "Obstacles to earthquake risk reduction, encountered in Romania", Millennium III Workshop of Ideas and Projects for European Integration and Global Civilization - Summer 2007, no. 15-16. Black Sea University Foundation, Romanian Academy, ARCOR (Romanian Association for the Club of Rome), IPID (Institute for Development Projects) & Cadran Politic, Bucharest, 2007.

Sandi, H.,: "Some considerations on the specification of seismic input data for engineering analyses". Proc. 7-ème Colloque National de Génie Parasismique, Paris, 2007.

Sandi, H.,: "Seismic vulnerability assessment. Methodological elements and applications to the case of Romania". Proc. International Symposium on Strong Vrancea Earthquakes and Risk Mitigation, October 4-6, 2007 Bucharest, Romania.

Sandi, H.,, I. S. Borcia: "A summary view on the implications of available strong motion data on Vrancea earthquakes "Proc. International Symposium on Strong Vrancea Earthquakes and Risk Mitigation, October 4-6, 2007 Bucharest, Romania.

Sandi, H.,: "Some remarks on the seismic risk to lifelines, with references to the activity of the Vrancea seismogenic zone" Proc. 3-rd International Conf. on Science and Technology for Safe Development of Lifeline Systems. Progress on seismic and geotectonic modeling across CEI territory and implications on preventing and mitigating seismic risk. Bucharest, Romania, October 24th – 26th, 2007.

Sokolov V., Wenzel F., Mohindra R., Grecu B., Radulian M., Probabilistic seismic hazard assessment for Romania considering intermediate-depth (Vrancea) and shallow (crustal) seismicity, Proc. CRC-461 International Symposium on Strong Vrancea Earthquakes and Risk Mitigation, MATRIX ROM, Bucharest, p.132-147, 2007.

Tugui A., Craiu M. (2007). Waveform inversion of the 27th October 2004 earthquake, Proc. CRC-461 International Symposium on Strong Vrancea Earthquakes and Risk Mitigation, MATRIX ROM, Bucharest, p.174-181, 2007.

Zaharia B., Radulian M., Popa M., Grecu B., Paulescu D., H/V Spectral Ratios Technique - Application for Bucharest area, Proc. CRC-461 International Symposium on Strong Vrancea Earthquakes and Risk Mitigation, MATRIX ROM, Bucharest, p.284-288, 2007.

2008

Apostol B. F., Cune L. C., Apostol M., Scaling and universal power laws in time series of seismic events, *Rom. Journ. Phys.* 53, 593–600, 2008.

Apostol B. F., Resonance of the surface waves. The H/V ratio, *Romanian Reports in Physics* 60, 91-94, 2008.

Aptikaev, F., I. S. Borcia, O. Erteleva, H. Sandi, V. Alcaz: "Development of instrumental criteria for intensity estimate. Some studies performed in the frame of a NATO project". (Paper no. 02-0042). Proc. 14th World Conf. on Earthquake Engineering, Beijing, 2008.

Bălan S. F., Cioflan C. O., Apostol B. F., Tătaru D., Grecu B., The resonance of the surface waves. The H/V ratio in the metropolitan area of Bucharest, Seismic Engineering Conference Commemorating the 1908 Messina and Reggio Calabria Earthquake, eds. A. Santini, N. Moraci, Univ. Reggia, 207-215, 2008.

Bălă A., Zihan I., Ciugudean V., Răileanu V., Grecu B., Physical and dynamic properties of the quaternary sedimentary layers in and around Bucharest city, *Romanian Reports in Physics* 60, 389-401, 2008.

Bălă A., Cristea P., Răileanu V., Nitica C., Continuous distribution of elastic parameters of the shallow quaternary layers along the 3C seismic profile East Bucharest, *Romanian Reports in Physics* 60, 111-129, 2008.

Bălă A., Bălan S.F., Ritter J.R.R., Hannich D., Arion C., Seismic in situ measurements in Boreholes in Bucharest City, Romania, GEO 2008, The Scientific meeting of the Faculty of Geology and Geophysics, 23-24 mai 2008, University of Bucharest, 144 – 150, Ed. Vergiliu, Bucuresti. ISBN 978-973-7600-49-3, 2008.

Bălă A., Grecu B., Hannich D., Răileanu V., Methods to assess the site effects based on in situ measurements in Bucharest City, GEO 2008, The Scientific meeting of the Faculty of Geology and Geophysics, 23-24 mai 2008, University of Bucharest, 151 – 157, Ed. Vergiliu, Bucuresti. ISBN 978-973-7600-49-3, 2008.

Bonjer K.P., Ionescu C., Sokolov V., Radulian M., Grecu B., Popa M., Popescu E., Ground Motion Patterns of Intermediate-Depth Vrancea Earthquakes: The October 27, 2004 Event, in "Harmonization of Seismic Hazard in Vrancea Zone" (Eds. A. Zaicenco, I. Craifaleanu, I. Paskaleva), NATO Science for Peace and Security Series – C, Springer, Dordrecht, 47-62, 2008.

Borleanu F., Rogozea M., Ghica D., Popescu E., Popa M., Radulian M., Romanian earthquakes analysis using BURAR seismic array, *Romanian Reports in Physics* 60, 145-155, 2008.

Borleanu F., Popa M., Grecu B., Radulian M., Azimuth and slowness corrections at BURAR array estimated from regional events occurred in the Mediterranean area, *Romanian Reports in Physics* 60, 1137-1149, 2008.

Borleanu F., Popa M., Radulian M., Panaiotu C., Evidence of strong lateral inhomogeneous structure beneath SE Carpathians and specific mantle flow patterns, *Acta Geodaetica et Geophysica Hungarica* 43, 119-130, 2008.

Cioflan C.O., Mărmureanu A., Mărmureanu G., Nonlinearity in site effects evaluation, Proc. *Conf. AMCSIT – CEEX- Brasov* 24-26 Oct. 2008, 14 pp.

Enescu D., Application of the Wiener predictive filter and the Benioff graphs to foreeast Vrancea (Romania) earthquakes, *Romanian Journal of Physics* 53, 567-574, 2008.

Enescu B., Struzik K., Kiyono K., On the recurrence time of earthquakes: insight from Vrancea (Romania) intermediate-depth event, *Geophys. J. Int.*, 172, 395-404, 2008.

Ghica D., Schweitzer J., Automatic data processing at BURAR seismic station**,** in G. Schmidt et al. (eds.), *International Symposium on Strong Vrancea Earthquakes and Risk Mitigation*, Oct. 4-6, 2007, Bucharest, Romania, Bucuresti, ISBN 978-973-755-247-1, 496 pp., 164-169, 2008.

Grecea C., Bala A., Oros E., Studies and geodetic solutions for future evolutions and monitoring earthquakes in Banat county. *RevCad-Journal of Geodesy and Cadastre*, Universitatea Alba Iulia, 8, 47-54, 2008.

Grecu B., Radulian M., Mândrescu N., Panza G. F., Relevance of H/V Spectral Ratio Technique for Bucharest City, in "Harmonization of Seismic Hazard in Vrancea Zone" (Eds. A. Zaicenco, I. Craifaleanu, I. Paskaleva), NATO Science for Peace and Security Series – C, Springer, Dordrecht, 133-149, 2008.

Grigore A., Grigore A. Jr., National Institute for Earth Physics (NIEP) progresses in seismic monitoring, from the past to the future, *Romanian Reports in Physics* 60, 917-928, 2008.

Hainzl S., Christophersen A., Enescu B., Impact of earthquake rupture extensions on parameter estimations of point-process models, Bull. Seismol. Soc. Amer. 98, 2066-2072, 2008.

Hurukawa N., Popa M., Radulian M., Relocation of large intermediate-depth earthquakes in the Vrancea region, Romania, since 1934 and a seismic gap, *Earth Planets Space*, 60, 565–572, TerraPub, 2008.

Ionescu C., Sisteme de alarmare seismica in timp real pentru instalatii industriale, Ed.Tehnopress, ISBN:973-702-585-7, 2008.

Ionescu C., Neagoe C., Romanian Seismic Network development, Acta Geod. Geophys. Hung. 43, 145-152,

2008.

Ivan, M., Popa M., Ghica D., SKS splitting observed at Romanian broad-band seismic network, *Tectonophysics* 462, 89-98, 2008.

Leydecker, G., Busche, H., Bonjer, K.-P., Schmitt, T., Kaiser, D., Simeonova, S., Solakov, D., Ardeleanu, L., Probabilistic seismic hazard in terms of intensities for Bulgaria and Romania – updated hazard maps, Nat. Hazards Earth Syst. Sci., 8, 1431–1439, 2008.

Mândrescu N., The large Vrancea intermediate-depth earthquakes occurred in the XXth century and their effects on the Romanian territory – photographic testimonies, *Publishing House of the Romanian Academy,* Bucharest, 176p., 2008.

Mândrescu N., Radulian M., Mărmureanu G., Ionescu V., Integrated research of the geological, geophysical and seismological data for local response evaluation in Bucharest urban area, *Publishing House of the Romanian Academy,* Bucharest, 136p., 2008.

Mărmureanu G., Cioflan C. O., Mărmureanu A., New approach on seismic hazard isoseismal map for Romania, Proc. *Conf. AMCSIT- Politehnica, CEEX 2008, Braşov,* iulie 27-29, 2008.

Mărmureanu G., Cioflan C. O., Mărmureanu A., New approach on seismic hazard isoseismal map for Romania, Romanian Reports in Physics 60, 1123-1137, 2008.

Mărmureanu G., Ionescu C., Mărmureanu A., Early Warning System, Shake Map and Disaster Maps for Deep Vrancea Earthquakes Developed in Romania as Parts of Disaster Reduction and Risk Management, Proc. IDRC Davos, 25-29 August 2008, Switzerland, p. 15-20, 2008.

Moldovan I.A., Popescu E., Constantin A., Probabilistic seismic hazard assessment in Romania: application for crustal seismic active zones, *Romanian Journal of Physics* 53, 575-591, 2008.

Moldovan I.A., E. Popescu, A. Constantin, C. Cioflan, (2008) Seismic hazard assessement in the Western part of the Moesian Plarform-Romania, *Proceedings of 31rd General Assembly of the European Seismological Commission, 7-12 Septembrie 2008*, Hersonissos, Creta, Grecia, p. 280-287 & CD-ROM.

Mori J., Kano Y., Enescu B., Comparison of early aftershock sequences for the 2004 Mid-Niigata and 2007 Noto Hanto earthquakes in central Japan, Earth Planets Space 60, 151-154, 2008.

Oros E., Review of Historical Seismicity in the western and south-western territory of Romania (Banat Seismic Region). *Acta Geodaetica et Geofisica Hungarica,* 43, 153-161, 2008.

Oros E., Popa M., Moldovan I.A., Seismological database for Banat seismic region of Romania - part 1: the parametric earthquake catalogue, *Romanian Journal of Physics* 53, 955-964, 2008.

Oros E., Popa M., Popescu E., Moldovan I.A., Seismological database for Banat seismic region (Romania) – part 2: the catalogue of the focal mechanism solutions, *Romanian Journal of Physics* 53, 965-977, 2008.

Oros E., Paulescu D., Popa M., The M6.4, 26th January, 1916 earthquake under review: new data on the seismicity of Fagaras Seismogenic Region (Romania). *Proceedings, 31st General Assembly of the European Seismological Commission ESC 2008*, Hersonissos, Crete, Greece, 7-12 September 2008, 4 pp.

Oros E., Oros V., The study of the 20th century strong Romanian earthquakes using historical instrumental data – a success of EUROSEISMOS 2002-2006 Project. *Proceedings, 31st General Assembly of the European Seismological Commission ESC 2008*, Hersonissos, Crete, Greece, 7-12 September 2008, 8 pp.

Panza G.F., Kouteva M., Vaccari F., Peresan A., Cioflan C.O., Romanelli F., Paskaleva I., Radulian M., Gribovzki K., Herak M., Zaichenco A., Marmureanu G., Varga P., Zivcic M., Recent achievements of the neo-deterministic seismic hazard assessment in the CEI region, Proc. International Workshop on Seismic Hazard and Risk Reduction in Countries Influenced by Vrancea Earthquakes, Kishinew, 2008.

Panza G. F., Kouteva M., Vaccari F., Peresan A., Cioflan C. O., Romanelli F., Recent achievements of NDSHA in CEI region, International Centre for Earth Physics, IC2008 /009, 10p., 2008.

Panza G. F., Cioflan C.O., Vrancea earthquakes: A special challenge for seismic base isolation in Bucharest, in „Modern Systems for Mitigation of Seismic Action" Editors: I. Vlad, H. Sandi, U. Sannino, A. Martelli, AGIR Publishing House, Bucharest 2008, p.339-355, 2008.

Popa M., Radulian M., Panaiotu C., Borleanu F., Lithosphere–asthenosphere interaction at the Southeastern Carpathian Arc bend: Implications for anisotropy, *Tectonophysics*, 462, 83-88, 2008.

Radulian M., Popa M., Cărbunar O.F., Rogozea M., Seismicity patterns in Vrancea and predictive features, *Acta Geodaetica et Geophysica Hungarica* 43, 163-173, 2008.

Sandi, H.,: "Educația, factor esențial în protecția antiseismică" (Education, essential factor in earthquake protection). Proc. Symp. "Education – Essential Component of the Environment Policy", AGIR (General Association of Romanian Engineers), Bucharest, June 2008.

Sandi, H.,, I. S. Borcia, I. Vlad, M. N. Vlad: "A summary view on the implications of available strong motion data on Vrancea earthquakes" (Paper no. 01-1109). Proc. 14th World Conf. on Earthquake Engineering, Beijing, 2008.

Sandi, H.,, I. S. Borcia: "On the verification criteria for base isolation systems". Proc. Symp. on "Modern systems for mitigation of seismic action", ASTR / AGIR, Bucharest, October 2008.

Sandi, H.,, I. S. Borcia: On the verification of base isolation criteria, nder the conditions of Romania. Proc. Academic Days of the Academy of Technical Sciences of Romania. Cluj - Napoca, 2008

Sandi, H.,: A critical look on the modellings used in structural engineering. Proc. 4th Scientific Session, "CIB 2008", organized by the University Transilvania Braşov, Braşov, Romania, November 2008.

Sokolov V., Bonjer K.-P., Wenzel F., Grecu B., Radulian M., Ground-motion prediction equations for the intermediate depth Vrancea (Romania) earthquake, *Bull. Earth. Engineering*, 8, no. 3, Springer Netherlands, 2008.

Tugui A., Craiu M., Inversion of 27.10.2004 Vrancea (Romania) earthquake using teleseismic waveforms data, *Acta Geod. Geoph. Hung.,* 43, 175-181, 2008.

Tumanian M., 2008, Thermal models simulating the tectonic processes in the extra-Carpathian area (on the Romanian territory): rheological models and their interpretation in relation with the local seismic wave attenuation models*, Acta Geodaetica et Geophysica Hungarica, 43, no.2-3, 183-194.*

Zaharia B., Radulian M., Popa M., Grecu B., Tataru D.*,* The estimation of the local response in Bucharest using Nakamura method, *Romanian Reports in Physics*, 60, 125-134, 2008.

2009

Ardeleanu L., Răileanu V., Waveform modeling to estimate the seismic wave attenuation in the crust, in the Vrancea region, Romanian Journal of Physics 54, no. 9-10, 2009.

Ardeleanu L., Depth-dependent Q-models by high frequency waveform modelling, National Scientific Symposium GEO 2009, Faculty of Geology and Geophysics, University of Bucharest, Sect 3, CD-ROM, 2009.

Ardeleanu L., Răileanu V., The focal mechanism of small earthquakes from the bending of the Eastern Carpathians and surroundings, National Scientific Symposium GEO 2009, Faculty of Geology and Geophysics, University of Bucharest, Sect 3, CD-ROM, 2009.

Bălan S. F., Rădulescu F., Studies on physical characteristics of some Romanian sites, Rom. Journ. Phys. 54, 721–732, 2009.

Bălă A., Grecu B., Ciugudean V., Răileanu V., Dynamic properties of the Quaternary sedimentary rocks and their influence on seismic site effects. Case study in Bucharest city, Romania, *Soil Dynamics and Earthquake Engineering* 29, 144-154, 2009.

Bălă A., Bălan, S. F., Ritter J., Hannich D., Seismic site effect modelling based on in situ borehole measurements in Bucharest, Romania, in NATO Advanced Research Workshop on "Coupled Site and Soil-Structure Interaction Effects with Application to Seismic Risk Mitigation" (Eds. T. Schanz, R. Iankov), 30 August – 3 September 2008, Borovets, Bulgaria, NATO Science for Peace and Security Series – C, Springer, Dordrecht, 101-111, 2009.

Bălă A., Aldea A., Hannich D., Ehret D., Răileanu V., Methods to assess the site effects based on in situ measurements in Bucharest city, Romania, Rom. Reports in Physics 61, 335-346, 2009.

Bălă A., Radulian M., Grecu B., Popescu E., Source effects vs. site effects of Vrancea earthquakes recorded in the Bucharest city, Romania, Proc. 4-th National Conf. on earthquake engineering, Bucharest. UTCB, 2009,, Ed. CONPRESS, ISBN 978-973-100-096-1,, pp. 41-45, Ed. Conspress, ISBN 978-973-100-096-1.

Bălă A., Arion C., Neagu C., Bălan S.F., In situ Borehole Measurements in Bucharest, Romania as a Tool for

Assessment of the Seismic site Effects, Proc. 4-th National Conf. on earthquake engineering, Bucharest. UTCB, 2009,, Ed. CONPRESS, ISBN 978-973-100-096-1, Ed. Conspress, Bucharest, vol 1, 31-40, 2009. ISBN 978-973-100-096-1.

Bratosin D., Bălan F. S., Cioflan C. O., Soils nonlinearity effects on dominant site period evaluation, Proceedings of the Romanian Academy, 10, 3, 2009.

Borcia, I. S. , H. Sandi: "A summary view on instrumental data obtained during recent strong Vrancea earthquakes". Proc. 4-th National Conf. on earthquake engineering, Bucharest. UTCB, 2009.

Cioflan C. O., Mărmureanu A., Mărmureanu G., Nonlinearity in seismic site effects evaluation, Romanian Journal of Physics 54, no. 9-10, 2009.

Constantin A. P., Pântea A., Stoica R., Amarandei C., Stefan S., New data about historical earthquakes occurred on the Romanian territory, Rom. Journ. Phys. 54, 239–248, 2009.

Dobrica, V., Demetrescu, C., Boroneant, C., Maris, G., 2009, Solar and geomagnetic activity effects on climate at regional and global scales: Case study – Romania, *J. Atmos. Solar-Terr. Phys., 71, 1727-1735, doi:10.1016/j.jastp.2008.03.022*.

Enciu D. M., Knapp C. C., Knapp J. H., Revised crustal architecture of the southeastern Carpathian foreland from active and passive seismic data, Tectonics 28, 2009.

Enescu D., A new application of Benioff graphs and Wiener predictive filter to forecast Vrancea (Romania) earthquakes, Rom. Journ. Phys. 54, 231-238, 2009.

Enescu B., Mori J., Miyazawa M., Kano Y., Omori-Utsu law c-values associated with recent moderate earthquakes in Japan, Bull. Seismol. Soc. Amer. 99, 884-891, 2009.

Enescu B., Hainzl S., Ben-Zion Y., Correlations of seismicity patterns in Southern California with surface heat flow data, *Bull. Seismol. Soc. Am.*, 99, 6, 3114-3123, doi: 10.1785/0120080038, 2009.

Hainzl S., Enescu B., Cocco M., Woessner J., Catalli F., Wang R., Roth F., Aftershock modeling based on uncertain stress calculations, J. Geophys. Res. 114, DI 10.1029/2008JB006011, 2009.

Iio Y., Shibutani T., Matsumoto S., Katao H., Matsushima T., Ohmi S., Takeuchi F., Uehira K., Nishigami K., Miyazawa M., Enescu B., Hirose I., Kano Y., Kohno Y., Tatsumi K., Ueno T., Wada H., Yukutake Y., Precise aftershock distribution of the 2004 Mid-Niigata prefecture earthquake-Implication for a very weak region in the lower crust, Phys. Earth Planet. Inter. 172, 345-352, 2009.

Mărmureanu A., Rapid magnitude determination for Vrancea early warning system, Romanian Journal of Physics 54, no. 9-10, 2009.

Moldovan I. A., Moldovan A. S., Panaiotu C. G., Plăcintă A. O., Mărmureanu G., The geomagnetic method on precursory phenomena associated with 2004 significant intermediate-depth Vrancea seismic activity, Romanian Journal of Physics 54, 249-261, 2009, http://www.nipne.ro/rjp/2009_54_1-2/0249_0263.pdf, No.1-2.

Moldovan I.A., Constantin A.P., Popescu E., Plăcintă A.O., Moldoveanu T., Incadrarea in clase de risc seismic a barajelor situate in Platforma Moesica, Proc. 4-th National Conf. on earthquake engineering, Bucharest. UTCB, 2009,, Ed. CONPRESS, ISBN 978-973-100-096-1,Vol. 1, pag 123-132, ISBN 978-973-100-096-1, 2009.

Neagoe C., Ionescu C., Toward a dense real-time seismic network in Romania, Romanian Reports in Physics 61, 359–366, 2009.

Oros E., Site effects investigation in the city of Timisoara using spectral ratio methods, Romanian Reports in Physics 61, 347–358, 2009.

Oros E., Oros V., New and updated information about the local hazard seismic sources in the Banat Seismic Region. Proc. 4-th National Conf. on earthquake engineering, Bucharest. UTCB, 2009,, Ed. CONPRESS, ISBN 978-973-100-096-1, Vol., 1, 133-139, 2009.

Popa M., Radulian M., Mandrescu N., Paulescu D., Seismicity patterns in Vrancea region as revealed by revised historical and instrumental catalogues, Proceedings of the workshop „Seismicity patterns in the Euro-Med region" (Ed. A. Oth), *Cahiers du Centre Européen de Géodynamique et de Séismologie*, vol. 28, 147-152, Luxembourg, 2009.

Rădulescu F., Romanian seismology – historical, scientific and human landmarks, Rev. Roum.

GÉOPHYSIQUE, **52–53**, p. 101–121, 2009.

Răileanu V., Dinu C., Ardeleanu L., Diaconescu V., Popescu E., Bălă A., Crustal seismicity and associated fault systems in Romania, Procedings of the 27th ECGS Workshop: Seismicity Patterns in the Euro-Med Region, Luxembourg, 17-19 Nov.2008, in "Cahiers du Centre Europeen de Geodynamique et de Seismologie", 153-159, 2009 (ISBN 9.7829-19-89702-5).

Rogozea M., Popa M., Radulian M., Detailed seismicity analysis in the Vrancea area and implications for the seismic cycle evolution, *Romanian Reports in Physics* 61, No. 3, 740–747, 2009.

Sandi, H.,: "Considerations on the updating of earthquake resistant design codes". Proc. 10th International Conf. on Structural Safety and Reliability, ICOSSAR 2009. Osaka, Sept. 2009.

Sandi, H.,, I. S. Borcia, F. Aptikaev, O. Erteleva, V. Alcaz: "Studies on the refinement of the seismic intensity concept (a project sponsored by NATO)". Proc. 4-th National Conf. on earthquake engineering, Bucharest. UTCB, 2009.

Trendafiloski G., Wyss M., Rosset P., Mărmureanu G., Constructing city models to estimate losses due to earthquakes Worldwide: Application to Bucharest, Romania, Earthq. Spectra 25, 665-685, 2009.

Tugui A., Craiu M., Rogozea M., Popa M., Radulian M., Seismotectonics of Vrancea (Romania) zone: the case of crustal seismicity in the foredeep area, *Romanian Reports in Physics* 61, 325-334, 2009.

Tugui A., Necula C., Panaiotu C., Preliminary rock magnetic properties of Quaternary basalts from the Perşani Mountains (Romania), Romanian Reports in Physics 61, 730–739, 2009.

Wang L., Wang R., Roth F., Enescu B., Hainzl S., Ergintav S., Afterslip and viscoelastic relaxation following the 1999 M 7.4 Izmit earthquake from GPS measurements, Geophys. J. Int. 178, 1220-1237, 2009.

Zaharia B., Enescu B., Radulian M., Popa M., Koulakov I., Parolai S., Determination of the lithospheric structure from Carpathians arc bend using local data, *Romanian Reports in Physics* 61, 748–764, 2009.

2010

Aoi S., Enescu B., Suzuki W., Asano Y., Obara K., Kunugi T., Shiomi K., Stress transfer in the Tokai subduction zone from the 2009 Suruga Bay earthquake in Japan, Nature Geoscience, 3, 7, 496-500, doi:10.1038/ngeo885, 2010.

Apostol B. F., Elastic waves in a semi-infinite body*,* Physics Letters A, 374, 1601–1607, 2010.

Apostol B. F., The effect of the inhomogeneities on the propagation of the elastic waves in isotropic bodies, Mechanics Research Communications, 37, 458–462, 2010.

Apostol B. F., Elastic waves produced by localized forces in a semi-infinite body, Rom. Reps. Phys., 62, 2, 2010.

Alcaz, V., I. S. Borcia, H. Sandi: "Some data and results concerning ground motion in Moldova during recent strong earthquakes of 1986 and 1990". Quantification of seismic action on structures (studies related to a project sponsored by NATO in the frame of the Program Science for Peace). (Program Director & Editor: H. Sandi). AGIR Publishing House, Bucharest, 2010.

Bălan S. F., Apostol B. F., Modeling geodynamical parameters for seismic local effects estimation. Example for Galaţi and Tecuci seismic areas, Rom. Reps. Phys., 2010 (in press).

Bălă A., Modele geologice şi geofizice cu aplicaţii în evaluarea efectelor seismice locale în Bucureşti, Ed. GRANADA, 176 p, cod CNCSIS 332-2009, ISBN 978-973-8905-88-7, 2010.

Bălă A., Bălan S.F., Ritter J.R.R., Rohn J., Huber G., Hannich D., Site-effect analyses for the earthquake-endangered metropolis Bucharest, Romania, 127 p, Ed. Univ. "Alexandru Ioan Cuza", Iasi, 2010, ISBN: 978-973-703-546-2, 2010.

Bălă A., Hannich D., Ritter J.R.R., Ciugudean – Toma V., Geological and Geophysical Model of the Quaternary Layers based on *in situ* measurements in Bucharest, Romania, *Romanian Reports in Physics, in print,* 2010.

Borleanu F., Ghica D., Popa M. , Grecu B. , Radulian M., Lateral structure in the Mediterranean region as revealed by azimuth and slowness deviations detected by array-type systems, *Romanian Reports in Physics* (trimisa spre publicare).

Boudjada M. Y., Schwingenschuh K., Doeller R., Rohznoi A., Parrot M., Biagi P. F., Galopeau P.H.M.,

Solovieva M., Molchanov O., Biernat H.K., Stangl G., Lammer H., Moldovan I. A., Voller W., Ampferer M., Decrease of VLF transmitter signal and chorus-whistler waves before l'Aquila earthquake occurrence, Nat. Hazards Earth Syst. Sci., 10, 1487-1494, DOI:10.5194/NHESS-10-1487-2010, 2010, http://www.nat-hazards-earth-syst-sci.net/10/1487/2010/nhess-10-1487-2010.pdf .

Bratosin D., Bălan F. S., Cioflan C. O., Multiple resonances of the site oscillating systems, Proceedings of the Romanian Academy, Serie A: Mathematics, Physics, Technical Sciences, Information Sciences, Volume 11, Number 3, July-September 2010, 261-268.

Borcia, I. S., H. Sandi.: "Techniques and results of processing of macroseismic and instrumental information for sample events, in relation to the calibration of instrumental criteria". Quantification of seismic action on structures (studies related to a project sponsored by NATO in the frame of the Program Science for Peace). (Program Director & Editor: H. Sandi). AGIR Publishing House, Bucharest, 2010.

Borcia, I. S., H. Sandi, F. Aptikaev, O. Erteleva, V. Alcaz: "Some statistical results related to the correlation of macroseismic estimates with instrumental estimates of seismic intensity". Quantification of seismic action on structures (studies related to a project sponsored by NATO in the frame of the Program Science for Peace). (Program Director & Editor: H. Sandi). AGIR Publishing House, Bucharest, 2010.

Cocco M., Hainzl S., Catalli F., Enescu B., Lombardi A.M., Woessner J., Sensitivity study of forecasted aftershock seismicity based on Coulomb stress calculation and rate- and state-dependent frictional response, *J. Geophys. Res.*, B05307, doi:10.1029/2009JB006838, 2010.

Demetrescu, C., Tumanian, M., Dobrica, V., Mares, C., Mares, I., 2011, Pre-observational evolution of surface temperature in Romania as inferred from borehole temperature measurements, *Pure and Applied Geophysics, under review*.

Dobrica, V., Demetrescu, C., Maris, G., 2010, On the response of the European climate to the solar/geomagnetic long-term activity, *Annals of Geophysics,53, 39-48*.

Fillerup M. A., Knapp J. H., Knapp C. C., Raileanu V., Mantle earthquakes in the absence of subduction? Continental delamination in the Romanian Carpathians, *Lithosphere,* October 2010, v. 2, 333-340, doi:10.1130/L102.1

Ganas A., Grecu B., Batsi E., Radulian M., Vrancea slab earthquakes triggered by static stress transfer, Natural Hazards and Earth System Sciences, *Nat. Hazards Earth Syst. Sci.*, 10, 2565–2577, 2010.

Gheorghiță M., Suciu E., Moldovan A. S., Moldovan I. A., Testing a new installed VLF/LF radio receiver for seismic precursors' monitoring in Romania, Rom. Journ. Phys., Vol. 55, 830–840, Bucharest, 2010, http://www.nipne.ro/rjp/2010_55_7-8/0830_0840.pdf .

Ionescu C., Drăgoicea M., MACROSEIS: a tool for real-time collecting and querying macroseismic data in Romania, Rom. Journ. Phys., Vol. 55, 852–861, Bucharest, 2010.

Ivan M., Cormier V. F., high frequency PKKPbc around 2.5 Hz recorded globally, Pure Appl. Geophys., http://dx.doi.org/10.1007/s00024-010-0192-z, 2010.

Koulakov, I., Zaharia, B., Enescu, B., Radulian, M., Popa, M., Parolai, S., Zschau J., Delamination or slab detachment beneath Vrancea? New arguments from local earthquake tomography, *Geochem. Geophys. Geosyst. (G3)*, 11, 3, Q03002, doi:10.1029/2009GC002811, 2010.

Mărmureanu G., Cioflan C. O., Mărmureanu A., Intensity seismic hazard map of Romania by probabilistic and (neo)deterministic approaches, linear and nonlinear analyses, *Romanian Reports in Physics,* Vol .61, No.1 (in press).

Moldovan I. A., Moldovan A.S., Ionescu C., Panaiotu C. G., MEMFIS - Multiple Electromagnetic Field And Infrasound Monitoring Network , Rom. Journ. Phys., Vol. 55, Nos. 7–8, 841–851, 2010, http://www.nipne.ro/rjp/2010_55_7-8/0841_0851.pdf .

Neagoe C., Popa M., Diaconescu M., Radulian M., Possible deep lithospheric roots beneath South-Eastern Carpathians back-arc region, Acta Geodaetica et Geophysica Hungarica 45, 340-355, doi: 10.1556/Ageod.45.2010.3.8, 2010.

Oros E., Seismicitatea Regiunii Seismice Banat – Monitorizare, caracteristici, hazard seismic local, Buletinul AGIR, nr. 2-3/2010, 30-35, 2010.

Panza G. F., Radulian M., Kronrod T., Paskaleva I., Radovanovic S., Popa M., Drumea A., Gribovszki K., Dojchinovski D., Kouteva M. , Varga P., Pekevski L., Integrated unified mapping of the Vrancea macroseismic data for the CEI region, Proceedings of the 14th European Conference on Earthquake Engineering, Skopje-Ohrid, August 2010, 8 pp., 2010.

Popescu E., Borleanu F., Plăcintă A. O., Neagoe C., Radulian M., Scaling properties of the Vrancea (Romania) seismic source at intermediate depths, Rev. Roum. Geophys. (submitted).

Popescu E., Borleanu F., Radulian M., Vrancea earthquake of 25th April 2009: source parameters and directivity, Rev. Roum. Geophys. (acceptata).

Popescu E., Proprietati de grupare si de sursa ale cutremurelor subcrustale vrancene in contextul seismicitatii Romaniei, Editura GRANADA, ISBN 978-973-8905-81-8, Bucuresti, 163 pp., 2010.

Popescu E., Modele de propagare ale miscarii seismice. Surse seismice crustale., Editura GRANADA, ISBN 978-973-8905-83-2, Bucuresti, 183 pp, 2010.

Rădulescu A. F., Bălan S. F., Studii privind evaluarea parametrilor fizico-elastici ai unor terenuri din Romania, Monitorul de petrol si gaze, Serie noua, anul VIII, nr. 10 (104)/2010, 40-44, 2010.

Sandi, H.,, I. S. Borcia: "A major reason to fundamentally revise the traditional concept of macroseismic intensity: to avoid possible zonation mistakes. An illustrative case." Quantification of seismic action on structures (studies related to a project sponsored by NATO in the frame of the Program Science for Peace). (Program Director & Editor: H. Sandi). AGIR Publishing House, Bucharest, 2010.

Sandi, H.,: "Seismic intensity and hazard quantifications, versus some earthquake engineering requirements" (slides). Proc. Advanced Conference on "Seismic Risk Mitigation and Sustainable Development". Trieste, 10 – 14 May 2010, Abdus Salam International Centre for Theoretical Physics.

Sandi, H.,: " Towards a Gumbel – Fréchet type family of extreme value distributions". Proc. International Symposium on Reliability Engineering and Risk Management, Shanghai, 2010, Kluwer.

Sandi, H.,, I. S. Borcia, F. Aptikaev, O. Erteleva, V. Alcaz: "Studies on the refinement of the seismic intensity concept (a project sponsored by NATO)". (ID: 247). Proc. 14-th European Conference on Earthquake Engineering, Ohrid, Macedonia, 2010.

Sandi, H.,, I. S. Borcia: "A summary view on the variability of the spectral contents of ground motion during successive strong Vrancea earthquakes" (ID: 248). Proc. 14-th European Conference on Earthquake Engineering, Ohrid, Macedonia, 2010.

Sandi, H.,, I. S. Borcia, F. Aptikaev, O. Erteleva, V. Alcaz: " Studies on seismic intensity. A NATO project." Proc. 5-th Conference „Zilele Academice ASTR" of the Academy of Technical Sciences of Romania. Craiova, 2010.

Sandi, H.,, I. S. Borcia: "A summary view of instrumental data on recent strong Vrancea earthquakes and implications for seismic hazard". PAGEOPH Topical Volume on Advanced Seismic Hazard Assessments (online edition 2010, to be printed 2011).

Sandi, H.,, I. S. Borcia: "Intensity spectra versus response spectra. Basic concepts and applications." PAGEOPH Topical Volume on Advanced Seismic Hazard Assessments (online edition 2010, printed in Volume 168, Issue 1(2011), Page 261).

Sandi, H.,: "Towards better fitting extreme value distributions in the analysis of actions". Proc. International Scientific Conference CIBv 2010. Braşov, 2010.

Sandi, H.,: "A view on current needs of structural health monitoring in Romania". MEMSCON Workshop "Structural monitoring and status – dependent maintenance and repair of constructed facilities". Bucharest, 2010.

Ticleanu M., Pântea A., Nicolescu R., Constantin A., Gheuca I., Ion A., Lines of seismic sensibility and systematic faulting directions on the territory of Romania – actualizations and perspectives, *Proceedings of Annual Conference of the Geological Society of Romania,* Bucharest, 5-6 November 2010, 190-192pp, CD-ROM.

International Association of Volcanology and Chemistry of the Earth's Interior

IAVCEI ACTIVITIES IN ROMANIA 2007 - 20011

Romanian IAVCEI Committee

National Correspondent, President of the Committee:

Alexandru Szakács
Sapientia University, Dept. of Environmental Sciences
4, Matei Corvin St.
400112 Cluj-Napoca, Romania
Phone/Fax: +40-264-439266
E-mail: Szakács@sapientia.ro

and

Institute of Geodynamics "Sabba S. Stefanescu", Romanian Academy
19-21, Jean-Louis Calderon St.
70201 Bucharest, Romania
Phone: +4021- 2113086
Fax: +4021-2100604
E-mail: Szakács@k.ro

Secretary: **Eugenia Nițoi**
Geological Institute of Romania
1, Caransebes Street
78344, Bucuresti 32, Romania
Phone: +40-21-224 1530/216
Fax: +40-21-224 0404
E-mail: jeniNițoi@yahoo.com

Member: **Alexandrina Fülöp**
North University of Baia Mare
62/A, Victor Babeş St,
430083, Baia Mare, Romania
Phone: +40-262-422 196
Fax: +40-262-276 812
E-mail: alexandrinafulop@yahoo.com

Professional organizations:

Geological Society of Romania

Mineralogical Society of Romania

Romanian Society of Geophysics

Universitary education:

University of Bucharest, Faculty of Geology and Geophysics, Bucharest

Babeş-Bolyai University, Faculty of Biology and Geology, Cluj-Napoca

Sapientia University, Faculty of Natural Science and Arts, Dept. of Environmental Sciences, Cluj-Napoca

Alexandru Ioan Cuza University, Faculty of Geography and Geology, Iaşi

North University of Baia Mare, Faculty of Mineral Resources and Environment, Baia Mare

Scientific symposia:

National Symposium of Geophysics

Publications:

Revue Roumaine de Géologie

Revue Roumaine de Géophysique

Studia Universitatis Babeş-Bolyai, Cluj-Napoca

Analele Universității „Al. I. Cuza" Iaşi, Geologie

Romanian Journal of Petrology

Romanian Journal of Mineral Deposits

Romanian Journal of Geophysics

PART I: INTRODUCTION AND ORGANIZATION

by Alexandru Szakács

National Correspondent, President of the Committee
(Szakács@sapientia.ro)

During the inter-IUGG General Assembly time period 2007-2011, the small volcanological community in Romania continued to cope with serious problems related to the economic and social transition of the country in the post-communist era. Romania Joined the European Union at January 1st, 2007, a new status which was hoped to significantly improve the availability of both National and EU funds for scientific research, volcanology included. Those hopes have not been fulfilled, at least in the domain of IAVCEI-interest research. Both financial and institutional problems strongly influenced IAVCEI-related activities in this period. Since most of the Romanian IAVCEI members were employees of the Geological Institute of Romania, the financial crisis this institution still copes with, had negatively influenced geological investigation in Romania including the domains of IAVCEI interest. Many researchers actively involved in volcanological and petrological/geochemical investigation had to find alternative jobs and part of them gave up with their former research work. The strong research nucleus active in these fields within the Geological Institute of Romania in the 90's dispersed early in the 2000's and remained so, and no other group aggregated later elsewhere.

In the same time, research effort in volocanology shifted towards Universities, such as Babeş-Bolyai University and Sapientia University in Cluj-Napoca and North University in Baia Mare. The "Alexandru Ioan Cuza" University in Iaşi is specialized in geochemistry, especially related to CEI topics. However, only few researchers are actively involved in volcanological investigation at each university center, mostly on individual basis, more ore less isolated from each other. They benefit from poor or no institutional support doing so. At this time there is no any strong and internationally recognized research group specialized in IAVCEI topics in Romania. Most of the scientific results reported here were obtained through unsupported and uncoordinated individual efforts of certain researchers. The notable exception is the Sapientia University (Cluj-Napoca) interdisciplinary research group, where geologists, physicists, chemists, geographers and biologist run research projects on the post-volcanic processes and their environmental effects in the East Carpathian Neogene volcanic range.

The trend of declining Romanian IAVCEI membership signaled in our previous report, continued during the time period considered here. Low wages (under US$ 7500/year in general), and job instability precluded effectiveness of new membership recruitment, while a number of former IAVCEI members gave up their membership for similar reasons. The Romanian IAVCEI membership – a former "success story" (see Romanian IUGG Report, 1999) - continued shrinking, and this trend could not be reversed so far.

In such circumstances, the Romanian National IAVCEI Section considers further membership recruitment as one of its major current tasks. Membership "erosion" from the Group is caused by objective and subjective factors, such as inability to pay the annual membership fee because financial shortage, frustration related to unrealistic expectations upon subscription, poor fit of changing professional duties and interests with IAVCEI activities and research topics, job instability, etc. Despite of such "erosion", a few scientists with constant

interest and dedication in IAVCEI-related science, still forms the small stable and active core of the Romanian National IAVCEI Section. They are active in research and publication and are willing to take part in IAVCEI-organized activities and events.

Despite the difficulties, scientific progress in IAVCEI-related research domains has been attempted to be kept at a steady-state pace. Individual efforts have also been made to maintain and develop connection of researchers with the international community by publication, attendance of scientific meetings and assemblies, and participations in international cooperation and correlation projects.

Members of the Romanian National IAVCEI Section Committee have tried to actively interact with IAVCEI officials and leaders of IAVCEI Commissions (especially CEV and CVS) by electronic correspondence and personal contacts during international meetings whenever attendance was possible.

Research centers in Romania where IAVCEI-related topics are being investigated

Active research in IAVCEI-related scientific domains, such as paleovolcanology, petrology of volcanic rocks, igneous rocks-related mineralogy, granite studies, metamorphic petrology, geochemistry, ore geology in volcanic areas and geophysics of volcanic areas, is conducted mostly by individuals and small groups of professionals at a number of institutions in Romania, from which the IAVCEI membership is recruited:

- Institute of Geodynamics „Sabba S. Ştefănescu", Romanian Academy;
- The Geological Institute of Romania (Department of Mineralogy and Petrology; Department of Geophysics);
- Sapientia University, Cluj-Napoca (Department of Environmental Sciences);
- „Babeş-Bolyai" University, Cluj-Napoca (Department of Mineralogy);
- North University of Baia Mare (Department of Geology and Environmental Engineering);
- University of Bucharest (Department of Mineralogy and Petrology, Department of Geophysics);
- „Alexandru Ioan Cuza" University (Department of Geology), Iaşi;
- S.C. Prospecțiuni S.A., Bucharest.

Membership: **currently listed in the IAVCEI membership Directory**

Alexandrina Fülöp	**North University of Baia Mare**
Corina Ionescu	**Babeş-Bolyai University, Cluj-Napoca**
Marinel Kovacs	**North University of Baia Mare**
Ioan Seghedi	**Institute of Geodynamics „Sabba S. Ştefănescu", Romanian Academy Bucharest**
Alexandru Szakács	**National Correspondent**
	Sapientia University, Cluj-Napoca, and Institute of Geodynamics „Sabba S. Ştefănescu", Romanian Academy, Bucharest

PROFESSIONAL EVENTS

Scientific events organized in Romania including IAVCEI-interest topics

- European Science Foundation Exploratory Workshop EW06-030 „New perspectives on volcano behavior, volcanic hazards and volcanism-related mineral resources", organized in Sovata, Romania, September 4-7, 2007 by Alexandru Szakács and Derek Rust (UK)

International scientific events with Romanian involvement in their organization

- AGU (American Geophysical Union) Joint Asembly, 22-25 May 2007, Acapulco, Mexico, Program & Abstracts, Session V31A-02: „What is a volcano? New answers to an old question". Convened by Edgardo Canon-Tapia and Alexandru Szakács
- AGU (American Geophysical Union) Joint Assembly, 24-27 May 2009, Toronto, Canada Session V32A „Ore Genesis and Volcano Instability". Convened by Alexandru Szakács and Edgardo Canon-Tapia
- IMA2010, 20th Genereal Meeting of the International Mineralogical Association, 21-27 August, 2010, Budapest, Hungary. Session GP81 „Volcanoes: The mineral factory". Convened by Alexandru Szakács, Masaaki Shimizu and Yuri Taran
- IMA2010, 20th Genereal Meeting of the International Mineralogical Association, 21-27 August, 2010, Field Trip RO1: „Ore deposits and other classic localities in the Eastern Carpathians: from metamorphics to volcanics" Leaders Ovidiu Gabriel Iancu and Marinel Kovacs
- XIX Congress of the Carpathian-Balkan Geological Association, Thessaloniki, Greece, 23-26 September 2010. Session S16. „Progress in understanding the evolution of the Late Alpine-Quaternary magmatism and geodynamic history of the Carpathian-Balkan region." Conveners: Ioan Seghedi and Hilary Downes

Participation to IAVCEI events and to events including IAVCEI-interest topics

- The AGU (American Geophysical Union) Joint Asembly, 22-25 May 2007, Acapulco, Mexico has been attended by Alexandru Szakács who co-convened session and presented an oral contribution on the definition of "volcano"
- The 6th Hutton Symposium, 2-6 July 2007, Stellenbosch, South Africa, has been attended by Marian Munteanu, who presented a poster on some granites associated with conduit-related mafic-ultramafic intrusions in Sichuan Province, China.
- The EGU (European Geosciences Union) General Assembly (Vienna, 15-20 April 2007) has been attended by Marinel Kovacs who presented a poster related to the evolution of the metallogeny in connection with the convergent margins magmatism from Gutai Volcanic Zone (N Romania)
- The IUGG XXIV General Assembly (Perugia, July 2-13 2007) has been attended by Marinel Kovacs who presented two oral contributions in the IAVCEI Symposia sessions VS007 and VS016 on volcanology and petrology of the Neogene Volcanism from the

Northern Romania

- The IAVCEI General Assembly in Reykjavik (Iceland, August 2008) has been attended by Alexandru Szakács who presented an oral contribution on the volcanic facies concept
- The International Lithosphee Program, Joint Task Forces Meeting, Ensenada, Baja California, Mexico, September 21-26, 2008 has been attended by Alexandru Szakács and Ioan Seghedi, each presenting an oral contribution related to the magmatism in the Carpathian-Pannonian Region
- The AGU (American Geophysical Union) Joint Assembly, 24-27 May 2009, Toronto, Canada has been attended by Alexandru Szakács who co-convened session V32A and presented an oral contribution on the consequences of volcano instability on ore genesis and by Ioan Seghedi who had an oral contribution co-authored by Alexandrina Fülöp on the Late Miocene debris-avalanche deposit at the Gutâi shield volcano, NW Romania, re-evaluation of geological mapping and mineral deposits.
- The session GP81 at the 20th Genereal Meeting of the International Mineralogical Association, 21-27 August, 2010, Budapest, Hungary have been co-convened by Alexandru Szakács who also presented an oral conribution on the mineral chemistry of the Dej Tuff, Transylvanian Basin
- The session GP80 at the 20th Genereal Meeting of the International Mineralogical Association, 21-27 August, 2010, Budapest, Hungary has been attended by Marinel Kovacs who presented a poster related to petrogenesis of a Neogene composite igneous complex from Gutai Volcanic Zone (N Romania)
- The sessions covering IAVCEI-topics at the XVIIth Congress of the Carpatho-Balkan Geological Association (CBGA) in Thessaloniki, Greece (23-26 September, 2010) have been attended by a number of Romanian researchers with oral and poster contributions

Involvement of Romanian IAVCEI members in international co-operation projects

- The current phase (2008-2012) of a long-term inter-Academic bilateral co-operation project involving scientists from Romania and Hungary is running. Its topic is the geochronological investigation and correlation of the Cretaceous to Quaternary volcanic province in the Carpathian-Pannonian area, located mostly on the territories of the two countries. The study profits of the K-Ar, and recently Ar-Ar, dating facilities of the Institute of Nuclear Research of the Hungarian Academy of Science (ATOMKI) in Debrecen. IAVCEI members Alexandru Szakács and Ioan Seghedi are involved.
- Ioan Seghedi and Alexandru Szakács are involved in the International Lithosphee Program, and attended the Joint Task Forces Meeting, Ensenada, Baja California, Mexico, September 21-26, 2008

PART II: PROGRESS REPORT OF SCIENTIFIC RESEARCH IN RELEVANT IAVCEI-INTEREST DOMAINS IN ROMANIA

Romanian researchers, whether IAVCEI members or not, achieved some significant progress of knowledge in a number of research domains which are within the area of IAVCEI interests. The following part of this report consists of a list of papers and abstracts published in the time interval 2007-2011 from which a general picture of the main results obtained may emerge.

Books and fieldtrip guides

Tămaş, C.G. (2007) Endogene breccia pipe and breccia dyke structures and petrometalogenesis of the Roşia Montană (Metaliferi Mts., Romania) ore deposit. (in Romanian). Ed. Casa Cărții de Știință, Cluj-Napoca, 230 p.

Ionescu, C., Hoeck, V., Tămaş, C., Balica, C. (2009) – MAEGS-16 field trip guide: geology of the Apuseni Mountains (Romania). Cluj University Press, 31 p. ISBN 978-973-610-913-3

Benea, M., Tămaş, C.G. (2010) – Neogene volcanics in the Apuseni Mts.: historical mining, and gold deposits. IMA Field trip Guide RO3, Acta Mineralogica-Petrographica, vol. 21, 24 p., University of Szeged, Hungary.

Iancu, O. G. Kovacs, M. (2010) - Ore deposits and other classic localities in the Eastern Carpathians: from metamorphics to volcanics. IMA Field trip Guide RO1, Acta Mineralogica-Petrographica, vol. 19, 55 p., University of Szeged, Hungary

Tămaş, C.G. (2010) Endogene breccia pipe and breccia dyke structures and petrometalogenesis of the Roşia Montană (Metaliferi Mts., Romania) ore deposit. (in Romanian). 2nd edition. Editura Mega, 168 p.

Papers

2007

Feier, N., Minuț, A., O'Connor, G., Tămaş, C.G**.** (2007) – Multiple intrusions and brecciation events and their role in precious metal mineralization at Roşia Montană, Apuseni Mountains, Romania. Proceedings of the Ninth Biennal SGA Meeting, Dublin, 2007, p. 869 – 872.

Munteanu, M. and Yao, Y. (2007) The Gaojiacun intrusion: Rift- or subduction-related? Comment on "Revisiting the "Yanbian Terrane": Implications for Neoproterozoic tectonic evolution of the western Yangtze Block, South China" by Li et al. (2006) [Precambrian Res. 151 (2006) 14–30]. **Precambrian Research**, 155, 324-327.

Seghedi I., Szakács A., Pacheco A. H., Brändle Matesanz J.-L. 2007. Miocene Lamproite Volcanoes in south-eastern Spain – an association of phreatomagmatic and magmatic products. **Journal of Volcanology and Geothermal Research** 159, 210-224.

Seghedi I., Bojar A.-V., Downes H., Roşu E., Tonarini S., Mason P., 2007. Generation of normal and adakite-like calc alkaline magmas in a non-subductional environment: A Sr-O-H Isotopic Study of the Apuseni Mountains Neogene magmatic Province, Romania. **Chemical Geology,** 245, 70-88

Vinkler A. P., Harangi Sz., Ntaflos T., Szakács A. (2007) Petrolographic and geochemical study of pumice from Csomád vulcano (East Carpathinas) – petrogenetical implications. (in Hungarian with Englisg Abstract) **Földtani Közlöny** 137/1, p. 103-128, Budapest

2008

Néda T., Szakács A., Mócsy I., Cosma C. (2008) Radon concentration levels in dry CO2 emanations from Harghita Băi, Romania, used for curative purposes. **Journal of Radioanalytical and Nuclear Chemistry**, Vol. 277, No.3, p.685–691

Néda T., Szakács A., Cosma C., Mócsy I. (2008) Radon concentration measurements in mofettas from Harghita and Covasna Counties, Romania. **J. Environ. Radioact**., 99, 12, 1819-1824

Papp, D. C., Niţoi, E. 2008. Volcanic geosites of the East Carpathians: a project for informal geological education and awareness. **Anuarul IGR**, vol.75, p. 43, Bucureşti.

Seghedi I., Ntaflos T. and Z. Pécskay, 2008: The Gataia Pleistocene lamproite: a new occurrence at the southeastern edge of the Pannonian Basin, Romania. in: COLTORTI, M. & GREGOIRE, M. (eds) Metasomatism in Oceanic and Continental Lithospheric Mantle. **Geological Society, London, Special Publications 293**, 83-100.

Ureche, I., Onescu, D., Papp, D. C. (2008) Designing dacite quarry developing options, Romanian Journal of Mineral Deposit & Romanian Journal of Mineralogy, vol. 83, 153 – 160.

2009

Constantina C., Szakács A., Pécskay Z. (2009) Petrography, geochemistry and age of volcanic rocks in the Gurasada area, southern Apuseni Mts., **Carpathian Journal of Earth and Environmental Sciences**, Vol. 4, No.1, p. 31-47.

Kovacs M., Fülöp A. (2009) Baia Mare Geological and Mining Park- a potential new Geopark in the northwestern part of Romania. **Studia Universitatis Babeş–Bolyai**, **GEOLOGIA,** 54, 1, 27-32.

Pécskay Z., Seghedi I., Kovacs M., Szakács A., Fülöp A. (2009) Geochronology of the Neogene calc-alkaline intrusive magmatism in the "Subvolcanic Zone" of the Eastern Carpathians (Romania). **GEOLOGICA CARPATHICA**, 60, 2, 181—190

Seghedi I., Maicher D., Kurszlaukis S., 2009. Volcanology of Tuzo pipe (Gahcho Kué cluster) — Root–diatreme processes re-interpreted. **Lithos 112S,)** 553–565.

Tămaş, C. G., Baron, S., Cauuet, B. (2009) - Minéralogie et signature isotopique du plomb des minerais auro-argentifères exploités durant l'époque romaine à *Alburnus Maior* (Roşia Montană, Roumanie). ArcheoSciences – Revue d'Archéométrie 33, 83-90p

2010

Brandle, J.L., Szakács, A., Seghedi, I. (2010) Darwin's influence in the development of the igneous petrology. **Földtani Közlöny**, 140/3, p. 313-320, Budapest

Cañon-Tapia E., Szakács A. (2010) Introduction. In Canon-Tapia, E. and Szakács, A., eds., What is a Volcano? **Geological Society of America Special Paper 470**, 123-140

Lexa, J., Seghedi, I., Németh, K., Szakács, A., Konečný, V., Pécskay, Z., Fülöp, A., Kovacs, M. (2010) Neogene-Quaternary Volcanic forms in the Carpathian-Pannonian Region: a review. **Central European Journal of Geosciences**, Volume 2, Number 3/SEPTEMBER 2010 "New advances of understanding physical volcanology processes in the Carpathian-Balkan Region from a global perspective", 207-270,

Munteanu M, Wilson AH, Yao Y, Chunnett G, Luo Y., 2010a. Sequence of magma emplacement and sulfide saturation in the Gaojiacun–Lengshuiqing intrusive complex (SW China). **Mineralium Deposita** 45, 517-529.

Munteanu M, Wilson AH, Yao Y, Harris C, Chunnett G, Luo Y, 2010b. The Tongde dioritic pluton (Sichuan, SW China) and its geotectonic setting: Regional implications of a local scale study. **Gondwana Research**, 18, 455-465.

Munteanu, M., Wilson, A.H., Yao, Y., Jiang, S.Y., Chunnett, G., Luo, Y., Mafurutu, L., Phadagi, R., 2010c. A conduit-related genesis of the Lengshuiqing intrusive assemblage (Sichuan, SW China). **Journal of Volcanology and Geothermal Research**, 189, 118-130

Papp, B., Szakács, A., Néda, T., Papp, Sz, Cosma, C. (2010) Soil radon and thoron studies near the mofettes at Harghita Bai (Romania) and their relation to the field location of fault zones. **Geofluids**, 10, 4, 586-593

Seghedi I., Maţenco L., Downes H., Mason P. R.D., Szakács A., Pécskay Z. (2010) Tectonic significance of changes in post-subduction Pliocene-Quaternary magmatism in the south east part of the Carpathian-Pannonian Region. **Tectonophysics**, http://dx.doi.org/10.1016/j.tecto.2009.12.003

Seghedi, I., Szakács, A., Roşu, E., Pécskay Z., Gméling, K. (2010) Note on the evolution of a Miocene composite volcano in an extensional setting, Zârand Basin (Apuseni Mts., Romania). **Central European**

Journal of Geosciences, Volume 2, Number 3/SEPTEMBER 2010 "New advances of understanding physical volcanology processes in the Carpathian-Balkan Region from a global perspective", 321-328,

Seghedi I. 2010: Permian subaqueous rhyolitic domes changing to surtseyan tuff deposits and subaerial domes: Sirinia Basin (SW Romania-Eastern Europe). **J. Volcanol. Geotherm. Res.** 201, 312–324.

Szakács A. (2010) From definition of volcano to conceptual volcanology. In Canon-Tapia, E. and Szakács, A, eds., What is a Volcano?: **Geological Society of America Special Paper 470**, 67-76

Szakács A., Cañon-Tapia E. (2010) Some challenging new perspectives of volcanology. In Canon-Tapia, E. and Szakács, A, eds., What is a Volcano?: **Geological Society of America Special Paper 470,** 123-140

Tschegg, C., Ntaflos Th, Seghedi I., Harangi Sz., Kosler J., Coltorti C., 2010: Paleogene alkaline magmatism in the South Carpathians (Poiana Ruscă, Romania): Asthenosperic melts with geodynamic and lithospheric information. **Lithos** 120, 393–406

2011

Baron, S., Tămaş, C. G., Cauuet, B., Munoz, M. (2010) - Lead Isotopes analyses of Gold – Silver Ores from Roşia Montana (Romania): a first step of metal provenance study of Roman Mining Activity in *Alburnus Maior* (Roman Dacia). Journal of Archaeological Sciences, 38, p. 1090-1100

Seghedi, I., Maţenco L., Downes, H., Mason, P.R.D., Szakács, A., Pécskay, Z., (2011) Tectonic significance of changes in post-subduction Pliocene–Quaternary magmatism in the south east part of the Carpathian–Pannonian Region. **Tectonophysics** 502, 146-157, doi:10.1016/j.tecto.2009.12.003

Seghedi I. (2011) Permian subaqueous rhyolitic domes changing to surtseyan tuff deposits and subaerial domes: Sirinia Basin (SW Romania-Eastern Europe). **J. Volcanol. Geotherm. Res.** 201, 312-324 (2010), doi:10.1016/j.jvolgeores.2010.07.015

Szakács A. (2011) Earthquake prediction using extinct monogenetic volcanoes: A possible new research strategy. **Journal of Volcanology and Geothermal Research**, 201, 404-411

Book and fieldtrip guide chapters

Seghedi I., Ntaflos T. and Z. Pécskay, 2008: The Gataia Pleistocene lamproite: a new occurrence at the southeastern edge of the Pannonian Basin, Romania. in: COLTORTI, M. & GREGOIRE, M. (eds) Metasomatism in Oceanic and Continental Lithospheric Mantle. Geological Society, London, Special Publications 293, 83-100

Iancu O.G. (2010) The Călimani-Gurghiu-Harghita Volcanic Chain. In: Iancu, O.G. & Kovacs, M. (eds.) Ore deposits and other classic localities in the Eastern Carpathians: From metamorphic to volcanic. IMA 2010 Field trip guide RO1. Acta Mineralogica Petrographica, Field Guide Series, Volume 19 (2010), University of Szeged, p. 17-21

Ioane D., Bedelean H. (2010) Ancient gold mining in Rosia Montana (Apuseni Mts,

Romania). in Evelpidou, N.; Figueiredo, T. de; Mauro, F.; Tecim, V.; Vassilopoulos, A. (Eds.) "Natural Heritage from East to West. Case studies from 6 EU Countries", Springer Verlag, p.95-99, ISBN 978-3-642-01576-2

Kovacs M., Fülöp A.(2010) Baia Mare Neogene metallogenetic district. In: Iancu, O.G.& Kovacs, M.(eds.) „Ore deposits and other classic localities in the Eastern Carpathians: from metamorphics to volcanics", IMA 2010 Field trip guide RO1, Acta Mineralogica-Petrographica, Field Guide Series, Volume 19 (2010), University of Szeged, p. 5-13

Mărunţeanu C., Ioane D. (2010) Muddy volcanoes. in Evelpidou, N.; Figueiredo, T. de; Mauro, F.; Tecim, V.; Vassilopoulos, A. (Eds.) "Natural Heritage from East to West. Case studies from 6 EU Countries", Springer Verlag, p.79-85, ISBN 978-3-642-01576-2

Szakács A., Seghedi I. (2010) Rock-forming minerals in the Neogne Călimani-Gurghiu-Harghita volcanic range, Eastern Carpathians, Romania. A review. In Sándor Szakáll and Ferenc Kristály (eds.) Mineralogy of Székleyland, Eastern Transylvania, Romania. Csík County Nature and Conservation Society, Miercurea Ciuc, p. 129-145, ISBN 978-606-8235-01-1

Szakács A. (2010) Post-volcanic Phenomena in the East Carpathians. in Evelpidou, N.; Figueiredo, T. de; Mauro, F.; Tecim, V.; Vassilopoulos, A. (Eds.) "Natural Heritage from East to West. Case studies from 6 EU Countries", Springer Verlag, p.87-93, ISBN 978-3-642-01576-2

Science divulgation papers

Iancu O.G. (2010) Location of volcanoes in the Country of the Rising Sun within the plate tectonic context (in Romanian). Epifania, 12, 2010, p. 182-186

Abstracts

2007

Fülöp, A., Kovacs, M.(2007): 15.4 Felsic ignimbrites caldera in Gutai Mts., Carpathians, Romania. Proceedings of IUGG XXIV General Assembly, 6766, Perugia, Italy

Kovacs, M., Fülöp, A., Pécskay, Z. (2007) Spatial and temporal evolution of metallogeny in connection with convergent margins magmatism in Oas-Gutai and Tibles Mts., Eastern Carpathians, Romania. European Geosciences Union General Assembly - Geophysical Research Abstracts, Vol. 9, 2007SRef-ID: 1607-7962/gra/EGU2007-A-10511, Vienna

Kovacs, M., Fülöp, A. (2007) Miocene extensional and arc-type calc-alkaline volcanism in Gutai Volcanic Zone (Eastern Carpathians). Proceedings of IUGG XXIV General Assembly, 6931, Perugia, Italy

Munteanu, M., Wilson, A., Yao, Y., Chunnett, G., 2007. The Gaojiacun granites (Yangtze Craton, SW China) – silicic magmas related to mafic conduits. 6th Hutton Symposium, 2-6 July Stellenbosch, South Africa

Nițoi, E., Papp, D. C. (2007) Magma /enclave interaction in the neogene calc-alkaline magmatism from the subvolcanic zone of the East Carpathians: a mineralogical and isotopic integrated study, Proc. IUGG XXIV General Assembly, Perugia, Italy, July 2007.

Pintilei M., Kasper H.U., Gandrabura E.I. (2008) REEs and other trace elements distribution in the Vinta granitic intrusion (Apuseni Mountains, Romania). An. Ştiinț. Univ. „Al.I.Cuza" Iaşi, Geologie, LIII (2007), 55-62, Iaşi.

Szakács A., Pécskay Z., Seghedi I., Balogh K. (2007) A 21 Ma long story of Neogene-Quaternary magmatism in the Carpathian-Pannonian Region (Eastern Europe): Time-space evolution patterns. Agenda and abstarcts. The Sewcond International Conference on the Geology of Tethys, Cairo University, 19-22 March 2007. The Tethys Geological Society, Cairo, Egypt, p.91

Szakács A. (2007) From definition of „volcano" to conceptual volcanology. AGU (American Geophysical Union) Joint Asembly, 22-25 May 2007, Acapulco, Mexico, Program & Abstracts, Session V31A-02

Szakács A. (2007) Volcano instability, re-equilibration processes and their possible influences on the volcano-hydrothermal system. ESF/LESC Exploratory Workshop EW06-030 "New perspectives on volcano behaviour, volcanic hazards and volcanism-related mineral resources", Sovata, Romania, 4-7 September, 2007, Programme and abstracts, p. 19-20.

2008

Kovacs, M., Fülöp, A. (2008) Constrains for a new geopark in Romania- the Baia Mare geopark. Anuarul Institutului Geologic al Romaniei, Vol. 75, p. 28, Bucuresti

Murariu T., Răileanu M., Calcan C. (2008) Rb/Ba Ratio in K – Minerals of the granitic pegmatites as a metallogenic indicator. Rom. Journ. of Mineral Deposits, v. 83, p. 101-104, Bucureşti

Papp, D. C., Nițoi, E., Ureche , I., Onescu, D. (2008) Integrated geological and geophysical constraints on the evolution of the Neogene shallow intrusive magmatism from the Inner Carpathian Arc., IAVCEI General Assembly, Reykjavik, Iceland, 17-22 August 2008, Abstracts.

Papp, D. C., Nițoi, E. (2008) Enclaves in calc-alkaline rocks: new petrological and isotopic evidences on the nature of the lower crust in the subvolcanic zone of the East Carpathians. Proc. 33rd International Geological Congress, Oslo, Norway, August 2008.

Seghedi I., Szakács A., Balogh K., Pécskay Z. (2008) The role of finger-like baby plumes in the genesis of Miocene-Plioene alkalic basaltic volcanic fields from the Western part of the Carpathian-Pannonian Region, Central Europe. GEOS, Unión Geofísica Mexicana, A.C., Vol. 28, No1, p. 44-45, International Lithosphee Program, Joint Task Forces Meeting, Ensenada, Baja California, Mexico, September 21-26, 2008, ISSN 0186-1891.

Stumbea D. (2008) Zoned tourmaline from pegmatite bodies of Romania. An. Şt. Univ. "Al. I. Cuza", Ser. Geologie, Iaşi, vol. LIV, p. 47-55.

Szakács A. (2008) Volcanic facies revisited. Application to areas of closely-spaced composite volcanoes. IAVCEI General Assembly, Reykjavik, Iceland, 17-22 August 2008, Abstracts., p. 83

Szakács A., Seghedi I., Pécskay Z. (2008) Long-term evolution of individual volcanoes and volcanic systems recording lithosheric processes. The example of the Carpathian-Pannonian Region (Central-Eastern Europe). GEOS, Unión Geofísica Mexicana, A.C., Vol. 28, No1, p. 36-37, International Lithosphee Program, Joint Task Forces Meeting, Ensenada, Baja California, Mexico, September 21-26, 2008, ISSN 0186-1891

2009

Androne D, Buzgar N., Dorohoi D. O., Kasper H.U. (2009) Complex Investigation Data on Tourmaline from Granitic Pegmatites. Revista de Chimie, Bucureşti, Vol. 60, 4, 356-358

Munteanu, M., Wilson, A., Yao, Y., Chunnett, G. and Luo, Y., 2009. The Ni-Cu mineralisation from Lengshuiqing-Gaojiacun (SW China): Petrogenetic and metallogenetic insights. International Symposium on magmatic ore deposits. 1-4 December 2009, Bhubaneswar, India.

Papp D. Nițoi E., Szakács A. Genetic Model of an Aborted Porphyry-copper System. AGU (American Geophysical Union) Joint Assembly, 24-27 May 2009, Toronto, Canada Eos Trans. AGU, 90(22), Jt. Assem. Suppl., Abstract V32A-05

Papp B., Szakács A., Néda T., Cosma C., Papp S. (2009) Soil radon and thoron measurements near the mofettas at Harghita Bai (Romania) for field location of fault zones. The 10th International Conference on Gas Geochemistrey, Cluj-Napoca, Romania, 14-21 September 2009. Volume of Abstracts, p.79, ISBN 978-973-0-06984-6

Pintilei M. (2009) Biotite geochemistry of Vința graNițoid (Apuseni Mts.). An. St. Univ. "Al.I. Cuza" Iaşi, s. GEOLOGIE, LV/2, 87-95.

Pintilei M. (2009) Geochemical aspects of major elements distribution in Vința graNițoid (Apuseni Mts.). An. St. Univ ."Al.I. Cuza", s. GEOLOGIE, Iaşi, LV/2, 125-136.

Szakács A. (2009) Can extinct monogenetic volcanoes be used for earthquake prediction? 3rd. International Maar Conference, Malargüe, Argentina, April 14-17, 2009, Abstracts, CD, P.49

Szakács A. (2009) Evaluating the Consequences of Edifice Instability-Related Processes in Hydrothermal Ore Genesis at Composite Volcanoes. AGU (American Geophysical Union) Joint Assembly, 24-27 May 2009, Toronto, Canada Eos Trans. AGU, 90(22), Jt. Assem. Suppl., Abstract V32A-04

Szakács A., Gál Á. (2009) Rock and mineral type localities in Romania as potential geosites and subjects of the international geological cultural heritage. MAEGS – 16 Meeting of Association of European Geological Societies Geology for Society: Education and Cultural Heritage, 9 - 13 July 2009, Cluj-Napoca, Romania. Studia Univ. Babeş-Bolyai – Geologie, Special Issue, 63-64

2010

Azzali E., Dal Santo M., Capitani L., Forray F., Gál Á., Grieco G., Marescotti P., Pareschi R., Porro s., Szakács A. (2010) Mineralogical and geochemical spatial analyses of the Hop waste-rock dump at the Rosia Montana gold mine, Romania. Acta Mineralogica-Petrographica. Abstrarct Series, Vol. 6, IMA2010, 20th Genereal Meeting of the International Mineralogical Association, 21-27 August, 2010, Budapest, Hungary. p. 341, HU ISSN 0324-6523, HU ISSN 1589-4835

Downes H., Seghedi I., Matenco L., Szakács A., Pécskay Z. (2010) Post-subduction Pliocene-Quaternary magmatism in the south-east part of the Carpathian- Pannonian Region: tectonic significance. Geologica Balcanica, 39.1-2, XIX Congress of the Carpathian-Balkan Geological Association, Thessaloniki, Greece, 23-26 September 2010. Abstracts Volume, p. 100-101, Sofia, ISSN 0324-0894

Fülöp A. & Kovacs M. (2010) Volcaniclastic rocks in the geological record of the Oas and Gutai Mts., Eastern Carpathians: fragmental and reworking processes. XIX Congress of the Carpathian-Balkan Geological Association, Thessaloniki, Abstracts Volume, Geologica Balcanica, Vol. 39/1-2, p.116, Sofia

Gál Á., Kristály F., Szakács A., Molnár F., Weiszburg T. (2010) Illite and kaolinite in the Coranda low sulphidation type epithermal deposit, Apuseni Mts., Romania. Acta Mineralogica-Petrographica. Abstrarct Series, Vol. 6, IMA2010, 20th Genereal Meeting of the International Mineralogical Association, 21-27 August, 2010, Budapest, Hungary. p. 295, HU ISSN 0324-6523, HU ISSN 1589-4835

Gál Á., Molnár F., Szakács A., Kristály F., Weiszburg T., Pécskay Z. (2010) The Certej hydrothermal ore deposit (Apuseni Mts., Romania): fluid inclusions, types and age of the related hydrothermal alteration. Geologica Balcanica, 39.1-2, XIX Congress of the Carpathian-Balkan Geological Association, Thessaloniki, Greece, 23-26 September 2010. Abstracts Volume, p. 118, Sofia, ISSN 0324-0894

Iancu O. G., Robu I.N., Brandtstaetter F. (2010) Cathodoluminescence spectra of zircons from some eruptive and endogenous rocks located in Romanian Western and Southern Carpathians. Acta Mineralogica Petrographica, Abstract Series, Volume 6, IMA 2010, 20th General Meeting of the International Mineralogical Association, 21 – 27 August 2010, Budapest, Hungary, University of Szeged, p. 457.

Jurje M., Ionescu C., Hoeck V. (2010) Neogene quartz andesites from the Oaş-Gutâi Mts. (Romania): new geochemical data. Acta Mineralogica Petrographica, Abstract Series, Volume 6, IMA 2010, 20th General Meeting of the International Mineralogical Association, 21 – 27 August 2010, Budapest, Hungary, University of Szeged, p. 520

Kovacs, M., Fülöp, A., Cook, N. J., Kovács-Pálffy, P., Pécskay, Z. (2010) Magma mingling and mixing as key processes in the petrogenesis of the Laleaua Albă Neogene composite igneous complex, Gutâi Volcanic Zone, Northern Romania. IMA 2010 Abstracts, Acta Mineralogica-Petrographica, Vol.6, p.522, Szeged, Hungary

Kovacs, M., Pécskay, Z., Fülöp, A., Jurje, M., Edelstein, O. (2010) Time and space distribution of the Neogene intrusive magmatism from Oaş-Gutâi Mts., Eastern Carpathians, Romania. XIX Congress of the Carpathian-Balkan Geological Association, Thessaloniki, Abstracts Volume, Geologica Balcanica, Vol. 39/1-2, p. 214-215, Sofia

Kovacs, M., Fülöp, A (2010) Mixing and mingling processes in the petrogenesis of the Neogene volcanic rocks from Gutâi Mts. (NW Romania). Annual Conference of the Geological Society of Romania, Abstracts Volume, p. 98-101, Bucharest

Lexa J., Molnár F., Szakács A. (2010) Magmatic control of volcanic hosted meneralization in the Carpthian-Pannonian Region. Acta Mineralogica-Petrographica. Abstrarct Series, Vol. 6, IMA2010, 20th Genereal Meeting of the International Mineralogical Association, 21-27 August, 2010, Budapest, Hungary. p. 286, HU ISSN 0324-6523, HU ISSN 1589-4835

Lexa J., Fülöp A., Konecny V., Kovacs M., Németh K., Pécskay Z., Seghedi I., Szakács A. (2010) Neogene-Quaternary volcanic forms in the Carpathian-Pannonian Region: a review. Geologica Balcanica, 39.1-2, XIX Congress of the Carpathian-Balkan Geological Association, Thessaloniki, Greece, 23-26 September 2010. Abstracts Volume, p. 231, Sofia, ISSN 0324-0894

Munteanu, M., Wilson, A.H., Yao, Y., Chunnett, G., Sibanda, S., Luo, Y.N. 2010. Distribution and significance of the PGE contents in the Lengshuiqing Ni-Cu deposit, Sichuan, Southwest China. 11th International Platinum Symposium, June 21-24, 2010, Sudbury, Canada, Abstracts CD.

Munteanu, M., Chunnett, G., Yao, Y., Wilson, A.H., Luo, Y.N., 2010 - The Panxi Region (SW China) – structure, magmatism and metallogenesis. Proceedings of the International Symposium "Geology of Natural Systems – Geo Iaşi 2010", Sept. 1-4 2010, Iaşi, Analele Ştiinţifice ale Universităţii "Alexandru Ioan Cuza" din Iaşi, Special Issue, p. 200-203.

Nicolescu, S., Mârza, I. (2010) - The Dej Tuff of Transylvania (Romania): how old, what flavour and where from?; 20th General Meeting of the International Mineralogical Association, 21–27 August, 2010 Budapest, Hungary; Abstract Volume, Acta Mineral. Petrogr. Abstr. Ser.; v. 6, 684

Popa M., Radulian M., Szakács A., Seghedi I., Zaharia B. (2010) Seismicity in the southern part of the Haghita Mountains and its possible correlation with recent volcanic actvity. Geologica Balcanica, 39.1-2, XIX Congress of the Carpathian-Balkan Geological Association, Thessaloniki, Greece, 23-26 September 2010. Abstracts Volume, p. 320, Sofia, ISSN 0324-0894

Seghedi I., Szakács A., Roşu E., Pécskay Z., Gméling K. (2010) Note on the evolution of a Miocene composite volcano in an extensional setting, Zarand Basin (Apuseni Mts., Romania). Geologica Balcanica, 39.1-2, XIX Congress of the Carpathian-Balkan Geological Association, Thessaloniki, Greece, 23-26 September 2010. Abstracts Volume, p. 355, Sofia, ISSN 0324-0894

Szakács Al. (2010) Compositional sequences in the „Dej Tuff" (Transylvanian Basin, Romania) as recorded by mineral chemistry. Acta Mineralogica-Petrohgraphica. Abstrarct Series, Vol. 6, IMA2010, 20th Genereal Meeting of the International Mineralogical Association, 21-27 August, 2010, Budapest, Hungary. p. 542, HU ISSN 0324-6523, HU ISSN 1589-4835

Szakács A., Lexa J., Molnár F., Seghedi I., Kovacs M., Márton I. (2010) The role of the time factor in the hydrothermal metallogenesis related to the Neogene volcanism in the Carpathian-Pannonian Region. Geologica Balcanica, 39.1-2, XIX Congress of the Carpathian-Balkan Geological Association, Thessaloniki, Greece, 23-26 September 2010. Abstracts Volume, p. 382-383, Sofia, ISSN 0324-0894

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