SSA 2024 Annual Meeting Sessions-Anchorage, Alaska, 29 April-3 May 2024

All conveners are listed in alphabetical order by last name. Corresponding conveners are listed in bold.

36. Research Advances in “High-Impact” “Under-Studied” Earthquakes and Their Impacts on Communities
37. Seismic Cycle-Driven Sea-Level Change Over Decades to Centuries: Observations and Projections
38. Seismoacoustic, Geodetic and Other Geophysical Investigations of Active Volcanoes
39. Seismology in the Oceans: Pacific Hemisphere and Beyond
40. Six Decades of Tsunami Science: From the Source of the 1964 Tsunami to Modern Community Preparedness
41. Spatial Correlation of Earthquake Intensity Measures: Methods and Applications
42. Strategies for Large Scale Data Analysis
43. Structure and Behavior of the Alaska-Aleutian Subduction Zone
44. Structure, Seismicity and Dynamics of the Queen Charlotte-Fairweather Fault System
45. Tectonics and Seismicity of Stable Continental Interiors
46. The 2023 USGS National Seismic Hazard Model and Beyond
47. The OSIRIS-REx Sample Return Capsule Re-entry: Geophysical Observations
48. Towards Advancing Earthquake Forecasting and Nowcasting: Recent Progress Using AI-Enhanced Methods
49. Translating Seismic Imaging into Geodynamic Understanding
50. Understanding and Quantifying the Variability in Earthquake Source Parameter Measurements

3D Wavefield Simulations: From Seismic Imaging to Ground Motion Modelling

Advances in numerical methods and continued evolution of computer hardware and high-performance computing infrastructures have made it now routine to simulate full 3D seismic wave propagation at local, regional and global scales. This capability and the growing efficiency in accomplishing it result in a broad range of applications, from ground motion simulation and scenario earthquakes incorporating 3D models, physics-based fault rupture dynamics simulations, to simulation-based seismic imaging methods such as full-waveform inversion. By taking advantage of ever-growing seismic observations, these applications have considerably expanded our understanding of seismic hazard, earthquake physics and regional and global tectonics. This session invites any seismic contributions that leverage the capabilities of full-wave simulations, including applications related to earthquake ground motion modelling, kinematic and dynamic rupture simulations, ambient noise and seismic imaging at all scales as well as other novel applications.

Conveners
Ebru Bozdag, Colorado School of Mines (bozdag@mines.edu)
Bryant Chow, University of Alaska Fairbanks (bhchow@alaska.edu)
Andreas Fichtner, ETH Zurich (andreas.fichtner@erdw.ethz.ch)
Qinya Liu, University of Toronto (liuqy@physics.utoronto.ca)
Erin W. Moriarty, U.S. Geological Survey (emoriarty@usgs.gov)
Artie Rodgers, Lawrence Livermore National Laboratory (rodgers7@llnl.gov)

Advancements in Forensic Seismology and Explosion Monitoring

Geophysical techniques are vital to enhance the detection and characterization of anthropogenic activity. This session calls for abstracts showcasing the latest in geophysical forensic analysis used in global security and monitoring. Topics may encompass observation, modeling and characterization of ground coupled events such as explosions, mining, collapse and bolides. We also seek to highlight the advancements in source, propagation and signal analysis relating to controlled source experiments. We encourage submissions that integrate multi-modal observations and innovative instrumentation such as distributed acoustic sensing, remote sensing, infrasound and large-N arrays. The aim of this session is to encourage collaboration and discussion among institutional experts to drive innovations in forensic seismology and explosion monitoring.

Conveners
Richard A. Alfaro-Diaz, Los Alamos National Laboratory (rad@lanl.gov)
Louisa Barama, Lawrence Livermore National Laboratory (barama1@llnl.gov)
Jorge A. Garcia, Sandia National Laboratories (jgarc26@sandia.gov)
Carl Tape, University of Alaska Fairbanks (ctape@alaska.edu)
Cleat Zeiler, Nevada National Security Site (ZeilerCP@nv.doe.gov)

Advances in Operational and Research Analysis of Earthquake Swarms

Earthquake swarms are clusters of earthquakes that are localized in space and time but without a distinctive mainshock or characteristic temporal decay of aftershock event rates. While a classic aftershock sequence typically arises due to the adjustment or "settling" of fault stresses after a mainshock, earthquake swarms can be produced from a wide variety of tectonic, structural, geothermal and anthropogenic conditions. Spatiotemporal variations in earthquake rates during swarms tend to depart from traditional mainshock-aftershock sequences resulting in unpredictable swarm durations and spatial extents.

The purpose of this session is to provide a broad overview of work related to earthquake swarms. Potential topics include but are not limited to: operational practices for capturing and forecasting swarms, methods for swarm analysis, geologic and tectonic interpretations and hazard analysis of swarms. Submission of studies at various time and geographic scales and those using both traditional and novel analysis methods are encouraged. This session aims to foster collaboration and the sharing of techniques and data sets to advance the community's capabilities to study and understand these phenomena.

Conveners

Kyren R. Bogolub, Nevada Seismological Laboratory, University of Nevada, Reno (kbogolub@unr.edu)
Jeffery L. Fox, Ohio Geological Survey (jeffrey.fox@dnr.ohio.gov)
Andrea L. Llenos, U.S. Geological Survey (allenos@usgs.gov)
William H. Savran, Nevada Seismological Laboratory, University of Nevada, Reno (wsavran@unr.edu)
Daniel T. Trugman, Nevada Seismological Laboratory, University of Nevada, Reno (dtrugman@unr.edu)
Elizabeth A. Vanacore, University of Puerto Rico Mayagüez, Puerto Rico Seismic Network (elizabeth.vanacore@upr.edu)

Advancing Seismology with Distributed Fiber Optic Sensing

Distributed fiber optic sensing (DFOS) has emerged as a transformative technology in seismology, offering unparalleled sensing density and cost-effectiveness compared to classical seismic acquisitions, especially in challenging-to-access areas. DFOS enables a wide range of seismic studies, including earthquake detection and location, source focal mechanism and fault rupture process inversions, geo-hazard early warning, microseismic monitoring, subsurface imaging, near-surface and reservoir characterization, urban and environmental monitoring and nondestructive testing. The unused land and subsea telecommunication fiber optic cables, commonly known as 'dark fibers', have progressively contributed to significant new findings in the Earth sciences.

Moreover, novel sensing techniques and improved instruments are extending the range, enhancing sensitivity and diminishing the noise floor of DFOS, enabling the observation of physical phenomena with an unprecedented resolution. DFOS also makes it possible to integrate multi-physics measurements, such as strain/strain rate (e.g., distributed acoustic sensing or DAS), temperature, electric and magnetic fields, in combination with other point-based sensors, to better constrain subsurface structures and processes and quantify their spatial and temporal variations. Both traditional and novel big-data technologies, including high-performance computing, cloud storage and computing, as well as machine learning, are now successfully employed to effectively manage, process and exploit the vast amounts of data collected by DFOS.

This session aims to explore the latest developments in DFOS technologies, applications and challenges in the integration of DFOS into seismological research. We welcome experts, researchers and practitioners from various disciplines to share, network and exchange innovative ideas to leverage DFOS and advance its applications in seismology and Earth sciences.

Conveners

Ettore Biondi, California Institute of Technology (ebiondi@caltech.edu)
Daniel Bowden, ETH Zurich (daniel.bowden@erdw.ethz.ch)
Derrick Chambers, Colorado School of Mines (derrickchambers@mines.edu)
Julia Correa, Lawrence Berkeley National Laboratory (juliacorrea@lbl.gov)
Manuel Mendoza, University of Colorado, Boulder (Manuel.Mendoza@colorado.edu)
Krystyna Smolinski, ETH Zurich (krystyna.smolinski@erdw.ethz.ch)
Veronica Rodriguez Tribaldos, GFZ Potsdam (verort@gfz-potsdam.de)
Shihao Yuan, Colorado School of Mines (syuan@mines.edu)

Anisotropy Across Scales

Mapping the distribution of seismic anisotropy (radial and azimuthal) provides fascinating insights into dynamic processes of Earth (for example, lithospheric deformation, asthenospheric flow pattern, plate boundary dynamics, core-mantle boundary processes and ice dynamics). However, given the complexity of possible anisotropic structures and symmetries, and the different strengths and weaknesses of various measurement techniques, resolving anisotropy in the Earth remains challenging. The growing volume of seismic data and novel analysis methods allow us to characterize anisotropic properties on different scales and attempt to reconcile seismic observables with experimental results and geodynamic models. The aim of this session is to bring together scientists working on different aspects of seismic anisotropy to provide state-of-the-art insights from both an observational and a modeling point of view.

Conveners

Frederik Link, Yale University (frederik.link@yale.edu)
Eric Loeberich, Yale University (eric.loeberich@yale.edu)
Walid B. Mansour, Washington University in St. Louis (walid@wustl.edu)

Applications and Discoveries in Cryoseismology Across Spatial and Temporal Scales

Polar and mountainous regions are evolving rapidly in response to climate change, carrying significant implications for Earth's cryosphere. These changes impact natural hazards, alter the availability of natural resources, and influence global trade dynamics and additional economic factors. The rapid expansion of data collected by broadband seismometers, nodal instruments, and distributed acoustic sensing (DAS) has led to the emergence of a unique interdisciplinary field at the intersection of glaciology and seismology. Observations from seismic and microseismic signals offer valuable constraints for deducing structures and processes within Earth's cryosphere. As a result, our understanding of the complex interconnections within Earth systems and climate dynamics is further enriched. Seismic techniques used in recent studies have provided in-situ quantitative insights to illuminate the dynamics of various cryospheric systems and environments including glacial flow, retreat, iceberg calving, ice shelves, basal and episodic slip, hydrology, and sea ice migration. Active and passive seismic methods allow for analysis and imaging of Earth's structure in polar and mountainous regions, including glaciers, ice sheets, sea ice and permafrost. Furthermore, seismic methods prove useful for monitoring Earth's cryosphere, and related phenomena, in a changing world. This session aims to assemble diverse experts to present the latest cryoseismology research and foster collaborations in this emergent field. We welcome a wide range of contributions, encompassing studies that focus on monitoring and analyzing seismicity of tectonic or cryogenic origin, natural hazards, and near-surface processes and structures. We also encourage investigations into tectonic-scale structures and dynamics. Furthermore, we invite submissions that explore the advancement of innovative seismic methods, aiming to enhance monitoring and understanding of Earth's cryosphere. In addition to showcasing excellent science, this inaugural cryoseismology session will help advance SSA's mission of fostering scientific connections and collaborations within an inherently interdisciplinary field.

Conveners

Rick Aster, Colorado State University (rick.aster@colostate.edu)
John Cassidy, Natural Resources Canada, Geological Survey of Canada (john.cassidy@nrcan-rncan.gc.ca)
Jan Dettmer, University of Calgary (jan.dettmer@ucalgary.ca)
Jeremy M. Gosselin, University of Calgary (jeremy.gosselin@ucalgary.ca)
Celeste Labedz, University of Calgary (celeste.labedz@ucalgary.ca)
John-Morgan Manos, University of Washington (jmanos@uw.edu)
Elisa McGhee, Colorado State University (elisa.mcghee@colostate.edu)
Stephanie Olinger, Harvard University (stepholinger@fas.harvard.edu)
Rachel Willis, Colorado School of Mines (rwillis1@mines.edu)

Applications of Subduction Zone Science for Hazard and Loss Modeling

Subduction zones systems, from the deep inslab environments through the megathrust and shallow crustal faults, are the locus of multiple perils including ground shaking, fault displacement, tsunami, liquefaction and co-seismic landslide. Much fundamental science has occurred and is planned to investigate the conditions that encourage and trigger these events, improving our understanding of the complex dynamics across time and space. The application of this knowledge allows us to keep people and infrastructure safer through modelling of expected outcomes and real-time monitoring.

This session explores and encourages contributions concerning the application of subduction zone science to quantify earthquake shaking, ground failure, tsunami and their impacts to society, including building and infrastructure damage. Such applications include but are not limited to: empirical and numerical modeling of shaking and impacts, earthquake scenarios and mitigation planning, loss and risk assessment, financial loss considerations, earthquake response tools, understanding long-duration ground motions and building response and other related analyses. We also encourage comparison of shaking and loss estimates from other global subduction earthquakes for evaluating anticipated Cascadia and Alaskan megathrust, crustal and intraslab earthquakes effects. This session is meant to be separate from the additional challenges of constraining earthquake occurrence, locations, rates, magnitudes and other topics that are typically covered under PSHA.

We hope to highlight the use cases of fundamental subduction science. By bridging the gap between earthquake science and application, our scientific community will be better positioned to meet the needs of stakeholders and end users such as policy makers, planners, emergency managers and grass roots organizations.

Conveners
John Cassidy, Geological Survey of Canada (john.cassidy@nrcan-rncan.gc.ca)
Tiegan E. Hobbs, Geological Survey of Canada (thobbs@eoas.ubc.ca)
Hong-Kie Thio, AECOM (hong.kie.thio@aecom.com)
David Wald, U.S. Geological Survey (wald@usgs.gov)
Erin Wirth, U.S. Geological Survey (emoriarty@usgs.gov)

Assessing Seismic Hazard for Critical Facilities and Infrastructure – Insights and Challenges

Critical facilities such as nuclear plants, industrial facilities, dams, tailings dams and waste disposal sites need to remain safe under potential shaking even from large, rare seismic events. Similarly, seismic shaking presents hazards to distributed systems serving power, water, transportation and waste disposal. Hazards are usually assessed through specialized frameworks including PSHA and PFDHA. Challenges in seismic hazard assessment for major structures provide a springboard for research and innovation in the Engineering and Seismological communities, and lead to cutting- edge solutions and advances. Large national and international projects aimed at critical sites often shape the state-of-the- art, but notable contributions have also come from smaller teams from academia, government and civilian practice. New approaches and innovations are bringing advances in topics such as source, site and ground motion characterization, quantification and refinement of uncertainties and more.

In this session, we would like to bring together the seismological and engineering communities in a forum for discussion regarding advances in any aspect of seismology and engineering seismology where innovation has been driven by the needs of seismic safety and hazard assessment for critical facilities or infrastructure. We welcome contributions from academia and practice, regulating and operating parties, research-led consulting firms, energy and other sectors. We look forward to discussing challenges, insights and best practices from past and current endeavors, with a view to new directions in data, models and methods and potential applications.

Conveners
Céline Beauval, ISTerre, Université Grenoble Alpes (celine.beauval@univ-grenoble-alpes.fr)
Glenn Biasi, U.S. Geological Survey (gbiasi@usgs.gov)
Olga-Joan Ktenidou, National Observatory of Athens (olga.ktenidou@noa.gr)
Andreas Skarlatoudis, AECOM (andreas.skarlatoudis@aecom.com)

Characteristics and Mechanics of Fault Zone Rupture Processes, from Micro to Macro Scales

Fault zones are governed by diverse mechanical processes that hold the key to advancing our understanding of fault rupture behaviors and the related seismic hazards. This session seeks to delve into the interplay of intrinsic fault zone properties, stress regimes and kinematics patterns that dictate rupture mechanics of earthquakes and slow-slip events. Through the lens of advanced multi-geophysical observations from stress accumulation and release to the initiation, propagation, and termination of fault ruptures, we are gaining deeper insights into the mechanical processes governing fault zones. However, weaving these insights into a comprehensive understanding remains a challenge. This session invites contributions that focus on the mechanics of fault zone rupture behaviors, from micro to macro scales. We encourage interdisciplinary submissions that synthesize observational, experimental, theoretical and computational insights on the mechanics that control rupture dynamics in the fault zones.

Conveners
Xiaowei Chen, Texas A&M University (xiaowei.chen@tamu.edu)
Yifang Cheng, University of California, Berkeley (chengyif@berkeley.edu)
Zhe Jia, University of California, San Diego (z5jia@ucsd.edu)
Junle Jiang, University of Oklahoma (jiang@ou.edu)

ESC-SSA Joint Session: Climate Change and Environmental Seismology
Climate change and associated environmental impacts will be some of the most pressing global-scale challenges of the coming century. Many of their effects can be observed and evaluated with seismology. With decades of analog seismograms predating the satellite era, an increasing density of seismic networks around the globe, and advances in data analysis methods, our science can make significant contributions to understanding climate change and its environmental impacts. This session is seeking abstracts showcasing the application of seismology to advancing the observation, modeling and decision-making associated with climate change and other environmental hazards, including how seismology can support the real-time management of natural hazards caused or exacerbated by extreme climate conditions. We welcome seismic and seismoacoustic studies from all domains impacted by climate change. Presentations are also encouraged on the effects of climate change on the practice of seismology, from challenges posed to network operations, to effects on seismic data, to additional data streams needed to improve climate and environmental monitoring capabilities.

This session is jointly organized by the European Seismological Commission and SSA.

Conveners
Robert E. Anthony, U.S. Geological Survey (reanthony@usgs.gov)
Allison Bent, Natural Resources Canada (allison.bent@nrcan-rncan.gc.ca)
Michael Dietze, Georg-August-University (mdietze@gfz-potsdam.de)
Shujuan Mao, Stanford University (sjmao@stanford.edu)
Robert Mellors, University of California, San Diego (rmellors@ucsd.edu)
Siobhan Niklasson, New Mexico Institute of Mining and Technology (siobhan.niklasson@student.nmt.edu)

Cordilleran Strike-Slip Faults as Seismogenic and Seismological Features

The North American Cordillera extends from southern Mexico to northern Alaska and includes several active fault systems. Strike-slip faults are a major feature in the neotectonic framework of the North American Cordillera and, in many places, coincide with profound geophysical boundaries in the lithosphere. Syntheses of regional geological and geophysical datasets reveal that the crustal-scale architecture of the faults is tied to their geologic evolution, but a number of questions remain regarding the long-term evolution of these structures, leading to the present-day crustal structure and seismogenic behavior. This session seeks to highlight present research relating the long-term geological evolution of Cordilleran strike-slip faults as it relates to the neotectonic, seismological and geophysical signature of the faults.

Conveners

Richard Lease, U.S. Geological Survey (rlease@usgs.gov)
Sean Regan, University of Alaska, Fairbanks (sregan5@alaska.edu)
Sarah Roeske, University of California, Davis (smroeske@ucdavis.edu)
Trevor S. Waldien, South Dakota School of Mines and Technology (trevor.waldien@sdsmt.edu)

Creating Actionable Earthquake Information Products

The earthquake science and engineering community can provide leading-edge earthquake impact information to improve mitigation, response and recovery through accessible and actionable communication of earthquake hazard, loss and risk. This session explores and encourages contributions concerning earthquake information tools and their development cycle: science, system and product objectives and design; iterating through end-user engagement and product redesign; and public and professional user information campaigns necessary for their rollout.

We invite presentations highlighting research and applications of earthquake information, particularly those that consider and engage with users to improve earthquake information tools. Example topics include but are not limited to: presenting near-real-time shaking and impact estimates; alerting and follow-up EEW-related information related to earthquake early warnings; tools for communicating hazards and risk, engineering design and mitigation tools; earthquake information apps; and product evaluation and user engagement efforts.

Conveners

Tiegan Hobbs, Geological Survey of Canada (thobbs@eoas.ubc.ca)
Sabine Loos, University of Michigan (sloos@umich.edu)
Marísa A. Macías, U.S. Geological Survey (mmacias@usgs.gov)
Jessie K. Saunders, California Institute of Technology (jsaunder@caltech.edu)
David Wald, U.S. Geological Survey (wald@usgs.gov)

Cryptic Faults: Advances in Characterizing Low Strain Rate and Environmentally Obscured Faults

Identifying and characterizing active faults can now be performed almost routinely in places with high strain rates and clear geomorphology. In high strain rate domains, seismicity typically aligns along active fault planes, and slip rates are detectable with GNSS networks. Furthermore, standard methodologies in tectonic geomorphology have developed and matured in arid environments with minimal vegetation, such as in the deserts of the Western United States or Asia.

However, these conditions are not met in all seismically active regions. In low strain rate domains, faults may not produce pronounced geomorphic expressions, and if there are significant ruptures, exceptionally long recurrence intervals contribute to challenges in identifying them. This problem is especially acute in recently glaciated regions where the very young landscapes may not preserve a complete earthquake record. Furthermore, thick vegetation common to many of the same regions (e.g., Western Canada, Alaska), can make remote sensing and field observations of the bare earth difficult. Microseismicity, even when rigorously relocated, often does not align along fault planes, and GNSS networks do not have the necessary precision to measure strain accumulation across faults. Consequently, there is often disagreement between different disciplines about whether there is enough evidence to consider a fault "active" and hazardous. In this session, we solicit abstracts on inconspicuous active faults, and those which are difficult to observe and assess. We hope to hear from a wide variety of practitioners using innovative techniques in paleoseismology, field geology, marine geology, observational seismology, geodesy, remote sensing and modelling to find and characterize these challenging, cryptic faults.

Conveners
Theron Finley, University of Victoria (tfinley@uvic.ca)
Tiegan Hobbs, Geological Survey of Canada (tiegan.hobbs@NRCan-RNCan.gc.ca)
Barrett Salisbury, Alaska Division of Geological & Geophysical Surveys (barrett.salisbury@alaska.gov)
Lydia Staisch, U.S. Geological Survey (lstaisch@usgs.gov)

De-Risking Induced Seismicity: Monitoring, Modelling and Management Advances

Emerging subsurface operations (e.g., geothermal energy or carbon storage) are potential pathways to greener or more sustainable energy solutions. However, concerns around induced earthquakes are a serious impediment to their development and widespread adoption. Thus, tools to identify and de-risk induced seismicity concerns will be necessary to reach climate goals. In this session, we invite abstracts aimed at better understanding induced earthquakes and how to best manage their risks.

We strongly encourage contributions from EGS/geothermal or carbon storage projects. Additionally, we are also interested in lessons learned from induced seismicity caused by other anthropogenic operations (e.g., disposal, production, hydraulic fracturing). Examples can include field test sites that focus on geophysical technologies, such as real-time monitoring and characterization of induced seismicity, distributed acoustic sensing, large-N array, active surface seismic, vertical seismic profiling, seismic imaging of faults and fracture zones, laboratory experiments and novel instrumentation. We also welcome submission of abstracts like laboratory studies that focus on the role that fluids play in fault reactivation, modelling studies at all scales, seismicity forecasting models, hazard/risk analysis, good-practice guidelines and mitigation strategies that would help in reducing commercial costs or enhancing the safety of future projects.

Conveners
Federica Lanza, ETH Zurich (federica.lanza@sed.ethz.ch)
Nori Nakata, Lawrence Berkeley National Laboratory (nnakata@lbl.gov)
Annemarie Muntendam-Bos, Delft University of Technology (A.G.Muntendam-Bos@tudelft.nl)
Kris Pankow, University of Utah (pankowseis2@gmail.com)
Ryan Schultz, ETH Zurich (ryan.schultz@sed.ethz.ch)

Detecting, Characterizing and Monitoring Mass Movements

In light of evolving climate patterns and land-use changes, coupled with improved monitoring capabilities, we are witnessing a notable increase in detections of mass movements, such as landslides, debris and snow avalanches, lahars and glacial events. These events can pose significant hazards, and there is a pressing need to better understand, characterize and mitigate them. While these sources are not routinely monitored in real-time like earthquakes, recent advancements in seismoacoustic data and ground-based, airborne and satellite imagery offer opportunities for rapid early warning and post-event detection and analysis. These improved data sources and techniques can also help search for reliable precursors to catastrophic failure and can be used to characterize existing unstable slope instabilities.

This session aims to explore innovative methods to improve our comprehension of these non-earthquake seismic sources and enhance our ability to characterize and monitor them and mitigate associated hazards. We invite presentations that investigate various types of mass movements by leveraging seismoacoustic, geodetic, and remote sensing techniques along with the application of machine learning. Topics of interest encompass but are not limited to: source detection, location, characterization, modeling and classification, precursory signal analysis, monitoring and hazard mitigation.

Conveners
Kate Allstadt, U.S. Geological Survey (kallstadt@usgs.gov)
Clément Hibert, University of Strasbourg (hibert@unistra.fr)
Ezgi Karasozen, Alaska Earthquake Center (ekarasozen@alaska.edu)
Liam Toney, U.S. Geological Survey (ltoney@usgs.gov)

Earth's Structure from the Crust to the Core
This session will cover all aspects of "structural seismology" and highlight new contributions to research of core and mantle dynamics, the role of the mantle transition zone in mantle convection, volcanism in different settings around the world, the structure of subducting slabs, deep lithospheric deformation and processes, lithosphere-asthenosphere interactions and their feedbacks into geohazards. We encourage submissions that introduce new or new combinations of seismological data types, advances in global and regional-scale seismic tomography, 3D waveform modeling, array- based approaches and the analysis of correlation wavefields.

Conveners
Keith Koper, University of Utah (kkoper@gmail.com)
Jeroen Ritsema, University of Michigan (jritsema@umich.edu)

Vera Schulte-Pelkum, University of Colorado (vera.schulte-pelkum@colorado.edu)

Empowering Science and Education in Seismology through Cutting-Edge Cyberinfrastructure

The rise of seismic data volume and computing power is a paradigm shift in seismological research practice. Vast data is used to infer earthquake processes and Earth's structural models. For example, combining numerical models of physical processes and high-resolution Earth models enables computing at multi-petaflop/s performance of fully dynamic rupture models, predicting earthquake behavior and ground shaking in urban areas. Data mining techniques discover many seismic phenomena such as earthquakes, surface processes, volcanic processes, ocean dynamics, wildlife activities, etc. To enable such frontier science, seismologists must be trained to utilize advanced cyberinfrastructure and modern numerical methods for high-performance computing (HPC), big-data management for clusters, cloud and edge computing. This session aims to gather contributions demonstrating modern cyberinfrastructure (HPC, Cloud, Edge) in scientific investigations and education of large-scale seismological problems such as dynamic rupture modeling, full waveform simulations and inversions, data mining using large seismic networks and distributed acoustic sensing. The session also welcomes education-focused contributions that discuss pedagogical approaches to training the next- generation workforce (e.g., user training of software, entry-level education for undergrads, and advanced ones for early career scientists, science-focused vs. cyberinfrastructure-focused). Contributions discussing community efforts to facilitate this adoption, such as SCOPED, MTMOD, CRESCENT, SCEC, ChEESE, GeoInquire and Quakeworx are also welcome.

Conveners
Alice-Agnes Gabriel, University of California, San Diego (algabriel@ucsd.edu)
Marine A. Denolle, University of Washington (mdenolle@uw.edu)
Amanda Thomas, University of Oregon (amthomas@uoregon.edu)
Ian Wang, University of Texas at Austin (iwang@tacc.utexas.edu)

End-to-End Advancements in Earthquake Early Warning Systems

The field of Earthquake Early Warning (EEW) has expanded and evolved significantly since the first public system came online in Mexico in 1991. Public EEW systems can now be found in many countries around the globe. These systems make use of cutting-edge scientific, technological and social science advancements to deliver alerts as rapidly, accurately and with as much positive impact as possible.

EEW systems comprise various elements that must work together synchronously and seamlessly to deliver useful alerts. These components include world-class seismic and geodetic networks, rapid telecommunications, algorithms that are capable of quickly and correctly detecting earthquakes, and technical recipients that are capable of turning alert messages produced by the system into useful warning products. To maximize effectiveness of EEW systems, people must also be educated about how to take safe response actions, such as Drop, Cover and Hold On. To establish the necessary culture of awareness and preparedness, EEW organizations must work with others, including public safety organizations, to ensure a broad, consistent and authoritative EEW education and outreach effort. Such initiatives should include engagement with critical infrastructure operators, and take special care to address vulnerable populations, such as low-income, special needs, new immigrants, indigenous and elderly.

This session welcomes abstracts related to all aspects of innovating, optimizing and maintaining EEW systems including traditional and novel sensor developments, advancements in communications, methodology and algorithmic development, system assessment and abstracts related to education, outreach and engagement for EEW.

Conveners

Ronni Grapenthin, University of Alaska Fairbanks (rgrapenthin@alaska.edu)
Angie I. Lux, Berkeley Seismology Laboratory (angie.lux@berkeley.edu)
Mouse Reusch, University of Washington (topo@uw.edu)
Brian Terbush, Washington State Emergency Management Division (Brian.Terbush@mil.wa.gov)
Fabia Terra, Berkeley Seismology Laboratory (terra@berkeley.edu)

Energy Transition with Geologic Carbon Storage and Geothermal Energy

The energy transition will progressively shift from fossil-based energies to low- or zero-carbon energies. Geologic carbon storage and geothermal energy will play crucial roles in achieving the net-zero emission goal by 2050. New seismic and non-seismic technologies are needed for ensuring safe and long-term geologic carbon storage and for geothermal energy development. We invite contributions from research on novel seismic and non-seismic technologies and applications of novel and advanced seismic techniques to geologic carbon (and hydrogen) storage and geothermal energy. We welcome submissions of abstracts on computational, artificial intelligence (AI)/machine learning (ML), laboratory experimental and field-scale studies.

Conveners

Erkan Ay, Shell (Erkan.Ay@shell.com)
Kai Gao, Los Alamos National Laboratory (kaigao@lanl.gov)
Chet Hopp, Lawrence Berkeley National Laboratory (chopp@lbl.gov)
Lianjie Huang, Los Alamos National Laboratory (ljh@lanl.gov)
Nana Yoshimitsu, Kyoto University (yoshimitsu.nana.6i@kyoto-u.ac.jp)
Yingcai Zheng, University of Houston (yzheng24@central.uh.edu)

From Earthquake Recordings to Empirical Ground-Motion Modelling

The engineering seismology community has made a major effort in recent years to develop advanced ground motion models (GMMs). These developments have been facilitated by the availability of very rich earthquake databases made possible by the expansion of seismological networks around the world and open data policies. However, uncertainties in GMMs remain significant and reducing the epistemic uncertainties is currently one of the main challenges in seismic hazard assessment. In empirical GMMs it is often assumed that the earthquakes are recorded at the free surface of the Earth, that the sensor installation conditions and the seasonal effects can be neglected, and that all instruments provide recordings with reliable amplitudes. In practice, many seismic stations are located at depth (e.g., in borehole, in tunnels) or in an urban environment, errors in the metadata can occur, and detailed site characterization and site-effect assessment are performed only on a limited subset of stations.

With this background, this session welcomes contributions highlighting any effects (from station installation conditions to complex site-effects) that could affect the recorded ground motion, with consequent implications for GMMs, especially at high frequency. Topics of interest include data processing and data quality control, instrument coupling, soil-structure interaction, depth effect (down-going waves), seasonal variations, topography effect, site-effects, site characterization, regional and local attenuation, small-scale heterogeneity and scattering. Studies comparing several techniques at the same site and those integrating a variety of datasets are also encouraged. Studies on improving our current practices in earthquake databases and GMMs development, or on the enhanced understanding of the high-frequency content of seismic records are particularly welcome.

Conveners
Carlo Cauzzi, ORFEUS, Swiss Seismological Service, ETH Zürich (carlo.cauzzi@sed.ethz.ch)
Fabrice Hollender, CEA Cadarache (fabrice.hollender@cea.fr)
Vincent Perron, CEA Cadarache (vincent.perron@cea.fr)
Zafeiria Roumelioti, University of Patras (zroumelioti@upatras.gr)
Paola Traversa, Electricite de France (paola.traversa@edf.fr)

From Faults to Fjords: Earthquake Evidence in Terrestrial and Subaqueous Environments

Strong ground motion and surface deformation caused by slip on plate boundary, intraslab and crustal faults perturb surficial processes and leave geologic evidence in terrestrial and subaqueous environments. This two-part session explores paleoseismic approaches that use geologic evidence to reconstruct records of past earthquakes. Part one will address earthquake evidence in terrestrial settings. This evidence may be produced by coastal, fluvial and colluvial processes that together shape the ultimate sedimentary and geomorphic response to tectonic surface deformation. Presentations also may focus on ground failure and landslides triggered by earthquake shaking. Part two will feature subaqueous lake bottom and seafloor imprints and processes triggered by earthquakes. These earthquake-triggered responses are governed by the properties of the passing seismic waves (frequency, amplitude, duration) and the geomechanics of the substrate (grain size, composition, shear strength). Presentations may focus on the array of subaqueous sedimentary responses to strong ground motion, including different styles of mass failure, surficial sediment remobilization, soft sediment deformation and/or seismic strengthening.

We invite presentations from Alaska and beyond that highlight paleoseismic records from all depositional environments, laboratory analyses, modeling studies, or syntheses and comparisons of global records. We particularly encourage presentations of: 1) Novel techniques using geophysical survey tools, sediment sampling analyses and remote sensing techniques to quantify tectonic deformation; 2) Studies with high geochronological precision, beyond the limitations of typical radiometric dating; 3) Studies that compare paleoseismic records from adjoining subaqueous and terrestrial environments, pointing out the promises and pitfalls of different approaches; and 4) Experiments that simulate the array of surficial processes that form geologic evidence of earthquakes.

Conveners

Danny Brothers, U.S. Geological Survey (dbrothers@usgs.gov)
Tina Dura, Virginia Polytechnic Institute and State University (tinadura@vt.edu)
Jenna Hill, U.S. Geological Survey (jhill@usgs.gov)
Kristin Morell, University of California, Santa Barbara (kmorell@ucsb.edu)
Belle Philibosian, U.S. Geological Survey (bphilibosian@usgs.gov)
Derek Sawyer, Ohio State University (sawyer.144@osu.edu)
Drake Singleton, U.S. Geological Survey (dsingleton@usgs.gov)
Katleen Wils, University of Innsbruck (katleen.wils@uibk.ac.at)
Rob Witter, U.S. Geological Survey (rwitter@usgs.gov)
Mark Zellman, BGC Engineering (mzellman@bgcengineering.ca)

From Geodynamics to Earthquake Rupture, Models That Cross Time- and Length-Scales

This session brings together researchers in geodynamic modelling and earthquake rupture modelling to exchange ideas in the areas of algorithms, software tools, benchmarks and, of course, scientific results.

The timescales of interest in global geodynamics range from the overturn time of the mantle to the timescale of measurable change of plate motions. This latter timescale becomes increasingly shorter as our capacity to measure deformations reaches sub-millimetre accuracy (driven by the need to understand pressing issues in global climate change, for example). Geodynamic timescales now overlap those associated with surface relaxation times of large earthquakes. Coming from the other direction, models of earthquake rupture run over the seismic cycle and capture the long-term evolution of the surface deformation and capture the accumulated offset along individual faults.

As we approach the computing power and model capacity to attempt to unify long-term geodynamic models with short timescale seismic rupture models, we propose this session to ask: What stands in our way? What algorithm developments are needed? Are there mathematical or physical scale-crossing problems that need to be overcome? Can the geodynamics and earthquake modelling community talk to each other?

Conveners
Matthew Knepley, University at Buffalo (knepley@gmail.com)
Louis Moresi, Australian National University (louis.moresi@anu.edu.au)

How Well Can We Predict Broadband Site-Specific Ground Motion and Its Spatial Variability So Far?

Over the past few decades, a large number of studies have focused on the impacts of the shallow geological subsurface structure (within the uppermost one to two km) on the intensity and frequency content of ground motions recorded at the surface. One of the most significant developments in the field is the growing evidence that simplified 1D ground response models have only limited ability to accurately match recorded ground motions. For this reason, very detailed and computationally expensive methods for analysing the ground response are gaining more interest as of late.

In this session, we invite presentations on site characterization and ground motion modeling covering amplification and attenuation in a wide range of frequencies from < 1 Hz (interesting from an engineering perspective) to > 10 Hz (of special interest for the characterization of attenuation). Numerical or empirical studies on the frequency-dependent effects of spatial variability on attenuation and amplification, an often overlooked issue, are specifically welcome. Similarly, contributions about multidimensional ground response analyses are encouraged. Further topics of interest include the use of Artificial Intelligence (AI) to enhance and/or reduce the computational load of very detailed ground response analyses and site characterization as well as other geophysical surveys using active and passive seismic sources. This session aims to provide researchers and engineers with an opportunity to discuss different modeling approaches and their required computational effort, and to compare the numerical results against real, observed ground motions over a broadband frequency range.

Conveners

Mohamad M. Hallal, University of California, Berkeley (mhallal@berkeley.edu)
Chunyang Ji, North Carolina State University (cji3@ncsu.edu)
Andrés Olivar Castaño, University of Potsdam (andres.olivar-castano@uni-potsdam.de)
Marco Pilz, GFZ Potsdam (pilz@gfz-potsdam.de)

Illuminating Complex, Multiplet Earthquake Sequences at Kahramanmaras (Turkiye), Herat (Afghanistan), and Beyond

Multiplet earthquakes (doublets, triplets, etc.) pose distinct challenges compared to standard mainshock-aftershock sequences, including recurring strong ground motions that can destroy already-damaged buildings and stretch emergency services. The overlapping seismic or surface deformation signals can also complicate the scientific interpretation and response. However, multiplet sequences also have great potential for illuminating earthquake processes such as stress triggering, fault interactions, and rupture nucleation, propagation, and arrest. Notable recent examples include the 6 February 2023 Kahramanmaras, Turkiye Mw 7.8 and 7.6 doublet, the October 2023 Herat, Afghanistan Mw 6.3 quadruplet, the 1 July 2022 Mw 6.0 Hormozgan, Iran doublet, the 14 November 2021 Mw 6.2 and 6.3 Fin, Iran doublet, the 2020 Mw 7.8 and 7.6 Shumagin, Alaska doublet, and the 2019 Minandao, Philippines Mw 6.4–6.8 quadruplet, which together offer a wealth of new data to explore. We solicit work on these and other multiplet sequences that involve seismic analyses, remote sensing, geodesy, field observations, numerical modelling, or combinations of these approaches. We solicit studies that address the progression of fault slip through time (the kinematics) and/or help explain this sequence of events (the dynamics). We also seek contributions that offer insights into why some fault systems may be more prone to multiplets than others, or perhaps even offer suggestions for how these sequences might be better incorporated into seismic hazard analyses. Through in-depth discussions, we aim to emphasize the significance of enhancing international collaboration, implementing monitoring technologies, and establishing disaster preparedness strategies to mitigate the impact of future seismic events.

Conveners

Aybige Akinci, National Institute of Geophysics and Volcanology (aybige.akinci@ingv.it)
Pınar Büyükakpınar, GFZ Potsdam (pinar@gfz-potsdam.de)
Gareth Funning, University of California, Riverside (gareth@ucr.edu)

Alice-Agnes Gabriel, University of California, San Diego (algabriel@ucsd.edu)
Mohammadreza Jamalreyhani, SUSTech, China (jamalreyhani@sustech.edu.cn)
Edwin Nissen, University of Victoria (enissen@uvic.ca)

Induced Earthquakes: Source Characteristics, Mechanisms, Stress Field Modeling and Hazards

Induced earthquakes triggered by oil and gas production, enhanced geothermal systems, fluid injection for mining and carbon capture have raised significant concerns. The spatial and temporal evolution of induced seismicity is intricately connected to multiple factors, including the poroelastic response of the site, fluid budget, duration of operations and halts, dimension and hydromechanical properties of the substratum, and fault-slip modes under undrained/drained conditions. These factors vary between nonproducing unconventional reservoirs and porous conventional reservoirs. The spatiotemporal progression of induced earthquakes appears closely tied to pre-existing tectonic structures, the orientation of faults, the diffusion of pore pressures, stress redistribution over time and poroelastic stress transfer. Multidisciplinary approaches can help to unravel underlying mechanisms, thereby, providing insights into the development of multifaceted mitigation strategies.

We invite submissions of case studies that offer insight into the underlying physics of induced earthquakes and the dynamic evolution of stress on host faults. We encourage interdisciplinary studies showcasing source properties of induced earthquakes, 3D imaging of faults, numerical simulations, stress field modeling, InSAR modeling, ground motion prediction models tailored for induced earthquakes, and integrated hydrologic and geo-mechanical modeling linked to production/injection operational data. We welcome contributions that delve into innovative datasets such as deep learning, distributed acoustic sensing and large-N arrays. We also seek computational, laboratory and in-situ experiments to unravel hydromechanical processes governing triggering mechanisms over time.

Conveners
Asiye Aziz Zanjani, Southern Methodist University (aazizzanjani@smu.edu)
Farzaneh Aziz Zanjani, University of Miami (fzanjani@earth.miami.edu)
Nadine Igonin, University of Texas at Dallas (Nadine.Igonin@utdallas.edu)

Integrative Assessment of Soil-Structure Interaction and Local Site Effects in Seismic Hazard Analysis

In seismically active regions, the execution of reliable site response analyses stands out as a cost-efficient measure during the design phase. The dynamic interactions between structural components and underlying soil layers, known as soil- structure interaction (SSI), impact the overall seismic performance and safety of the structures. The incorporation of SSI is vital during the design of critical infrastructures such as railroad and tunneling systems and power plants.

In this session, we invite researchers and practitioners to contribute to a cohesive understanding of SSI and local site effects, two essential components of the seismic hazard analysis (SHA). This session seeks to foster of cutting-edge methodologies and innovative approaches in areas including but not limited to site response analysis (e.g., nonlinear 2D/3D site effects), kinematic and inertial effects of SSI (e.g., numerical and physical modeling), vertical SSI, role of physics-based simulations in improving our understanding of SRA and SSI, complexities of SSI in urban settings and structures with deeply embedded foundations and large footprints (e.g., nuclear power plants).

Conveners

Swasti Saxena, Pacific Northwest National Laboratory (swasti.saxena@pnnl.gov)
Mohammad Yazdi, Mott MacDonald (mohammad.yazdi@mottmac.com)
Peiman Zogh, University of Nevada, Reno (pzogh@unr.edu)

Learning Across Geological, Geophysical and Model-Derived Observations to Constrain Earthquake Behavior

Earthquakes are dynamic events, but leave permanent markers of rock deformation and displacement. Geologic field studies identify these permanent markers, often used to determine the magnitude of slip in past earthquakes and combined with dating techniques to determine long-term rates over multiple earthquake cycles. Geophysical methods track ongoing plate motions and earthquake-cycle deformation captured by satellites using techniques involving GPS and InSAR. Analog and numerical models capture long-term geologic deformation and/or short-term dynamic behavior associated with earthquakes. However, in order to best advance both seismic hazard mitigation and earthquake science, the methods and results from these different lines of inquiry should be integrated and well understood by all. This is critical as we face the challenge of accounting for complex fault geometry and ruptures, off-fault damage and distributed deformation, all of which have been revealed as common features in recent earthquakes. Modeling can fill gaps in observational data, target future field sites and help determine the processes responsible for observed deformation features. Likewise, observational data is critical to characterizing earthquake behavior and provides necessary constraints on modeling input and output. This session aims to bring together scientists from these different lines of study to facilitate mutual understanding and collaboration. We encourage submissions that are methods- and/or results-based studies across structural geology, paleoseismology, Quaternary geology, geodesy and modeling of fault behavior and earthquake dynamics.

Conveners

Kimberly Blisniuk, San José State University (kimberly.blisniuk@sjsu.edu)
Roland Burgmann, University of California, Berkeley (burgmann@berkeley.edu)
Elizabeth Madden, San José State University (elizabeth.madden@sjsu.edu)

Machine Learning for Full Waveform Inversion: From Hybrid to End-to-End Approaches

Machine learning (ML) is quickly changing the landscape of how we approach seismic inverse problems, including full waveform inversion (FWI) where the seismic waveforms are directly used to solve for properties such as seismic velocities, migrated images, source locations, moment tensors and more. ML can potentially overcome some of the outstanding challenges associated with conventional FWI techniques by increasing computational efficiency, automating to reduce human labor and expertise requirements, mitigating cycle skipping, parameterization and convergence issues, implementing uncertainty quantification through deep learning-based approaches, and reducing the need for a suitable starting model. The wide breadth of ML methods and emerging scientific ML, deep learning architectures, and optimization algorithms that are rapidly expanding warrant a review of current application of these technologies in the seismic inverse domain.

We encourage submissions ranging from ML methods and tools that assist conventional physics-based FWI to full end-to-end deep learning FWI methods that estimate variety of inverted properties. All ML approaches are welcome, including but not limited to deep neural networks, generative methods, decision trees, unsupervised dimensionality reduction and clustering, physics-informed ML, and application of various learning algorithms including supervised, self-supervised and unsupervised learning.

Conveners
Jennifer L. Harding, Sandia National Laboratories (jlhardi@sandia.gov)
Mrinal K. Sen, University of Texas at Austin (mrinal@utexas.edu)
Hongkyu Yoon, Sandia National Laboratories (hyoon@sandia.gov)

Marine Seismoacoustics

The depths of oceans, rivers and other water bodies, and the processes occurring within them, continue to be explored through the use of seismic and acoustic observations. Here we invite contributions from the full spectrum of submarine research fields, including geophysical and geodynamical imaging and/or modeling, earthquake/tsunami early warning, interactions at the seafloor interface, water/ice interface, climate induced changes, particularly in polar regions, tracking of marine life and the latest advances in underwater sensors and other related technologies.

Conveners
Kasey Aderhold, EarthScope Consortium (kasey.aderhold@earthscope.org)
Helen Janiszewski, University of Hawaiʻi at Mānoa (hajanisz@hawaii.edu)
Siobhan Niklasson, Los Alamos National Laboratory (sniklasson@lanl.gov)
Charlotte Rowe, Los Alamos National Laboratory (char@lanl.gov)

Multidisciplinary Approaches for Volcanic Eruption Forecasting

Detecting volcanic unrest and forecasting volcanic eruptions, how they will evolve and when they will finish is one of the main challenges in volcanology. The interaction of volcanic systems with their environment during an eruptive process affects many different physical and chemical parameters. Many of these parameters, called observables, are monitored in volcanic systems in near-real time, being the base of alert-level strategies and forecasting protocols. Exploring these observables involves complex data processing, time series analysis and the development of numerical models of volcanic processes, with the goal of improving our understanding of the interaction between subsurface processes and volcanic activity.

Inferring conceptual and numerical models of how volcanoes work requires a multidisciplinary analysis integrating data and methodologies from different disciplines, including geology, seismology, remote sensing and geodesy; as well as physics or chemistry, signal processing and statistical approaches. At present, several promising results have been derived from this joint analysis, improving our knowledge of volcanic unrest and magma ascent, which helps eruption forecasting and decision-making.

This session aims to encourage the multidisciplinary community working in volcanology to submit their most recent results on unrest detection and eruption forecasting. We welcome (but are not limited to) contributions from volcano statistics, event trees analysis, data assimilation techniques, the use of artificial intelligence and machine learning to study volcanic signals, analysis of time series in volcanology, study of the evolution of new seismic parameters/features, development of innovative analytical methods and probabilistic volcanic hazard assessment. We invite researchers to share their valuable work in this session, contributing to the collective knowledge and progress in the field of volcanic forecasting.

Conveners

Alberto Ardid, University of Canterbury (alberto.ardid@canterbury.ac.nz)
Francesca Bianco, Istituto Nazionale di Geofisica e Vulcanologia (francesca.bianco@ingv.it)
Társilo Girona, Alaska Volcano Observatory, University of Alaska Fairbanks (tarsilo.girona@alaska.edu)
Janire Prudencio, Universidad de Granada (janire@ugr.es)

Network Seismology: Recent Developments, Challenges and Lessons Learned

Seismic monitoring is not only an essential component of earthquake response but also forms the backbone of a substantial amount of research into seismic hazards, the earthquake process and seismotectonics. To ensure networks best serve the public, media, government and academic communities, it is important to continue to develop monitoring networks' abilities to accurately and rapidly catalog earthquakes. Due to the operational environment of seismic monitoring, seismic networks encounter many unique challenges not seen by the research community. In this session, we highlight the unique observations and challenges of monitoring agencies and look to developments that may improve networks' ability to fulfill their missions. Seismic operation centers play a crucial role in collecting seismic data, and generating earthquake products including catalogs, warnings and maps of ground shaking. The purpose of the session is to foster collaboration between network operators, inform the wider seismological community of the interesting and challenging problems within network seismology and look to the future on how to improve monitoring capabilities. This session is not only an opportunity for monitoring agencies to highlight new developments in their capabilities, but we also encourage submissions describing new instrumentation, methods and techniques that would benefit network operations for detecting, locating and characterizing earthquakes, particularly in a near real-time environment.

Conveners

Blaine Bockholt, Idaho National Laboratory (blaine.bockholt@inl.gov)
Renate Hartog, University of Washington (jhartog@uw.edu)
Kristine L. Pankow, University of Utah (pankowseis2@gmail.com)
Adam Ringler, U.S. Geological Survey (aringler@usgs.gov)
Dmitry Storchak, International Seismological Centre (dmitry@isc.ac.uk)

New Insights into the Development, Testing and Communication of Seismicity Forecasts

The increasing availability and quality of geophysical datasets, including high-resolution earthquake catalogs, fault information and interseismic strain data, has enabled the creation of statistical and physics-based seismicity models, some of which underpin probabilistic seismic hazard analyses. New machine learning (ML) techniques have also improved data acquisition and analysis for seismicity modelling. Forecasts produced by such models can be tested and compared prospectively, e.g., within the framework of the Collaboratory for the Study of Earthquake Predictability, paving the way for potentially more informative earthquake forecasts. In turn, forecast models are being operationalized by public and private agencies to provide a range of audiences with reliable information on the occurrence of earthquakes. This poses communication challenges that require solutions from the social sciences. We welcome contributions that help us elucidate the main advantages and limitations of current seismicity models, identify the most informative forecasting methods, improve our understanding of the earthquake generation process, and facilitate the communication and visualization of earthquake forecasts. Submissions may include models based on ML-derived earthquake catalogs, new hypotheses explaining what controls earthquake potential, quantitative analyses evaluating the predictive skills of seismicity forecasts, or studies on the effective communication of earthquake forecast information.

Conveners

Jose Bayona, University of Bristol (jose.bayona@bristol.ac.uk)
Kelian Dascher-Cousineau, University of California, Berkeley (kdascher@berkeley.edu)
Leila Mizrahi, Swiss Seismological Service (leila.mizrahi@sed.ethz.ch)
William Savran, University of Nevada, Reno (wsavran@unr.edu)
Max Schneider, U.S. Geological Survey (mschneider@usgs.gov)

Numerical Modeling in Seismology: Developments and Applications

We equally invite both contributions to numerical-modeling methods/algorithms and applications in any dimension if appropriate. Progress in seismology is unthinkable without continuous developments of theory and numerical-modeling methods. This is well seen in very recent important advances in the discontinuous Galerkin, finite-difference and spectral- element methods as well as in emergence of the new powerful distributional finite-difference method.

Recent developments include faithful rheological and geometrical complexity of the Earth's interior, earthquakes and other important seismological phenomena, time-space discretization, optimizations of computational algorithms and computer codes, optional balance between accuracy and efficiency. Remarkable progress in the finite-difference modeling in seismic exploration poses a useful challenge for numerical modeling in earthquake seismology. New observations and data from local dense networks make it possible for numerical modeling to considerably contribute to our understanding of rupture dynamics, seismic wave propagation, earthquake ground motion including non-linear behavior, seismic noise and earthquake hazard. We especially welcome applications to compelling observational issues in seismology.

Conveners
Alice Agnes-Gabriel, University of California, San Diego (algabriel@ucsd.edu)
Martin Galis, Comenius University Bratislava (martin.galis@uniba.sk)
Jozef Kristek, Comenius University Bratislava (kristek@fmph.uniba.sk)
Peter Moczo, Comenius University Bratislava (moczo@fmph.uniba.sk)
Arben Pitarka, Lawrence Livermore National Laboratory (pitarka1@llnl.gov)
Wei Zhang, Southern University of Science and Technology (zhangwei@sustech.edu.cn)

Physics-Based Ground Motion Modeling

Physics-based wave propagation simulations have the potential to quantify the contribution to ground motion estimates from individual features included in the modeling, such as basin edge effects, topographic scattering, nonlinear soil effects, small-scale heterogeneities, source effects and general 3D path effects. Such quantification is useful for understanding wave propagation as well as which features must be included to reproduce observed seismic records. This session welcomes submissions on physics-based numerical modeling of wave propagation, including studies focused on the dynamic or kinematic rupture models as well as development and validation of community seismic velocity models, and quantification of contributions from these model features on simulated ground motions.

Conveners
Evan Hirakawa, U.S. Geological Survey (ehirakawa@usgs.gov)
Kim B. Olsen, San Diego State University (kbolsen@mail.sdsu.edu)
William Stephenson, U.S. Geological Survey (wstephens@usgs.gov)

Regional-Scale Hazard and Risk Assessments

Efforts toward improving the resilience of urban environments to seismic hazards and associated geohazards are challenged by spatially variable ground motions and permanent ground deformations (e.g., due to co-seismic landslides or soil liquefaction). Regional-scale probabilistic seismic hazard and risk analyses are often used to evaluate large, distributed infrastructure systems such as pipelines and transportation networks or portfolios of structures in densely populated cities. While relevant work in the last decade has contributed toward multi-scale probabilistic modeling of regional ground shaking and deformation, important advances to support regional risk assessments remain missing. For instance, accurately characterizing the spatial variability of ground motions and their associated effects is important to capture the seismic risk of exposed communities in earthquake-prone areas, which is increasing with urbanization and, highly interdependent and aging infrastructure systems.

Even though there are common aspects between site-specific and regional seismic hazard analyses, the characterization of ground motions, geologic conditions and deformations present different challenges to the data collection and modeling efforts. Thus, this session invites contributions on 1) simulations and analyses of spatiotemporal variations of ground motion and deformation at regional scales, 2) tools developed for earthquake scenarios that capture the spatial correlation of ground motions, 3) advances in earthquake early-warning systems and rapid post-earthquake assessments, 4) methods based on the integration of site-specific data and geospatial analytics, 5) regional-scale approaches to estimate the occurrence and uncertainty of ground failure (liquefaction-induced deformations, landslides, or surface fault rupture), 6) regional scale portfolio asset risk analyses and methodologies, and 7) regional scale exposure and vulnerability assessments.

Conveners

Ashly Cabas, North Carolina State University (amcabasm@ncsu.edu)
Rodrigo Costa, University of Waterloo (rodrigo.costa@uwaterloo.ca)
Cassie Gann-Phillips, North Carolina State University (cvgann@ncsu.edu)
Mike Greenfield, Greenfield Geotechnical (mike@greenfieldgeotechnical.com)
James Kaklamanos, Merrimack College (kaklamanosj@merrimack.edu)
Albert Kottke, Pacific Gas and Electric Company (albert.kottke@gmail.com)
Sabine Loos, University of Michigan (sloos@umich.edu)
Cristina Lorenzo-Velazquez, North Carolina State University (clorenz@ncsu.edu)
Andrew Makdisi, U.S. Geological Survey (amakdisi@usgs.gov)
Eric Thompson, U.S. Geological Survey (emthompson@usgs.gov)

Research Advances in "High-Impact" "Under-Studied" Earthquakes and Their Impacts on Communities

Many regions of the world are at risk of earthquakes with significant human and economic impacts due to regional seismic hazard and lack of earthquake preparedness (termed "high-impact"). The cause of the earthquakes might be poorly understood due to a lack of resources, a low probability of occurrence, a lack of interested seismologists, their remote locations, and/or a lack of awareness of the hazard (termed "under-studied"). The 2023 M6.8 Morocco earthquake serves as a striking example, where high mountains exist with little seismicity a few hundred kilometers from a plate boundary, and which caused shaking-related fatalities and injuries plus large economic losses. This session focuses on "high- impact," "under-studied" (HIUS) earthquakes, and we welcome abstracts across all areas of solid-earth science, earthquake geology and engineering, and social science that study or address HIUS earthquakes. We invite presentations highlighting research from any discipline with the potential to respond to the needs of vulnerable populations that have been historically underserved by current earthquake science, engineering and public policy. Example topics include: 1) community-driven or community-based research results; 2) discoveries advancing our understanding of seismic hazards in areas of low probability but high impact earthquakes (including intraplate and induced earthquakes); 3) strategies for implementing practical, research-inspired solutions for communities; 4) research engaging low-resourced communities or historically marginalized populations; 5) existing efforts to coordinate research and projects for broader community benefits; and 6) integration of social science with seismology. We encourage presenters to highlight strategies and efforts to improve inclusivity, diversity, equity and accessibility in seismology and earthquake science in these regions.

Conveners

Susan Bilek, New Mexico Institute of Mining and Technology (susan.bilek@nmt.edu)
Marianne Karplus, University of Texas at El Paso (mkarplus@utep.edu)
Zhigang Peng, Georgia Institute of Technology (zpeng@gatech.edu)
Elizabeth Vanacore, University of Puerto Rico (elizabeth.vanacore@upr.edu)
Aaron A. Velasco, University of Texas at El Paso (aavelasco@utep.edu)

Seismic Cycle-Driven Sea-Level Change Over Decades to Centuries: Observations and Projections

As global sea levels rise, coastal communities worldwide will be forced to adapt or retreat. Projections of relative sea-level change across decades or centuries will become essential planning tools to mitigate the vulnerability of these communities.

In seismically active regions, changes in land elevation associated with the earthquake cycle —including interseismic, coseismic and postseismic deformation, as well as slow-slip events — can either mitigate or exacerbate climate-driven sea-level rise over similar timescales. To ensure accurate projections of relative sea-level change, it is therefore necessary to evaluate the influence of tectonic vertical land movements (VLM) in the relevant analyses.

Estimating and incorporating tectonic VLM into projections of relative sea-level rise requires two key components:

1. Collecting and analyzing geologic and geodetic observations to constrain present and past contributions of VLM to relative sea-level change throughout all phases of the seismic cycle.
2. Modelling to project observed tectonic VLM decades and centuries into the future.

We welcome contributions that link VLM resulting from the seismic cycle to relative sea-level changes, through data analysis, modelling, or a combination of both.

Furthermore, vertical deformation is not always primarily associated with tectonic signals, as nontectonic processes, such as sediment loading and glacial isostasy adjustment, can also have significant influences on VLM of the lithosphere. Studies that help identify and account for such nontectonic processes to improve VLM projections, and thus relative sea- level projections, are also welcomed.

Conveners
Kate J. Clark, GNS Science (k.clark@gns.cri.nz)
Andrew Howell, University of Canterbury (andrew.howell@canterbury.ac.nz)
Jeonghyeop Kim, University of Washington (jey.kim@uw.edu)

Seismoacoustic, Geodetic and Other Geophysical Investigations of Active Volcanoes

Seismology has long been the primary means through which to study and monitor the movement of magma and other fluids in active volcanic systems. However, despite decades of seismic monitoring at volcanoes, answers to important questions about the ascent of magma, the circulation of fluids within volcanic systems, and how these phenomena are reflected in geophysical signals, remain elusive. In recent decades, improvements in instrumentation and processing techniques have led to the widespread use of additional geophysical tools capable of tracking fluid movement, including infrasound, high-rate GPS, InSAR and gravity. These tools, often used in concert with seismological techniques, have brought forth many new insights that were previously unknown. We seek submissions that showcase the breadth of interdisciplinary geophysical monitoring and study of active volcanoes using any of the methods described above or other interdisciplinary approaches. We encourage contributions that emphasize advances in numerical modeling or machine learning, feature new instrumentation or analytical methods, and/or provide novel insights into the physical processes controlling fluid movement or other volcanic signals.

Conveners

Josh Crozier, U.S. Geological Survey (jcrozier@usgs.gov)
Ricardo Garza-Giron, Colorado State University (rgarzagi@ucsc.edu)
Margaret Glasgow, U.S. Geological Survey (mglasgow@usgs.gov)
Alicia Hotovec-Ellis, U.S. Geological Survey (ahotovec-ellis@usgs.gov)
John J. J. Lyons, U.S. Geological Survey (jlyons@usgs.gov)
Diana Roman, Carnegie Science (droman@carnegiescience.edu)

Seismology in the Oceans: Pacific Hemisphere and Beyond

The ocean realm provides a clear, relatively pristine view into many of the fundamental tectonic and geodynamical processes that form our planet, including rifting, volcanism and hydrothermal processes at mid-ocean ridges; the origin and nature of mid-plate and hot-spot volcanism, transform-fault earthquake dynamics, hydration of oceanic lithosphere and the nature of multi-scale convection and its relationship to plate evolution, to name a few. The Pacific basin provides a natural laboratory for studying these processes, and it has been the focus of a number of experiments exploiting recent advances in marine-seismic instrumentation, including those affiliated with the multinational grassroots collaboration PacificArray. We invite contributions from scientists utilizing active- and passive-source marine-seismic datasets to investigate fundamental Earth-science processes in the Pacific and other ocean basins.

Conveners

James Gaherty, Northern Arizona University (james.gaherty@nau.edu)
Jianhua Gong, Indiana University (gongjian@iu.edu)
HyeJeong Kim, University of Utah (hyejeong.kim@utah.edu)
YoungHee Kim, Seoul National University (younghkim@snu.ac.kr)
Joshua Russell, Syracuse University (jbrussel@syr.edu)
Lindsay Worthington, University of New Mexico (lworthington@unm.edu)

Six Decades of Tsunami Science: From the Source of the 1964 Tsunami to Modern Community Preparedness

Tsunami science has evolved significantly in the 60 years since the 1964 Great Alaska Earthquake. There have been important advances in tsunami source characterization, propagation and runup modeling, tsunami warning and forecasting and probabilistic tsunami hazard assessment. After the recent tsunami disasters of 2004 and 2011, tsunami science has encompassed new fields of research that include studies of survivability, resilience, loss estimates and recovery potential of coastal communities. Translating tsunami hazards into potential risk estimates, educating the public, counteracting disaster amnesia and preserving the memories of tsunamis for future generations are all important tasks that the tsunami community will be working on for decades.

We welcome both focused and multidisciplinary contributions to this session covering any of the following: analytical and numerical modeling of different tsunami generation mechanisms, including submarine and subaerial landslides, volcanic eruptions and air-pressure disturbances; mapping tsunami inundation and evacuation zones; paleotsunami studies; regional and local studies that deal with hazard, risk, vulnerabilities and exposure; tools and procedures for more efficient forecast and warning; studies of community preparedness and human behavior; and best practices in public education and outreach.

Conveners
Dmitry Nicolsky, University of Alaska Fairbanks (djnicolsky@alaska.edu)
Anthony Picasso, Alaska Division of Homeland Security & Emergency Management (anthony.picasso@alaska.gov)
Barrett Salisbury, Alaska Division of Geological & Geophysical Surveys (barrett.salisbury@alaska.gov)
Elena Suleimani, University of Alaska Fairbanks (ensuleimani@alaska.edu)

Spatial Correlation of Earthquake Intensity Measures: Methods and Applications

The spatial correlation of earthquake intensity measures (IMs) is a key factor for probabilistic seismic hazard analysis (PSHA) and seismic risk assessment of spatially distributed assets like portfolios of buildings and infrastructure networks, as it determines the joint probability of exceeding a certain earthquake IM level at multiple sites of interest. Most existing models for spatial correlation of earthquake IMs assume isotropy, meaning that the correlation depends only on the distance between two sites, not their relative orientation. However, recent studies have shown that IMs can exhibit anisotropic behavior, meaning that the correlation varies with the direction of the separation vector between two sites. Spatial correlations can be induced by different factors, such as the rupture directivity, wave propagation effects, site conditions and the IM definition. In this session, we will review the methods for modeling and estimating the spatial correlation of IMs, and we will discuss their applications in PSHA and seismic risk assessment studies. In this regard, we will discuss the statistical methods that can be used in spatially correlated modeling of the random field of earthquake IMs. We will also present examples of spatial correlation models for different IMs and regions based on empirical data and simulations. This session will provide an overview of the current state-of-the-art and future directions for research on this topic. The session will be interactive and engaging, with case studies, polling and audience participation.

Conveners
Morteza Abbasnejadfard, International Institute of Earthquake Engineering and Seismology (m.abbasnejad@iiees.ac.ir)
Morteza Bastami, International Institute of Earthquake Engineering and Seismology (m.bastmi@iiees.ac.ir)
Afshin Fallah, Imam Khomeini International University (a.fallah@sci.ikiu.ac.ir)
Chiara Smerzini, Politecnico di Milano (chiara.smerzini@polimi.it)

Strategies for Large Scale Data Analysis

Advancements in instrumentation are increasing the variety, complexity and volume of geophysical datasets (e.g. fiber optic sensing, InSAR, etc.). Improvements in cyberinfrastructure have been helping to reduce the effort and cost in collecting, storing and sharing large datasets. Utilization of edge computing, cloud compute and cloud storage resources have the potential to make large temporal and spatial analyses more tractable and accessible for a larger audience. Furthermore, with more data center facilities providing access to datasets in the cloud, the opportunity to process data without transferring it across the internet significantly reduces the operational burden, and potentially cost, of research computation.

Cloud computing services, like distributed messaging queues, serverless functions, object storage and container orchestration, expand the options for how research at very large scales can be performed. Open software frameworks that can be used in the cloud such as Apache Spark, xarray and Dask, Ray, etc. provide even more options. When coupled with open data, these workflows can ensure open, reproducible and transformative science.

In this session, we invite researchers, data producers and data providers to share their experiences designing, creating and/or deploying resources in new computing and data management environments to support or conduct data collection, transformation, analysis, storage and distribution at scale.

Conveners
Henry Berglund, EarthScope Consortium (henry.berglund@earthscope.org)
Tim Dittmann, EarthScope Consortium (tim.dittmann@earthscope.org)
Zoe Krauss, University of Washington (zkrauss@uw.edu)
Eileen Martin, Colorado School of Mines (eileenrmartin@mines.edu)
Chad Trabant, EarthScope Consortium (chad.trabant@earthscope.org)

Structure and Behavior of the Alaska-Aleutian Subduction Zone

The Alaska-Aleutian subduction zone is one of the most seismically and volcanically active plate boundaries in the world. Over the past decade, it has ruptured in several large interplate and intraplate earthquakes and produced notable volcanic eruptions and non-eruptive activity. It exhibits profound along-strike variations in geodynamics, lithospheric configuration, locking, rupture history of the megathrust and other fault systems, slow-slip events, and magmatic processes. The Alaska-Aleutian subduction zone is thus an excellent place to address fundamental questions regarding subduction zone processes and associated earthquake and volcanic activity. The availability of new geophysical datasets onland and offshore and the occurrence of a series of recent, well-characterized large earthquakes in the Alaska-Aleutian subduction zone have enabled a plethora of new results and insights into subduction processes. We invite a wide spectrum of contributions that focus on the Alaska-Aleutian subduction zone, including investigations utilizing newly available geophysical imaging and monitoring datasets, paleoseismology and geological studies and numerical and experimental studies.

Conveners
Grace Barcheck, Cornell University (grace.barcheck@cornell.edu)
Julie Elliot, Michigan State University (ellio372@msu.edu)
Ronni Grapethin, University of Alaska (rgrapenthin@alaska.edu)

Donna Shillington, Northern Arizona University (donna.shillington@nau.edu)
Xiaotao Yang, Purdue University (xtyang@purdue.edu)

Structure, Seismicity and Dynamics of the Queen Charlotte-Fairweather Fault System

The Queen Charlotte - Fairweather Fault System (QC-FW) is a transform plate boundary that spans >1000 kilometers of the western edge of North America, between the Cascadia and Alaska convergent margins. In the last 100 years, the QC-FW has hosted several major earthquakes, including the 1949 magnitude (M) 8.1 Queen Charlotte earthquake, the 1958 (M 7.9) on the Fairweather Fault, and the 2012 Haida-Gwaii (M 7.8) and 2013 Craig (M 7.5) earthquakes. The tectonics of the QC-FW are variable along its length, including oblique convergence in the south at Haida Gwaii, comparably simple shear offshore Southeast Alaska, and oblique collision with the Yakutat microplate in the north. The QC-FW is similar in length and in slip rate (~4-5 cm/yr) to the San Andreas fault system. However, the remote location of the QC-FW, largely offshore hugging the North American continental shelf and slope, leaves major gaps in our understanding of its structure, seismicity, and dynamics. We welcome abstracts that explore the QC-FW system, including but not limited to its natural hazards, earthquakes, subsurface properties, structure, and tectonics. We encourage a large range of methods and seek perspectives that compare the QC-FW with other plate boundary systems.

Conveners

Collin Brandl, University of New Mexico (cbrandl@unm.edu)
Andrew Gase, Western Washington University (gasea@wwu.edu)
Emily Roland, Western Washington University (rolande2@wwu.edu)
Lindsay Worthington, University of New Mexico (lworthington@unm.edu)

Tectonics and Seismicity of Stable Continental Interiors

Earthquakes in stable continental interiors, far from active plate boundaries, such as in central and eastern North America, northern Europe, western and southern Africa, Australia and parts of Asia, are perhaps the least understood. Nevertheless, advances in intraplate seismicity are being achieved through a variety of approaches. Examples include local- and national-scale seismic monitoring efforts that increase completeness of earthquake catalogs, detection algorithms that identify ever-smaller earthquakes from existing data, imaging of subsurface faults using relocated seismicity, seismic tomography and other geophysical methods, studies that constrain historical slip on such faults, quantification of geodetic, geomorphologic and elevation changes and through improved measurements of local stresses. In parallel with these efforts, ongoing ground motion studies continue to improve our understanding of source, path and site response characteristics unique to intraplate regions.

This session seeks diverse contributions related to intraplate earthquake hazards with goals of improving earthquake catalogs, identifying and characterizing active faults and/or deformation in stable continental interiors, deciphering long- term earthquake histories, statistical analyses of seismicity, assessing potential ground motion impacts, constraining models of kinematics and geodynamic properties and understanding the mechanisms that cause enigmatic intraplate earthquakes. Contributions regarding recent intraplate earthquake sequences are especially welcome.

Conveners
Oliver Boyd, U.S. Geological Survey (olboyd@usgs.gov)
Jessica Jobe, U.S. Geological Survey (jjobe@usgs.gov)
William Levandowski, TetraTech (will.levandowski@tetratech.com)
Zhigang Peng, Georgia Institute of Technology (zpeng@gatech.edu)
Anjana K. Shah, U.S. Geological Survey (ashah@usgs.gov)

The 2023 USGS National Seismic Hazard Model and Beyond

The USGS National Seismic Hazard Models (NSHMs) are a bridge between best-available earthquake science and public policy. The National Seismic Hazard Model Project (NSHMP) recently published a 50-state update that provided updates to the conterminous U.S., Alaska and Hawaii NSHMs. The USGS plans to update the Puerto Rico and U.S. Virgin Islands (PRVI) NSHM by the end of 2025 and the Guam and Northern Mariana Islands and American Samoa and Neighboring South Pacific Islands NSHMs by the end of 2026. For this session we will present the 2023 NSHMs for Alaska and the conterminous U.S. and progress on the update of the 2025 PRVI NSHM and invite contributions on topics that will influence future seismic hazard models, with an emphasis on Alaska. Topics include, but are not limited to: seismicity catalogs, declustering and smoothed seismicity models, geologic and geodetic deformation models, multi-fault ruptures, improved representation and quantification of epistemic uncertainty, new ground motion models (GMMs), including non-ergodic models, incorporation of physics-based (3D simulation) GMMs, basin effects, site response, directivity and time dependence. We also invite contributions on the use of NSHMs for scenario development, risk assessment for both buildings and infrastructure and other applications of risk mitigation including those within the insurance industry. We are also interested in contributions that highlight potential impacts of hazard modeling uncertainties on downstream applications.

Conveners
Jason M. Altekruse, U.S. Geological Survey (jaltekruse@usgs.gov)
Julie A. Herrick, U.S. Geological Survey (jherrick@usgs.gov)
Mark D. Petersen, U.S. Geological Survey (mpetersen@usgs.gov)
Peter M. Powers, U.S. Geological Survey (pmpowers@usgs.gov)
Emel Seyhan, Moody's RMS (Emel.Seyhan@rms.com)
Allison M. Shumway, U.S. Geological Survey (ashumway@usgs.gov)

The OSIRIS-REx Sample Return Capsule Re-entry: Geophysical Observations

The 24 September 2023 re-entry of the NASA’s OSIRIS-REx Sample Return Capsule (SRC) was only the fifth re-entry from interplanetary space since the end of the Apollo era. It provided a unique opportunity to geophysically observe an ‘artificial meteor’ with known dimensions, speed, and mass. A diverse set of institutions utilized nodal seismic arrays, ground and airborne acoustic sensors, distributed acoustic sensing, GPS sounding, and ionosphere Doppler sounding to record the object’s passage through the atmosphere. Results from these studies have implications for the remote detection and characterization of meteoroids and high-speed artificial objects (e.g., re-entry, orbital debris) on Earth and may inform mission concepts for planetary exploration (e.g., Venus, Mars, Titan, Jupiter). We invite contributions that emphasize geophysical observations of the OSIRIS-REx SRC re-entry, and discuss their broad scientific implications for remote sensing on Earth and beyond.

Conveners

Chris Carr, Los Alamos National Laboratory (cgcarr@lanl.gov)
Brian Elbing, Oklahoma State University (elbing@okstate.edu)
Charles Langston, University of Memphis (clangstn@memphis.edu)
Richard Lewis, The Defense Threat Reduction Agency (richard.d.lewis1.civ@mail.mil)
Yasuhiro Nishikawa, Kochi University of Technology (nishikawa.yasuhiro@kochi-tech.ac.jp)
Elizabeth A. Silber, Sandia National Laboratory (esilbe@sandia.gov)

Towards Advancing Earthquake Forecasting and Nowcasting: Recent Progress Using AI-Enhanced Methods

New technologies like advanced machine learning (ML) of big data (BD) and artificial intelligence (AI), together with signal processing tools that emerged in the past decade, have brought a wave of intensified studies of earthquake forecasting and nowcasting. In addition, fast-expanding datasets due to the installation of dense sensing networks, diversified observations (e.g., acoustic, elastic, satellite observations), injection-induced seismicity from around the world, and high-resolution ML-based catalogs provide more resources and constraints for studying the earthquake nucleation mechanism. These methods also allow the exploration of physical earthquake precursors and call for advanced computing architectures and data management plans in their effective usage. These new methods and datasets open the door to multi-disciplinary collaboration in a seamless way. In this session, we welcome the contribution from a wide spectrum of advances in the field of earthquake forecasting and nowcasting, including but not limited to: new data-driven or physics- based ways for forecasting/nowcasting earthquakes; machine learning and AI-enhanced methods to boost accuracy, verification and reliability; earthquake forecasting/nowcasting from laboratory to field; break-through real case studies; cross-disciplinary studies of earthquake forecasting/nowcasting; and new sensing and processing technologies for capturing the precursor signals.

Conveners

Yangkang Chen, University of Texas at Austin (yangkang.chen@beg.utexas.edu)
Katsumi Hattori, Chiba University (khattori@faculty.chiba-u.jp)
Lisa G. Ludwig, University of California, Irvine (lgrant@uci.edu)
Dimitar Ouzounov, Chapman University (ouzounov@chapman.edu)
John Rundle, University of California, Davis (john.b.rundle@gmail.com)

Translating Seismic Imaging into Geodynamic Understanding

Seismic imaging provides valuable information about the subsurface of the Earth. Travel times and waveforms from natural and controlled sources can be used to construct 2D and 3D velocity, attenuation and anisotropy models of the Earth's interior from the core to the crust. These seismically determined quantities are subsequently interpreted into physical properties and integrated into geodynamic models to explore a wide range of dynamical processes to understand Earth's past, present and future evolution.

This session seeks to increase the exchange between seismic and geodynamic model communities to better understand data and model uses and limitations. Contributions that explore applications of seismic imaging results in computational models that increase our understanding of Earth dynamics, model uncertainty and data resolution, and software tools used to construct model data are welcome. This includes but not limited to dynamics of the deep Earth including core-mantle interaction, mantle convection and mantle plumes; dynamics of the lithosphere including subduction zones, rifting and glacial isostatic adjustment; and dynamics of the crust including fault, geothermal and volcanic systems.

Conveners
Ebru Bozdag, Colorado School of Mines (bozdag@mines.edu)
Rebecca Fildes, University of California, Davis (rfildes@ucdavis.edu)
Menno Fraters, University of Florida (menno.fraters@ufl.edu)
Lorraine J. Hwang, University of California, Davis (ljhwang@ucdavis.edu)
Andrew Lloyd, Lamont-Doherty Earth Observatory, Columbia University (andrewl@ldeo.columbia.edu)
Brandon VanderBeek, Università di Padova (brandonpaul.vanderbeek@unipd.it)

Understanding and Quantifying the Variability in Earthquake Source Parameter Measurements

Earthquakes source parameters such as stress drop, magnitude and moment tensors are fundamental terms used to describe earthquakes. They are also key ingredients in earthquake ground motion modeling, rupture simulation, source physics analysis and statistical seismology. For this reason, the estimation of these parameters is often the first step in any analysis of earthquakes, but due to variability in site characterization, network capability and resources different procedures and methods are often used in their estimation. These issues and uncertainties depend on length scale, and therefore vary across magnitudes. For example, high frequency (>10 Hz) shallow site effects will strongly affect smaller earthquakes (M<3), while larger events are more strongly affected by issues at lower frequencies. This variability in method and inconsistencies across magnitude scales can yield artifacts which mask physical trends, leading to contrasting interpretations of earthquake scaling relationships, and earthquake dynamic rupture processes. For example, catalog magnitude estimation varies regionally, and by event size and network capability, producing artifacts that can influence important statistics like magnitude exceedance probabilities. Source parameters quantifying stress and energy release are fundamental to understanding fault strength and dynamic rupture propagation but can vary by orders of magnitude among studies. Estimating these parameters accurately, or at least uniformly, is needed to understand earthquake mechanics and ground motion hazard.

We seek all interested researchers to compare and validate source parameter estimates for any magnitude. We encourage studies that aim to quantify the uncertainties of these measurements, comparative studies of multiple methods and those that focus on reliable interpretation of results.

Conveners
Rachel E. Abercrombie, Boston University (rea@bu.edu)

Shanna Chu, U.S. Geological Survey (schu@usgs.gov)
Sydney Gable, University of Michigan (gablesyd@umich.edu)
Gene Ichinose, Lawrence Livermore National Laboratory (ichinose1@llnl.gov)
Colin N. Pennington, Lawrence Livermore National Laboratory (pennington6@llnl.gov)