SSA 2025 Annual Meeting Sessions-Baltimore, Maryland, 14 April-18 April 2025

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

31. Mechanistic Insights into Fluid-induced Earthquakes from the Laboratory to the Field
32. Modern Waveform Processing and Engineering Datasets - Accessibility, Quality Control, and Metadata
33. Neotectonics and Geohazards of the Interior Alaskan and Canadian Cordillera
34. Network Seismology: Recent Developments, Challenges and Lessons Learned
35. New Directions in Environmental, Seismic Hazard and Mineral Resource Exploration Studies
36. Numerical Modeling in Seismology: Theory, Algorithms and Applications
37. Performance and Progress of Earthquake Early Warning Systems Around the World
38. Predictability of Seismic and Aseismic Slip: From Basic Science to Operational Forecasts
39. Recent Advances in Modeling Near-source Ground Motions for Seismic Hazard Applications
40. Regional and Global Models of the Deep Structure and Tectonics of Asia
41. Scientific Machine Learning for Forward and Inverse Wave Equation Problems
42. Seismology for the Energy Transition
43. Station Installations and Site Conditions, a Quest for Improved Strong Motion Database
44. Temporally Variable Records of Earthquake Behavior and Considerations for Seismic Hazard Analyses
45. Testing, Testing 1 2 3: Appropriate Evaluation of New Seismic Hazard and Risk Models
46. Unusual Earthquakes and Their Implications
47. Visualization and Sonification in Solid Earth Geosciences, What's Next?
48. Why Ignore the Structure? Soil-structure Interaction and Site Response at Local and Regional Scales

Accuracy and Variability of Physics-based Ground Motion Modeling

Accurate velocity and rupture models are essential to estimate realistic ground motions for seismic hazard and risk analysis. This session welcomes submissions assessing the importance of various model features on the accuracy of predicted ground motions through physics-based numerical modeling. Examples include dynamic and kinematic rupture models, development, calibration and validation of community seismic velocity models, and quantification of the contribution of various model features to the ground motions. In addition to guidance on model features required for accurate mean predictions, we welcome physics-based contributions that aim to model realistic variability of the ground motions. Finally, studies on mapping of uncertainty in velocity and source models into the resulting ground motions are encouraged.

Conveners

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Advanced Geophysical Observations, Analytical Methods, and New Insights for Earthquake Swarms

Earthquake swarms are clusters of earthquakes that are localized in space and time but do not have a distinctive mainshock or a temporal decay of event rates characteristic of aftershocks. Earthquake swarms can trigger large, damaging earthquakes; however, their causality is not yet clear. In the last decade, there has been a remarkable surge in geophysical observations, such as dense seismic arrays, distributed acoustic sensing (DAS), borehole strainmeters, Global Navigation Satellite System (GNSS), and Interferometric Synthetic Aperture Radar (InSAR). This wealth of geophysical data provides an unprecedented opportunity to improve our understanding of the processes governing earthquake swarms and their hazards across various temporal and spatial scales, including tectonic, structural, geothermal, and anthropogenic conditions. Advances in the development of computing algorithms provide new opportunities to further probe earthquake sequence evolution within complex fault systems and to link these processes with improved observations.
The aim of this session is to explore innovative geophysical methodologies to observe and analyze earthquake swarms and to illuminate fresh perspectives on the underlying physics. We welcome contributions that encompass a wide range of topics, including but not limited to:

1. novel algorithms for constructing earthquake catalogs, incorporating state-of-the-art artificial intelligence tools,
2. advanced geospatial and statistical analyses and simulations of observed swarms,
3. hazard applications using seismology and other complementary geophysical data such as GNSS and InSAR.

Conveners

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Advancements in Forensic Seismology and Explosion Monitoring

Geophysical signatures are crucial for enhancing the detection and characterization of anthropogenic activity. This session invites abstracts showcasing the latest advances in geophysical forensic analysis for global security and monitoring. Topics may encompass observation, modeling, and characterization of events that produce ground coupled signals including explosions, mining collapse, and bolides. We also seek to highlight advancements, physics-based and data-driven, in source, propagation, and signal analysis related to controlled source experiments. Submissions integrating multimodal observations and innovative instrumentation, such as distributed acoustic sensing, gradiometry, remote sensing, infrasound, and large-N arrays, are encouraged. This session aims to foster collaboration and discussion among experts to drive innovations in forensic seismology and explosion monitoring.

Conveners

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Advances in Reliable Earthquake Source Parameter Estimation

Reliable characterization of earthquake sources is fundamental to ground motion modeling, rupture simulation and statistical analyses. Estimates of earthquake source parameters such as location, magnitude, stress drop, and - for small and moderate earthquakes - their moment tensor components are used to describe and understand earthquake ruptures. Larger earthquakes may require a finite fault model to describe their source processes. Different procedures used in the estimation of source parameters may introduce variability in source, site, and path characterization intrinsic to the method used. These issues increase with the complexity of ruptures and require inversions with uncertainties that are difficult to quantify. The resulting artifacts may mask physical trends and lead to contradictory interpretations of earthquake scaling relationships and rupture processes. We encourage studies that aim to improve the reliability of earthquake source characterization, including ones that quantify the uncertainties of standard measurements, compare multiple methods or different datasets, and propose improved approaches to characterize complex sources and ruptures.

Conveners

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Advancing Time-dependent PSHA and Seismic Risk Assessment: Accounting for Short- to Medium-term Clustering

Traditional probabilistic seismic hazard and risk assessment often overlook the dynamic nature of earthquake clustering, including foreshocks, aftershocks, and extended sequences, as well as the damage accumulation from multiple earthquakes. Recent sequences, such as the 2010/2012 Canterbury earthquakes in New Zealand, the 2019 Ridgecrest earthquakes in the USA, and the 2023 Turkey-Syria earthquakes, highlight the need to refine our methodologies to better capture the dynamic nature of earthquake clustering. This session will focus on approaches to integrating time-dependent models into seismic hazard and risk assessments.

We invite contributions on advancements in time-dependent seismic hazard analysis and methods for incorporating earthquake clustering, including clustering-based models that address spatiotemporal variations, techniques for integrating aftershocks and foreshocks into hazard assessments, and vulnerability assessments that incorporate time-dependent fragility curves and damage accumulation. Additionally, we welcome studies that include real-world applications that assess the effectiveness of these analyses, or tackle current limitations and propose solutions. One of the goals of the session is to promote strategies for building capacity and upskilling end-users to effectively utilize these methodologies.

This session is targeted at seismologists, earthquake engineers, policymakers, insurance and re-insurance professionals, and academics in geosciences and structural engineering. The session will foster dialogue on the future of time-dependent seismic hazard and risk analysis. By embracing the complexities of earthquake behavior, we can enhance future risk assessments and strengthen community resilience.

Conveners

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Adventures in Social Seismology: Earthquake Early Warnings, Operational Forecasts and Beyond

In virtually every endeavor in which seismology is involved, there are considerations that warrant the participation of other disciplines. Social science and social scientists comprise one of these disciplinary areas and practitioners. As applied to real world issues, including earthquake hazard warnings, general and public education regarding earthquake hazards, establishing institutional trust and credibility, and other areas involving communication with various publics, social scientists are increasingly called upon to provide insights based on empirical studies and theoretical orientations. The social and behavioral sciences can provide valuable information on the social and culture environments in which scientific developments are shared with community residents and various institutional sectors.

A recent example is the effort to understand how, as earthquake early warning systems expand globally, this relatively new technology is being used: whether the recommended drop, cover and hold on self-protection strategy is being implemented by those who receive alerts; user assessments of the value of EEW; perceptions regarding threshold levels for alerting; alert message content and post-alert information; and whether users understand how EEW systems work. In short, social scientists are playing a productive role between scientific discovery and technological advances, and implementation for public benefit. Social scientists may also have a role in operational earthquake forecasting in the identification of actions that can be taken in situations involving a low probability forecast with very serious potential consequences as well as high probability forecasts for aftershocks.

The example above, involving earthquake hazard warnings, is just one example of how the social sciences intersects with seismology and we invite social scientists and seismologists with an interest in the social and economic applications of earth science developments to join this session.

Conveners

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Building and Decoding High-resolution Earthquake Catalogs With Statistical and Machine-learning Tools

Recent application of advanced earthquake detection techniques such as template matching and machine learning (ML) have produced exponential growth in the quantity of earthquakes listed in next-generation high-resolution catalogs around the world. These improved catalogs can include relocated seismicity on the order of tens of thousands to a few million individual events, making it challenging to use standard analysis and modeling tools such as the Epidemic Type Aftershock Sequence (ETAS) model or the nearest neighbor algorithm for de-clustering, to extract key features and forecast seismicity. This session welcomes contributions on recent efforts to build high-resolution earthquake catalogs using waveform-based and ML methods such as transformers or foundation models. We also solicit presentations on innovative methods to decode these high-resolution catalogs using statistical analyses and advancing our understanding of earthquake interactions, swarms, fault geometries or localization processes, as well as predictive modeling approaches including neural and Bayesian point processes, deep Gaussian process models, and other generative models. We especially encourage submissions that compare new results with benchmarks, e.g. with respect to standard catalogs, or to model benchmarks such as statistical ETAS models or physics-based models such as Coulomb Rate-and-State (CRS) models to forecast seismicity.

Conveners

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Challenges and Opportunities in Constraining Ground-motion Models from Physics-based Ground-motion Simulations

Ground-motion models (GMMs) are an integral part of a seismic hazard analysis; moreover, they are crucial for earthquake early warning, shake maps and earthquake rapid response applications. In the last two decades, the abundance of instrumentally recorded data at regional and national scales has allowed recent developments in partially and fully non-ergodic GMMs in certain regions across the globe. However, constraining such path and site-specific effects in data-scarce regions (or sites) remains a challenge in addition to constraining the scaling of Ground motions for larger magnitude and complex ruptures. Moreover, empirical GMMs face major limitations when evaluating ground motions in regions/locations with dominant 2D/3D site effects.

Thanks to the rapid advancement of high-performance enabled, exascale parallelized simulation methods, deterministic physics-based ground motion modeling has been gradually integrated into seismic hazard analysis, with a specific focus on near-source complexity and site-specific considerations (e.g., basin response modeling). The ongoing development in source modeling approaches and in high-resolution regional 3D velocity models is a crucial component in improving the accuracy and predictive power of physics-based ground motion modeling simulations.

This session is targeted at studies focused on integrating such simulations into empirical ground-motion models. It includes regional scale ground-motion simulations, basin, site and source-specific simulations. Topics related to calibration of simulations with observed data, data formats and dissemination of such simulations results are also encouraged. Studies focused on the use of ground-motion simulations in constraining regionally varying GMMs, partially and fully non-ergodic GMMs are of particular interest. The session also welcomes studies related to advanced empirical approaches for ground-motion modeling.

Conveners

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Community Efforts in Distributed Acoustic Sensing (DAS)

Over the past decade, distributed acoustic sensing (DAS) has undergone significant technological advances and overcome many challenges. DAS turns fiber-optic cables into dense arrays of seismic sensors that span the length of the cable, collecting data across spatial and temporal scales that were not previously possible with traditional seismic instrumentation. These recent advances have enabled detailed understanding and active monitoring of earthquakes, glaciers, volcanoes, oceans, rivers, urban centers, and more. Despite considerable progress, a wider adoption of DAS technology still faces challenges. The lack of data and metadata standards, large quantity of data, cost of instrumentation, power consumption for field deployments, ambiguous instrument to instrument responses, and relatively small software ecosystems are prohibitive. We invite contributions focused on, but not limited to, data and metadata standardization, efficient data storage and transport, dataset discovery and exchange mechanisms, software ecosystems, instrumentation comparisons, and general best practices for field deployments.

Conveners

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Compiling Active Faults for Improved Hazard Modeling from Cascadia to Alaska

Active faults refer to faults which are believed to be capable of rupturing again in the future, generally meaning they have demonstrated activity in the Late Quaternary. Identifying these faults is crucial for understanding seismic hazard, particularly at near-source distances. Unfortunately, identification is thwarted in regions with low strain rates, dense vegetation, recent glaciation, extensive anthropogenic reworking, and/or other complicating factors. This is particularly true in the forearc of the Cascadia subduction zone, Alaskan subduction zone, and intervening North American crust of British Columbia and the Yukon. Nonetheless, many recent studies have sought to better constrain the crustal faulting potential from the offshore region all the way to the eastern edge of the cordillera, as part of research within academia and industry.

This session seeks to bring together recent studies on active faults or their implications for seismic hazard and risk, including contributions in the field of paleoseismology, geodesy, seismology, marine acoustics, geochronology, and seismic hazard and risk modeling. Negative results and methodological submissions are welcomed, to contribute to a robust discussion on the difficulties of assembling a complete crustal fault map across this remote and rugged swath of western North America.

Conveners

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Data-driven and Computational Characterization of Non-earthquake Seismoacoustic Sources

Non-earthquake seismoacoustic sources, such as landslides, avalanches, volcanoes, glacial calving, utilities & industrial blasts, bolide airburst and their impacts on Earth, are commonly recorded by seismoacoustic monitoring networks. This session focuses on data-driven and computational methods and algorithms that aim to better understand and characterize these non-earthquake sources, and to ultimately better monitor and mitigate their associated hazards. We encourage contributions from studies that include, but not limited to, seismoacoustic, geodetic, and remote sensing techniques at all relevant spatiotemporal scales with emphasis on multisensors Bayesian & Dempster-Shafer statistical data integration & fusion, high-performance deterministic & stochastic computational modeling & simulation, and AI-driven & physics-informed ML techniques. We solicitate studies that include, but not limited to, source detection, location, characterization, modeling, classification, monitoring, and hazard mitigation.

Conveners

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Earthquakes, Lithospheric Structure, and Dynamics in Stable Continental Regions

Damaging earthquakes can occur far from tectonic plate boundaries, where shaking impacts large areas because of low seismic attenuation in bedrock and amplification by sedimentary deposits. Long time intervals between earthquakes, low strain rates, and human development pose challenges to understanding seismic hazard in intraplate areas such as central and eastern North America, northern Europe, central Asia, and Australia. Geophysical imaging, geodynamic modeling, and geologic studies indicate that features inherited from prior tectonism such as intraplate basins, rifts, faults, arches, and domes can be reactivated seismogenically by the modern stress field. This session seeks diverse contributions related to intraplate seismic hazards, lithospheric structure, and dynamics. Studies of recent earthquakes (e.g., 2024 M4.8 Tewksbury, NJ, USA; 2019 M4.9 Le Teil, France) are especially encouraged, as are those of historical seismicity, paleoseismic features, seismic attenuation and ground motions, and constraints on ground shaking ranging from balanced rocks to railroads. We welcome approaches that cross spatial and temporal scales and the disciplinary boundaries between structural geology, geophysics, geochronology, rock physics, and geodynamics.

Conveners

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Earthquake Shaking and the Geologic Record: Triggered Phenomena and Preserved Fragile Geologic Features

The geologic record includes evidence of strong shaking from earthquakes, including shaking intensity and timing, with their distribution sometimes allowing earthquake locations to be inferred. Evidence of strong shaking intensities can also be due to ruptures of blind faults, providing further evidence for areas with less understood seismic occurrence. Some geologic shaking evidence is unique, preserving the rarest and most intense earthquake shaking over millennial timescales, which until recently have largely gone undocumented by seismometers. The geologic record of shaking includes turbidites, landslides, paleo liquefaction, speleothems, and fault-plane slickenlines. In addition, preserved fragile geologic features provide negative evidence for maximum shaking intensities. In this session, we welcome presentations that: 1) use geologic features to identify past strong ground motions, and infer the timing of such motions; 2) characterize the distribution of past strong ground shaking and recognize seismogenic sources through regional evidence; 3) estimate the likely maximum strengths of past ground motions permitted by the presence of fragile geologic features; 4) develop methodologies to locate and constrain ages of geologic features indicative of past ground motions; and 5) directly relate past strong ground motions to seismic hazard assessments.

Conveners

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Earthquake-triggered Ground Failure: Data, Hazards, Impacts and Models

Landslides and liquefaction triggered by earthquakes are a diverse set of phenomena that can cause widespread and significant impacts during and after earthquake shaking. Advances in our ability to model the initiation, extent, and impacts of ground failure are needed to improve our ability to quantify the magnitude and uncertainty of hazard and risk, as well as predict near-real-time losses for emergency response. Models of earthquake-triggered ground failure should consider the complex spatial-temporal variations (e.g., spatial heterogeneity of material properties, climate change, wildfire, anthropogenic changes to the landscape and groundwater levels) on hazard and risk. However, the complete physics of earthquake-triggered ground failure is often impossible to capture at any scale, and simplified probabilistic, regionalized, and or time-dependent modeling of ground failure, as well as the development of detailed inventory and case-history data, are essential to building practical models of ground failure susceptibility, hazard, and loss.

We welcome all submissions relating to earthquake-triggered ground failure, including but not limited to: regional scale susceptibility and hazard assessment; characterizing uncertainty, or developing ensemble model predictions; studies on the impacts, losses, and risk modeling for coseismic ground failure; new or revised inventories, or case histories, from recent and historic earthquakes; as well as advances in information or communication products for earthquake-triggered ground failure.

Conveners

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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 datasets or new combinations of seismological data types, advances in global and regional-scale seismic tomography, 3-D waveform modeling, array-based approaches, and the analysis of correlation wavefields.

Conveners

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ESC-SSA Joint Session: Seismology in the Global Oceans: Advances in Methods and Observations

Seismological studies beneath the global oceans, which cover 70% of Earth's surface, provide key insights into tectonic processes. These investigations have advanced our understanding of fundamental topics such as the differences between oceanic and continental lithosphere-asthenosphere systems, the evolution of oceanic plates from mid-ocean ridges to subduction zones, and the influence of mantle plumes in these processes. Seismic imaging of subduction zones and transform faults has also been instrumental in improving our understanding of earthquake hazards and volcanic activity.

This session invites contributions that showcase recent advancements in overcoming the challenges of collecting, processing, and interpreting oceanic seismic data. Topics may include but are not limited to, innovations in noise reduction (e.g., reverberations, tilt, compliance, bottom currents), the use of probabilistic and machine learning methods for modeling wave reflections and conversions, and novel approaches to imaging oceanic plate structures. We welcome studies utilizing ocean-bottom and land-based seismic data to investigate oceanic features, such as SS precursors, ambient noise, and surface wave tomography. Contributions highlighting new geophysical experiments, seismic deployments, and instrumentation are also encouraged, along with any research offering new insights into tectonic processes beneath the global oceans.

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

Conveners

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Ethical Engagement in Geosciences

Earthquake professionals focus on understanding earthquakes and the hazards they pose, but can sometimes face myriad ethical dilemmas during fieldwork and other professional situations. Post-earthquake investigations and other fieldwork are not done in a lab; they are done in the real world and often involve interfacing with local communities and, for earthquakes outside of one's home country, international populations and/or partners. Results of hazards-focused research also have direct societal implications, and sometimes pose challenges for effective communication with nonspecialists. In this session we invite contributions that focus on the ethical considerations associated with earthquake science investigations and communications, including but not limited to engagement with partners and students, issues associated with working with indigenous populations, and issues associated with communication of timely but potentially sensitive information such as aftershock forecasts.

Conveners

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Exploring Planetary Interiors and Seismology: Observations, Models, Experiments and Future Missions

Advancing our understanding of planetary interiors requires the integration of geophysical observations, quantitative models, and experimental studies. This session aims to promote discussions on how recent geophysical measurements from various planetary missions, combined with new numerical and experimental constraints, illuminate the internal structures and dynamics of planetary bodies. Topics will include the implications of these findings for the density, fluid content, and temperature variations from crust to core. Contributions that incorporate recent mission data, constraints, and their implications for the interior dynamics of the Moon, Mars, and other planetary bodies are particularly encouraged, along with Earth-based seismological approaches that inform comparative planetology.

Conveners

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Exploring the Complexity of Fault Discontinuities

How is deformation accommodated in structurally-immature, discontinuous fault zones? Strain accommodation is rarely limited to kinematically and/or geometrically homogeneous fault segments, and often involves strain partitioning between systems of faults that work together to release seismogenic strain. This is especially true in young or structurally immature zones such as fault tips, stepovers, transfer zones, fault relays, or other along-strike discontinuities, but may also occur on mature faults. Deformation in these zones is also often spatially or temporally variable over multiple earthquake cycles, challenging our seismic hazard assessments. We invite contributions that aim to characterize these complex zones, including the spatiotemporal expression of slip, both at depth and at the surface. Approaches from neotectonic mapping, paleoseismology, geodesy, modeling, and novel techniques are welcome.

Conveners

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Fiber-optic Sensing Applications in Seismology

Fiber-optic sensing methods, such as Distributed Acoustic Sensing (DAS), Distributed Temperature Sensing (DTS), and Distributed Strain Sensing (DSS), are transforming seismology by advancing our understanding of seismic sources and Earth's structure. These innovative technologies convert fiber-optic cables into dense sensor arrays capable of capturing seismic and deformation signals across the solid Earth, oceans, and glaciers with unprecedented resolution. We invite contributions on recent developments in fiber-optic seismology applications, including but not limited to the detection and characterization of various seismic sources (e.g., earthquakes, icequakes, volcanic activities, ocean processes, atmospheric phenomena, energy extraction and storage activities, and anthropogenic signals), Earth's structure imaging (e.g., urban setting, offshore, and cryosphere), environmental monitoring (e.g., the dynamics of oceans, rivers, lakes, critical zones, soil moisture, groundwater, permafrost, and glaciers), and natural hazard mitigation (e.g., earthquake, tsunami, and volcanic eruption monitoring and early warning). We also welcome recent engineering advancements in the theoretical, methodological, and instrumental aspects of fiber-optic sensing for future Earth and planetary applications. Contributions from the computational and data science communities focused on exploring fiber-optic data are encouraged, including areas such as machine learning, advanced signal processing techniques, data compression, high-performance computing, and cloud computing and storage. We aim to bring together researchers from diverse fields, including Earth science, computational and data science, and fiber-optic sensing engineering to open a discussion on the future opportunities enabled by these new technologies.

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Fifty Years and Beyond of Broadband Seismic Instrumentation: Performance, Precision and Uncertainties

Inertial broadband seismometers, introduced five decades ago, are now standard measuring tools for seismology. These feedback instruments permit high quality ground motion measurements over four to five decades of frequency, while resolving them with astonishingly high resolution, from the order of cm/s down to nm/s. They provide high dynamic range, digital measurement of 3 components of ground motion, and linear, well described response functions allowing the original ground motion to be reconstructed. Thus, it is important to be able to document the precisions and uncertainties of the measurements of these instruments, and of other seismic sensors like accelerometers and geophones, and to assess and manage their performance over time.

One example of such documentation is linking the precision of seismometer measurements to the international system of units (SI) and tracking it over the lifetime of a broadband seismometer or seismic station. An effort is currently underway to develop such a link and thereby introduce seismometers to standardized procedures common in the world of metrology. At the same time, instrument manufacturers deploy a variety of individual techniques to calibrate their wares before they are sold, while network operators deploy clever procedures to remotely monitor the performance of their instruments during their lifetime in the field. With the advent of the use of optical fibers and other innovative seismic measuring devices, the question of procedures and tools to describe, assess and monitor performance becomes broader.

We invite everybody interested in seismic instrumentation to submit abstracts to this session. Topics of interest include calibration techniques; long term assessment of instrument performance; precision and uncertainties and their influence in interpreting seismic data; and comparison of high precision measurements of ground motion from inertial seismometers with observations from optical fibers and other techniques.

Conveners

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From Physics to Forecasts: Advancements and Future Directions of Induced Seismicity Research

Induced seismicity has been associated with many anthropogenic activities involving fluid mobilization in subsurface formations such as hydraulic fracturing, waste-water injection, geothermal exploitation, and carbon sequestration. Research on this topic has matured over recent decades, and dominant controls of induced seismicity have been identified. The spatio-temporal evolution of these earthquakes is mostly modulated by the fluid volumes, flow rates, hydromechanical properties of the subsurface, regional geological conditions, and proximity and orientation of existing fault structures. However, it is often hard to reconstruct the complex interplay between these factors that led to the earthquakes.

New technologies and multi-disciplinary approaches to subsurface modeling advance our knowledge of the underlying physics of these events and quantify the remaining stochastic variability. Ongoing induced seismicity research addresses such questions as: How can the likelihood of future large seismic events be reduced during these anthropogenic activities? How can the physics of induced earthquakes guide hazard assessment over short and long timescales? Do we have better success at forecasting earthquake hazards in induced vs tectonic settings – and how should the public and/or regulatory agencies utilize these forecasts?

We invite contributions that present new modeling technologies, resulting datasets, that update, or present new, models of the processes leading to induced seismicity. We particularly welcome multi- and interdisciplinary studies, and we encourage contributions across a broad range of geo-scientific disciplines including, but not limited to Earth imaging, numerical modeling, seismicity, and earthquake source processes. We also welcome challenging case studies where the induced seismicity is difficult to model, the model results propagate to time-dependent seismic hazard assessment and forecasting, and recommendations for future directions for this field.

Conveners

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Geodynamics at the Intersection of Geophysical Observations

Geophysical probing of the Earth has revealed astounding detail of its internal structure through images of seismic wave speeds, resistivity, and density. Yet more fundamental petrophysical and thermomechanical properties, such as composition, temperature, viscosity, as well as the presence and distribution of fluids and melt, remain elusive and instead must be inferred from geophysical images based on laboratory relationships or numerical modeling combined with other constraining geophysical observations. These inferences are critical for initializing and further evaluating geodynamic models that explore a wide-range of dynamic processes operating in Earth's past, present and future.

This session seeks to facilitate the exchange between the observational, laboratory, and modeling communities to better understand data and model uses and limitations. Contributions that explore applications and interpretation of geophysical or laboratory data in combination with computational models to increase our understanding of Earth dynamics, model uncertainty and data resolution, and software tools to facilitate model and data integration are welcome. This includes, but is not limited to: (1) geodynamic modeling including core-mantle interactions, mantle convection, mantle plumes, subduction zones, and rifting; (2) deformation modeling associated with GIA, solid Earth tides, and post-seismic deformation; and (3) dynamics of the crust including fault, geothermal, and volcanic systems.

Conveners

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Geophysics in a Changing World: Monitoring Applications from Seismology and Beyond

Recent developments in environmental monitoring with geophysical tools demonstrate their utility for mapping small-scale changes in the shallow subsurface. Such innovative applications are becoming increasingly relevant as society faces challenges related to sustainability in the context of changing environments. Passive seismic investigations have used recordings of ambient noise to resolve groundwater fluctuations on the basin scale, and to monitor and characterize fluvial system bedload transport and flood response. Resistivity and electromagnetic techniques have been used for soil characterization and to map saltwater intrusion, with implications in hazards, resource mapping, and climate change. Microgravity and passive-seismic surveys have been used independently and jointly to assess dam stability, to detect karst, and for other near-surface applications. Moreover, seismic and infrasonic data have become useful for real-time landslide detection and have shown potential for detecting severe weather phenomena such as tornadoes and hurricanes. While focusing on seismology, this session invites presentations from a wide range of geophysical applications to study Earth's surface and near-surface processes, and other aspects of the emerging fields of environmental seismology and geophysics.

Conveners

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Historic and Prehistoric Earthquakes in Stable Cratons, with a Focus on Central and Eastern North America

Knowledge of the historic and prehistoric earthquakes is important for establishing seismic hazard in all parts of the world. This is especially true for intraplate regions, where the modern instrumental seismicity may not provide an accurate picture of where strong earthquakes can occur and how big those earthquakes might be. We invite papers that improve our understand of historic and paleoseismic earthquakes and associated seismotectonics in intraplate regions. We are especially interested in studies that focus on the eastern and central part of North America, away from the more tectonically active regions of western North America. Contributions from tectonically analogous regions elsewhere are also welcome. Studies of relevance to seismic hazard assessment are encouraged.

Conveners

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Improving First-order Seismic Characterization

A significant portion of seismic research relies on the first-order source characterizations provided by seismic catalogs, specifically earthquake hypocenters and magnitudes. Many earthquake catalogs rely on long-standing algorithms to estimate these parameters, leveraging seismology's long history of single-event location and amplitude-based magnitude strategies (e.g., mb, mL, and mS). In many cases, such as supporting the Comprehensive Nuclear-Test-Ban Treaty, it is critical to have accurate and calibrated rapid hypocenter and magnitude estimates with well-described uncertainties. Similarly, because such a large portion of seismic research depends on earthquake catalogs, improvements to the information provided by these catalogs can fundamentally impact seismic research. In this session, we encourage submissions that evaluate or develop practical strategies to improve upon first-order observations. This may include a wide range of topics, for example, strategies to improve measurements and estimate measurement error, data collection and quality control, censoring of data (i.e., the effect of noise overprinting signal), evaluated correlated errors and station biases, and the reconciliation of historical observations with more modern approaches.

Conveners

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Improving the State of the Art of Earthquake Forecasting Through Models, Testing and Communication

Current earthquake forecasting models utilize only a fraction of the existing knowledge about earthquakes, thereby lacking important information on seismogenesis. With the advent of increased computational power and high-resolution geophysical datasets, including fault information, interseismic strain data, highly detailed machine-learning-based catalogs, laboratory observations of microseismicity, etc., our understanding of the physical processes involved in earthquake nucleation is continuously growing. Yet, translating this theoretical knowledge into practical, informative earthquake forecasts remains a significant hurdle. Furthermore, testing these forecasts against observations and communicating them to non-scientific audiences similarly require innovative solutions so earthquake forecasts can realize their potential for seismic risk reduction.

In this session, we welcome contributions that seek to improve the state of the art of earthquake forecasting by bridging the gap between theoretical advancements and real-world applications. We invite submissions that integrate our growing understanding of earthquake processes with the creation of generalizable, statistically robust and interdisciplinary models that are more informative than the currently widely-used empirical clustering models - both for natural and induced seismicity, and across scales from micro-scale in the laboratory to continental catalog analysis. Complementarily, we seek contributions that explore tests or metrics that better characterize model performance and thus identify promising areas for their improvement. We also encourage the submission of new communication and visualization strategies that turn earthquake probability estimates into practical, actionable and societally relevant information.

Conveners

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Berman Neri, Tel Aviv University (neriberman@gmail.com)
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Innovative Applications of Seismic Nodal Technology for Hazard Mitigation and Earth System Monitoring

Seismic Nodal arrays have revolutionized the way we monitor and study geodynamic Earth processes such as earthquakes, volcanic activity, landslides, ocean dynamics and anthropogenic activity. Their flexibility, dense spatial coverage, and ease of deployment allow for unprecedented high-resolution seismic data collection across a range of environments and scales. These portable and autonomous sensors provide detailed insights into subsurface structures, fault zone mechanics, and volcanic systems.

In this session, we seek to explore the cutting-edge advancements in seismic nodal technology and their applications. We invite contributions that focus on innovative field deployments, novel data analysis techniques, and case studies showcasing the impact of nodal arrays on our understanding of tectonic phenomena. We encourage researchers from all disciplines within the geoscience community to submit abstracts and share their latest findings and experiences using seismic nodal arrays and other related knowledge.

Conveners

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The Landscape Record of Earthquakes and Faulting

Recent earthquakes have left vastly different records in the landscape, from coastal uplift in the 2024 Mw7.5 Noto, Japan, earthquake to large lateral surface rupture in the 2023 Mw7.8 and Mw7.5 Türkiye earthquakes, and subtle or blind displacement in the 2024 Mw7.0 Aykol, China, earthquake. How long the earthquake record remains in the landscape depends on the surface rupture (or lack thereof) and shaking signatures of the earthquake as well as the lithology and climate of the region. Field and remote sensing observations of recent and past ruptures highlight the variable rupture geometries, surface slip distributions, damage zones, distributed or off-fault deformation, and ground shaking. The extent to which the complex and heterogenous patterns are consistent or variable between earthquakes is a fundamental question in earthquake science, critical for hazard modeling, and remains largely unknown. Meanwhile, advances in numerical and physical models and laboratory experiments expand the ability to study strain accumulation and release and the landscape response through multiple earthquake cycles. In this session, we encourage abstracts that investigate spatial and temporal patterns in strain accumulation and release spanning coseismic to geologic timescales, including their causes and uncertainties. We welcome contributions from geodesy, earthquake geology, tectonic geomorphology, lacustrine paleoseismology, numerical modeling, analog experiments, and especially contributions with novel approaches integrating multiple data sources to further our understanding of how strain accumulation and release are stored in, interpreted from, and alter the landscape.

Conveners

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Hanna Elston, Smith College (helston@smith.edu)
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Macroseismic Intensity: Past, Present and Future

Macroseismic intensity (MI) observations and analyses connect our collective seismological past with the present and the present to the future. MI facilitates estimating earthquake hazards and communicating the effects of ground shaking to a wide variety of audiences, across the ages. Invaluable ground-shaking and building damage information is gained through standardized, systematic approaches for assigning MI values and, importantly, sharing and archiving those assignments in a reproducible form. Traditional macroseismic surveys provide vital constraints on critical aspects of earthquakes and their impacts on society, whereas internet-based macroseismic datasets are extremely valuable for real-time earthquake situational awareness and contribute to subsequent engineering loss and risk analyses. These important applications of MI observations require us to revisit traditional macroseismic surveys for modern environments, standardize internet-based collection strategies, and assure compatibility between traditional and internet-based approaches of macroseismic data collection.

This session aims to connect researchers and practitioners in earthquake seismology, earthquake engineering, and macroseismology. Accordingly, we encourage contributions related to historical and modern MI collection, including internet macroseismology, recent and historical MI analyses, intensity prediction equation and ground-motion conversion equation development, assigning higher intensities with rigorous building damage data collection, and developments related to the International Macroseismic Scale (IMS; a recent update to the European Macroseismic Scale, EMS-98).

Conveners

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Mechanistic Insights into Fluid-induced Earthquakes from the Laboratory to the Field

Fluid-induced earthquakes, including those that are triggered, occur both naturally and anthropogenically and are fundamentally connected to fluid-fault and/or fluid-fracture mechanical interactions. Fluid-induced seismicity has become a significant phenomenon and concern during natural fluid migration or human-made fluid injection and extraction activities, such as hydraulic flows, slab dehydration, hydrocarbon or hydrogen production, wastewater and CO_2 injection, and geothermal production. The physical mechanisms driving the seismicity have been extensively studied and include pore-pressure diffusion, poroelastic stress changes, fluid-driven aseismic slip, and shear stress transfer. However, understanding these mechanisms is challenging due to their context-specific nature and because there is a lack of high-quality geophysical measurements that quantify subsurface and fault zone properties and in-situ stress evolutions. This complexity necessitates comprehensive studies that explore the effects of heterogeneous fault or fracture properties, varying host materials, and environmental conditions on the generation and evolution of triggered or induced seismicity. Such research will help clarify the intricate physical processes underlying the complex spatiotemporal distribution and behavior of the seismicity. Moreover, these insights will enhance the characterization and mitigation of seismic hazards.

We invite submissions of studies, ranging from laboratory experiments to field observations, that offer new perspectives on the underlying physics of fluid-fault and/or fluid-fracture interactions. We welcome contributions from national labs, academics, regulators and industry members, focusing on : 1) studies using laboratory experiments and numerical simulations to explore the physical processes that control fluid-induced seismicity, and 2) studies of spatiotemporal behavior of fluid-induced seismicity across various natural scales and settings, particularly those that offer new insights into the mechanisms driving fluid-induced seismicity in the field.

Conveners

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Modern Waveform Processing and Engineering Datasets - Accessibility, Quality Control, and Metadata

Open access to seismic waveform datasets across a variety of geographic terrains on Earth and beyond offer the opportunity to evaluate ground motions with increased resolution and depth. Workflows can be tailored towards different applications, but generally aim towards reducing uncertainty and maximizing signal quality. Increasing data quality is a universal goal, regardless of application. Here we aim to discuss topics broadly related to ground motion processing, such as new approaches and techniques (both automatic and manual) for ground motion processing and quality assurance. We also encourage presentations that highlight newly developed ground motion datasets using strong-motion and/or broadband data from permanent as well as temporary networks and arrays, as well as hybrid (empirical and simulated) or simulated datasets. We welcome work on new use cases from analyzing ground motion datasets, improving quality control, and on the integration and development of both basic and advanced station metadata (including housing and site characterization). Inspired by the notion of data FAIRness (Findability, Accessibility, Interoperability, and Reuse) of digital assets, we also welcome discussion regarding open data access for seismic data, associated products and metrics related to signal processing and associated site metadata.

Conveners

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Neotectonics and Geohazards of the Interior Alaskan and Canadian Cordillera

Alaska and western Canada is a region of complex tectonic processes, both past and present. This includes lithospheric-scale fault systems, magmatism, and multiple periods of orogenesis. The geologic landscape in Alaska and western Canada is also shaped by geologically recent effects, including multiple glaciations and climate fluctuations, which may obscure signals of tectonic deformation and potentially modulate natural hazards. Future planned experiments and recent advances in geophysical instrumentation promise to resolve many unanswered questions regarding the neotectonics and geohazards of the Cordilleran interior. Specifically, advanced remote sensing technologies and improved seismic and geodetic networks advance our understanding of how and where deformation is accommodated inboard of the active plate margins. New data and methods are helping us determine the locations, geometries, and kinematics of active faults, but debate continues regarding the competing influences of plate boundary forces, gravitational forces, mantle processes, and glacial isostatic adjustment as driving mechanisms.

This session welcomes contributions addressing questions on the structure, dynamics, and hazards of the North American Cordillera, with emphasis on the interior of Alaska and northern Canada. We welcome research spanning disciplines of paleoseismology, geomorphology, numerical modeling, seismicity, earthquake source processes, and geophysical imaging from surface to mantle scales. This session aims to assemble researchers with diverse geoscientific backgrounds to explore and reconcile the main geoscientific interpretations of the region.

Conveners

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Jeremy M. Gosselin, Natural Resources Canada, Sidney (jeremy.gosselin@nrcan-rncan.gc.ca)
Nicolas Harrichhausen, University of Alaska, Anchorage (njharrichhausen@alaska.edu)

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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

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New Directions in Environmental, Seismic Hazard and Mineral Resource Exploration Studies

The identification and assessment of ground displacement hazards, their environmental and social impacts, and mineral resource exploration targets are of growing importance for populations near industrial settings and in urbanized areas. As infrastructure development accelerates, multi-hazard assessments are needed to ensure the safety and sustainability of these regions. New approaches for collecting high-resolution geophysical and geological datasets and advances in methodologies allow us to image the subsurface at increasingly higher resolution. Advances in time-lapse imaging and event detection provide new opportunities for monitoring underground storage sites, changes in aquifer systems, and fault zone properties over time. These advances are key for improving community preparedness and resilience.

This session focuses on new directions in subsurface research for environmental studies, mineral resource exploration, and seismic hazard evaluation, including data collection, methodologies, and the application of dense seismic arrays and other instrumentation. Such studies create new avenues for interdisciplinary research, enabling geoscientists, engineers, and environmental scientists to collaborate and integrate findings across fields. We invite submissions on potential unidentified hazards and environmental impacts in well-researched and in understudied geographic areas. We encourage submissions from early-career researchers, cross-disciplinary approaches, and studies using innovative methodologies such as machine learning and distributed acoustic sensing (DAS).

Conveners

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Valeria Villa, California Institute of Technology (vvilla@caltech.edu)
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Numerical Modeling in Seismology: Theory, Algorithms and Applications

Progress in seismology is unthinkable without continuous developments of theory and numerical-modeling methods. Recent advances in finite-difference, discontinuous-Galerkin, spectral-element and distributional finite-difference methods prove the irreplaceable role of numerical modeling in investigation of earthquake source, earthquake ground motion, seismic ambient noise, and Earth's structure.

We equally invite contributions to numerical-modeling methods and efficient computational algorithms, both in all dimensions, and applications to earthquake phenomena and specific sites of interest. We invite contributors to share their advances in the numerical modeling and understanding of seismic wave propagation, earthquake rupture, earthquake ground motion, and seismic ambient noise. Better understanding of physics of these phenomena based on new observations, seismic data from dedicated networks, and efficient numerical modeling should eventually help to progress in predicting earthquake ground motion.

Recent developments in numerical modeling of seismic waves, earthquake ground motion and rupture propagation aim to account for more realistic rheology as well as geometrical complexity of material interfaces and faults. They also address discretization in time and space and their relations to accuracy and computational efficiency. Remarkable progress in the efficiency and accuracy of finite-difference modeling in seismic exploration poses a useful challenge for numerical modeling in earthquake seismology.

We especially welcome applications to compelling observational issues in seismology.

Conveners

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Performance and Progress of Earthquake Early Warning Systems Around the World

Earthquake early warning (EEW) systems aim to rapidly detect that an earthquake is happening and issue alerts for incoming shaking. Such systems can provide crucial seconds for people and automated systems to take protective actions before shaking arrives, potentially mitigating the impacts of damaging ground motions. The development and operation of EEW systems is a multidisciplinary effort at the intersection of seismology, engineering, and social science. Timely alerting requires both sophisticated network engineering to provide real-time seismic and geodetic observations as well as earthquake characterization algorithms that use small portions of these data to rapidly detect earthquake shaking and estimate ground motion distributions. Social science and emergency management research help determine what alert messages should say and illuminate public perception of the system's performance. Selecting alerting strategies that balance tradeoffs among prediction accuracy, available warning time, and the level of shaking for which users desire alerts requires insight from all disciplines.

There are many EEW systems around the world that are in various stages of operation and development. The details of a given EEW system vary, but system operators look to each other for new ideas and lessons learned from recent earthquakes. This session welcomes contributions across all disciplines of EEW science, including abstracts that discuss the performance of current EEW systems, the development of new EEW approaches, and education and outreach efforts to encourage adoption of these systems.

Conveners

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Predictability of Seismic and Aseismic Slip: From Basic Science to Operational Forecasts

A central problem of earthquake seismology is time-dependent earthquake forecasting. We are currently unable to reliably predict damaging earthquakes --- or the lack thereof --- within relatively short and therefore actionable space and timeframes. It may be that the earthquake nucleation process is complex enough that such prediction is impractical. However, new pieces of the forecasting puzzle continue to accumulate from lab and field experiments, multi-disciplinary observations, theory, physical modeling, advanced computing and machine-learning.

This session welcomes approaches to evaluate constraints on short-timescale forecasting as well as opportunities for the predictability of seismic and aseismic fault slip, fracturing, and their associated processes, such as crustal deformation, aftershocks, fluid flow or geochemical alterations. If the old, central problem of earthquake prediction is too ill-conditioned, how do we integrate across disciplinary boundaries to make progress on more predictable variables and processes?

We welcome a broad range of contributions that provide new perspectives on the predictability of seismic and aseismic slip and associated phenomena. These may include new insights from: lab and field experiments, analyses of aseismic slip or low-frequency earthquakes and their interaction with fast earthquakes, models of fault slip, evaluations of seismicity forecasting models including machine learning models, enhanced earthquake catalogs, advanced computing and machine learning techniques, or integrated predictive modeling of a broad spectrum of phenomena beyond purely seismic slip.

Conveners

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Maximilian J. Werner, University of Bristol (max.werner@bristol.ac.uk)

Recent Advances in Modeling Near-source Ground Motions for Seismic Hazard Applications

In recent years, modeling efforts that characterize the earthquake source in greater detail have enabled a better understanding of earthquake behavior and resulting broadband ground motion. For example, modeling the geometry of fault surfaces and propagation of rupture has helped map source properties into ground motion amplification patterns and variability. This improved accuracy from modeling finite-fault effects can be influential in studies investigating predictions of earthquake ground motions and other downstream efforts involving seismic hazard assessment. Here, we invite studies that model earthquake source processes targeting improved ground shaking via either empirical or simulation-based approaches. Example topics of interest include observations of azimuthally varying ground motion, rupture directivity from both small and large events, polarization of ground motion records, complex source modeling using kinematic or dynamic ruptures, and near-source efforts that study median and ground motion variability terms, isolated in terms of either intra- or inter-event standard deviation. Studies using machine learning methods, utilizing both empirical and synthetic datasets are welcomed as well.

Conveners

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Regional and Global Models of the Deep Structure and Tectonics of Asia

Asia encompasses 10% of the Earth's surface and 30% of its landmass. This region includes prominent examples of the tectonic provinces that drive the evolution of the Earth, from the formation of Archean cratons (e.g., North China) to late-Cenozoic orogens (e.g., the continental collision in Tibet and the oceanic-continental collision in western Indonesia). Recent high-resolution seismic imaging studies have probed the crustal and lithospheric structure of Asia and seismotectonic studies have shed light on Asian geodynamics. This session welcomes all new studies of Asia, continental and marine. Results based on active- and passive-source seismology are encouraged. Investigations of the tectonic evolution of Asia are welcome, along with multidisciplinary studies of lithospheric composition and physical properties. Results from earthquake seismology are encouraged particularly as they pertain to tectonics. Global studies that offer a new perspective on the structure of the Asian lithosphere and deeper mantle are solicited.

Conveners

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Scientific Machine Learning for Forward and Inverse Wave Equation Problems

The synergy between scientific machine learning (SciML) and computational mechanics is transforming our approach to forward and inverse problems governed by complex partial differential equations, particularly in seismic wave propagation. This session brings together experts from various disciplines -including seismology, computational geomechanics and dynamics, and the broader SciML community - to explore cutting-edge methods and real-world applications in this interdisciplinary arena. The goal is to bridge the gap between traditional computational approaches and emerging AI-driven techniques in the modeling and analysis of wave phenomena. We welcome contributions that leverage data-driven and physics-inspired machine-learning techniques to enhance the modeling, simulation, and interpretation of seismic wave phenomena across different fields. Topics of interest include but are not limited to (1) Applications of PINNs in solving forward and inverse wave problems, handling complex boundary conditions and subsurface velocity models; (2) Advancements in neural operators, such as Deep Operator

Networks and Fourier Neural Operators for efficient and accurate wavefield simulations; and (3) Innovative uses of SciML in related fields such as acoustics and ultrasound imaging, elastodynamics, structural health monitoring, planetary seismology, environmental monitoring, and natural hazard assessment. We particularly encourage submissions highlighting how SciML techniques applied to wave equation problems can be adapted or inspire solutions in adjacent fields, fostering the exchange of ideas and methodologies. This session provides a dynamic forum for attendees to discuss theoretical developments, share practical experiences, and identify future research directions that transcend traditional domain boundaries. Through these interactive exchanges, we aim to advance the capabilities of computational models and unlock new potentials in scientific research and engineering applications.

Conveners

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Seismology for the Energy Transition

As the energy transition accelerates toward low- and zero-carbon sources, technologies such as geothermal and hydrogen energy, alongside geologic carbon storage, will be essential to achieving the net-zero emissions goal by 2050. The success of this transformation relies on advanced seismic and non-seismic technologies to optimize the exploration and development of geothermal and hydrogen energy, as well as to ensure safe, long-term geologic carbon storage.

This session invites cutting-edge research on site and reservoir characterization and monitoring, utilizing techniques such as passive and active seismic methods, distributed acoustic sensing (DAS), ambient noise analysis, induced seismicity, advanced sensors, other emerging approaches, and non-seismic techniques. We encourage contributions that explore applications of these techniques in geothermal energy (including hydrothermal, enhanced geothermal systems and superhot geothermal), hydrogen energy development, hydrogen and geothermal storage, and geologic carbon storage. We welcome abstracts on laboratory experiments, numerical modeling, AI and machine learning innovations, and field-scale studies.

Conveners

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Hiroshi Hiroshi, National Institute of Advanced Industrial Science and Technology (AIST) in Japan (h.asanuma@aist.go.jp)
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Station Installations and Site Conditions, a Quest for Improved Strong Motion Database

This session emphasizes the practical challenges related to how seismic data is recorded and to the factors that introduce uncertainties in ground motion databases. Ground Motion Models (GMMs) used in seismic hazard assessment (SHA) often rely on proxies to model site effects. These proxies are often estimated indirectly because of the lack of site characterization of the seismic station used to develop the strong-motion database. Either directly or indirectly assessed, the use of proxies introduce uncertainty in GMMs predictions. Moreover, in empirical GMMs it is often assumed that the earthquakes are recorded at the free surface of the earth, that sensor installation conditions and 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 boreholes or in tunnels) or in an urban environment, errors in the metadata can be found, 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 frequencies. Topics of interest include data processing and data quality control, soil-instrument coupling, soil-structure interactions, depth effects (down-going waves), seasonal variations, topography effects, site effects, site characterization, regional and local attenuation, and small-scale heterogeneity and scattering. Studies demonstrating the value of site instrumentation and characterization in improving site-specific SHA are also encouraged. Studies focusing on improving our current practices in earthquake database implementation or on the enhanced understanding of the high-frequency content of seismic records are particularly welcome.

Conveners

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Zafeiria Roumelioti, Department of Geology, University of Patras (zroumelioti@upatras.gr)
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Temporally Variable Records of Earthquake Behavior and Considerations for Seismic Hazard Analyses

Geologic data used to constrain past earthquakes – geologic slip rates and paleoseismic chronologies – are inherently time-variable data streams due to irregular earthquake occurrence through time. While time-varying by their nature, these records are used to extrapolate and infer long-term fault behavior, most notably in time-independent seismic hazard analyses. We seek submissions discussing new contributions in the field of earthquake geology, particularly studies geared to address time-dependence of geologic slip rates, paleoseismic chronologies and recurrence intervals, regional geologic deformation models, and displacement and/or surface rupture variability at a point through time. We also welcome contributions comparing geologic data to geodetic deformation models to further assess discrepancies rooted in sampling decadal (geodetic) vs. longer (geologic) time scales. We encourage submissions that pose ideas for the implementation of these geologic data in future time-independent and time-dependent seismic hazard model development.

Conveners

Alexandra E Hatem, U.S. Geological Survey (ahatem@usgs.gov)
Belle Philibosian, U.S. Geological Survey (bphilibosian@usgs.gov)
Ashley Streig, Portland State University (streig@pdx.edu)

Testing, Testing 1 2 3: Appropriate Evaluation of New Seismic Hazard and Risk Models

Many models used in earthquake science have societal impact, whether directly such as through insurance premiums calculated on the basis of hazard maps, or indirectly, such as the fault rupture sets which underpin these maps. Frequently, such models are developed initially from a perspective of scientific curiosity rather than downstream application. This session seeks to explore the question of what constitutes appropriate testing and evaluation of models with potential life-safety impact, whether by design or in terms of their future potential. In particular, as observations of earthquakes have become more numerous, more detailed and more precise, the range of earthquake phenomena understood to be possible has continued to expand. In this context, how can we develop methods of evaluation which require models to be both consistent with our (limited) observations to date, and not overly constrained by observation bias? We invite contributions on all aspects of testing and evaluation of models with societal applications, and would particularly welcome speakers interested in these questions as applied to multi-fault, multi-cycle earthquake simulators.

Conveners

Kirsty Bayliss, GEM Foundation, (kirsty.bayliss@globalquakemodel.org)
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Unusual Earthquakes and Their Implications

Many earthquakes challenge paradigms about earth mechanics and pose troubling implications for hazard and risk. Earthquakes can occur in unexpected regions: low shear-stress stable continental interiors; deep in subduction zones where high pressures and temperatures should inhibit brittle failure; and even on the Moon, Mars and other planets. Earthquakes can behave in unusual ways: ruptures can slip "backwards" or propagate in unexpected directions; large earthquakes can happen in rapid succession; or they can happen with multiple slip episodes with rupture speeds faster or slower than expected. Such events often require new physical explanations that push the boundaries of our understanding of seismogenesis and rupture propagation. They also complicate hazard and risk analyses, requiring those models to go beyond standard statistical and physical approaches. We welcome contributions on any unusual or thought-provoking earthquakes.

Conveners

Zhe Jia, University of Texas at Austin (zjia@ig.utexas.edu)
Chris Rollins, GNS Science | Te Pū Ao (c.rollins@gns.cri.nz)
Alice R. Turner, University of Texas at Austin (alice.turner@jsg.utexas.edu)

Visualization and Sonification in Solid Earth Geosciences, What's Next?

The integration of visualization and sonification techniques, leveraging the human auditory and visual systems in tandem, has opened new avenues for understanding complex solid Earth processes and presenting them to a general audience. However, as the volume and complexity of geophysical data continue to grow, traditional high-level methods often fall short in conveying the significance of underlying patterns and insights. This session aims to explore developments in these areas, highlighting innovative methods and applications that enhance data interpretation, accessibility, and communication within and beyond the geoscience community.

We invite contributions that address the following topics:

- Novel visualization/sonification techniques for exploration of basic or high-resolution catalog data, multi-parameter timeseries, or multidisciplinary data.

- Case studies showcasing the impact of visualization/sonification on research, education and outreach.

- Applications of machine learning (ML) and artificial intelligence (AI) in enhancing visualization and sonification processes, applications in which ML/AI algorithms are developed through use of sonification/visualization, and other novel algorithms for mapping data to soundscapes.

- Future directions and challenges in the integration of these techniques in active research, citizen science projects, and public outreach.

Conveners

Julien Chaput, University of Texas, El Paso (jachaput@utep.edu)
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Why Ignore the Structure? Soil-structure Interaction and Site Response at Local and Regional Scales

In regions prone to seismic activity, the execution of reliable site response analyses stands out as a cost-efficient measure during the design phase of critical infrastructure such as buildings, rail and tunneling systems, and power plants and utility networks. The dynamic interactions between structural components and underlying soil layers, known as soil-structure interaction (SSI), impact the overall seismic performance and safety of structures, and are relevant at both site-specific and regional scales.

In this session, we invite researchers and practitioners to contribute to a cohesive understanding of SSI and local site effects, two essential components of seismic design. This session seeks fostering of cutting-edge methodologies and innovative approaches in areas including but not limited to site response analysis (e.g., nonlinear 1D/3D site effects), kinematic and inertial effects of SSI (e.g., numerical and experimental modeling), and their effects on structures with deeply embedded foundations and large footprints (e.g., nuclear power plants). Additionally, we welcome studies investigating the role of physics-based simulations in improving our understanding of SRA and SSI, the complexities of SSI in urban and regional settings, and risk assessments of portfolios of infrastructure assets such as densely built environments or pipeline networks.

Conveners

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