IASPEI Newsletter

February 2019

Foreword

Dear Readers,

At the beginning of this Newsletter, I repeat the call for 2019 IASPEI Medal nominations. Please inform me about potential candidates as soon as possible.

Then follows more information about IASPEI related Symposia during this year's General Assembly of the IUGG in Montréal, Canada (http://iugg2019montreal.com/). I am sure you and your colleagues will find one Symposium, in which your research results fit best. **But please do not miss the deadline for submitting your abstract (18 February 2019)**.

Please do not forget to inform me about international conferences and workshops with IASPEI related topics. Then, I can add these events to the Meetings Calendar of future Newsletters.

Johannes Schweitzer
Secretary General

Call for 2019 IASPEI Medal nominations

The award of an IASPEI medal has been decided during the 2011 General Assembly in Melbourne.

The IASPEI medal is awarded for distinguished contributions in seismology: for sustaining IASPEI goals and activities and for scientific merits in the field of seismology and physics of the Earth's interior. The IASPEI Bureau is in charge of taking the decision about who, among the candidates nominated at large, will be the medal recipient.

Until now, the IASPEI Medal has been awarded to Robin Adams (2013), Willie H.K. Lee (2015) and Bob Engdahl (2017).

Nominations of candidates for the 2019 IASPEI Medal are due until 28 February 2019.

Please send nominations attached with a CV of the candidate and a letter of motivation for the nomination to:

Johannes Schweitzer, IASPEI Secretary-General (iaspei@norsar.no)
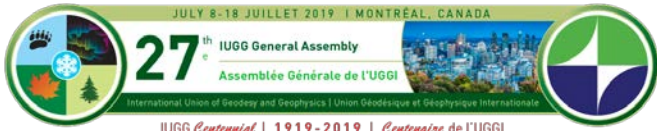
IUGG in Montréal, Canada

Union Symposia

The following tables give access to the different Union Symposia planned during the Assembly just follow the links to see the Symposia descriptions and convener lists:

U01	Achieving Sustainable Development: The Role for Earth Sciences
U02	Georisk Reduction: Science, Resources, and Governmental Action
U03	Mathematics of Planet Earth: The Science of Data
U04	Data-driven Science for Earth and Space Exploration
U05	New Discoveries in Earth's Deep Interior
U06	Recent Advances and Discoveries in Planetary Science and Comparative Planetology
U07	Centennial of International Cooperation in Earth and Space Sciences
U08	Earth and Space Observations
U09	Early Career Scientists' Symposium

IASPEI Symposia

S01 - Observational Seismology - Open Symposium Seismology

Conveners: Torsten Dahm (Germany), Susana Custódio (Portugal)

The commission of seismological observation and interpretation (CoSOI) covers a broad and diverse field of developments, approaches and application. We invite presentations from all fields of CoSOI including also new developments of integrating non-seismological data into seismic observations.

S02 - Standardization and Automatic Procedures in Source Studies

Convener: Simone Cesca (Germany)
Co-Conveners: Domenico Di Giacomo (ISC), Allison Bent (Canada)

Routine and automatic earthquake source parameter and moment tensor inversion methods are ever evolving and are used by several agencies, universities and surveys. Systematic global and regional services are becoming a standard in many countries, and different catalogs developed from temporal and permanent deployments are provided for the community. Software toolboxes offer standard source parameter tools – but results depend very much on the data pre-processing, data selection and implementation methods. Often, quality criteria for the processing and implementation methods are not easily available or are not provided. Therefore, a systematic comparison between parameters retrieved from different tools and procedures is not always straight-forward. The symposium invites both contributions focusing on scientists developing tools, and working towards automated source parameter estimation, as well as case studies where source inversion methods are applied to earthquakes, seismic sequences or large datasets. We aim to

collect contributions based on a broad variety of approaches, from traditional methods to new concepts of massive data and machine learning, including uncertainty quantification and testing platforms to calibrate and compare automated methods and their robustness.

S03 - Induced and Triggered (Anthropogenic) Seismicity: A Global Perspective

Convener: Stanislaw Lasocki (Poland)
Co-Conveners: David Eaton (Canada), Harsh K. Gupta (India), Yehuda Ben Zion (USA), Marco Bohnhoff (Germany)

Under suitable geological conditions, anthropogenic activities such as creation of the artificial water reservoirs, underground coal and metal mining, hydrocarbon production, underground storage of CO_2, geothermal energy production etc. can trigger/induce earthquakes. There is a very fine distinction between the induced and triggered earthquakes. When the causative activity accounts for a substantial part of the stress change, the resultant earthquake is termed as induced, while in the case of triggered - earthquakes, the stress changes associated with causative activity are very small. Reservoir triggered seismicity (RTS) has been observed at over several hundred sites globally and damaging earthquakes exceeding magnitude 6 have occurred at 4 of these sites. The largest RST event of M 6.3 occurred at Koyna, India on 10 December 1967. The largest induced earthquakes have exceeded magnitude 5 in gold mines of South Africa and India and at sites of oil production in USA and elsewhere. Despite vigorous research on induced seismicity since the 1960's, fundamental questions on conditions controlling the rate and size of induced earthquakes and other topics remain unanswered. The socio-economic impact of induced/triggered earthquakes is immense. This symposium takes a global perspective to survey recent progress in understanding induced seismicity from various triggering mechanisms, on topics ranging from numerical simulation of earthquake initiation and rupture processes, laboratory studies, seismological observations using a range of techniques, hazard assessment, and mitigation methods including advanced traffic light protocols.

S04 - Seismic Scattering, Ambient Noise, and Monitoring Earth's Structure

Convener: Hisashi Nakahara (Japan)
Co-Conveners: Ulrich Wegler (Germany), Matt Haney (USA)

Seismic scattered waves or coda waves carry rich information on heterogeneities within the Earth. Amplitude information from coda waves has been used to estimate the spatial distribution and the frequency dependence of the strength of scattering attenuation and intrinsic absorption in the Earth. Recently, ambient noise cross-correlation has also been used to study seismic structure in the Earth thanks to the development of seismic interferometry. Time-lapse imaging or monitoring of the Earth has been conducted using tiny changes in phase information of cross-correlation functions of ambient noise as well as coda waves. In this symposium, we would like to widely invite presentations related to theoretical and observational studies of coda waves and ambient noise, and their applications to the imaging and monitoring of the Earth's structure.

S05 - Seismology in the Oceans

Convener: Vera Schlindwein (Germany)
Co-Conveners: Chris Bean (Ireland), Torsten Dahm (Germany)

Seismological instrumentation of the ocean floor is continuously developing in recent year. New instrument types and measuring approaches are developed and more and more datasets are becoming open for scientific applications. This includes borehole seismic observations and ocean floor cables. Further, new methods in ocean bottom

seismology are rapidly developing, ranging from theoretical simulations to data analysis and the characterization and exploration of ambient seismological fields. Low frequency seismo-acoustics and the study of specific acoustic and seismological signals only observed in the oceans are evolving topics. This symposium aims to discuss all developments in ocean-bottom seismology and enhance collaboration and exchange from all groups using ocean floor data or studying ocean related seismic signals.

S06 - Advancements in Observation, Processing and Interpretation of Seismological Data

Conveners: Torsten Dahm (Germany), Wenyuan Fan (USA)

Freely available large datasets, including both Large-N nodal arrays and continental arrays, have greatly advanced our understanding of tectonic and earthquake processes. Combination of the big datasets, new monitoring instrumentations and novel processing methods, including improvements in rapid communication of scientific results, has led to breakthroughs in many subfields of seismology. For instance, earthquake location and large earthquake rupture processes are now routinely resolved within a few days by multiple agencies, which have led to new developments in damage impact assessment. Moreover, high-performance computing has enabled machine learning being applied to massive datasets to identify previously unknown patterns. However, results of these automatized processing approaches may have errors when their uncertainties are not carefully evaluated, suggesting future research focus directions. The symposium invites contributions from both structural and earthquake seismology studies with large datasets. In particular, we solicit studies tackling result uncertainty issues associated with big datasets from theoretical, modeling, and observational aspects.

S07 - Challenges and Prospects in the Investigation of Palaeo- and Historical Earthquakes

Conveners: Paola Albini (Italy), Kenji Satake (Japan)

Evidence of global seismic activity from instrumental records covers about one century, too short a period to catch the recurrence interval of large earthquakes. Historical seismological studies and macroseismic intensity data have significantly expanded backwards in time our knowledge of the seismic behaviour of many areas in the world. Paleoseismological studies of inland active faults, as well as coastal geological studies on tsunami deposits or marine terraces, and marine geological studies on deep-ocean turbidites, have provided important information for the past occurrence of pre-instrumental earthquakes, too.

The combination of data deriving from these three domains would result in a better vision of the long-term seismicity, which may be utilized for long-term forecast. However, challenges are still posed to researchers on how to best derive earthquake parameters from originally non-seismological observations of earthquake effects, as it is the case of both macroseismic and geological data.

This symposium welcomes contributions suggesting new prospects related to these topics, such as case studies of historical and paleoseismological records, their unfiltered association to specific events as well as their usual parameterization in seismological terms, or their combination with modern instrumental data, or any further issue on long-term seismicity analysis and forecast of moderate and especially of large earthquakes.

S08 - National and Regional Earthquake Centers: Highlights and Challenges

Convener: Aaron A. Velasco (USA)
Co-Conveners: Kristine Pankow (USA), Dmitry Storchak (ISC), Xyoli Perez-Campos (México)

National and regional seismic operation centers play an important role in monitoring for natural earthquakes, volcanic eruptions, and other phenomena, such as induced seismicity. The products generated by these centers, from raw waveforms to earthquake catalogs are used by a wide variety of stakeholders, including researchers, emergency management agencies, policy makers, educators, regulators, and the general public.

This symposium focuses on the important role that earthquake centers play in advancing scientific study, especially as it relates to local and regional hazard; integrating new technological advances in data acquisition and processing; and communicating earthquake hazard and risk.

We welcome contributions describing new and evolving networks, data policies and data sharing, new processing algorithms, hazard assessments, and novel education and outreach initiatives. Other topics that highlight current advances and challenges for earthquake operation centers are also of interest.

Potential outcomes of the symposium may include summary publications, organized advocacy, and frameworks for closer collaboration

S09 - Advances in Geophysics, Atmospheric Science, and Signal Analysis for Monitoring the CTBT

Convener: Stephen Myers (USA)
Co-Conveners: Ronan Le Bras (CTBTO), István Bondár (Hungary)

The Comprehensive Nuclear-Test-Ban Treaty (CTBT) distinguishes itself from other international agreements by establishing a verification regime that includes the International Monitoring System (IMS) and the International Data Centre (IDC). The IMS is a global, multi-physics network of sensors that record seismic, hydro-acoustic, infrasound, and radionuclide signals that are generated by nuclear explosions. The first twenty years of the CTBT focused on installation of the IMS network and implementation of robust methods for detection and processing of signals recorded on the IMS.

This symposium calls for contributions of state-of-the art methods and focused studies that can advance the science of CTBT verification across the four IMS sensor technologies. Although the emphasis is on the IMS and IDC, all studies that have applicability to monitoring science are encouraged. We seek contributions in the areas of source physics, signal propagation, and signal analysis. Source physics studies improve understanding of the nuclear explosion source and other sources, whether non-nuclear anthropogenic sources or natural sources, that may generate signals that are recorded by the IMS. Signal propagation studies include characterization of Earth's interior, the oceans, and the atmosphere, as well as methods to predict propagation of signals from the source to any sensor. Signal analysis includes methods to detect and analyze signals, associate signals generated by a common source, and methods to simultaneously analyze multi-physics data sets.

S10 - Advances in Array Seismology: Design, Theory and Applications

Conveners: Keith Koper (USA), Myrto Pirli (Norway)

We invite abstracts on new developments in the field of array seismology. Topics of interest include three-component arrays, 3D arrays, non-planar wavefields, incoherent

array processing, multi-array processing, and methods of detection that capitalize on array data. We welcome studies focused on all types of seismic and infrasonic sources (earthquakes, explosions, ocean waves, landslides, rivers, lakes, glaciers, meteors, etc.), as well as studies focused on imaging Earth structure. We also accept abstracts that describe new seismic and infrasonic array deployments and data sets.

S11 - Advances in Seismic Hazard and Risk Assessment

Conveners: Laurentiu Danciu (Switzerland), Marco Pagani (Italy)

In this symposium we aim to discuss recent progress on subjects related to seismic hazard and risk analysis. In particular, we welcome contributions related to the following topics:

- Data compilation and harmonization for use in earthquake hazard and risk assessment, with focus on homogenous earthquake catalogues, active faults, geodesy and tectonics, and strong ground motion datasets;
- Components of seismic hazard models such as seismic source models created using different methodologies (e.g. modelled strain, geological constrains). Model building process and related uncertainties, formal elicitation of expert opinion, comprehensive treatment of aleatory and epistemic uncertainties, development of innovative testing procedures.
- Ground motion models, stochastic and simulation-based models and uncertainties modelling;
- Case studies of seismic hazard analyses completed at the regional, national as well as site specific level;
- Elements of risk assessment such as exposure and vulnerability models and methods used for risk assessment. Case studies for earthquake risk assessment at regional and/or regional scale.

- The validation of hazard models including statistical tests of activity rates, calibration of ground motion models, hazard model parameterization and implementation, sensitivity analyses of key parameters and results.
- New methods for seismic hazard and risk analysis, for example short-term hazard analysis and simulation-based hazard analysis.

S12 - Genesis of Devastating Continental Earthquakes

Conveners: Prantik Mandal (India), Zhongliang Wu (China)

Moderate to large size devastating continental earthquakes have occurred at many locations in the world, e.g. New Madrid (USA), Kachchh and Koyna (India), Tennant Creek (Australia), Ungava (Canada), Latur (India), Wenchuan (China), and Christchurch (New Zealand). Since these events generally occur in the strong continental crust, thus, their seismogenesis is not well understood. The recent occurrences of continental earthquakes have caused substantial damages and deaths due to the growing population and poor constructions. Several modeling approaches can help us to understand the generation process of these events and hazard associated with them, which, in turn, can help us to develop earthquake resilient society. To reflect the modern advancements in the modeling of earthquake cycle, source processes and earthquake hazard associated with large continental earthquakes, and to foster inter-disciplinary international exchange and cooperation in these fields, this symposium will be focusing on, but not limited to, the following topics:

1) Seismogenesis of devastating intraplate earthquakes, 2) Evaluation of seismic hazards associated with the large intraplate earthquakes, 3) Study of source scaling of intraplate earthquakes, 4) Study of statistical characteristics of the long-tail aftershock sequence, 5) Study of non-volcanic tremor

(NVT) in intraplate regions, and 6) Source Modeling of large intraplate earthquakes.

S13 - Open Symposium. Earthquake Generation Process: Physics, Modelling Including Laboratory Experiments and Monitoring for Forecast

Convener: Eleftheria Papadimitriou (Greece)
Co-Conveners: Alexey Zavyalov (Russia), Luciano Telesca (Italy)

It is known that the process of destruction is not a momentary act, but there is a process taking place in time and space. In preparation of macro-destruction destruction process is going through a number of levels (stages), starting with the micro-scale and ending on macro-scale, including earthquake focal area. In this symposium, we invite researchers to discuss the results and directions for further researches on the physics of seismic process - from experiments in laboratory conditions, rock bursts in mines and in seismically active regions during the preparation of strong earthquakes.

Special emphasis will be given to quantitative physical models of the seismic process at different scales, describing the origin of the future earthquake source and its evolution in time and space, observations on earthquake triggering by other earthquakes or nearby faults, and synchronization between nearby faults with positive stress coupling, fault system interactions controlling earthquake occurrence, the connection of smaller magnitude seismicity with stress changes as expressed through the Rate/State model, calculation of stress changes from changes in earthquake occurrence. Modeling and simulations across a wide range of spatial and temporal scales provide a better understanding source processes and interactions, and advance predictive capabilities.

S14 - Earthquake Forecasting Models: Formulation, Testing and Application

Convener: David Rhoades (New Zealand)
Co-Conveners: Maximilian Werner (UK), Peter Shebalin (Russia)

Contributions are invited on all aspects of models designed to forecast earthquake occurrence in time and/or space. The development of earthquake forecasting models is being facilitated by the improvement of data and modelling inputs. Some modeling efforts are focused on short-term clustering of earthquakes, others on the time-varying probability of rupture of major fault sources, and others on the space-time-magnitude variation of the rate of earthquake occurrence in extended regions. Models can be statistical or physics-based. Data inputs include the past earthquake catalog, known or inferred dates of previous fault ruptures, modeled physical variables such as stress-accumulation and strain rates, and proposed precursory phenomena. Improved methods to test the performance of forecasting models are being developed. Reports on the application of forecasts to inform the public or in support of earthquake countermeasures-planning are welcome.

S15 - Interdisciplinary Observations of Pre-Earthquake Processes: A New Approach Towards Earthquake Prediction Studies

Convener: Dimitar Ouzounov (USA)
Co-Conveners: Sergey Pulinets (Russia), Katsumi Hattori (Japan), Patrick Taylor (USA)

This symposium concerns the multidisciplinary observations related to earthquakes, which would lead to an understanding of the physical processes preceding earthquakes. Some new results were obtained from modeling of the atmosphere-ionosphere connection and analyses of seismic records (foreshocks /aftershocks), geochemical, electromagnetic, and thermodynamic processes related to stress changes in the lithosphere, along with

their statistical and physical validation. Recent large magnitude earthquakes in Asia, Central America and Europe have shown the importance of these various studies in the search for earthquake precursors either for short-term forecasting or predictions. This symposium will provide the next development of the topics presented in the new AGU Geophysical Monograph published this year (Ouzounov et al, 2018). Presentations will include but are not limited to: observations; modeling and analyses; seismic, geochemical and electromagnetic thermodynamic processes; and case histories related to stress changes in the lithosphere along with their statistical and physical validation. Presentations on the latest developments in earthquake predictability and prospective testing associated with major earthquakes are welcomed.

S16 - Structure and Dynamics of the Extended Transition Zone (400 – 1000 km) and Mid-Mantle

Convener: Barbara Romanowicz (France, USA)
Co-Conveners: Carolina Lithgow-Bertelloni (USA), Hauke Marquardt (UK)

The separation between the upper and the lower mantle has traditionally been placed at the 660 km discontinuity, which is a well-documented phase change in the olivine system, and the last one of its kind down to D" depths. Yet, there is mounting evidence from seismic tomography that the character of mantle dynamics changes around 1000 km depth, resulting in the notion of an "extended transition zone" (ETZ) that may be critical for understanding of how plate tectonics works. This symposium invites contributions from seismic imaging, geodynamics modeling and mineral physics that provide insights on the structure of the ETZ, including the phase transitions at 400 and 600 km as well as the nature and role of the emerging fuzzy boundary at 1000 km depth.

S17 - Large Low Shear Velocity Provinces and Lower Mantle Structure

Conveners: Bernhard Steinberger (Germany), Trond Torsvik (Norway)

The Large Low Shear Velocity Provinces (LLSVPs) of the lowermost mantle are tomographically-observed regions beneath Africa and the Pacific that exhibit lower-than-average shear-wave velocities. Additional seismic studies infer that they have well-defined boundaries and may be compositionally-distinct from the surrounding mantle.

Furthermore, they are spatially correlated with present day hotspots and potentially the original locations of many large igneous provinces. Understanding the cause of and dynamics associated with LLSVPs is critical toward understanding Earth structure, large-scale mantle convection, thermal and chemical evolution, and the source of mantle plumes. This symposium aims to broadly include research from multiple fields (observational, experimental, and theoretical) to better understand the properties and dynamics of LLSVPs and lower mantle structure in general

S18 - Cratonic Evolution, Structure and Resource Potential

Convener: Christian Schiffer (UK)
Co-Conveners: Stéphane Rondenay (Norway), Andrew Schaeffer (Canada), Michael Kendall (UK), Fiona Darbyshire (Canada)

Cratons have been formed and shaped over billions of years and are assumed to be stable over long geologic time scales. These stable cores of Earth's continents have borne witness to and preserved an archive of past tectonic and geodynamic processes from the Archean and to present-day including the billions of years of repeated Wilson cycles: rifting, accretion, and intra-continental deformation events.

Despite the typically assumed long-lived stability of cratons, more recently we have observed that they do in fact experience more significant reworking and deformation than was previously thought, mostly along their margins, but also interestingly in their interiors. While Proterozoic-Phanerozoic orogenic and rifting events have rejuvenated craton edges, lithosphere destabilisation and delamination may eventually lead to complete or partial destruction of cratons. Furthermore, these regions are infrequently host to poorly understood, yet devastating intra-cratonic earthquakes, triggered in part by glacial unloading.

Cratons remain a key area of research, to large part due to their enigmatic evolution and billions-of-years rock record, but also, because they represent one of the key tectonic environments hosting natural resources critical for the continued development of our global economy. These resources include ores, minerals (especially diamonds), in addition to hydrocarbons trapped in intra-cratonic basins.

In this symposium, we encourage contributions from all branches of geoscience with a focus on further probing the structure, composition and evolution of the Earth's cratons. This includes interrogations of thermal and compositional structure, processes leading to the formation and destruction of cratonic lithosphere, and the formation and stabilisation of critical resources hosted within these regions. We welcome submissions from, but not limited to, geophysics, geodynamics, tectonics, metallogeny, geochemistry, and petrology.

S19 - Planetary Seismology

Convener: Philippe Lognonné (France)
Co-Conveners: Bruce Banerdt (USA), Domenico Giardini (Switzerland), Brigitte Knapmeyer-Endrun (Germany), Tom Pike (UK), Mark Panning (USA)

Following the landing of Apollo 11 in 1969 and after the expected landing of InSight on Mars on November 26th, seismology is no longer limited to Earth. This symposium will first present preliminary results of the InSight SEIS experiment, about 6 months after the start of the monitoring phase of the mission, which is expected to continue for a full Martian year until the end of 2020. All topics explored by the seismic experiment will be welcome, including those associated to joint seismic-acoustic-weather analysis with the APSS sensors, as well as issues and challenges encountered during the installation and commissioning, both on the instrument and deployment sides.

But the symposium will also be open to presentations related to the reprocessing of past planetary seismological experiments (Apollo-ALSEP, Viking), on seismic sources and seismic propagation modeling challenges in planetary seismology, and on recent advances in Earth-based giant planet seismology. Presentations on existing space qualified seismic instruments, new instrumental and mission concept to solar systems planets, Earth Moon, icy moons and small bodies, Earth seismic experiments in planetary analog fields, and the outreach/education dimension of planetary seismology will also be welcome.

S20 - Earthquake Source Mechanics

Convener: Satoshi Ide (Japan)
Co-Conveners: Naofumi Aso (Japan), Simone Cesca (Germany), Daniela Kühn (Norway), Yajing Liu (Canada), Seok Goo Song (Korea)

Recent high-quality seismic and geodetic observations provide large volumes of data, which enable accurate determination of earthquake source parameters, including locations, magnitudes, moment tensors, and detailed imaging of coseismic rupture processes. Further, techniques for solving inverse problems have improved substantially in the recent past. Abundant information from these analyses is the basis for studying a

variety of earthquakes including swarms, tectonic and volcanic events as well as induced events, and to seek the governing laws and conditions for rupture initiation, growth and arrest. It also provides useful input to estimate the stress state, fault geometry, and fluid movement around seismic regions. The entire earthquake process from long-term tectonic loading and slow nucleation to rapid rupture propagation with strong motion radiation is now studied using numerical simulations. The validity of assumptions in these simulations is tested by data analysis and laboratory experiments supported by several drilling projects. In this symposium, we invite contributions on data analysis and interpretation of earthquake parameters and source processes, on improvement and validation of routine analysis techniques, on theoretical and numerical modeling of dynamic ruptures and earthquake sequences, and observational and experimental studies on the physics of earthquakes. In addition, studies of significant earthquakes including recent events such as the 2016 Kumamoto, Japan (Mw 7.0), Central Italy (Mw 6.2), and 2017 Mexico (Mw 8.1 & 7.1) earthquakes are welcome.

S21 - Uncapping Flood Basalt Covered Terrains

Conveners: Nimisha Vedanti (India), Daniel Peter (Saudi Arabia)

There are large prospective areas of the sedimentary basins around the world that remain under-explored as these are concealed below a thick pile of the flood basalts, which makes imaging difficult. Various exploration programs carried out in such terrains have validated the existence of potentially prolific petroleum systems, which can be exploited to meet future energy needs. Seismic exploration in such terrain is still a challenge, as basalts show extremely variable physical properties, which are related to the emplacement mechanisms. The key to unlock the huge potential of the flood basalt covered terrains is to characterise the basalt and

develop advanced approaches to image subsurface structures.

In the past, quite a few attempts have been made to explore the sub-basalt terrains by integrating different geophysical data sets. Some authors have advocated the use of low-frequency source or acquisition of passive seismic data to complement the conventional active source seismic data. Further, with increasing computational power and advancements in seismic data processing and interpretation techniques, it has become possible to generate a high-resolution image of structures concealed under the basalt cover. We welcome contributions on the application of passive seismic methods and other advanced geophysical techniques like RTM, FWI to map the basalt concealed terrains around the world.

S22 - The Lithosphere-Asthenosphere System

Convener: Prakash Kumar (India)
Co-Conveners: Rainer Kind (Germany), Mian Liu (USA)

The nature of the lithosphere-asthenosphere boundary (LAB), initially defined as a mechanical boundary, remains uncertain. Seismological methods, including using surface waves and receiver functions, have yield results in many regions that are complex and subjected to different interpretations, such as the mid-lithospheric discontinuities. Some recent studies suggest that the LAB is a complex transition zone rather than a sharp boundary. A better understanding of the nature of LAB is critical for studying many fundamental geological processes, such as delamination, convective thinning, geochemical differentiation, and destabilization of cratonic roots. We welcome contributions from all fields, including seismology, geochemistry, and geodynamic modeling, that are related to the lithosphere-asthenosphere system.

S23 - Integrated Seismological Studies of the Continental Lithosphere – What We Can Learn From Seismology About the (Micro-)Plate Structure and Fabrics

Conveners: Uli Achauer (France), Jaroslava Plomerova (Czech Republic)

Over the last few decades we all have learned that the lithosphere beneath continents is highly heterogeneous and often consists of micro-plates, as a result of assemblage of different fragments of crustal terranes and mantle-lithosphere domains, each of them being both exposed deformation processes and preserving their fossil fabrics.

In this symposium we would like to discuss the newest findings and hypotheses in the light of the use of integrated seismological methods, applied particularly on large-scale array data to find out structures, the size and degree of heterogeneity, fabrics and processes that govern building the continental lithosphere in tectonically different provinces

Presentations exploiting complementary dataset of different physical parameters are especially welcomed.

S24 - Subduction Zones in South and Central America: Geometry, Geodynamics and Geohazards

Convener: Sergio Barrientos (Chile)
Co-Conveners: Marino Protti (Costa Rica), Susan Beck (USA), Andreas Rietbrock (Germany)

Large megathrust earthquakes and arc volcanism are two examples of the wide variety of tectonic processes taking place at subduction zones. Seismic coupling and rupture dynamics, with the consequent impact on seismic hazard, is the results of a combination of factors such as source geometry, temperature, composition, fluid and stress distribution, etc. Increased instrumentation along subduction zones in Latin America, particularly strong ground

motion and GNSS devices in addition to BB instruments, has led to improved seismic imaging and better characterization of many recent megathrust earthquakes. In this symposium we invite presentations on earthquake rupture, slow-slip events, seismicity, forearc and backarc deformation, geochemical processes at volcanic arcs, earthquake and volcanic hazards, especially in the South and Central America subduction zones, as well as in the Caribbean.

S25 - Seismology Education and Global Development

Conveners: Raju Sarkar (Bhutan), Rémy Bossu (France)

Advancing awareness and understanding of seismology is a global challenge. The goals include increasing the quantity and enhancing the quality of seismology education; expanding opportunities for the public to understand and appreciate seismology; providing education to students and the public. However, constraining conditions such as lack of infrastructure, poorly resourced schools, limited information and communication technologies, and unstable economic and political structures mean that seismology educators in developing countries face different challenges and have different needs from those in developed countries. The global awareness of seismicity would help the general public in taking steps and actions during a seismic event especially in developing nations where there are limited information and communication technologies. Educators and stakeholders who are working in the field of seismology need to come up with innovative ideas and techniques to educate the public and form policies to overcome the challenges associated with it. Research on the following topics would be welcome

a) Enhancing the quality of seismology education in developing nations

b) Studies of the use of information and communication technologies in under-resourced schools or communities
c) Study of technologies for the collection and study of geophysical data
d) Emphasizing seismology and the use of seismic data for global use
e) Reports on understanding and awareness towards seismicity
f) Case studies of public understanding seismic products and services
g) Comparative research studies evaluating country performance
h) Descriptions of developing-developed world partnership models in the field of seismology
i) Theoretical papers/case studies that focus on the linkages between seismology education and development.

S26 - Age Dependences of Terrestrial Heat Flow in Continental and Oceanic Settings

Convener: Valiya Hamza (Brazil)
Co-Conveners: Mohan Lal Gupta (India), Shaowen Liu (China)

Traditionally, age dependence of terrestrial heat flow has found widespread acceptance in thermal studies of the lithosphere. The theory of plate tectonics provides a physical basis for this relation, while several thermal and thermo-mechanical lithospheric models are constrained by their validity in continental and oceanic regions. Presently available experimental data sets, statistically analyzed in a proper manner, lends strong support for age dependence of terrestrial heat flow.

Nevertheless, there are uncertainties as to the exact values of the parameters that characterize this relation in several of the geotectonic provinces. This is evident in the difficulties encountered in attempts to understand the nature of reduced heat flow/tectonic age relations in continental regions. In this context the purpose of the proposed symposium is to evaluate the relevant heat flow and tectonic age data in the different tectonic settings. Specifically, it is important to outline distinct heat flow/age

profiles that characterize orogenic belts, extensional regions, sedimentary basins and magmatic provinces. The connecting links are multifaceted, spanning over such diverse topics as thermo-physical characteristics of tectonic units, brittle – ductile transition in the lithosphere and consequences of magma emplacement in the crust. It is also important to reexamine the criteria employed in choice of basal heat flow values and their influence in predictions of theoretical models that yield physically meaningful results. Specifically, the focus of the symposium will be on concepts and case examples on the interactions between heat flow and tectonic activities on local, regional and global scales. Accordingly, we call for contributions with focus on concepts and case examples on the interactions between heat flow and tectonic activities on local, regional and global scales.

IASPEI led Symposia joint with other Associations

JS01 - Cryoseismology (IASPEI, IACS, IAG)

Convener: Masaki Kanao (Japan, IASPEI)
Co-Conveners: Douglas Wiens (USA, IASPEI), Timothy C. Bartholomaus (USA, IACS), Mirko Scheinert (Germany, IAG)

In high latitude and elevation regions, the Earth's glaciers, ice sheets, sea ice, permafrost, and snowpacks are undergoing rapid change. However, our understanding of the processes governing these changes are hindered by a lack of observations with sufficient temporal and spatial resolution, in these generally remote landscapes. Fortunately, many of the cryospheric processes of interest produce ground vibrations. Analysis of these seismic signals can yield insight into the relationship between environmental forcings and the response of ocean - cryosphere - solid earth systems. The properties of these systems, such as mantle rheology or till thickness, can also be inferred

from both passive and active studies. Impulsive events with small magnitudes (icequakes) and M = 5 teleseismically detected glacial earthquakes can be generated by calving or basal slip. Continuous study of their time and space variability informs our understanding of climate change. In this joint symposium between IASPEI and IACS on "Cryoseismology," we invite submissions which cover the full gamut of seismology on and regarding the frozen earth. We encourage contributions treating the observation and modeling of seismic signals involving dynamics of ice sheets, sea ice, icebergs and glaciers, as well as changes to the thermal and physical structure of permafrost and snow.

JS02 - Early Warning Systems for Geohazards (IASPEI, IAG, IAGA)

Convener: Massimiliano Pittore (Germany, IASPEI)
Co-Conveners: Aldo Zollo (Italy, IASPEI), David McCormack (Canada, IASPEI), John LaBrecque (USA, IAG), Alan Thomson (UK, IAGA)

Damaging phenomena related to a variety of geo-hazards constantly threaten people, the built environment and its vulnerable infrastructure on a global scale. These phenomena depend on the type of underlying geologic process and may unfold across different spatial and temporal scales. The increasing urbanization and subsequent socio-economic development continuously raise the bar for the Civil Protection authorities and decision makers striving to control and reduce the associated risk. The development of Early Warning systems has been often proposed as a technological solution for mitigating the impact of geo-hazards. The development and implementation of such systems depends on understanding, modelling and monitoring the underlying natural processes.

The Symposium aims at bringing together scholars and practitioners with mutual interest in modelling, computational and experimental methods and technological advances from the design to the practical implementation of early warning systems for a broad range of geo-hazards. The symposium encourages original research, benchmark studies and practical examples with particular emphasis on open questions, unsolved issues and societal impact. The overall goal is to foster a holistic, multi-disciplinary discussion addressing the key challenges for the design and development of next generation early warning systems in the context of the 2015-2030 Sendai Framework for Disaster Risk Reduction.

Topics of interest include but are not limited to: Multi-source real-time data collection, sensors fusion; dynamic, evolutionary process modelling; decision-making strategies; rapid response and performance-driven approaches; from forecasting to nowcasting to early warning; industrial and mission-critical applications; (Near) real-time risk mitigation; Cost-benefit analysis and socio-economic impact; practical case studies.

JS03 - Subduction Zone Deformation and Structure (IASPEI, IAG, IAVCEI)

Convener: Yajing Liu (Canada, IASPEI)
Co-Conveners: Michael Bostock (Canada, IASPEI), Kelin Wang (Canada, IASPEI), Lucinda Leonard (Canada, IAG), Simon Peacock (Canada, IAVCEI)

Subduction zones encompass a range of significant processes contributing to the long-term evolution of the Earth. Megathrust earthquakes along subduction margins define a major geohazard capable of catastrophic damages, as evidenced by the 2011 Japan and 2004 Indian Ocean earthquakes, that are stark reminders of what is likely in store for Cascadia. However, our understanding of subduction zone processes and ultimately characterization of geohazards is hampered by a lack of observations, in particular offshore. For Cascadia, this data gap lies directly above the seismogenic zone and its

downdip transition to slow earthquake phenomena, where material properties evolve due to hydro-mechanical variations and metamorphic reactions. In recent years, improvements to permanent monitoring networks and dense temporary deployments have focused on a 4D characterization of stress, strength and fluid pressure evolution in subduction zones. In this session we invite contributions from a broad range of disciplines that address first-order questions about how megathrusts work, based on onshore/offshore surveys and integration of observation and modeling approaches for global subduction zones.

JS04 - Seismo – Geodesy (IASPEI, IAG)

Conveners: Takuya Nishimura (Japan, IASPEI), Yoshiyuki Tanaka (Japan, IAG)

In the past two decades, space geodetic techniques such as GNSS and InSAR have provided a detailed image of lithospheric deformation caused by earthquakes. Accumulating geodetic data, including those associated with recent giant earthquakes in Sumatra, Chile and Japan, have manifested peculiar deformation patterns that occur at different stages in an earthquake cycle. Fine-scale deformations mapped by LiDAR and InSAR revealed complexity of surface deformation related to deep seismic sources. Recent advances of marine geodesy and improvements in the networks of borehole tilt/strainmeters and seismometers have enabled us to monitor faint, small-scale wide-frequency phenomena due to slow and fast earthquakes in a subduction zone. Studies based on such a wide variety of deformation data as well as terrestrial and satellite gravity data have dramatically improved insights on earthquake rupture process, seismicity modulated by small stress perturbations, rheology of lithosphere and asthenosphere and frictional property and fluid migration in a fault zone.

In this interdisciplinary symposium, we welcome presentations of new results on geodetic and seismological measurements and modeling related with fast and slow earthquakes, postseismic transients, interseismic elastic strain accumulation and permanent inelastic deformation.

JS05 - Probabilistic & Statistical Approaches in Geosciences (IASPEI, IAG, IAVCEI)

Convener: Kerry Gallagher (France, IASPEI)
Co-Conveners: Nico Sneeuw (Germany, IAG), Andrew Bell (UK, IAVCEI)

Probabilistic and statistical approaches to modeling different types of Geoscience data have become more popular in the last 15 – 20 years, partly due to advances in methodological approaches and algorithms, and also due to increasing computing power. Different applications include analysis of large and/or complex data sets, inverse modeling, model choice, assessment of multiple forward modeling scenarios and forecasting, all potentially allowing for uncertainties in observations, model formulations and estimation of model parameters. In this symposium, we solicit submissions addressing new methods, comparisons of methods and application/ case studies of probabilistic/statistical techniques aimed at improving how we can identify and extract information from data and models in the general context of the Geosciences.

JS06 - Old Data for New Knowledge: Preservation and Utilization of Historical Data in the Geosciences (IASPEI, IAG, IAHS, IAGA, IAMAS, IACS, IAPSO, IAVCEI)

Convener: Josep Batlló Ortiz (Spain, IASPEI)
Co-Conveners: Alberto Viglione (Austria, IAHS), József Ádám (Hungary, IAG), Edward Cliver (USA, IAGA), Kris Harper (USA, IAMAS), Bruce Raup (USA, IACS), Florence Fetterer (USA, IACS), E. Pattabhi Rama Rao (India, IAPSO), Roberto Carniel (Italy, IAVCEI)

Studying a changing world needs long series of data. Moreover, reanalysis of old geophysical/geodetic data in the light of our present knowledge has become an important tool for understanding topics such as solar variability, climatic change, tectonics, earth rotation, and extreme natural events (e.g., magnetic storms, hurricanes, rainfall, floods, earthquakes etc.). Those old data are in analogue form and, many times, are contained in unique documents. Historical information may also be retrieved from documentary evidence such as narrative sources and legal-administrative institutional documentation (e.g. chronicles, newspapers, private and official protocols and correspondence, account books, etc.). Techniques and methodologies for preservation, dissemination, interpretation, homogenisation and use of such data, as well as for their present scientific use are important topics for advancing of our understanding of the changing Earth and of past extreme events. Different approaches have been devised to deal with different data and problems. Sharing the already large accumulated experience in the different fields covered by the IUGG shall contribute to improve our preservation and dissemination tools, our analysis methods and, ultimately, to further research results. This symposium welcomes contributions on:

(a) Locating, assessing, preserving, and disseminating historical data about sunspots, polar motion, time and temperature measurements, magnetograms, seismograms, eruptions, glacier extent, tide gauge records, aurorae, flood/drought events and many others and
(b) Methodologies and study cases using these historical data to advance our understanding of the Earth.

JS07 - Integrated Geophysical Programs for Earth Systems Monitoring (IASPEI, IAG)

Convener: Thomas James (Canada, IAG)
Co-Conveners: David Eaton (Canada, IASPEI), Stéphane Rondenay (Norway, IASPEI), Jeff Freymueller (USA, IAG), Alison Kirkby (Australia, IAG), Tilo Schöne (Germany, IAG)

Large-scale integrated geophysical programs that combine seismology, GNSS, InSAR and other methods are providing valuable new insights about Earth Systems processes through synoptic imaging and monitoring capabilities. Ongoing or recent programs including EarthScope, SINOPROBE, AlpArray and IPOC have made many significant contributions to Earth System monitoring, with applications ranging from tectonic processes, hazards, resources and global change. EarthScope's USArray program, for example, has changed how the general public can envision earthquakes along with refining the capacity for tomographic imaging deep into the mantle, whereas Australian federal programs such as AusLAMP have provided critical pre-competitive framework for resources exploration. Various types of instrumentation have contributed to outcomes that were not foreseen at the outset; for example, GPS reflected rays are now being used for monitoring vegetation growth, soil moisture, snow and sea ice accumulation. Canada's LITHOPROBE program was among the first to integrate high-resolution geophysical methods with a variety of other approaches to address geoscientific problems at the plate scale. Canada is now working towards initiating the CCArray and EON-ROSE programs, which will expand on the exceptional outcomes from the EarthScope program. This symposium welcomes submissions that focus on new scientific insights and serendipitous applications arising from integrated geophysical array programs.

JS08 - Climate Modeling, Climate Change and Subsurface Temperature Field (IASPEI, IAHS)

Conveners: Vladimir Cermak (Czech Republic, IASPEI), Makoto Taniguchi (Japan, IAHS)

Subsurface temperature field reflects time changes in the ground surface conditions, produced by the changing climate in general. On the local scale other events may modify the downward propagation of this "climate" signal, such as e.g. long-term changes in the vegetation cover, land use, urbanization and other human activities. Borehole climatology developed in the past several decades contributed to the reconstructions of the climate of the past several millennia and proved to be a suitable research tool. We want to invite contributions discussing theoretical aspects of borehole temperature inversion methods as well as papers summarizing new practical inversion results obtained on local, regional and global scales. Welcomed are evidences of the repeated measurements of temperature-depth profiles as a useful direct tool to understand the ongoing global warming, various geothermal aspects of the changing climate (heat island effect) in large megapolis as well as urbanization and its global warming impacts

JS09 - Tectonophysics of the Continental Lithosphere: Integrating the Thermal Field with Thermo-Barometric, Seismological, Electromagnetic and Seismicity Data (IASPEI, IAVCEI, IAGA)

Convener: Andrea Förster (Germany, IASPEI)
Co-Conveners: Rainer Kind (Germany, IASPEI), Alan Jones (Canada, IAGA), Gianluca Gola (Italy, IAVCEI)

Geotherms are fundamental for the quantification of the Earth's thermal structure and the understanding of tectonophysical processes. They are numerical models that require a sound understanding of surface heat flow, and sensu stricto terrestrial heat flow,

rock thermal conductivity (which is pressure and temperature dependent) and radiogenic heat production. For stabilized crust, known values of mantle heat flow can help to constrain those thermal properties of the crust. The ambiguity of the lithospheric thermal regime is large owing to uncertainties in the quantification of the governing parameters, for example the lithosphere structure and composition and the lithosphere-asthenosphere depth.

Uncertainties also arise from the different laboratory measurements deployed in constraining the heat flow and rock thermal properties. Other problems are linked with transient thermal processes not depicted yet by surface heat flow. It is therefore desirably to seek for independent evidence to verify the thermal

field, which is e.g. by xenolith-derived thermo-barometry data, data on the cut- off depth of earthquakes, by seismology and electromagnetic surveys. We therefore welcome papers that address an integration of the thermal field with geophysical imaging techniques to answer fundamental questions in rheology and geomechanics, and young geodynamic processes.

JS10 - Physics and chemistry of earth materials with implications for earth structure and dynamics (IASPEI, IAVCEI)

Convener: Jiuhua Chen (USA, IASPEI/IAVCEI))
Co-Conveners: Tomo Katsura (Germany, IAVCEI), Sergio Speziale (Germany, IASPEI)

Research progress in field-based observations, laboratory experiments, and theoretical modeling advance our understanding of the structure and dynamics of the Earth's interior. This interdisciplinary symposium will bring together new results from seismological and electrical sounding directed towards elucidating the structure of the mantle and core (including discontinuities, anisotropy and attenuation), observations of

the Earth's magnetic field and its relationship to planetary heat flow, relevant research on earth materials (including phase equilibria, element partitioning, deformation and the development of texture, the influence of volatiles on partial melting, seismic and electrical properties, and rheology), and numerical modeling of properties and processes on distance scales ranging from atomic to global, and on timescales ranging from accretion and core formation to the present.

Other Association Symposia joined by IASPEI

JA01 - Geophysical Constraints on the Earth's Core and Its Relation to the Mantle (IAGA, IASPEI, IAG)

Convener: Jon Aurnou (USA, IAG)
Co-Conveners: Michael Bergman (USA, IAG), Carla Braitenberg (Italy, IAG), George Helffrich (Japan, IASPEI), Tine Thomas (Germany, IASPEI)

This symposium seeks contributions covering from core to mantle, including observations, material properties, structure and dynamics. In the mantle, composition, rheology, density, electric and magnetic properties are required to define the dynamical evolutionary path through space-time. The recent satellite missions GRACE, GOCE and SWARM, and novel teleseismic methods give new insights into deep Earth physical properties and state. Models of mantle convection and the interaction with lithospheric plates and subducted relics use these data as input to define the models in greater detail. Geodetic and seismic data provide inputs necessary for constraining possible stable layers in the outer core, with high resolution models of the geomagnetic field required to make further progress in our understanding of core dynamics and dynamo generation. Seismology and mineral physics continue to

work in tandem to further our understanding of inner core structure and dynamics. We also welcome studies concerning global-scale coupling, including the dynamical interaction between the inner, outer core, the mantle and earth rotation.

JA02 - Geophysical Data Assimilation (IAGA, IACS, IAG, IAHS, IAMAS, IAPSO, IASPEI, IAVCEI)

Convener: Sabrina Sanchez (Germany, IAGA)
Co-Conveners: Marie Bocher (Switzerland, IASPEI), Matthias Morzfeld (USA, IAGA/IAMAS), Takemasa Miyoshi (Japan, IAMAS), Entcho Demirov (Canada, IAPSO), Julien Brajard (France, IAPSO/IACS), Salvatore Grimaldi (Italy, IAHS), Pavel Novak (Czech Republic, IAG)

Data assimilation has become a valuable tool for improving our understanding of the Earth and its different dynamical layers, such as the core, mantle, oceans, atmosphere and magnetosphere. By merging sparse observations, complex physical models and their respective errors, data assimilation attempts to unveil hidden features of a given system as well as predicting its evolution. Although its long-term development in the field of meteorology has led to a well-established framework, data assimilation methodologies still bear considerable challenges. Amongst those we can cite the numerical stability of ensemble-based methods such as the Ensemble Kalman Filter, the identification and handling of model errors and biases, the hybridization of variational and sequential approaches, and the usage of multi-model ensembles for parameter estimation. Moreover, in many fields of application, such as core and mantle dynamics, as well as volcanism and space weather, data assimilation remains fairly exploratory. However, these novel applications can provide a platform for further analysis of the aforementioned challenges. This symposium aims at promoting a constructive dialogue between the different geophysical communities with a shared

interest in the development of innovative strategies in data assimilation. We therefore particularly encourage the participation of contributions connected to emerging research fields of geophysical data assimilation, as well as the development of libraries, testbeds and computationally efficient data assimilation schemes.

JA03 - Geophysical Records of Tectonic and Geodynamic Processes (IAGA, IASPEI, IAG, IAVCEI)

Convener: Fernando Poblete (Chile, IAGA)
Co-Conveners: Leonardo Sagnotti (Italy, IAGA), Matthias Morzfeld (USA, IAGA/IAMAS), Marie Bocher (Switzerland, IASPEI), Haluk Ozener (Turkey, IAG), Heather Handley (Australia, IAVCEI)

This symposium aims to bring together a wide range of investigations related to paleomagnetism, magnetic anisotropy, gravimetry, seismic, volcanologic and other geophysical studies intended to unveil tectonic and geodynamic processes at different scales and their links to Earth Dynamics. Thus, presentations may include:

- Characterization of subsurface structures and implications in tectonic evolution
- Tectonic evolution of subduction related orogens
- Geodynamic processes in a collisional setting
- Geodynamic processes at convergent/divergent plate margins
- Plate kinematics

JA07 - Geoscience Data Licensing, Production, Publication, and Citation (IAGA, IACS, IAG, IAHS, IAMAS, IAPSO, IASPEI, IAVCEI)

Convener: Masahito Nosé (Japan, IAGA)
Co-Conveners: Simon Flower (UK, IAGA), Yasuhiro Murayama (Japan, IAMAS), Helle Pedersen (France, IASPEI), Attilio Castellarin (Italy, IAHS), Gabriel Guimarães (Brazil, IAG), Toru Suzuki (Japan, IAPSO), Aude Chambodut (France, UCDI), Giuseppe Puglisi (Italy, IAVCEI)

A number of national and international geoscience research infrastructures have been created in recent years, for example, EPOS (the European Plate Observing System), Copernicus (European Union's Earth Observation Programme), IUGONET (the Inter-university upper atmosphere global observation network), EarthCube (the 'system of systems' infrastructure for geosciences) and AuScope (the Autralian geoscience and geospatial infrastructure). At the same time the World Data System is evolving and certification of data repositories (ICSU-WDS, CoreTrustSeal) is becoming an important concern. Together these initiatives make it possible for users to easily access huge archives of disparate geoscience data and metadata in a secure and reliable manner, a task that was complex and time consuming before these initiatives were available.

Clear licensing of geoscience data gives users clarity over how they can use and share the data, protects the rights of data providers and promotes integrated research. Data publication and citation will benefit data suppliers by giving them proper credit, professional recognition and rewards for their works, in a similar manner to the way that publication of scientific results benefits scientific researchers. Licensing, publication and citation of data are becoming a requirement for contribution to geoscience infrastructures. The system of licensing, producing, publishing, and citing of geoscience data is a structure for persistent

intellectual content identification and management as well as for connection of users with content suppliers.

This symposium solicits contributions presenting actual practices and future plans of data licensing, producing, publication, and citation of scientific data, and possible related topics.

JA08 - Probing the Earth's Lithosphere and Its Dynamics Using Geophysical Modeling (IAGA, IASPEI, IAVCEI, IAG)

Convener: Foteini Vervelidou (Germany, IAGA)
Co-Conveners: Stavros Kotsiaros (USA, IAGA), Robert Tenzer (Hong Hong, IAG), Jörg Ebbing (Germany, IAG/IAGA), Rob Govers (Netherlands, IASPEI/IAG), Javier Fullea (Ireland, IASPEI), Magdalena Scheck-Wenderoth (Germany, ILP), Silvia Massaro (Italia, IAVCEI)

This symposium focuses on the structure and dynamics of the Earth's lithosphere. Multiple geophysical observations help us probe the Earth's lithospheric structure and understand its dynamic behavior. These include the magnetic and gravity field, electromagnetic induction, heat flow and seismological data.

The lithospheric magnetic field reflects properties like composition and temperature and carries information about tectonic, chemical, and thermal alterations that magnetized rocks have undergone throughout their history. Gravity field, apart from information on composition, reveals information about mass exchange mechanisms related to dynamic processes like sea level rise, glacial retreat, and lithospheric flexure. Magnetotelluric studies image Earth's electrical conductivity from the near-surface to deep within the mantle. Seismological methods including receiver functions map the location of major interfaces like the Moho and the Lithosphere-Asthenosphere Boundary. Seismic velocities can be inverted for density and temperature,

and seismic attenuation and seismic anisotropy are correlated with temperature and strain, respectively. Global heat flow measurements help constrain the lithospheric geotherm and Earth's energy budget. These geophysical data sets provide us with a highly valuable data pool for the study of the Earth's lithosphere and its mechanical strength.

We solicit contributions focused on any related geophysical data set or combinations of them with the ultimate goal of enhancing our knowledge about the structure, composition and dynamics of the Earth's crust and uppermost mantle. In this respect, we welcome contributions from studies focusing on data collection and processing, global or regional modeling and interpretation of data and models in terms of tectonic, geological or geophysical implications.

JA09 - Joint Inversion of Different Geophysical Data Sets (IAGA, IASPEI)

Convener: Alan Jones (Canada, IAGA)
Co-Conveners: Max Moorkamp (UK, IAGA), Juan Carlos Afonso (Australia, IASPEI), Jan Dettmer (Canada, IASPEI)

Combining complimentary data sets typically reduces the ambiguity of inversion results and facilitates subsequent interpretation. Hence, integration of multi-disciplinary data has become popular in many disciplines including hydrogeophysics, mineral exploration, sub-basalt and sub-salt problems, gas hydrate investigations, and studies involving deep crustal and mantle structures. Still, many questions remain: Which types of data should be inverted together? How to balance their influence in the inversion? How can we assess the differences between joint inversion, cooperative inversion and other integrated interpretation strategies?

This symposium welcomes research using joint inversion or other approaches to combine different types of geophysical data. Both case studies and technical contributions are welcome

JA10 - Electromagnetic Signals Generated by Volcanic Eruptions/Activity, Fluid Pressure, Earthquakes and Aseismic Fault Slip (IAGA, IAVCEI, IASPEI)

Convener: Jacques Zlotnicki (France, IAGA)
Co-Conveners: Malcolm Johnston (USA, IAGA/IASPEI), Takeshi Hashimoto (Japan, IASPEI/IAVCEI), Xuhui Shen (China, IASPEI), Yoichi Sasai (Japan, IAVCEI)

Changes in inter-related crustal stress, deformation, pressure/temperature of electrically conducting fluids and pore pressure in crustal rocks all occur in both volcanic regions and regions of seismic and aseismic fault failure. All these processes generate electric and magnetic (EM) fields. Furthermore, global EM effects are observed in the atmosphere and ionosphere with explosive ash eruptions. While co-eruptive effects and co-seismic fault failure effects in EM fields, deformation, seismicity and geochemistry are readily observed and modeled, the inter-relation between various parameters during periods of volcanic unrest and aseismic activity that are driven by perhaps the same underlying physics is much less clear. This symposium focuses on bringing together examples of multi-parameter land and satellite observations during volcanic activity and earthquake rupture (Part 1), non-eruptive volcanic activity (Part 2) and aseismic fault activity (Part 3) in order to identify the dominant but perhaps changing physical processes involved. Knowledge of the non-uniform EM tomography of volcanoes and fault systems is a necessary prerequisite for modeling these different processes.

JA11 - Cratonic Structure and Dynamics (IAGA, IASPEI)

Convener: Nikolay Palshin (Russia, IAGA)
Co-Conveners: Ute Weckmann (Germany, IAGA), Sergei Lebedev (Ireland, IASPEI), Irina Artemieva (Denmark, ILP)

Cratons record a long history of tectonic events. The result is a complex, stable collage of lithosphere fragments that can continue, however, to experience deformation and modification. Understanding the evolution, composition and structure of cratons remains a challenge, which includes the details of accretion and orogenesis, the roles of inherited structures and lithosphere thinning in past and ongoing deformation, and the mechanisms of craton construction, modification and stabilization.

This symposium seeks contributions that address structure, composition, evolution and the dynamic processes that have shaped cratonic lithosphere based on a range of approaches, including seismology and electromagnetic methods and other geophysical methods; geochemistry, petrophysics and geodynamic modelling. We particularly welcome integrated geophysical imaging techniques that cross disciplinary boundaries and those that link lithosphere dynamics with processes occurring at the Earth's surface and the deeper mantle.

JA12 - Innovation in Geoscience Education, Outreach and Citizen Science (IAGA, IAHS, IAPSO, IASPEI)

Convener: Manoj Nair (USA, IAGA)
Co-Conveners: Rick Saltus (USA, IAGA), Edgar Bering (USA, IAGA), Barbara Leichter (Austria, IAGA), Christophe Cudennec (France, IAHS), Isabelle Ansorge (South Africa, IAPSO), Laura Gallardo (Chile, IAMAS), Raju Sarkar (Bhutan, IASPEI), Paul Denton (UK, IASPEI), John Taber (USA, IASPEI)

This Symposium calls for papers describing innovations in geoscience instruction methods and citizen science initiatives. Papers are welcome describing advances in all levels of instruction, including secondary and higher education. We are particularly interested in papers about inventive approaches to inquiry-based learning in all geosciences. Involving students and the public in designing experiments and collecting data has been shown to foster a scientific identity, to

increase overall interest in science, and to improve the perceived value of scientific research. Papers are welcome on all aspects of education and citizen-science including methodology, data-collection, non-traditional areas of curriculum, case studies, etc. In particular we invite contributions that describe ways to broaden the public understanding and appreciation of science and to attract non-traditional and under-represented students into the sciences.

JG01 - Interactions of Solid Earth, Ice Sheets and Oceans (IAG, IACS, IASPEI)

Convener: Matt King (Australia, IACS/IAG)
Co-Conveners: Pippa Whitehouse (UK, IACS/IAG), Martin Horwath (Germany, IAG), Bert Wouters (Netherlands, IACS), Anya Reading (Australia, IASPEI)

Measurements of solid Earth, sea-level and ice-sheet change are influenced by a complex interaction of processes occurring over a large range of spatial and temporal scales. Proxy observations that constrain past ice sheets are influenced by glacial isostatic adjustment and changing mantle dynamic topography. Present-day observations of solid Earth deformation in one location are affected by present and past changes in global surface loading. Recent work highlights the role that solid Earth deformation has to play in controlling ice-sheet change, while seismological investigations are revealing crucial spatial variations in Earth rheology. In this symposium, we showcase model- and data-driven efforts to understand feedbacks between surface load changes and the solid Earth over all timescales.

Topics include:
- observations of mass changes in the cryosphere and oceans, and their interaction with solid Earth deformation
- influence of mantle dynamic topography and glacial isostatic adjustment on paleo observations of sea level or ice sheet behaviour

- seismic studies of the rheology of the solid Earth in the context of sea-level and ice-sheet studies

JG07 - Monitoring, Imaging and Mapping of Volcanic Belts (IAG, IAGA, IASPEI, IAVCEI)

Convener: José Fernardez (Spain, IAG)
Co-Conveners: Patrick Whelley (USA, IAVCEI), Mark Bebbington (New Zealand, IAVCEI), Jacob Richardson (USA, IAVCEI), Martyn Unsworth (Canada, IAGA), Philippe Jousset (Germany, IASPEI), Simone Cesca (Germany, IASPEI)

A range of important geological processes occur beneath volcanic belts. Subsurface fluxes of magma and hydrothermal fluids have generated both the continental and oceanic crust and formed many mineral deposits. However, the crustal structure of volcanic belts is not fully understood. This symposium seeks to advance this research area by gathering researchers studying the subsurface structure of active volcanic systems. We welcome all contributions that present (a) geophysical studies of volcanic belts and (b) geological studies that seek to interpret geophysical models in terms of laboratory experiments, (c) Geodetic measurements, imaging and topography of volcanic belts, and (d) multidisciplinary studies on volcanic belts.

JG08 - Earth Systems Literacy: Geophysics in K-16 Class Rooms, Outreach Projects, and Citizen Science Research Projects (IAG, IASPEI, IAVCEI)

Convener: Katherine Boggs (Canada, IASPEI)
Co-Conveners: Maite Agopian (USA, IASPEI), Beth Bartal (USA, IAVCEI), Josef Zens (Germany, IAG), Chris King (UK, IUGS-COGE)

Earth systems are complex and public awareness is critical for balancing societal demands for minerals and water with sound environmental practices, as well as building

resilience to natural hazards and a changing climate. Increasingly over the past decade large geophysical programs such as EarthScope, SINOPROBE, IPOC, AlpArray and AusLAMP have produced "Big Data" which is becoming more and more openly available for teaching in K-16 classrooms and citizen science research programs. Strong partnerships between scientists, data scientists, teachers and non-academic communities are critical for successfully guiding such citizen scientist and educator use of these data products. Such approaches are important for both recruiting the geophysicists of the future and for developing critical skills for our future generations. Key among these skills is the ability to assess and recheck claims made about environmental issues by interested parties, thus enabling evidence-based decision-making processes. This symposium invites contributions from scientists, educators, communicators and those who design, facilitate, fund or deliver such programs.

JP05 - Tsunamis (IAPSO, IASPEI, IAVCEI)

Convener: Vasily V. Titov (USA, IAPSO)
Co-Conveners: Fumuhiko Imumura (Japan, IAPSO), Maria Ana Baptista (Portugal, IAPSO), Alexander Rabinovich (Russia, IASPEI), Joan Marti (Spain, IAVCEI)

Tsunamis present persistent hazard for growing coastal population around the world. Tsunami events of this century vividly illustrated increasing risk of such disasters for coastal population and infrastructure. As the response to these deadly tsunamis of the XXI century, many new tsunamis forecast and warning capabilities have been developed and implemented. Tsunami warning systems have expanded from the Pacific to all world oceans, and now provide tsunami warning capabilities based on expanded set of real-time observations for virtually all vulnerable coastlines.

The global warning system presents new challenges for tsunami science. Newly

available real-time data provide large volume of high-quality observations that require new methods and data-assimilation tools for use in data-based forecast products. New modelling and analysis methods are required to take advantage of the new computational and observational capabilities, to convert scientific and modelling results into actionable and effective forecast and warning. The tsunami science now has the opportunity to make all coastal communities resilient to tsunami threat. The symposium will discuss progress and challenges of all aspects of tsunami research and practical warning applications.

JV01 - Advances in Volcano Seismology and Acoustics in a Multi-Disciplinary Context (IAVCEI, IASPEI)

Convener: Jürgen Neuberg (UK, IAVCEI/IASPEI)
Co-Conveners: Jeff Johnson (USA, IAVCEI), David Fee (USA, IASPEI), Läslo Evers (Netherlands, IASPEI)

Volcano seismology requires often special consideration due to the fact that the source mechanisms as well as wave propagation effects are significantly different from conventional tectonic earthquakes. Particularly for open volcanic systems, acoustic monitoring provides additional information and constraints regarding magmatic processes. Hence, seismic and acoustic monitoring of active and dormant volcanoes remains the key element of any monitoring program undertaken by volcano observatories or research institutions.

Major advances have been made in the last years allowing us to identify several categories of seismic and acoustic events, and interpret them in terms of different magmatic or tectonic processes encountered on a volcano. Attempts based on multi-disciplinary methodologies turned out to be particularly successful.

This symposium is dedicated to latest developments in volcano seismic and acoustic

monitoring techniques, as well as the interpretation and modelling methodology in a wider volcanological context.

We invite contributions for both oral and poster presentations that deal with any aspects relevant to seismic or acoustic monitoring, new methodologies as well as case studies from a variety of volcanic settings. This includes advances in instrumentation, as well as theoretical approaches. Particularly welcome are studies that combine seismic and acoustic monitoring and modelling techniques with other disciplines such as ground deformation, gas monitoring, petrology and fluid dynamics of magmatic systems.

JV02 - Petrological Reactions Forced by Transport and Deformation (IAVCEI, IASPEI)

Convener: Yan Lavallee (UK, IAVCEI)
Co-Conveners: Michael Manga (USA, IAVCEI/IASPEI), Jiuhua Chen (USA, IASPEI)

An increasing body of work is demonstrating that geochemical exchanges and petrological reactions may be strongly influenced by differential stresses and the resultant strain. In these systems a range of controlling processes and factors have been invoked or constrained, ranging from pressure solution, anisotropic diffusion, advection, shear heating, strain of the material micro- and macro- structure, and cage jumps (in colloids). Sharing these observations and interpretations between the different sub-disciplines of geoscience will help advance the next-generation petrological, mechanical and rheological models. In this symposium, we invite observational, experimental and modelling contributions in petrology, rheology, and rock physics that explore the nature of these anisotropic physico-chemical processes in relation to rocks, magmas, glasses and single-phase crystals. The discussions should aim to shed light on the implications for geological processes such as volcanic

eruptions, diagenesis, metamorphic reactions, and engineering applications.

JV03 - Strain Localisation and Seismic Hazards (IAVCEI, IASPEI, IAG)

Convener: Lori Kennedy (Canada, IAVCEI/IASPEI)
Co-Conveners: Boris Krauss (Germany, IAVCEI/IASPEI), Jeff Freymueller (USA, IAG/IAVCEI)

Tectonic deformation is often distributed across very broad plate boundary zones, especially in continental crust. However, within these broad zones there are almost always regions of significant strain localization, such that major fault systems accommodate the majority of the total plate motion. Strain localization can be controlled by pre-existing lithospheric weaknesses, plate boundary geometry and applied forces, thermal weakening through volcanism, or a combination of factors. The extent to which strain is localised or distributed has important impacts on long-term tectonics, and on the spatial distribution of earthquake hazards. At depth, the extent of strain localization within the mantle may have important impacts on the earthquake cycle. This session will combine observational, experimental, and theoretical studies using a variety of techniques to address the mechanical properties of the lithosphere and asthenosphere within plate boundary zones, and the processes that relate to localization of strain within the crust and mantle.

JV04 - Advances in Terrestrial Heat Flow Measurement and Interpretation (IAVCEI, IASPEI)

Convener: Shaopeng Huang (China/USA, IAVCEI/IASPEI)
Co-Conveners: Massimo Verdoya (Italy, IASPEI), Jacek Majorowicz (Canada, IASPEI), Guangzheng Jiang (China, IASPEI)

Terrestrial heat flow is a measure of the thermal energy flux from the interior of the

Earth. This parameter provides fundamental information on the Earth's energy budget, subsurface thermal structure, lithosphere thermo-tectonic history and bulk chemical composition (especially concerning the radiogenic heat-producing elements of the crust). Moreover, analyses of heat flow data are essential to evaluate the potential of geothermal energy and to reconstruct paleoclimate change on regional and global scales. Heat flow data are conventionally determined from the combination of geothermal gradient, obtained from underground temperature logs, and rock thermal conductivity measurements, often derived from laboratory experiments. High-quality heat flow measurements require appropriate raw data reduction, because both geothermal gradient and thermal conductivity are subject to site-specific perturbations associated with geological, geographical, hydrological, and even climatic settings. The major objective of this symposium is to provide a forum for discussions on all aspects related to the terrestrial heat-flow measurements and interpretation. We welcome contributions that describe results in theoretical and/or experimental works, as well as on the use of heat flow and underground thermal data for the exploration of geothermal energy.

Meetings Calendar

We report below titles, dates, places and websites of the forthcoming meetings relevant to the interests of IASPEI scientists. If you are aware of events not listed below, please inform the Secretary General.

2019

EGU General Assembly 2019
April 7 – 12, 2019, Vienna, Austria
URL: http://www.egu2019.eu/

Seismological Society of America (SSA)
April 23 – 26, 2019 Seattle, Washington, USA
URL: https://www.seismosoc.org/meetings/

Science and Technology (SnT) 2019
June 24 – 28, 2019, Vienna, Austria
URL: https://www.ctbto.org/SnT2019/

27th IUGG General Assembly
July 8 – 18, 2019, Montréal, Canada
URL: http://iugg2019montreal.com/

AOGS2019 16th Annual Meeting
July 28 – August 2, 2019, Singapore
URL:
http://www.asiaoceania.org/aogs2019/public.asp?page=home.htm

AGU Fall Meeting
December 9 – 13, 2019, San Francisco, USA
URL: https://fallmeeting.agu.org/2019/

2020

Seismological Society of America (SSA)
April 27 – 30, 2020, Albuquerque, New Mexico, USA
URL: https://www.seismosoc.org/meetings/

EGU General Assembly 2020
May 3 – 8, 2020, Vienna, Austria

AOGS2020 17th Annual Meeting
June 28 – July 4, 2020, South Korea

LACSC 4th General Assembly
August 3 – 5, 2020, Quito, Ecuador

ESC 37th General Assembly
September 6 – 11, 2020, Corfu, Greece

AGU Fall Meeting
December 7 – 11, 2020, San Francisco, USA

2021

AOGS2021 18th Annual Meeting
August 1 – 6, 2021, Singapore

2nd Joint IAGA-IASPEI Scientific Assembly
August 22 – 27, 2021 Hyderabad, India

2022

3rd European Conference on Earthquake Engineering and Seismology
2022, Bucharest, Rumania

General Information about IASPEI

The **I**nternational **A**ssociation of **S**eismology and **P**hysics of the **E**arth's **I**nterior [IASPEI] is one of the eight Associations of the **I**nternational **U**nion of **G**eodesy and **G**eophysics [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

Since July 2015, all scientists participating in IASPEI activities are counted as members of IASPEI (see http://www.iaspei.org/statutes.html). IASPEI welcomes all scientists throughout the world to join in seismological research.

IASPEI is subdivided into several 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

IASPEI can be found on the web 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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