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Foreword



Dear readers,

In this issue you will read two reports from IASPEI-related training activities and a report on the latest developments at the EMSC.

Another prominent seismologist and geophysicist has left us recently: Vladimir I. Keilis-Borok.

Keep on supporting all IASPEI activities!

Peter Suhadolc
Secretary General

MERRY CHRISTMAS AND
HAPPY NEW YEAR 2014 to all of you!



School on Reference Systems, Crustal Deformation and Ionosphere Monitoring

Instituto Geográfico Nacional Tommy Guardia
Panama City, Panama
October 21 - 23, 2013

In the framework of the IUGG Grants Program, the project "*Monitoring crustal deformation and the ionosphere by GPS in the Caribbean*" was granted support for the term 2012-2014. This project is further sponsored by IASPEI, IAG, and IAGA. The main objective of this initiative is to invite the Caribbean countries to participate actively in geodetic and geophysical projects that are going on in the Central and South American region, in order to enable the use of the acquired data for practice and science in their countries, and to promote geosciences. This includes capacity building activities providing the basis for profound education and sustainable development as well as the establishment of international and interdisciplinary contacts to participate in research projects at regional and global scales.

To facilitate this, a capacity building called "*School on Reference Systems, Crustal Deformation and Ionosphere Monitoring*" was carried out in Panama City, from October 21 to 23, 2013. The main topics treated during the school were:

- Types of coordinates, their definitions, relations and transformations.
- Geodetic reference systems and frames (celestial and terrestrial reference systems and frames, regional reference frames, SIRGAS, vertical reference frames).
- Installation and maintenance of observation instruments (in particular of GNSS), real-time data dissemination (via Internet), and data archiving and management.
- Coordinates determination from GNSS (observation equations, uncertainties in GNSS positioning, controlling errors in GNSS positioning, adjustment of GNSS networks).
- Crustal deformation observation and modelling (geodynamic processes, plate tectonics, seismic deformation, aseismic crustal deformation, monitoring deformations by GPS)
- Ionosphere modelling and analysis (structure of the atmosphere, models of the ionosphere, observation techniques, analysis of the ionosphere).

The school was attended by 145 participants from 28 countries: Germany, Argentina, Barbados, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Guatemala, Honduras, Jamaica, Mexico, Monserrat (UK), Nicaragua, Panama, Peru, Puerto Rico, Spain, St. Lucia, Suriname, Trinidad and Tobago, Turks and Caicos Islands, Uruguay, USA, and Venezuela. The main results of the school regarding this project are:

- To engage the Dominican Republic, Puerto Rico, Suriname, Trinidad and Tobago, Jamaica, St. Lucia and Turks and Caicos Islands in the IAG activities developed in the region through SIRGAS (the Geocentric Reference Frame for the Americas, the 1.3b Sub-commission of the IAG). Representatives of these countries have already made the necessary contacts to be integrated in different working and research groups.
- Trinidad and Tobago and Dominican Republic are interested on hosting a similar school in order to disseminate these topics to those people that were not able to come to Panama.
- Costa Rica, Dominican Republic, Guyana, Nicaragua and Puerto Rico are now integrating their geodetic reference stations into the continental reference frame.
- The objective of Dominica Republic to install a high-level GNSS processing centre.

This school provided a significant outreach in all related fields of geosciences and practice; especially in those disciplines covered by IUGG, IASPEI, IAG, and IAGA. The new knowledge transferred, contributes to the sustainable development of geosciences in the region and it is expected that the participants become more engaged in geodetic and geophysical activities. The Caribbean area is underrepresented in IUGG and its Associations, as well as in active participation in Earth science projects. This project enhanced the visibility of IUGG and encouraged colleagues to raise funds from their governments and private companies to extend the existing observational infrastructure and to support data processing at a high-level. As an immediate task, SIRGAS will support, as far as possible, all requirements of the Caribbean countries related to their integration in international geodetic and geophysical initiatives. These follow-on actions will provide a better coverage of the region in terms of observatories, data delivery, analysis and interpretation. This will have an effect not only on the scientific knowledge but also on

the sustainable development in practical applications (navigation, surveying, engineering, etc.).

The resources granted by IUGG were invested to support the travel of some Caribbean colleagues to Panama. However, applicants with travel support were requested to find additional resources to complement part of the costs (flight ticket, daily expenses or accommodation). In this way, it was guaranteed that attendees were really interested in the school and the so-called '*scientific tourism*' was avoided. In addition to the IUGG resources, it was possible to get economical support from the IAG and from the *Pan-American Institute of Geography and History* (PAIGH), also for travel grants. The school was hosted by the *Instituto Geográfico Nacional Tommy Guardia* of Panama under the coordination of the *SIRGAS Executive Committee*. All this support is highly appreciated.

Claudio Brunini, SIRGAS President
Laura Sánchez, SIRGAS Vice-president

The 13th International Workshop on Modeling of Mantle and Lithospheric Dynamics

31 August – 5 September 2013
Hønefoss, Norway

Because dynamic processes in the Earth's interior take place over time-scales of up to millions of years and at depths down to thousands of kilometres that are beyond direct observations, numerical modelling forms a prime tool for studying Earth dynamics. Numerical models are, among others, used to study processes related to extension, continental break-up, the formation of mid-ocean ridges, subduction, orogenesis, mantle circulation, and the core dynamo. A major computational challenge arises because the models that we need are intrinsically 3D, exhibit a complex structure, involve non-linear materials, and operate over a wide range of spatial and temporal scales. Models that focus on dynamics of the crust and lithosphere face additional numerical challenges related to accurately resolving large contrasts in viscosity that may occur across shear zones and between lithosphere and asthenosphere, the requirement of a stress-free top surface, and the ability to achieve large deformations including offsets on shear zones. In addition, new avenues are opening up as the

field of numerical Earth Sciences increasingly incorporates new knowledge from neighbouring disciplines such as mineral physics, geomorphology, and seismology. These add further complexity to the already complex non-linear numerical simulations.

To discuss scientific and technical aspects of geodynamic modelling, investigate exciting new avenues, foster international collaborations, and introduce students to the interesting challenges of mantle and lithosphere modelling, the numerical Earth Sciences community meets every two years at an international workshop. The workshop series started in 1987 in Neustadt an der Weinstrasse, Germany. Previous meetings have taken place in Germany, France, the Netherlands, Czech Republic, Italy and Switzerland. The 13th International Workshop on Modelling of Mantle and Lithosphere Dynamics (*Lucky13*) was the first to be held in a Scandinavian country. The workshop was sponsored by the Research Council of Norway, the Centre for Earth Evolution and Dynamics (University of Oslo), the EGU Conference Series, the European Research Council (ERC), and the International Association of Seismology and Physics of the Earth's Interior (IASPEI).

Lucky13 gathered 95 scientists, among whom were almost 50 early-stage researchers, from Europe, North America and Japan. Thirteen keynote speakers gave overviews and discussed the latest developments in subduction dynamics, plume dynamics, numerical techniques, surface and deep processes, and the dynamics of planetary interiors. The format of the workshop is such that ample time is allocated for poster presentations, informal discussions, and plenary-moderated discussions. Almost all participants presented posters, which highlights the active, hands-on approach of the workshop. Each day, a special meeting between the students and the day's keynote lecturers provided the opportunity to students to discuss the topics of the lectures in more depth, without other senior researchers attending. We received very good feedback on these discussions from both students and lecturers for the engaging and open atmosphere.

The abstracts to the workshop are accessible online at: <http://www.earthdynamics.org/lucky13/publications/Lucky13-Program-Abstracts.pdf>. The next meeting in this series will be held in France in 2015 and will be hosted by Dr. Laetitia Le Pourhiet (Université Pierre et Marie Curie Paris).

The workshop organisers: T.H. Torsvik, S.C. Werner, S.J.H. Buiter, P. Doubrovine, A. Bull-Aller and M. Dabrowski



Improving Earthquake Data Availability in the Euro-Med Region with EMSC

The European Mediterranean Seismological Centre (EMSC) is an NGO created in 1975 by the seismological community and under the auspices of the European Seismological Commission, to improve earthquake data availability in the Euro-Med region. EMSC is hosted by the Laboratoire de Détection Géophysique (LDG) in France and is primarily funded through European research projects and its members. It currently has 84 institutes as members from 55 countries. EMSC does not operate seismic stations; it collates data from seismological observatories to provide services at a broader geographical scale than individual contributing networks; all its activities being closely coordinated not only with its data providers but also with other relevant international organisations.

The initial activity back in 1975 aimed at rapidly sharing parametric data after significant earthquakes. Later on, it was complemented by an earthquake alert system to provide redundancy and back-up to the national institutes. Today, the activity has further evolved to the 2nd global earthquake information website (www.emsc-csem.org) reporting and providing information on 35 000 earthquakes annually. There is a growing number of data contributors outside the Euro-Med region improving service accuracy; one of which is the National Earthquake Information Centre of the US Geological Survey. An authoritative location scheme (its description is available in the New Manual of Seismological Observatory Practices) has been developed to limit discrepancies. Information about earthquakes' effects is collected from eyewitnesses through multilingual online macroseismic questionnaires, a tool to collect geo-located pics, and through real-time website traffic analysis, a method named flashsourcing.

The seismic portal (www.seismicportal.eu) is a more recent development performed in coordination with

ORFEUS (Observatories and Research Facilities for European Seismology), EMSC's sister organisation dealing with waveforms, and with ETH Zurich which is in charge of its hazard component. The portal has been developed thanks to several European projects (NERIES, NERA <http://www.nera-eu.org/>, SHARE <http://www.share-eu.org/>); it provides access to data and products for the scientific community, interactive access through the portal itself, remote access through webservices and, soon, standing orders for data will be implemented. It is based on open source technologies, and uses standards, to ensure interoperability with external developments and data discovery. Its developments are coordinated with GEM (<http://www.globalquakemodel.org/>) and EPOS (<http://www.epos-eu.org/>) initiatives.

Since 1998, EMSC has produced the Euro-Med bulletin by merging final seismological bulletins from 71 networks and 2500 stations; it is a multi-origin bulletin, meaning that all the collected locations remain available in the final bulletin. It contains nearly 8 million arrival times and, as with all EMSC products, it is freely available. It is the first bulletin that many Northern Africa and Middle East observatories have contributed to. The Euro-Med bulletin is also shared and coordinated with the International Seismological Centre (ISC). This coordination led to joint ISC-NEIC-EMSC propositions to IASPEI for a new station book system and, more recently, a new event type nomenclature to improve discrimination of anthropologic events.

Finally, collaboration with Northern Africa and the Middle East has always been one of EMSC's priorities. We have been involved for nearly 20 years in the UNESCO-led RELEMR (Reducing Earthquake Losses in Extended Mediterranean Region) initiative, and it was at the centre of the ESC2010 meeting that we organised in Montpellier in September 2010.

Remy Bossu
EMSC Secretary General

OBITUARY



Vladimir Isaakovich Keilis-Borok 1921-2013

On October 19, 2013 academician Vladimir Isaakovich Keilis-Borok, the founder of an institute and an outstanding Russian scientist in seismology and mathematical geophysics, passed away in Los-Angeles in his 93rd year.

Exceptional personal qualities, scientific intuition, dynamism and the ability to separate the most sufficient from a mass of factors, allowed Vladimir Isaakovich to find and unite experts from different scientific fields to address new initiatives and challenges. This is how new movements in science were created – computational seismology and non-linear dynamics in geophysics. Academician V.I. Keilis-Borok founded the International Institute for Earthquake Prediction and Mathematical Geophysics of the Soviet Academy of Sciences (currently the Federal State Budget Institution of Science Institute of Earthquake Prediction Theory and Mathematical Geophysics of the Russian Academy of Sciences) and was its first director from 1990 to 1998. He also organized the annual publication of

Computational Seismology collected papers, published under his editorship since 1966.

One of the key distinctive features of Vladimir Isaakovich's scientific activity was consistent application of modern mathematical and computational methods to solving the most high priority problems of geology and geophysics. His first research projects were devoted to modeling a seismic source and recreating motions inside it based on observations. The works that followed developed a theory of surface wave distribution in layered elastic media and produced a series of fundamental results in spectral properties of seismic waves. These results formed the basis for the criterion of distinguishing underground nuclear explosions, which remains the most efficient means for classifying seismic events into underground explosions and earthquakes. Further, Vladimir Isaakovich focused his scientific interests around solving inverse seismological problems, being the first to formulate them as a mathematical problem. He introduced new methods of modeling and determining the earthquake mechanism and reconstruction of the medium based on seismological observations. These and many other works in forward and inverse seismological problems created the basis for a new fundamental movement in geophysics – computational seismology.

The next key stage in Vladimir Isaakovich's scientific biography was to research problems of seismic risk assessment, together with predicting the location of future strong earthquakes. As a result, the general probability concept of seismic risk assessment was created, the problem of predicting locations of strong earthquakes was formulated and the corresponding mathematical methods were developed.

From detecting possible locations of future strong earthquakes Vladimir Isaakovich moved on to the problem of their prediction. At first his research was focused on the search for individual precursors. It was then when the earthquake explosion precursor was formulated and formalized. This precursor turned out to be one of the few whose statistical value was proven later. The work on searching for and statistical verification of precursors, held in collaboration with leading foreign geophysicists, permitted the development of algorithms for intermediate-term prediction of strong earthquakes. At the beginning of the 1980s Vladimir Isaakovich suggested a new approach to earthquake prediction, which consisted of shifting from using individual precursors to comprehensive analysis of

separate phases of strong seismic event preparation processes. This approach yielded the first formal algorithms for intermediate-term earthquake prediction in the history of geophysics.

Recently, Vladimir Isaakovich was actively involved in developing the general theory and methodology of predicting critical events in non-linear chaotic systems. His results are important for creating a new generation of earthquake prediction algorithms and they have also permitted the development of algorithms for predicting critical events in socio-economic systems.

Apart from extensive scientific research, Vladimir Isaakovich is known for his multifaceted activity in developing transnational scientific relations. In 1992-1997 he was a member of the scientific committee of the International Association for the Promotion of Cooperation with Scientists from the New Independent States of the Former Soviet Union, in 1987-1993 was a member of the International Council for Science Executive Committee, in 1987-1991, president of the International Union of Geodesy and Geophysics (IUGG), in 1979-1983, vice-president of the International Association of Seismology and Physics of the Earth's Interior (IASPEI), and in 1964-1979, head of the Committee for Mathematical Geophysics. Vladimir Isaakovich organized a number of international conferences and symposia in Russia and abroad. He was the founder and director of international schools for non-linear dynamics, seismic risk and earthquake prediction, held biennially at the Abdus Salam International Centre for Theoretical Physics governed by UNESCO-IAEA (Trieste, Italy). Its thirteenth school was held under his direct supervision in autumn 2011.

For his extraordinary scientific achievements Vladimir Isaakovich was elected a member of the Soviet Academy of Sciences and several foreign academies: the American Academy of Arts and Sciences, the National Science Academy, the Royal Astronomical Society, the Austrian Academy of Sciences, the Vatican Academy of Sciences, and the European Academy. He was an honorary member of the Institute of Physics of the Earth in Paris and was awarded a Lewis Fry Richardson medal of the European Geophysical Society for his outstanding contribution to non-linear geophysics.

V.I. Keilis-Borok is the author of over four hundred and twenty scientific papers. He mentored and advised on twenty-nine Candidate of sciences dissertations and fifteen Doctor of sciences dissertations.

We shall cherish the memory of Vladimir Isaakovich Keilis-Borok, a brilliant scientist and a wonderful person, in our hearts forever.

Alexey Zavyalov

Please mark your calendars for the two dates below!

2014 IASPEI Regional Assembly of the Latin American and Caribbean Seismological Commission

Bogotá, Colombia, July 23-25, 2014

IASPEI  **LATIN AMERICAN AND CARIBBEAN SEISMOLOGY COMMISSION – LACSC**
REGIONAL ASSEMBLY



III LATIN-AMERICAN CONGRESS OF SEISMOLOGY
"Exploring induced microseismicity and its potential to trigger tectonic events"

IV COLOMBIAN CONGRESS OF SEISMOLOGY
"Advances in Colombian Seismology after 20 years of monitoring by the Colombian National Network"

II LATIN-AMERICAN AND CARIBBEAN SYMPOSIUM ON GEOPHYSICS –
"Using microseismicity on exploration"

July 23 – 25, 2014, Bogotá, Colombia

Second European Conference on Earthquake Engineering and Seismology



A joint event of the 15th European Conference on Earthquake Engineering and the 34th General Assembly of the European Seismological Commission
Istanbul, Turkey, August 23-25, 2014

Meetings Calendar

A calendar of scientific meetings relevant to the interests of IASPEI scientists is maintained at:

<http://www.iaspei.org/meetings/forthcoming.html>

where more details can be found. We report below just the titles, dates, places and websites of the forthcoming meetings.

2013

AGU Fall Meeting

December 9-13, 2013, San Francisco, USA

URL: <http://fallmeeting.agu.org/2013/>

2014

European Geosciences Union General Assembly 2014

April 27 – May 02, 2014, Vienna, Austria

URL: <http://www.egu2014.eu/>

Seismological Society of America (SSA) Annual Meeting

30 April - 2 May 2014, Anchorage, Alaska, USA

URL: <http://www.seismosoc.org/meetings>

Int'l Workshop on Convergent Margins

May 21-23, 2014, Trabzon, Turkey

URL: <http://www.convergentmargins.com>

Latin American Caribbean Seismological Commission (LACSC) Regional Assembly 2014

July 23-25, 2014, Bogota, Colombia

URL: <http://geoslac.org/english/>

ESC General Assembly 2014

(joint with EAEE, 2nd ECEES)

August 24–29, 2014, Istanbul, Turkey

URL: <http://www.2eceedistanbul.org>

ASC General Assembly 2014

November 2014, Manila, Philippines

URL: <http://www.asc1996.com/>

AGU Fall Meeting

December 15-19, 2014, San Francisco, USA

URL: To be announced

2015

Seismological Society of America (SSA) Annual Meeting

21 – 23 April 2015, Pasadena, California

URL: <http://www.seismosoc.org/meetings>

International Union of Geodesy and Geophysics (IUGG), General Assembly

22 June-2 July, 2015, Prague, Czech

Republic

URL: <http://www.iugg2015prague.com>

General Information about IASPEI

The International Association of Seismology and Physics of the Earth's Interior is one of the eight Associations of the International Union of Geodesy and Geophysics [[IUGG](#)].

The other IUGG Associations are:

Int'l Association of Cryospheric Sciences [[IACS](#)]

Int'l Association of Geodesy [[IAG](#)]

Int'l Association of Hydrological Sciences [[IAHS](#)]

Int'l Association of Meteorology and Atmospheric Sciences [[IAMAS](#)]

Int'l Association for the Physical Sciences of the Oceans [[IAPSO](#)]

Int'l Association of Geomagnetism and Aeronomy [[IAGA](#)]

Int'l Association of Volcanology and Chemistry of the Earth's Interior [[IAVCEI](#)]

Scientific Assemblies

IASPEI holds an Ordinary General Assembly every four years in conjunction with each Ordinary General Assembly of IUGG. Between the General Assemblies, IASPEI holds a Scientific Assembly, sometimes meeting with one of the other Associations of IUGG.

Participation in IASPEI Activities

IASPEI welcomes all scientists throughout the world to join in research into Seismology. IASPEI is subdivided into a number of Commissions, many of which have working groups for the study of particular subjects in their general areas of interest. On occasion, these internal IASPEI groups issue their own newsletters or circulars and many maintain their own web sites. At the IASPEI Assemblies, the groups organize specialist symposia, invite scholarly reviews and receive contributed papers that present up-to-the-minute results of current research. The IASPEI web site gives, or provides links to, information on the range of IASPEI activities.

The IASPEI Web site

Information on IASPEI can be found at:

<http://www.iaspei.org/>

Contacting IASPEI

The Secretary-General is the main point of contact for all matters concerning IASPEI.

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