2020 Annual Meeting

Seismological Society of America
Technical Sessions
27–30 April
Albuquerque Convention Center
Albuquerque, New Mexico

PROGRAM COMMITTEE

The Co-Chairs of the 2020 SSA Annual Meeting are Rick Aster of Colorado State University and Brandon Schmandt of University of New Mexico.

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PRELIMINARY SCHEDULE

Monday, 27 April

- Workshops (see page 1097).
- SSA Board of Directors Meeting
- Registration. 3–7:30 PM, Outside Ballroom C
- Welcome Reception. 5–6:30 PM, Ballroom B
- Opening Lecture: Ross S. Stein, Ph.D., CEO & Cofounder of Temblor, Inc. (see page 1100). 6:30–7:30 PM, Room 115

Tuesday, 28 April

- Technical Sessions.
- SSA Luncheon (open to all attendees). Awards Ceremony to follow. Noon–1 PM, Hall 3.
- Mentoring Luncheon (RSVP required with registration). Noon–1 PM, Hall 3.
- SSA Awards Ceremony. 1:15–2:15 PM, Kiva Auditorium.
- Lightning Talks. 6:30–7:30 PM, Kiva Auditorium (see page 1096).
- Early-Career and Student Reception. 7:30–8:30 PM, Ballroom B.

Wednesday, 29 April

- Technical Sessions.
- SSA Luncheon (open to all attendees). Public Policy Lecture to follow. Noon–1 PM, Hall 3.
- Women in Seismology Luncheon (RSVP required with registration). Noon–1 PM, Hall 3.
- Public Policy Lecture. Speaker: Terry Wallace, Director Emeritus, Los Alamos National Laboratory, 1:15–2:15 PM, Kiva Auditorium (see page 1100).
- Joyner Lecture. Lecturer: Julian Bommer, Imperial College of London. 6:15–7:15 PM, Kiva Auditorium (see page 1100).
- Joyner Reception. 7:15–8:45 PM, Outdoor Plaza.
- Special Interest Group: Seismic Tomography 2020: What Comes Next? 8–9:30 PM, Room 215 + 220 (see page 1098).
- Special Interest Group: SOS: Save Our Seismograms. 8–9:30 PM, Room 230 + 235 (see page 1098).

Thursday, 30 April

- Technical Sessions.
- Luncheon. Noon–1:15 PM, Hall 3.

Friday, 1 May

- Field Trips (see page 1099).
- Post-Meeting Workshop (see page 1098).

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EVENTS

Lightning Talks

The Lightning Talks comprise an hour of 10 five-minute talks. The talks start at 6:30 PM on Tuesday, 28 April.

Real-Time, Real Magnitudes, Why We Need GNSS in Earthquake Early Warning

Kathleen Hodgkinson (hodgkinson@unavco.org)

Real-time GNSS measurements indicated the 2019 M7.1 Ridgecrest, California, earthquake was ~M6.9 within 13 seconds of the origin time. Why did it work so well for Ridgecrest? What does GNSS record that seismic doesn't? We make the case for real-time GNSS in EEW.

The M6.4 Indios Sequence from the Trenches

Elizabeth A. Vanacore (elizabeth.vanacore@upr.edu)

Beginning on December 28th, 2019, holiday celebrations Puerto Rico were disrupted by earthquake activity along the Punta Montalva Fault. What followed was a complex earthquake sequence encompassing multiple faults in southwestern Puerto Rico including a M6.4 event on January 7, 2020. This sequence, now called the M6.4 Indios Sequence, included multiple destructive earthquakes and generated fear amongst the local populace. At the Puerto Rico Seismic Network, the staff and students ran a delicate balance between locating events, maintaining operations, communicating with press and public and trying to find time to do the necessary science to provide critical information to emergency responders and government officials. Here the experience of the M6.4 sequence from the point-of-view of the responding regional network, PRSN, will be presented.

Fear and Loathing in Machine Learning

Sarah Albert (salber@sandia.gov)

The popularity of machine learning has increased dramatically in recent years. In seismology, peer-reviewed machine learning research ranges from automated phase picking and event discrimination to the digitizing of analog records. Despite these peer-reviewed studies, there is still a large amount of skepticism surrounding its usefulness. Skeptics argue that there is no way to tie results to the physical properties of a signal, making the whole discipline a "black box" where anything goes. Far from it! Machine learning is a statistical tool that can be powerful when used in the right context. This talk will introduce the statistical theory behind machine learning algorithms with the goal of dissolving the "black box". Steps to aid in determining whether a problem is suited for machine learning and potential applications within the field of seismology will also be discussed. SNL is managed and operated by NTESS under DOE NNSA contract DE-NA0003525.

Multi-Signature Ground- and Space Borne Observations: A Quick Forensic Analysis of the 21 June 2019 Philadelphia Energy Solutions Refinery Explosion

Joshua Carmichael (joshuac@lanl.gov)

On 21 June 2019 08:22 UTC, a fire at an oil refinery in Philadelphia, PA climaxed in the detonation of vaporized propane fuel that produced an explosion and fireball (https://www.youtube.com/watch?v=yCXysi2g61Q). This fireball was resolved in the infrared band of the spaceborne Geostationary Operational Environmental Satellite (GEOS) weather radar (https://www.space.com/philadelphia-refinery-fireball-seen-from-space.html), far above meteorological background levels. Residents located kilometers away from the refinery that did not all witness this fire tweeted that multiple explosions rattled their homes during the time of the fire. While the United States Geological Survey catalogued no earthquakes coincident with this event, seismic and infrasound stations recorded clear waveforms ≤ 177 km from the refinery at times that acoustic waves are predicted to arrive from-source, after the explosion origin time. These seismic waveforms show consistent elliptically-polarized correlation in the 2-10Hz band and provide strong evidence of Rayleigh waveforms. The presence of such seismo-acoustic signals at local distances (≤ 200 km) after the explosion suggests that blast-generated air waves provided the source of these ground-coupled, low group velocity Rayleigh waves. We promote these cumulative space-borne and ground observations that include unconventional sources (Twitter) as a forensic, multi-signature testbed dataset for urban centered explosions on the East Coast.

Crowd-Sourcing Tsunami Warnings with Ship Position Data

Anne F. Sheehan (anne.sheehan@colorado.edu)

The high cost associated with deployment and maintenance of cabled ocean bottom instrumentation and low latency tsunami buoys is a limiting factor to subduction zone-wide expansion of tsunami warning systems. In the interim, non-traditional observation strategies have been suggested including instrumentation of ship traffic in coastal regions. Ships routinely broadcast an automatic identification system (AIS) signal, which is used in vessel tracking and collision avoidance. These AIS signals are picked up by satellites, including the recent proliferation of CubeSat constellations. At any given time there are many tens of ships offshore Cascadia. Here we illustrate what can be done with ship heading and position data in a tsunami data assimilation framework. In the data assimilation method, long used in weather forecasting, real-time observations are continuously assimilated to produce a forecast. In tsunami data assimilation, seafloor pressure data, GPS buoy data, ship position data and other sources can be used to forecast a coastal tsunami, and a tsunami source model is not required. Future observation platforms for these kinds of forecast systems might even include GNSS on floating offshore windfarms.

Oh Moment, Where Art Thou?

Peter M. Powers (pmpowers@usgs.gov)

And other questions arising from a ten year odyssey in National Seismic Hazard Model development. Also, some unapologetic plugs for USGS products.

The Potential of Using Fiber Optic Arrays for Earthquake Magnitude Estimation

Noha S. Farghal (nfarghal@usgs.gov)

Recent work showed the potential of using borehole strainmeter records to estimate earthquake magnitudes and associated ground motions. These recent achievements show the value of the strain measurement in characterizing earthquakes. However, installing a strainmeter in a borehole is costly and not always feasible, since it may not always be possible to drill boreholes in critical locations around faults, especially offshore. Fiber optic sensing technology promises easier and cheaper scalability of measuring strain, providing thousands of strain sensing points with a few meters of optical fiber that can be deployed in telecom pipes and offshore. In this talk, I will showcase the value of strain records in detecting earthquakes and estimating their magnitudes and associated ground motions, and I will briefly discuss the future of fiber optic strain sensing for this application.

What Do You Believe?

Wendy Bohon (bohon@iris.edu)

For years, scientists have assumed that sharing the facts and figures of our scientific research is enough to convince people that the work we do, and the conclusions that we draw, are valid and important. Unfortunately, this tactic doesn't work. Research shows that most people don't make decisions using only facts and logic; they make decisions based on their individual values and belief systems. So how can we tap into people's values belief systems so that they understand, believe and value our science?

Teaching Old Data New Tricks

Thomas A. Lee (thomasandrewlee@g.harvard.edu)

Around the world, hidden away in closets, basements and almost every other storage space imaginable, is an oft overlooked but invaluable resource for seismology, analog seismograms. Seismograms were recorded for much of the 20th century, and while many of these records are still extant today, they are often in danger of deterioration, or worse, being discarded. Many unique and significant events are represented in these data sets, including great earthquakes, volcanic eruptions and above-ground nuclear tests. Additionally, study of long-term processes like the earthquake cycle and climate change greatly benefit from a time series of over a century. With the advances in computer image processing, it is now possible to digitize these records more quickly than ever, and utilize them like almost any other modern digital time series. Here, we present a brief overview of different media used to record/store seismograms, and how analog data can be taken from paper to digital time series for exciting research.

The Great Lisbon Earthquake and the Problem of Evil

Daniel C. Bowman (dbowma@sandia.gov)

According to Gottfried Leibniz, the problem of evil—why bad things happen to good people—was surely solvable, or at least understandable, in this "best of all possible worlds." Then came the Great Lisbon Earthquake of 1755, a catastrophe not only for the city but for philosophy itself. This disaster convinced many that moral and natural law are irrevocably divorced. This separation persists to the present day, but we are not powerless. We cannot prevent earthquakes by changing our thoughts and actions, but we can transform the study of the natural world from exclusive to inclusive—making it open to all of human society. The problem of evil may remain an open question, but human actions can still make the world a better place.

WORKSHOPS

Ally Skills Training

Monday, 27 April 2020, 2–4 PM or 4:30–6 PM
Instructor: Sherry Marts, S*Marts Consulting

In any situation in which you possess social privilege (an unearned advantage over others), you can be an ally to those with less privilege. Being an ally takes understanding privilege and recognizing the subtle behaviors, unspoken rules and unquestioned traditions that perpetuate oppression. It also takes a willingness to take effective action. Allies are key to creating an inclusive culture in any organization or environment. This training will teach you what is needed to be an effective ally and will include learning:

- Why allies are needed and why targets don't speak up.
- How codes of conduct bolster equity and inclusion efforts.
- How to recognize subtle forms of exclusion or harassment.
- Strategies to interrupt and respond to bias and a chance to practice these skills.

Machine Learning

Monday, 27 April 2020, 8:30 AM–12 PM or 1–4:30 PM
Instructors: Youzuo Lin, Los Alamos National Laboratory; Qingkai Kong, University of California, Berkeley; Maruti Kumar Mudunuru, Los Alamos National Laboratory; Daniel Trugman, Los Alamos National Laboratory

Learn how to use machine learning in your research!

The increase in computational capability in the past decade has created new opportunities for machine learning and data science in the seismological fields. This workshop offers an introduction to machine learning concepts and a hands-on look at how to use them in seismological research.

The workshop will cover introductory machine learning topics such as regression, classification, clustering, data cleaning, feature engineering and automatic feature extraction with deep learning. Attendees will then learn about the practical issues that are encountered when applying these methods to waveform and seismicity data.

Understanding and Analyzing Earthquake Catalogs

Monday, 27 April 2020, 1–4 PM
Instructors: Egill Hauksson, Caltech and Southern California Seismic Network; Andrew J. Michael, U.S. Geological Survey; Dmitry A. Storchak, International Seismological Centre

Earthquake catalogs provide deep insights into how the Earth works for our research and are a critical input to seismic hazard assessments. These readily available resources are the result of analyzing seismograms to detect earthquakes, identify wave arrivals and a series of inversions to produce estimates of hypocenters, magnitudes, moments and focal mechanisms. Understanding the strengths and uncertainties of each step is the key to doing excellent work. We will cover 1) the Southern California Seismic Network's real-time and reviewed earthquake catalogs along with special catalogs with refined locations, template matching for increased event detection and focal mechanisms; 2) the International Seismological Centre's global Bulletin, the ISC-EHB Bulletin and the ISC-GEM (Global Earthquake Model) catalogue; 3) the USGS Comprehensive Earthquake Catalog; and 4) catalog visualization tools to uncover artifacts, how to determine the magnitude of completeness and the parameters of the magnitude-frequency distribution.

Writing an Impactful Scientific Paper

Monday, 27 April 2020, 1–4 PM
Instructors: Roland Bürgmann, University of California, Berkeley, *BSSA* associate editor emeritus; John Ebel, Boston College, founding editor-in-chief of *SRL*; Brent Grocholski, *Science*, editor of all seismology papers for the journal.

This workshop will help you learn what goes into writing an excellent peer-reviewed paper and how to be a reliable reviewer for those peers. With examples of good figures, titles and abstracts as a guide, the instructors will demonstrate the elements that go into elevating a research paper to maximize its impact. The roles of the editors, the reviewers, the authors and the journal production staff in the publication process will be discussed. Participants will also get an in-depth look at how to review colleagues' papers in constructive and reliable ways. The free workshop is geared toward students and early-career seismologists, but is open to all Annual Meeting attendees

Borehole and Borehole Array Best Practices, Development and Testing

Friday, 1 May 2020, 8:30 AM–4:30 PM
Instructors: Tim Parker, Nanometrics, Inc.; Pete Davis, University of California, San Diego; Adam Ringler, U.S. Geological Survey; John Collins, Woods Hole Oceanographic Institution; Dave Mencin, UNAVCO

A one day workshop to share information for borehole operators, researchers and developers of the next generation geophysical and hazard monitoring boreholes and borehole arrays. There will be updates on best practices, the potential for new observations, testing of new approaches, recent developments, trends in borehole station array design and applications for significant initiatives. These initiatives include early earthquake warning and tsunami hazards systems. Performance trades related to cost, depth, signal to noise performance, maintenance and expected life of stations are an important consideration for these types of installations. Major borehole topics will include:

- Ocean boreholes and arrays, deep and shallow cased holes
- Global science monitoring networks
- EQ and Geologic hazard monitoring and warning networks
- CTBTO/Nuclear monitoring
- Multi-instrumented and cross disciplinary efforts

SPECIAL INTEREST GROUPS

Seismic Tomography 2020: What Comes Next?

Wednesday, 29 April 2020, 8–9:30 PM
Conveners: Andreas Fichtner, ETH Zürich; Clifford Thurber, University of Wisconsin-Madison

This Special Interest Group encourages SSA members to be involved in shaping and developing the Seismic Tomography 2020 meeting to be held 9–11 October 2020 in Toronto, Ontario. Tomography 2020 aims to be a forum for tomography experts and others working with tomography to present recent findings and evaluate techniques and models. The co-chairs are especially interested in encouraging attendees to come with ambitious ideas for advancing tomography's reach in the geosciences.

SOS: Save Our Seismograms

Wednesday, 29 April 2020, 8–9:30 PM
Conveners: Allison Bent, Natural Resources Canada; Diane Doser, University of Texas El Paso; Garrett Euler, Los

Alamos National Laboratory; Margaret Hellweg, University of California, Berkeley; Lorraine Hwang, University of California, Davis; Kaiwen Wang, Stanford University

Analog seismograms comprise a vast and largely untapped data source, one that is increasingly at risk. The era of analog seismic data spans more than a century, much longer than the current digital era. Although many seismograms have been lost to natural causes as well as willful destruction, there are still many millions of records in existence. All of these are at risk from deterioration and many from pressures related to storage space and its associated costs. Analog data collections range from small personal collections to institutional archives numbering in the millions of seismograms. These data sets are not only hard to access but require innovative approaches to perform any type of modern seismic analysis. To unlock their potential, these records and their associated metadata must be scanned and digitized. Strategies must be developed for standards and data sharing. Digitized legacy seismograms have the potential to enable discoveries in many fields. These include not only seismotectonics and seismic hazard, but also Earth structure from crust to core, induced seismicity, ambient noise, tsunamis, landslides, volcanoes and effects associated with climate change. As this data set is rediscovered, researchers have successfully adapted and applied techniques developed for use with digital data, among which are moment tensor inversion, machine learning, tomography and a myriad of spectral analyses. We invite you to learn more and join our growing community.

FIELD TRIPS

IRIS PASSCAL Instrument Center

Friday, 1 May 2020
Trip Leader: Bob Woodward, Incorporated Research Institutions for Seismology

Half day field trip featuring stops at the IRIS PASSCAL Instrument Center on the campus of New Mexico Institute of Mining and Technology and at the Minerals Museum, along with narration along the bus trip down the Rio Grande valley.

NMT is located in Socorro, NM, ~75 miles south of Albuquerque. The IRIS PASSCAL Instrument Center is an ~40,000 square foot NSF-funded facility that supports the IRIS PASSCAL program by providing what is likely the world's largest instrument depot dedicated to providing seismological instruments for use by the research community. The PASSCAL program has an inventory consisting of thousands of instruments, with a total value exceeding $70 M. The facility consists of warehouse, laboratory and office space. PIC staff can provide tours featuring: discussions describing where and how experiments are done; show the piers, vaults and laboratories used for instrument repair, test and calibration; and tour the warehouse to provide both a sense of scale and a first-hand view of the many different types of instruments in use by the research community today.

Seismotectonics of the Pajarito Fault System and Valles Caldera

Friday, 1 May 2020
Trip Leaders: James P. McCalpin, GEO-HAZ Consulting Inc.; Emily Schultz-Fellenz, Los Alamos National Laboratory; Erika Swanson, Los Alamos National Laboratory; Brandon Crawford, Los Alamos National Laboratory; Robert Givler, Lettis Consultants International Inc.; John Baldwin, Lettis Consultants International Inc.

This field trip travels north from Albuquerque to examine the Pajarito fault system (PFS) in the vicinity of Los Alamos, NM. The PFS is a N-S- striking, predominantly E-dipping normal fault that constitutes the active western boundary of the Neogene Rio Grande rift. Its surface trace has displaced the 1.256 Ma Bandelier Tuff plateau vertically by as much as 200 m (down to the east), creating an impressive but complex surface expression and fault scarp. The Los Alamos National Laboratory lies within the hanging wall of the PFS. Because the PFS dominates the seismic hazard at Los Alamos National Laboratory, especially at longer time periods, paleoseismic studies of the PFS began in the early 1990s (McCalpin, 1998; 1999; Reneau *et al.*, 2002; Gardner *et al.*, 2003; Lewis *et al.*, 2009) and are ongoing (Lettis Consultants International Inc., 2019). At the morning and midday stops, we will discuss the challenges of deriving unambiguous paleoseismic parameters (surface rupture length, displacement per event, recurrence, magnitude) from this bedrock fault scarp in an erosional environment.

Directly west of the PFS lies the Valles-Toledo caldera complex, which is the source of the Bandelier Tuff datum around Los Alamos. This volcanic center remained active through the late Pleistocene. Recent research by LANL staff explores whether the PFS might be more than a simple tectonic normal fault (Swanson *et al.*, 2019); it is possible that the volcano-tectonic systems are more mutually inclusive than previously understood, with possibility of the normal fault influenced or even driven by magmatic events in the caldera system. Afternoon stops will discuss the caldera and volcanic system on the footwall of the PFS and will discuss general principles of volcanic paleoseismology and assessment of volcano-tectonic hazards. The trip returns to Albuquerque via the Jemez Mountains, making a loop that rejoins our outbound route at Bernalillo, slightly north of Albuquerque.

USGS Albuquerque Seismological Laboratory

Friday, 1 May 2020
Trip Leaders: David Wilson, U.S. Geological Survey (dwilson@usgs.gov); Adam Ringler, U.S. Geological Survey (aring-

ler@usgs.gov); Robert Anthony, U.S. Geological Survey (reanthony@usgs.gov)

The U.S. Geological Survey Albuquerque Seismological Laboratory (ASL) is about 15 miles southeast of Albuquerque on the Pueblo of Isleta, adjacent to Kirtland Air Force Base. The ASL was established in 1961 as a seismic instrument design and testing facility, and it is now regarded as one of the top seismic testing facilities in the world. The ASL supports the Global Seismographic Network (GSN) Program and the Advanced National Seismic System (ANSS) through the installation, operation and maintenance of seismic stations around the world and serves as the premier seismological instrumentation test facility for the U.S. Government. The ASL also supports ANSS regional networks and Earthquake Early Warning through the operation of a seismic equipment depot that provides instrumentation to all of the networks of the ANSS. The tour will take you through the ASL operations center, instrument testing centers, the underground testing tunnels and the local GSN station IU-ANMO.

This field trip is open only to U.S. citizens due to visitor restrictions at Kirtland Airforce Base.

TECHNICAL PROGRAM

The 2020 SSA Technical Program comprises oral and poster presentations presented over three days, 27–30 April. The session descriptions, detailed program schedule and all abstracts appear in the following pages.

LECTURES

Opening Lecture

Monday, 27 April, 6:30–7:30 PM, Room 115
Ross S. Stein, Ph.D., CEO & Cofounder of Temblor, Inc.
"From the Loss of the Wager to Aircraft Black Boxes: Discovery, Grit and SSA's Opportunity."

I will argue that the Seismological Society of America should form and lead an international consortium to put a seismic black box in every commercial building in every quake-prone part of the world.

President's Address

Tuesday, 28 April, 1:15–2:15 PM, Kiva Auditorium
Susan Hough will present the President's Address, "SSA is YOU," after the luncheon on Tuesday, 28 April.

Policy Speaker

Wednesday, 29 April, 1:15–2:15 PM, Kiva Auditorium
Terry Wallace, Director Emeritus, Los Alamos National Laboratory
"When Geologic Time and Politics Collide: Assessing Risk for WIPP"

The Waste Isolation Pilot Plant (WIPP) is the nation's only certified nuclear waste repository. The purpose of WIPP is to isolate radioactive waste created in the production of nuclear weapons. The waste has very specific descriptions and is called transuranic waste (TRU). WIPP, located near Carlsbad, NM was chosen to entomb TRU waste in a deep, stable layer of halitic evaporites. WIPP is nearing its original operating capacity and expansion of WIPP is a priority of the Department of Energy. It is assumed that the entombing of the waste will be secure and stable for 10,000 years. This safety requirement begins to encroach on the scale of "geologic time," which juxtaposes unknowables in terms of hazards, human activity and even questions of the future of government. Seismology was central in the original certification for WIPP, and once again, with tremendous rejuvenation of hydrocarbon recovery in the Permian Basin is central to decision to expand WIPP.

Joyner Lecture

Wednesday, 29 April, 6:15–7:15 PM, Kiva Auditorium
Julian Bommer, Imperial College of London
"Are Small Earthquakes a Big Deal?

Earthquake engineering has traditionally focused on protecting society against the effects of large-magnitude earthquakes but in recent years there has been increasing interest regarding the impact of smaller earthquakes. This has been driven partly by the occurrence of some low-magnitude earthquakes that have been cause unexpected levels of damage and particularly by the heightened concern regarding earthquakes of anthropogenic origin. A number of case histories of small magnitude events reported to have caused damage are then reviewed, highlighting in each case the specific factors contributing to the impact—and in some cases arguing that the physical impact may have been exaggerated.

The lecture re-visits the often misunderstood rationale behind the exclusion of smaller magnitude earthquakes from probabilistic seismic hazard analysis as being related to the risk posed by such events. This is followed by a global analysis of small-to-moderate magnitude earthquakes to ascertain the likelihood of these resulting in damage and/or injury, also considering the generally shallower depths of induced events. Consideration is also given to the question of the smallest magnitudes of relevance to hazards other than ground shaking, including liquefaction and surface rupture. The lecture concludes with some insights regarding if and when smaller earthquakes should be a concern as well as discussing the challenges associated with modelling the resulting hazard and risk that such events can pose.

SSA MEETINGS CODE OF CONDUCT

SSA is committed to fostering the exchange of scientific ideas by providing a safe, productive and welcoming environment for all SSA sponsored meeting participants, including attendees, staff, volunteers and vendors. We value the participation of every member of the community and want all participants to have an enjoyable and fulfilling experience.

All participants at SSA meetings are expected to be considerate and collaborative, communicating openly with respect for others and critiquing ideas rather than individuals. Behavior that is acceptable to one person may not be acceptable to another, so use discretion to be sure that respect is communicated.

Unacceptable Behavior

Examples of unacceptable behavior include, but are not limited to:

- Physical or verbal abuse of any kind.
- Threatening or stalking any participant.
- Making inappropriate comments whether verbal or digital related to gender, gender identity and expression, age, sexual orientation, disability, physical appearance, body size, race, ethnicity, religion (or lack thereof), national origin, or other legally protected group status or characteristics.
- Inappropriate use of nudity and/or sexual images or language in public spaces or in presentations.
- Harassment intended in a joking manner still constitutes unacceptable behavior.
- Retaliation for reporting harassment is also a violation of this Code of Conduct, as is reporting an incident in bad faith.

Reporting Unacceptable Behavior

Any participant experiencing or witnessing behavior that at any time in their judgment constitutes an immediate or serious threat to public safety is advised to contact emergency services immediately (for hotel security at the Hyatt Regency Albuquerque, dial 55 from any house phone; for hotel security at the DoubleTree, dial 0 from any house phone; at the Albuquerque Convention Center, dial (505) 768-4590 from any house phone; or 911) and to notify on-site venue security and SSA staff.

If you are the subject of unacceptable behavior or have witnessed any such behavior, you are encouraged to notify an SSA staff member, call 408-647-5811, and write the Executive Director Nan Broadbent by emailing nbroadbent@seismosoc.org. Writing down the details of the incident is also recommended. Requests for confidentiality will be honored to the extent possible.

Consequences

SSA staff (or their designee) or security may take any action deemed necessary and appropriate for any unacceptable behavior, including but not limited to that described above. Possible actions include removal of a participant from the meeting, without refund. Suspension or termination of membership in SSA, denial to participate in future SSA events or meetings, or other action(s) may be taken in SSA's sole discretion, depending on the severity of the unacceptable behavior.

SSA is committed to handling all situations to the best of its ability. However, this Code of Conduct is informational and is not a contract.

Technical Sessions

Advances in Real-Time Operations for Hazards Monitoring

Real-time GNSS data are being incorporated into earthquake and tsunami early warning systems, space weather monitoring and near real-time meteorological forecasting. The upgrading of decades-old GNSS networks to real-time systems combined with the ability of NTRIP casters to distribute data streams from multiple networks is creating hemispherical-scale GNSS networks. For real-time GNSS to become an integral part of monitoring systems the networks must have redundant data flow paths, reliable power and latencies on the order of tenths of a second. This, and the interest in integrating existing GNSS, seismic and meteorological networks combined with the push of data processing to the network edge points has created a new set of challenges in network operations, data management and real-time data analysis.

This session provides an opportunity for network operators and researchers to discuss these challenges. We encourage presentations that discuss the merging of geophysical networks, the use of cloud technology to manage data flow and data processing and the development of real-time analytics and machine-learning algorithms to monitor the state of health of the networks and detect transients in the incoming data.

Conveners: Kathleen M. Hodgkinson, UNAVCO (hodgkinson@unavco.org); David J. Mencin, UNAVCO (dmencin@unavco.org)

Advances in Seismic Imaging of Earth's Mantle and Core and Implications for Convective Processes

Global, regional and local scale seismic array data and improved imaging methods are providing increasingly detailed constraints on the heterogeneous structure of Earth's mantle and core. Heterogeneity is documented by seismic properties such as isotropic wave speeds, anisotropy, attenuation, scattering and the topography, polarity and sharpness of reflective interfaces. These seismic results have implications for how the convection systems in the two largest layers of the Earth operate and potentially interact. We seek contributions that advance knowledge of the internal properties and boundaries of distinctive sub-layers ranging from the lithosphere to the inner core. Studies that use new seismic imaging results to test hypotheses related to thermal and compositional boundary layers, phase transitions, compositional mixing, the role of fluids and active deformation are especially encouraged.

Conveners: Alan Levander, Rice University (alan@rice.edu); Fenglin Niu, Rice University (niu@rice.edu); Peter Shearer, University of California, San Diego (pshearer@ucsd.edu); Brandon Schmandt, University of New Mexico (bschmandt@unm.edu)

Advances in Seismic Interferometry: Theory, Computation and Applications

Seismic interferometry extracts information from the ambient seismic field and enables imaging in the absence of earthquakes or artificial sources. Recent developments in seismic interferometry have benefited from the increasing availability of continuous records of ambient seismic noise from traditional broadband instruments and emerging new acquisition technologies, such as large-N nodal arrays and distributed acoustic sensing systems. This has opened up the possibility of performing high-resolution tomographic imaging anywhere dense networks are available. In addition to applications in seismic tomography, the potential temporal resolution in continuous seismic records provides the possibility of monitoring the transient changes of subsurface properties for various geological targets such as glaciers, volcanoes, groundwater, reservoirs, active faults, infrastructure and even other planetary bodies. The utilization of continuous seismic records meanwhile demands the development of computer programs capable of handling massive data sets (terabytes to petabytes). We welcome contributions of recent advances in seismic interferometry on a broad range of topics, including (but not limited to) theoretical developments in amplitude measurements and structural inversion, utilization of higher-order cross-correlations, new analyzing techniques and computer programs and novel applications across disciplines.

Conveners: Doyeon Kim, University of Maryland, College Park (dk696@umd.edu); Xiaotao Yang, Harvard University (xiaotaoyang@fas.harvard.edu); Tim Clements, Harvard University (thclements@g.harvard.edu); Ross Maguire, University of New Mexico (rmaguire@unm.edu); Tieyuan Zhu, Penn State University (tuz47@psu.edu); Nori Nakata, Massachusetts Institute of Technology (nnakata@mit.edu); Ved Lekic, University of Maryland (ved@umd.edu); Marine Denolle, Harvard University (mdenolle@g.harvard.edu)

Advances in Upper Crustal Geophysical Characterization

The upper crust plays a critical societal role, from access to clean water to the production of energy to the impact of geologic hazards. It is also our window into the layers below; geophysical variability in the near surface can map into deeper structure if not properly considered. With respect to seismic hazards and earthquake ground motions, variability in near surface geophysical properties can lead to an overall amplification or deamplification of strong ground motions, large lateral variability in site response, as well as resonance at specific ground shaking frequencies. With respect to groundwater, characterizing soil porosity, regolith development and fracture permeability all lead to better estimates of storage potential and groundwater flow rates. Geophysical characterization of the near surface is therefore critical to being able to address these issues. A vast number of methods exists with which to characterize the subsurface from direct methods that measure rock density and seismic velocity in-situ to indirect methods where seismic wave travel times, gravity, resistivity and other parameters are measured at the Earth's surface, and subsurface properties are inferred. We seek contributions that include direct and indirect field observations, laboratory experiments and geophysical theory that link observation and expectation to studies that explore the impact of competing assumptions.

Conveners: Oliver S. Boyd, U.S. Geological Survey (olboyd@usgs.gov); Bill Stephenson, U.S. Geological Survey (wstephens@usgs.gov); Lee Liberty, Boise State University (lliberty@boisestate.edu)

Alpine-Himalayan Alpide Shallow Earthquakes and the Current and the Future Hazard Assessments

Historically, the Alpine-Himalayan seismic belt has been frequently witnessed some of the most destructive earthquakes. This vast area, more than 15,000 km along from the southern margin of Eurasia, extends from Java and Sumatra to the Indochinese Peninsula, the Himalayas, the mountains of Iran, the Caucasus, Anatolia, the Mediterranean, terminating at the Atlantic Ocean.

The seismotectonic and occurrence sequences of earthquakes in each region on the Alpide belt are significant (Jackson and McKenzie,1984; Gupta,1993) and, due to the unique character of these active regions, deserves further attention from the scientific community. Earthquake-prone countries located along the Alpide major deformation belt include Nepal, Pakistan, Afghanistan, Iran, Turkey, Greece, Italy, etc. In last decades, there have been many large earthquake occurrences with magnitude 6 and larger events in the area such as the 2010 Kerman, Iran M6.3; 2012 East Azarbaijan M6.4; 2013 Sistan and Baluchistan, Iran M7.7; 2017 Kermanshah, Iran M7.3; 2011 Van, Turkey M7.2; 2015 Katmandu, Nepal M7.8; and 2015 Badakhshan, Pakistan M7.5 are examples of earthquakes within the Alp-Himalayan region.

The number of disastrous earthquakes in the Alpine areas is high, leading to hundreds of deaths and billions of dollars per year in comparison with similar scale earthquakes in other regions (*e.g.* the more developed countries). For example, in 2017, a M7.3 earthquake struck northern Iraq, causing more than 200 deaths and 1,900 injuries (Aon Benfield, 2017f). In 2018, an Indonesian earthquake of M6.9, killed 460 and displaced 350,000 people; in 2012, a northwest Iran earthquake caused 250 deaths and injured 2,000; and in 2011 in southeastern Turkey, an earthquake killed 200 and injured 1,000. Events within the Alp-Himalayan seismic belt show a broad range of human, social, financial, economic and environmental damage, with a potentially long-lasting, multi-generational effects (OECD, 2018).

Conveners: Zoya Farajpour, The University of Memphis (zfrjpour@memphis.edu); Shahram Pezeshk, The University of Memphis (spezeshk@memphis.edu); Sinan Akkar, Bogazici University (sinan.akkar@boun.edu.tr); Hadi Ghasemi, Geoscience Australia (hghasemi@gmail.com)

Amphibious Seismic Studies of Plate Boundary Structure and Processes

Recent years have seen a rapid increase in the number of shore-crossing seismic experiments aimed at characterizing seismicity, deformation and structure at continental margins. Many studies use controlled source imaging in conjunction with continuous recordings of natural seismic sources. Examples of data integration include using ocean-bottom seismometer data in both disciplines and combining results from shallower, high-resolution imaging with deeper, lithospheric-scale studies to understand structures that influence seismicity and plate boundary processes. We invite contributions from the community of seismologists studying plate boundary processes at the transition from onshore to offshore (ocean or lake) environments, including subduction zones, active or relict rifted margins and transform faults.

Conveners: Jenny Nakai, University of New Mexico (jenakai@unm.edu); Lindsay Lowe-Worthington, University of New Mexico (lworthington@unm.edu); Anne Trehu, Oregon State University (anne.trehu@oregonstate.edu)

Applications and Technologies in Large-Scale Seismic Analysis

The growth and maturation of technologies that make it easier to analyze large volumes of data has enabled new areas of research in seismology. Computational frameworks like Apache Spark and Dask augment existing tools like MPI. New programming languages like Julia and the emergence of new scalable analysis capabilities in languages like Java and Python supplement traditional languages like C and Fortran. Finally, new platforms like the commercial cloud offer alternatives to existing high performance computing platforms. Technologies like these increase accessibility to a new scale of inquiry, making large-scale research in seismology more tractable than ever before. In this session, we invite researchers and data providers to share work in data-hungry applications, approaches to large data collection, storage and access and experiences with processing platforms and architectures.

Conveners: Jonathan K. MacCarthy, Los Alamos National Laboratory (jkmacc@lanl.gov); Chad Trabant, Incorporated Research Institutions for Seismology (chad@iris.washington.edu)

Back to the Future: Innovative New Research with Legacy Seismic Data

There has been much discussion in recent years about Big Data and within the seismological community, how to cope with its ever-expanding volume of digital data. But there exists a source of yet Bigger Data: historical seismic records. With more than a century of seismic waveform data, there is opportunity to resolve intimate details of, and potentially revolutionize, our understanding of Earth dynamics, including phenomena associated with tectonic and geologic processes, seismic sources, climate change and seismic hazard. The challenge: much of the waveform data is tucked away on analog media such as paper, tape, film or archaic and arcane digital media in holdings that are at risk of being lost forever. These data sets are not only more difficult to physically access and read than their digital counterparts, but often demand innovative approaches to perform any type of modern seismic analysis.

We invite presentations that highlight the discovery, preservation and/or use of seismic datasets spanning multiple decades. Such presentations would include those that address the problems of restoration, digitization and storage of the vast archives of legacy data. We encourage contributions that illustrate the on-going value of legacy data in the general fields of study for which seismographic data have been used and the value of legacy seismographic data in other geophysical disciplines. A few examples include studies of regional or local seismicity, earthquake recurrence and prediction, seismic hazard, climate signatures, inner core rotation and growth and 4D seismic tomography. We also seek contributions that feature efforts in standardizing metadata and image data formats, improving accessibility through rapid scanning, advances in vectorization software and tuned data compression algorithms, efforts in compiling calibrations of seismometers and application of machine learning techniques to directly extract geophysical information from the legacy data.

Conveners: Garrett Euler, Los Alamos National Laboratory (ggeuler@lanl.gov); Brian Young, Sandia National Laboratories (byoung@sandia.gov); Ana Aguiar, Livermore National Laboratory (aguiarmoya1@llnl.gov); Thomas Lee, Harvard University (thomasandrewlee@g.harvard.edu); James Dewey, U. S. Geological Survey (jdewey@usgs.gov)

Crustal Stress and Strain and Implications for Fault Interaction and Slip

During earthquake cycles, crustal deformation includes multiple components such as inelastic strain increments associated with earthquakes, elastic strain accumulated in the interseismic period, aseismic slip on some fault sections and viscoelastic strain near and below the brittle-ductile transition depth. Resolving stress and strain distributions in the crust, specifically near fault zones, is essential for a better understanding of deformation processes, fault interactions and providing constraints on fault zone geometry and rheology.

This session focuses on (1) the estimation of the state of stress/strain in different phases of earthquake cycle and (2) the analysis of stress/strain distributions at different spatial and temporal scales by soliciting works based on theory, observations, modeling and laboratory experiments. Contributions are encouraged but not limited to address the following questions:

1. What can we extract from geodetic, geologic, borehole and seismic data regarding the state of stress and strain at regional and local scales?
2. How are stress and strain distributed in laboratory experiments and nature and how can we bridge the two?
3. What are the insights from numerical simulations on the state of stress and to what extent can models help in interpreting observations such as earthquakes or slow slip events?
4. How will spatial stress/strain variations from long-term data compilations improve our knowledge of the motion partitioning across complex fault zone areas, aseismic slip, fault zone structure and earthquake cycles?
5. How can information on the state of stress/strain be used to improve long-term earthquake forecasting and seismic hazard assessments?

Conveners: Niloufar Abolfathian, University of Southern California (niloufar.abolfathian@gmail.com); Thomas H. W. Goebel, University of Memphis (thgoebel@memphis.edu); Mong-Han Huang, University of Maryland (mhhuang@umd.edu)

Cryptic Faults: Assessing Seismic Hazard on Slow Slipping, Blind or Distributed Fault Systems

Characterization of active faults for seismic hazard often relies on the analysis of geomorphic records preserved within the landscape that indicate fault movement. In certain environments, particularly those that are slow (<5 mm/yr) slip rate, blind and distributed fault systems, the tectonic activity leaves subtle tectonic signals within the landscape, challenging the conventional methods of identification and characterization of these fault systems. In recent years, advances in remote sensing, including high-resolution topographic data from lidar and unmanned aerial vehicles, have revolutionized the identification of fault-related features at the Earth's surface and led to increasing confidence in the characterization (fault length, slip rate, recurrence interval) of faults. Recent numerical and experimental models further provide analogues for surficial fault rupture patterns and fault-related features to locate potential faults. In addition, advances in Quaternary geochronology and Bayesian modeling have refined ages of geomorphic and stratigraphic surfaces, resulting in better constraints on the activity of faults. Thus, the recognition of active and potentially active fault traces is expanding, ultimately leading to improved seismic hazard models.

This session will include studies that focus on new data and how methods have been applied to the characterization of cryptic faults. In particular, we welcome presentations on the application of remote sensing, geophysical, modeling and field work techniques, as well as geomorphic or paleoseismic case studies on slow slip rate, blind or distributed fault systems in any tectonic setting.

Conveners: Jessica A. T. Jobe, U.S. Bureau of Reclamation (jjobe@usbr.gov); Stephen J. Angster, U.S. Geological Survey (sangster@usgs.gov)

Data Fusion and Uncertainty Quantification in Near-Surface Site Characterization

Non-invasive methods for site characterization have clear advantages of cost and effort over their invasive counterparts. The inverse problem ill-posedness, however, the inherent complexity of the shallow crust and associated measurement and modeling uncertainties of active and passive surface wave techniques can lead to poor estimations of site properties, which would affect in turn the assessment of earthquake hazard at the site of interest. Recent studies have shown that joint inversion of multiple data-sets recording sub-surface heterogeneities (*e.g.* active and passive data, ground motion recordings) and statistical inference techniques can improve the estimated properties and better quantify associated uncertainties of non-invasive methods. We here invite contributions on the development and/or implementation of state-of-the-art methods in inverse problems, data assimilation and uncertainty quantification, to improve the characterization of near-surface site conditions.

Conveners: Elnaz Esmaeilzadeh Seylabi, University of Nevada, Reno (elnaze@unr.edu); Domniki Asimaki, California Institute of Technology (domniki@caltech.edu); Nori Nakata, Massachusetts Institute of Technology (nnakata@mit.edu); Alan Yong, U.S. Geological Survey (yong@usgs.gov.)

Early Results from the 2020 M6.4 Indios, Puerto Rico Earthquake Sequence

On January 7, 2020 a magnitude 6.4 earthquake occurred 8 km south of Indios, Puerto Rico. This earthquake is part of an ongoing sequence that started on Dec 28, 2019. The sequence includes 11 foreshocks M 4.0 and larger and numerous M 4-5 aftershocks. In the days following the mainshock, seismologists, geologists and engineers mobilized to gather data on the rapidly evolving earthquake sequence. In this session, we hope to bring together experts to discuss early results from the field. We especially encourage presentation of new results that contribute to improved understanding of the hazard posed by the poorly known and potentially tsunamigenic Muertos Trough subduction zone. Potential topics include: 1) high-quality earthquake catalogs, 2) region specific ground motion models, 3) local site amplification, 4) ground failure observations, 5) structural damage observations, 6) fault slip rates and 7) novel and creative methods and parameters that contribute to advancing probabilistic seismic hazard models for Puerto Rico.

Conveners: Daniel McNamara, U.S. Geological Survey (mcnamara@usgs.gov); Elizabeth Vanacore, University of Puerto Rico (elizabeth.vanacore@upr.edu); Alberto Lopez, University of Puerto Rico (lberto.lopez3@upr.edu); Emily Wolin, U.S. Geological Survey (ewolin@usgs.gov)

Earthquake Early Warning: Current Status and Latest Innovations

The field of earthquake early warning (EEW) is expanding, incorporating research from a wide range of other domains including computer science, civil engineering and social science. The number of examples of earthquakes recorded by operational EEW systems continues to grow. The 2019 Ridgecrest sequence, for example, included both the largest main shock and the most energetic aftershock sequence encountered by the US ShakeAlert EEW system. This sequence, along with other large earthquakes *e.g.* in Japan, Mexico and China, provide operational experience and insight into the potential and the limitations of EEW systems. Many challenges remain to maximize the potential of these systems. Unanswered questions range from the scientific (*e.g.*, real-time magnitude estimates of large earthquakes and rupture predictability) to the practical (*e.g.*, how to distribute alerts to the public most efficiently, minimizing data transmission delays).

In this session we welcome abstracts related to all aspects of EEW including, but not limited to, algorithm development, system performance, improved trigger detection/discrimination techniques, network build-out, alerting methods and technology and EEW education and outreach.

Conveners: Angela I. Chung, University of California, Berkeley (angiechung07@gmail.com); Men-Andrin Meier, Caltech (mmeier@caltech.edu)

Earthquake Ground Motion and Impacts

Description: This poster session encompasses earthquake strong ground motion and impact scenarios, methodologies, estimations and simulations, and observations.

Conveners: Richard C. Aster, Colorado State University (rick.aster@colostate.edu); Brandon Schmandt, University of New Mexico (bschmandt@unm.edu)

Earthquake Source Parameters: Theory, Observations and Interpretations

Understanding origin and spatio-temporal evolution of seismicity needs a careful quantitative analysis of earthquake source parameters for large sets of earthquakes in studied seismic sequences. Determining focal mechanisms, seismic moment tensors, static stress drop, apparent stress and other earthquake source parameters provides an insight into tectonic stress and crustal strength in the area under study, material properties and prevailing fracturing mode (shear/tensile) in the focal zone and allows investigating earthquake source processes in greater detail. In addition, studying relations between static and dynamic source parameters and earthquake size is essential for understanding the self-similarity of rupture processes and scaling laws and for improving our knowledge on ground motion prediction equations.

This session focuses on methodological as well as observational aspects of earthquake source parameters of natural or induced earthquakes in broad range of magnitudes from large to small earthquakes, including acoustic emissions in laboratory experiments. Presentations of new approaches to determination of focal mechanisms, seismic moment tensors and other source parameters as well as case studies related to analysis of earthquake source parameters are welcome. We also invite contributions related to scaling of static and dynamic source parameters, to self-similarity of earthquakes and inversions for stress and other physical parameters in the focal zone.

Conveners: Vaclav Vavrycuk, Institute of Geophysics of the Czech Academy of Sciences (vv@ig.cas.cz); Grzegorz Kwiatek, GFZ Potsdam (kwiatek@gfz-potsdam.de)

Environmental and Near Surface Seismology: From Glaciers and Rivers to Engineered Structures and Beyond

Environmental seismology is the study of seismic signals generated at and near the surface created by environmental forces in the atmosphere, hydrosphere or solid Earth. Contributions to this session are welcome on a wide variety of topics including—but not limited to— the seismic signals associated with the microseism, landslides, rock falls, debris flows, lahars, snow avalanches, cliff or pinnacle resonance, river bedload transport, flood events, fluid flow in open and confined channels, water gravity waves or infragravity waves, tides, sea ice variability, glacier stick-slip, iceberg calving, glacier crevassing, subglacial hydrology, hurricanes, tornadoes or anthropogenic sources. Studies focusing on engineering applications are additionally welcome and may include studies of groundwater and remediation, site characterization for geologic and seismic hazard applications, monitoring of critical infrastructure and geotechnical applications. In addition, other processes monitored by seismic waves such as permafrost, groundwater in confined or karst aquifers, glacier mass, using seismometers or DAS (distributed acoustic sensing; fiber-optic seismology) data are welcome. Contributions that seek to conduct monitoring, create physical or statistical models of source processes or systems, detect events, characterize a wave propagation environment or interact with other branches of the Earth or social sciences are additionally encouraged. Submissions running the gamut from site-specific case studies to ongoing methodological advances are warmly welcomed.

Conveners: Bradley P. Lipovsky, Harvard University (brad_lipovsky@fas.harvard.edu); Richard C. Aster, Colorado State University (rick.aster@colostate.edu); Will Levandowski, Tetra Tech, Inc. (will.levandowski@tetratech.com); Jamey Turner, Tetra Tech, Inc. (jamey.turner@tetratech.com)

Exploring Rupture Dynamics and Seismic Wave Propagation Along Complex Fault Systems

Investigations related to how complexities in fault parameters and geometry could potentially impact the behavior of earthquake rupture and affect seismic hazard are areas of active and challenging research. This session will highlight recent advances in rupture dynamics on complex fault systems. We are open to a wide range of studies related to numerical, experimental and observational fault rupture dynamic studies with heterogeneities such as fault geometry, fault roughness, frictional parameters, topography, creeping mechanisms, stress asperities, off-fault material properties, bi-material interfaces and wedge structures along subduction zones. We also encourage contributions on research that explores links between earthquake source physics, tsunami generation/propagation and ground motion variability.

Conveners: Roby Douilly, University of California, Riverside (roby.douilly@ucr.edu); Christos Kyriakopoulos, University of Memphis (ckyrkpls@memphis.edu); Kenny Ryan, Air Force Research Laboratory (0k.ryan0@gmail.com); Eric Geist, U.S. Geological Survey (egeist@usgs.gov); Ruth Harris, U.S. Geological Survey (harris@usgs.gov); David

Oglesby, University of California, Riverside (david.oglesby@ucr.edu)

Explosion Seismology Advances

Explosion sources are an important component of seismology used as a tool to characterize the sub-surface for a variety of applications. For example, in regions of low natural background seismicity, mine blasting can dominate monitoring catalogs and finding and separating these sources from tectonic earthquakes is important for hazard estimation. Recent work using template matching, waveform modeling for moment tensors and combining seismic and acoustic data has shown great success in discriminating explosions from earthquakes and other sources. With the advent of inexpensive and easy to deploy arrays and networks of sensors, the wavefield produced by explosions is being studied with unprecedented detail. We welcome abstracts on explosion source physics, wave propagation, Large-N network design, distributed acoustic sensing (DAS), new sensor technologies, multi-physics data fusion and advanced processing techniques applied to explosion sources.

Conveners: Catherine M. Snelson, Los Alamos National Laboratory (snelsonc@lanl.gov); Robert E. Abbott, Sandia National Laboratories (reabbot@sandia.gov); William R. Walter, Livermore National Laboratory (walter5@llnl.gov); Cleat P. Zeiler, Mission Support & Test Services (zeilercp@nv.doe.gov)

Forthcoming Updates of the USGS NSHMs: Hawaii, Conterminous U.S. and Alaska

The U.S. Geological Survey (USGS) National Seismic Hazard Models (NSHMs) are the bridge between best-available earthquake science and public policy. In the next few years, the National Seismic Hazard Model Project (NSHMP) will complete three model updates: Hawaii (2020), the conterminous U.S. (COUS, 2023) and Alaska (2024?). The Hawaii seismic hazard model was last updated in 1998. The NSHMP is currently in the process of updating this model and held a public workshop in September 2019 to present early findings and solicit feedback from the scientific community. The current status of the model will be presented in this session, as well as preliminary hazard results. The COUS model was last updated in 2018 and includes NGA-East ground motion models (GMMs) in the central and eastern U.S. and basin amplifications in the western U.S. (WUS). The next model update for the COUS will be in 2023 with a focus on updating the WUS source model and subduction zone GMMs. The deadline for publications that the USGS may consider for this update is December 2020. We have also begun to plan for the Alaska NSHM, last updated in 2007.

For this session, we invite contributions relevant to the 2023 COUS and Alaska NSHM updates including, but not limited to: Atlantic and Gulf Coast and other alternative site amplification models, new fault models (WUS and Alaska), UCERF3 update/simplification, NGA-Subduction GMMs, physics-based (3D simulation) ground motion model validation and implementation, non-ergodic aleatory uncertainty, basin models, new geodetic data and inversions, M-area scaling relations and the Alaska megathrust geometry and recurrence.

Conveners: Allison M. Shumway, U.S. Geological Survey (ashumway@usgs.gov); Mark D. Petersen, U.S. Geological Survey (mpetersen@usgs.gov); Peter M. Powers, U.S. Geological Survey (pmpowers@usgs.gov); Sanaz Rezaeian, U.S. Geological Survey (srezaeian@usgs.gov)

From Aseismic Deformation to Seismic Transient Detection, Location and Characterization

The fundamental role that slow earthquake phenomena are playing in our understanding of the physical mechanisms that lead to the preparation and generation of large earthquakes is, by this time, well-defined. Nevertheless, our knowledge about the nature of slow earthquakes and their complex behavior is far from being complete.

The main goal of this session is to provide an overview of the phenomenon in its entirety, from the aseismic to seismic event-components. Specifically, we welcome innovative studies based on the analysis of large data-sets of continuous seismic ground motions and/or geodetic (GPS) recordings.

We aim to focus on the most recent advances in the methodological developments of the detection and location techniques, together with the characterization and interpretation of the related events source characteristics.

We are particularly encouraging contributions that shine a light on the connection between slow and fast earthquakes.

Conveners: Florent Aden-Antoniow, University of Southern California (adenanto@usc.edu); Mariano Supino, Institut de Physique du Globe de Paris (supino@ipgp.fr); Sushil Kumar, Wadia Institute of Himalayan Geology (sushil_rohella@yahoo.co.in)

Full-Waveform Inversion: Recent Advances and Applications

With ever increasing computational resources, full-waveform inversion (FWI) is becoming a more feasible method to study the Earth's interior. There are, however, still many challenges that the method faces. Uncertainty quantification is an open debate, the scaling of cost with the number of modeled sources makes the usage of large datasets expensive, and probabilistic solutions are still in their infancy. The progress of FWI as an imaging method has largely been driven by increased computational resources, development of numerical wave propagation solvers and workflow software developments. FWI has the potential to greatly improve our understanding of the Earth's subsurface, but in order to make further progress, methodological innovations are essential as they can make the progress less dependent on the available computational resources.

In this session we encourage contributions related to technological, algorithmic or other advances of FWI, as well as recent applications of the method.

Conveners: Solvi Thrastarson, ETH Zurich (soelvi.thrastarson@erdw.ethz.ch); Dirk-Philip van Herwaarden, ETH Zurich (dirkphilip.vanherwaarden@erdw.ethz.ch); Carl Tape, University of Alaska Fairbanks (ctape@alaska.edu)

Innovative Seismo-Acoustic Applications to Forensics and Novel Monitoring Problems

Seismic and acoustic sensors are capable of recording ground motion and acoustic waves originating from many phenomena and activities. Besides traditional monitoring of natural environmental phenomena and military activities, seismo-acoustic measurements can also be used to detect, identify, locate, characterize and monitor animal, domestic and industrial processes that generate recordable acoustic, infrasonic and/or seismic waves. Both established and more innovative data analyses can extract useful information from these wavefields. As our homes, factories and communities get smarter, more data is needed, if not required, for safe operation. The information extracted from seismo-acoustic measurements of both persistent and transient activity will improve our state-of-health assessments of these environments. For example, seismo-acoustic signals related to machinery operations can be used to monitor status and specifics of the machinery independently.

We welcome submissions on collection and analysis of seismo-acoustic data and techniques including but not limited to (1) seismo-acoustic monitoring of animal, domestic and industry activities; (2) acoustic and seismic analyses of chemical, ammunition or vapor explosions; (3) multi-signature fusion of seismo-acoustic data with other geophysical signatures; (4) methods to quantify uncertainties of parameter estimates that are derived from observing surficial, transient sources in noisy and cluttered signal environments; (5) special geophysical considerations of human-made environments that can bias source parameter estimates; (6) leveraging unconventional data streams for association and source location that include social media posts; and (7) machine learning applications to acoustic and seismic signals.

Conveners: Chengping Chai, Oak Ridge National Laboratory (chaic@ornl.gov); Joshua D. Carmichael, Los Alamos National Laboratory (josh.carmichael@gmail.com); Monica Maceira, Oak Ridge National Laboratory (maceiram@ornl.gov); Omar Marcillo, Los Alamos National Laboratory (omarcillo@lanl.gov)

InSight Seismology on Mars: Results from the First (Earth) Year of Data and Prospects for the Future

The InSight mission landed on Mars on November 26, 2018 and was the first to place an ultra-sensitive broadband seismometer on the surface of another planet. It will provide key information on the composition and structure of an Earth-like planet that has gone through most of the evolutionary stages of the Earth up to, but not including, plate tectonics. Using seismology, geodesy and heat flow measurement, InSight aims to determine the thickness and structure of the Martian crust and mantle, the size and state of the core, the planet's thermal state and the level of tectonic activity and rate of meteorite impacts.

The two-year (one Mars year) InSight mission ushers in a new era in planetary seismology. In the coming years and decades NASA may launch missions to explore the interiors of our Moon, Venus and the "Ocean Worlds" of the Solar System (*e.g.*, Europa, Enceladus and Titan). Other Space agencies might also launch additional missions with seismometers. While the focus of these mission concepts vary from fundamental geophysics to detection of life and conditions for life, seismological exploration of planetary bodies' interiors is likely to play a key role in understanding planetary state and evolution by helping to determine their thermal and chemical make-up.

We invite contributions that take advantage of the seismic data from the first year on Mars, as well as modeling that looks forward to upcoming data from Mars or other planetary bodies. With data being made available through the IRIS Data Management Center, results from both within and outside the mission science team are welcome.

Conveners: Mark P. Panning, Jet Propulsion Laboratory, Caltech (mark.p.panning@jpl.nasa.gov); Sharon Kedar, Jet Propulsion Laboratory, Caltech (sharon.kedar@jpl.nasa.gov); Bruce Banerdt, Jet Propulsion Laboratory, Caltech (william.b.banerdt@jpl.nasa.gov)

Late-breaking Earthquakes

This poster session accommodates general studies of notable late-breaking earthquakes, including but not restricted to the M_w 7.7 Caribbean earthquake of January 28.

Conveners: Richard C. Aster, Colorado State University (rick.aster@colostate.edu); Brandon Schmandt, University of New Mexico (bschmandt@unm.edu)

Leveraging Advanced Detection, Association and Source Characterization in Network Seismology

In a classic seismic monitoring framework, automatic pickers detect earthquakes, individual detections are associated into events and events are further characterized using routine methods (*e.g.*, single-event locators, magnitude estimators). While this processing structure underlies the operations of the majority of seismic networks, researchers continue to develop novel ways to extract additional earthquake data from continuous waveforms. Template matching is routinely applied to lower detection thresholds. Machine learning algorithms detect earthquake signals and further classify key seismic characteristics (*e.g.*, phase-type). Multiple-event relocation algorithms retrospectively enhance earthquake hypocenter estimates. While many such techniques have vastly improved our understanding of cataloged seismicity, hurdles remain when applying these techniques to real-time systems and therefore they have not been routinely adopted. In this session, we invite submissions that investigate novel earthquake detection and characterization techniques, particularly with a focus on how these could be applied in a real-time environment to regional and global seismic networks.

Conveners: William L. Yeck, U.S. Geological Survey (wyeck@usgs.gov); Kris Pankow, University of Utah (pankowseis2@gmail.com); Gavin Hayes, U.S. Geological Survey (ghayes@usgs.gov); Paul Earle, U.S. Geological Survey (pearle@usgs.gov); Harley Benz, U.S. Geological Survey (benz@usgs.gov)

Mechanisms of Induced Seismicity: Pressure Diffusion, Elastic Stressing and Aseismic Slip

The rise of man-made earthquakes has generated interest from a broad range of scientists and stakeholders. The interest stems from both practical and scientific standpoints, whereby induced seismicity poses a hazard that can potentially be mitigated and also presents an opportunity to learn about earthquakes in an environment where driving mechanisms may be better constrained. Recent advances in seismic and geodetic monitoring has allowed for more detailed observations of anthropogenically induced and triggered seismicity. These observations have revealed more complex interactions beyond effective stress reduction, including aseismic processes and elastic stress effects. A better understanding of the contributions from these processes (as a function of distance and time, as well as flow and elastic parameters) has significant implications for the expected seismic hazard. In addition, seismic hazard assessment is tied to improved characterizations of the primary controlling factors on induced earthquakes (*e.g.* injection volumes and rates, change in reservoir pressure, induced stressing rates).

We solicit studies on any types of induced seismicity around the world, including geothermal, hydrocarbon production, waste-water disposal, CO2 sequestration and gas storage. Case studies from the laboratory to large-N array deployments to field-scales are welcomed. We also seek studies from a wide variety of disciplines that aim to monitor, observe and model injection-induced seismicity. The aim of this session is to bring together numerical, observational and experimental studies on both aseismic and seismic processes associated with induced earthquakes.

Conveners: Matthew Weingarten, San Diego State University (mweingarten@sdsu.edu); Ruijia Wang, University of New Mexico (ruijia@unm.edu); Thomas Göbel, University of Memphis (thgoebel@memphis.edu); Heather R. DeShon, Southern Methodist University (hdeshon@mail.smu.edu); Kyung-Won Chang, Sandia National Laboratories (kchang@sandia.gov)

Near-Surface Effects: Advances in Site Response Estimation and Its Applications

The effects of shallow geological layers and interfaces (within the upper 1-2 km) on the seismic-induced ground motion recorded at the surface have been the focus of numerous studies over the past few decades. However, while the methods for simulating ground shaking have rapidly evolved, making robust 3D calculations feasible for broadband seismograms, the approaches for determining their input parameters at the necessary level of detail still suffer from a range of limitations and uncertainties. Furthermore, it is today recognized that the ground shaking recorded at the surface is also affected by the energy released back to the ground by building structures that might contribute to locally increase or decrease ground motion.

The aim of this session is to present studies dealing with innovative approaches for the investigation of shallow geological layers and interfaces; site response assessment, in particular, considering the spatial variability of seismic ground motion at small wavelengths and uncertainties in site response models and their inputs; and building/city-soil interaction. Studies dealing with the assessment of the attenuation of wave propagation and those focusing on non-linear behavior by making use of arrays of sensors, both in boreholes and in buildings, are particularly welcome. Studies involving innovative applications of horizontal to vertical spectral ratio (HVSR) methods for investigations of shallow geological interfaces, seismic microzonation studies and site response assessment are also encouraged. Furthermore, case studies dealing with local secondary effects due to earthquake shaking, such as liquefaction and landslides, in non-standard situations are also invited.

Conveners: James Kaklamanos, Merrimack College (kaklamanosj@merrimack.edu); Dhananjay A. Sant, The Maharaja Sayajirao University of Baroda (sant.dhananjay-geology@msubaroda.ac.in); Stefano Parolai, Instituto Nazionale di Oceanograffia e di Geofisica Sperimentale (sparolai@inogs.it); Philippe Guéguen, ISTerre, Université Grenoble Alpes / Université Savoie Mont-Blanc/CNRS/IRD/IFSTTAR (philippe.gueguen@univ-grenoble-alpes.fr); Imtiyaz Parvez, CSIR Fourth Paradigm Institute (parvez@csir4pi.in); Hiroshi Kawase, Disaster Prevention Research Institute, Kyoto University (kawase@zeisei.dpri.kyoto-u.ac.jp); Ashly Cabas, North Carolina State University (amcabasm@ncsu.edu)

Numerical Modeling of Rupture Dynamics, Earthquake Ground Motion and Seismic Noise

Faithfully modeling rupture propagation, seismic wave propagation and earthquake ground motion in increasingly complex models of the Earth's interior requires algorithmically advanced and computationally efficient numerical-modeling methods. These methods are often developed in response to challenges imposed by new data but sometimes due to progress in mathematical and numerical methodology itself. Evolution of the HPC infrastructure further facilitates and influences numerical modeling in seismology.

We invite contributions focused on development, verification and validation of numerical-modeling methods as well as important applications of the methods especially to rupture dynamics, seismic wave propagation, earthquake ground motion including non-linear behavior, seismic noise and earthquake hazard.

Applications to compelling observational issues in seismology are especially welcome.

We also encourage contributions on the analysis of methods, fast algorithms, high-performance implementations and large-scale simulations.

Conveners: Peter Moczo, Comenius University Bratislava (moczo@fmph.uniba.sk); Steven M. Day, San Diego State University (sday@sdsu.edu); Jozef Kristek, Comenius University Bratislava (kristek@fmph.uniba.sk); Martin Galis, Comenius University Bratislava (martin.galis@uniba.sk)

Observations from the 2019 Ridgecrest Earthquake Sequence

The M_w 7.1 July 5 mainshock of the 2019 Ridgecrest Earthquake Sequence was the largest earthquake in California in the 20 years since the 1999 M_w 7.1 Hector Mine event and the first major earthquake in southern California since the regional seismic monitoring was expanded to pave the way for earthquake early warning. Over the past 20 years, our community has developed many advances in methods and technology used to observe pre-, co- and post-seismic deformation due to earthquakes. Such advances include the use of aerial and terrestrial lidar, image correlation methods, low-altitude aerial photography, interferometric synthetic-aperture radar (InSAR) and dense deployments of geophysical and geodetic sensors in both permanent and campaign arrays. In addition to augmenting the methods in our collective toolbox, we have learned from other continental strike-slip earthquakes in these intervening 20 years, allowing us to target fundamental questions and high-resolution datasets to characterize earthquake processes and fault behavior. These investigations include, as an example, coupling field and remote-sensing approaches to determine fine-scale slip distributions along and across fault strike to quantify strain partitioning and off-fault deformation. We welcome contributions with direct observations of the 2019 Ridgecrest Earthquake Sequence, including the July 4 M_w 6.4 foreshock event, that elucidate processes specific to this sequence that will help us better understand the behavior of earthquake and fault processes, as well as the characteristics of ground motions from large crustal earthquakes, globally.

Conveners: Alexandra E. Hatem, U.S. Geological Survey (ahatem@usgs.gov); Susan Hough, U.S. Geological Survey (hough@usgs.gov); Christopher W. D. Milliner, Jet Propulsion Laboratory, Caltech (christopher.milliner@jpl.nasa.gov); Sinan Akciz, California State University, Fullerton (sakciz@fullerton.edu); Alana Williams, Arizona State University (amwill25@asu.edu); Timothy Dawson, California Geological Survey (timothy.dawson@conservation.ca.gov)

Ocean Bottom Seismology – New Data, New Sensors, New Methods

The accelerating number of OBS deployments and research incorporating emerging technology such as distributed sensing has propelled marine seismology into a leading role in our field. New developments have opened doors for improving sensors, deployment methods, analysis techniques and calibration and understanding of propagation and noise characterization for the marine environment. We welcome contributions outlining new seafloor seismic deployments, new data sets, new methods and new insights within this growing branch of seismic monitoring and exploration. Whether you're imaging the lithosphere, modeling global or seafloor propagation or focused on offshore seismicity or earthquake early warning, we hope you will contribute to a lively session on expanded marine efforts.

Conveners: Charlotte A. Rowe, Los Alamos National Laboratory (char@lanl.gov); Susan L. Bilek, New Mexico Institute of Mining and Technology (sbilek@nmt.edu); Nathaniel J. Lindsey, University of California, Berkeley (natelindsey@berkeley.edu)

Photonic Seismology

Emerging measurement tools have the potential to expand how we apply seismology to study and monitor Earth systems. Recent advancement in the field of photonics has led to novel sensing methods based on optical interferometry, including Distributed Acoustic Sensing (DAS), which is rapidly becoming a popular tool among seismological research groups worldwide. DAS enables Large-N array seismology in novel and unique spaces such as in boreholes, mines, underneath streets in urban areas and offshore. The main advantages of DAS for seismology include, but are not limited to, high-resolution, long spatial and temporal deployment of sensors, time-lapse repeatability and the unique opportunity to leverage existing fiber infrastructure such as telecommunication cables for geophysics. Because data acquired with DAS instruments contain information on the displacement gradient of a seismic wavefield (*i.e.*, strain), there is a need to develop a fundamental theoretical framework to cope with this new data type. The high spatial resolution and broadband nature of DAS furthermore allows for new data analysis methods or the adaptation of existing Large-N methods to this new data type. This session will span a wide range of topics related to fiber-optic sensing methods in seismology and geophysics, including but not limited to: advancements in optical engineering; developments in theoretical and methodological aspects of fiber-optic sensing; case studies from ongoing fiber-optic sensing experiments worldwide; comparisons between non-inertial and inertial instruments; and insights gained from fiber-optic sensing measurements in the context of other types of seismological/geophysical datasets.

We invite contributions from research related to all aspects of photon-based sensing.

Conveners: Nathaniel J. Lindsey, University of California, Berkeley (natelindsey@berkeley.edu); Patrick Paitz, ETH Zurich (patrick.paitz@erdw.ethz.ch); Verónica Rodríguez Tribaldos, Lawrence Berkeley National Laboratory (vrodrigueztribaldos@lbl.gov)

Recent Advances in Very Broadband Seismology

Observational seismology is fundamentally limited by our ability to record seismic signals across a very large bandwidth. The sensitivity of modern seismic instrumentation to non-seismic noise sources as well as other undesirable signals can limit our ability to record seismic events with high fidelity. The purpose of this session is to communicate recent advances in seismic instrumentation and deployment methods, as well as observations that highlight the heavy demands on instrumentation of very broadband seismology. Abstracts that highlight recent advances, techniques or methods for seismic instrumentation, seismic network advances or advances in earthquake early warning instrumentation are encouraged. We also encourage abstracts that focus on long-period or high-frequency seismology that could show limitations in our ability to record such signals.

Conveners: David Wilson, U.S. Geological Survey (dwilson@usgs.gov); Adam Ringler, U.S. Geological Survey (aringler@usgs.gov); Robert Anthony, U.S. Geological Survey (reanthony@usgs.gov)

Recent Development in Ultra-Dense Seismic Arrays with Nodes and Distributed Acoustic Sensing (DAS)

Recently, ultra-dense seismic deployments, typically consisting of hundreds to thousands of short-period nodal instruments or distributed acoustic sensing (DAS) systems with fiber optic cables, have been widely used in seismological studies. These dense arrays have very close station spacings ranging from several meters to hundreds of meters to record well-sampled and unaliased wavefields in local or regional settings. Data acquired by such dense systems promote the development of new array-based analysis methods to mine seismic wavefields and greatly improve our understanding of fine-scale subsurface properties, microseismic activities and earthquake rupture processes. In this session, we invite contributions from areas that are broadly related to ultra-dense arrays. Example topics include, but are not limited to, novel instrument development, new field experiments with nodal or DAS arrays, high-resolution imaging of subsurface structure, environmental seismology, microseismic detection/relocation, source characterization and related big data processing techniques.

Conveners: Marianne S. Karplus, University of Texas at El Paso (mkarplus@utep.edu); Nori Nakata, Massachusetts Institute of Technology (nnakata@mit.edu); Xiangfang Zeng, Chinese Academy of Sciences (zengxf@whigg.ac.cn); Xiaobo Tian, Chinese Academy of Sciences (txb@mail.iggcas.ac.cn)

Regional Earthquake Centers: Highlights and Challenges

This session highlights the unique observations, opportunities and challenges of regional seismic operation centers. Regional seismic operation centers play an important role in monitoring for natural earthquakes and other phenomena, including induced seismicity. They also play an important role in advancing scientific study, especially as it relates to local and regional seismic hazard and the generation of high-quality seismic data and data products, such as earthquake catalogs. Regional seismic operation centers are also important for communicating hazard and risk to a wide variety of stakeholders, including researchers, emergency management agencies, policy makers, educators, regulators and the general public.

The purpose of the session is to foster collaboration and to communicate advances and challenges of monitoring at a regional scale. We welcome a wide range of contributions spanning science, operations and/or stakeholder engagement. Topics of interest include integrating new technological advances in data acquisition and processing; data policies and data sharing; interactions with stakeholders; and novel education and outreach initiatives. Other topics that highlight current advances and challenges for regional earthquake operation centers are also of interest. We encourage submissions from both large and small regional seismic networks. If you work with real-time data for regional seismic monitoring, we encourage you to submit an abstract.

Conveners: Kristine L. Pankow, University of Utah (pankowseis2@gmail.com); Renate Hartog, University of Washington (jrhartog@uw.edu); Mairi Litherland, New Mexico Bureau of Geology and Mineral Resources (mairi.litherland@nmt.edu); Jeri Ben-Horin, Arizona Geological Survey (jeribenhorin@email.arizona.edu)

Research, Discovery and Education Made Possible by Low-Cost Seismic Equipment

In the past three years, low-cost seismic devices have become very popular among citizen scientists and academic researchers alike. The amateur seismological network (AM) has expanded to become one of the largest online seismic networks at ~1000 online nodes in ~100 countries and continues to expand at a rate of 1-2 nodes per day. The potential has become increasingly apparent for academic seismologists and network operators to leverage data collected and shared from stations maintained by citizen scientists, educators and students. The network has tracked numerous seismic events, from hyperlocal to teleseismic and boasts high station density in locations that are typically regarded as lower priority for an expensive broadband installation. Presently, the AM network finds location and magnitude solutions for more than 50,000 earthquakes per year, many of which are too small or local to be identified by other networks. Low-cost seismic devices—and the AM network as a whole—have great value not only to seismological and geophysical research and network densification, but to education, science communication, structural health monitoring and emergency response applications as well.

This session welcomes contributions from a broad range of subjects including but not limited to: earthquake and aftershock studies, volcano monitoring, cryospheric research, coastal studies, structural monitoring, educational programs, public safety and various other societal benefits made possible by low-cost seismic devices.

Conveners: Ian M. Nesbitt, OSOP Raspberry Shake (ian.nesbitt@raspberryshake.org); Emily Wolin, U.S. Geological Survey (ewolin@usgs.gov); Austin J. Elliott, U.S. Geological Survey (ajelliott@usgs.gov)

Science Gateways and Computational Tools for Improving Earthquake Research

Science gateways allow research communities to access shared data, software, computing services, instruments, educational materials and other resources. Advances in earthquake science are becoming increasingly tied to the ability to fuse and model multiple data types, requiring advances in computational infrastructure. Earthquake scientists must rely on computational laboratories to integrate disparate data sets and perform simulation experiments, particularly because earthquake processes span multiple spatial and temporal scales, ranging from microscopic, millisecond source physics to long-term, global tectonic scales, earthquakes. This session focuses on identifying best technologies and management strategies of science gateways for facilitating data access and science analysis through user interfaces, middleware and community networking capabilities. Abstracts discussing advances in computational infrastructure and data synthesis for enhancing earthquake science, including software, supercomputing, simulation models, sensor technology, heterogeneous data sets, cloud computing, management of huge data volumes and development of community standards are encouraged. Abstracts identifying management strategies and recommendations for analytics software to provide a feedback loop for making science gateways useful are also encouraged.

Conveners: Andrea Donnellan, Jet Propulsion Laboratory, Caltech (andrea@jpl.caltech.edu); Lisa Grant Ludwig, University of California, Irvine (lgrant@uci.edu)

Seismic Imaging of Fault Zones

Material and geometrical properties of the subsurface strongly influence fault-zone dynamics, but are impossible to observe directly. Elastic waves produced by earthquakes, man-made energy sources and environmental disturbances, however, offer diverse signals which can be used to constrain these properties. Imaging fault-zone structures using these signals requires techniques as diverse as the signals themselves and the geometries of observing networks. Robustly interpreting the resulting images challenges seismologists, but also presents information that will help unravel the physics behind hazardous ruptures. In this session, we welcome all contributions pertaining to seismic imaging of fault zones––especially new and improved techniques, case studies and multi-disciplinary surveys.

Conveners: Malcolm C. A. White, University of Southern California (malcolm.white@usc.edu); Hongjian Fang, Massachusetts Institute of Technology (hfang@mit.edu)

Seismicity and Tectonics of Stable Continental Interiors

Perhaps the least understood seismicity and tectonic deformation is that in stable continental interiors far removed from active plate boundaries. Areas of interest include central and eastern North America, northern Europe, Australia and parts of Asia. New understandings of intraplate tectonic activity and corresponding seismicity have been made through a variety of approaches such as increased completeness of earthquake catalogs from local or national-scale monitoring efforts like USARRAY, from new methods of identifying smaller earthquakes from existing data, through analyses of data sets that image subsurface faults, through studies that constrain historical slip on such faults, from examinations of geodetic, geomorphologic and elevation changes, and through improved measurements of local stresses. Complementing these approaches are studies that show that the lower attenuation of ground motions and strong site responses in continental interior regions result in earthquakes having greater impacts than those at plate boundaries.

This session seeks diverse contributions related to intraplate earthquake hazards with goals of describing seismicity, characterizing active faults and/or deformation in stable continental interiors, learning the long-term earthquake histories, assessing potential ground motion impacts, applying lessons learned from induced earthquakes and understanding the mechanisms that cause enigmatic intraplate earthquakes.

Conveners: Anjana K. Shah, U.S. Geological Survey (ashah@usgs.gov); Christine Powell, University of Memphis (capowell@memphis.edu); Will Levandowski, TetraTech (will.levandowski@tetratech.com); Martin Chapman, Virginia Tech (mcc@vt.edu); Maurice Lamontagne, Geological Survey of Canada (maurice.lamontagne@canada.ca)

Understanding Non-Traditional Seismic Tsunami Hazards

Despite its intraplate and strike-slip source mechanism, the 2018 Palu earthquake had a large role in generating a deadly regional-scaled tsunami with run-up field measurements in excess of 4 m. In the Puget Sound and the Georgia Strait near Seattle, Washington, USA and Vancouver, British Columbia, Canada, paleoseismic investigations have begun to unearth shallow crustal faults which may be capable of generating locally damaging tsunami. Splay faults branching from the megathrust, normal faults in the outer rise, thrust faults in the accretionary wedge, strike slip events in plate interiors and seismic ground motion induced landsliding are all capable of generating tsunamis. Historically, however, the majority of tsunami modeling has focused exclusively on the shallow subduction interface. This can largely be attributed to past limits in computational power and our epistemic uncertainty in tsunamigenic processes. Advances in high-performance computing have eased the burden of running detailed and time-sensitive models, allowing for a richer view of seismic and tsunami source processes. Widespread attention, related to recent surprising earthquake and tsunami events, has increased capacity for studying an ever-expanding catalogue of faults and the cascading hazards that can result from their failure. Nevertheless, hazards from off-megathrust faults are currently underrepresented in traditional tsunami hazard assessments.

This session invites papers which aim to improve our limited understanding of the tsunamigenic impact beyond the shallow megathrust interface. Specifically, this session hopes to solicit studies using a broad range of geophysical, geological and oceanographic techniques to characterize non-traditional tsunamigenic processes, as well as estimate the risks imposed in terms of areal extent of impacts to populations and the built environment.

Conveners: Amy L. Williamson, University of Oregon (awillia5@uoregon.edu); Tiegan Hobbs, Natural Resources Canada (tiegan.hobbs@canada.ca); Valerie Sahakian, University of Oregon (vjs@uoregon.edu)

Waveform Cross-Correlation-Based Methods in Observational Seismology

Recent developments in observational seismology rely heavily on the mining of increasingly large datasets through waveform cross-correlation-based techniques to improve signal to noise ratios and extract useful information from continuous seismograms. These include obtaining accurate differential arrival times with waveform correlation analysis for accurate earthquake relocation and 3D seismic tomography, detecting low-magnitude events using array-based waveform matching, extracting empirical Green's functions (*e.g.*, surface and body waves) from cross-correlation of continuous ambient noise waveform and creating virtual sources or receivers from cross-correlating earthquake coda waveforms. In this session, we welcome both methodologically and observationally focused contributions that utilize correlation-based methods to detect repeating earthquakes near creeping faults and volcanoes, relocate microearthquakes and low-frequency earthquakes around seismically active regions and image subsurface structures and monitor their temporal changes with ambient noise and earthquake coda correlation techniques. We hope to provide a platform for discussing how to efficiently apply correlation-based methods to ultra-dense arrays and long-duration continuous waveforms to better extract useful seismic events and image subsurface structures.

Conveners: Zhigang Peng, Georgia Institute of Technology (zpeng@gatech.edu); Esteban J. Chaves, Volcanological and Seismological Observatory of Costa Rica, Universidad Nacional (esteban.j.chaves@una.cr); Marine Denolle, Harvard University (mdenolle@g.harvard.edu); William

Frank, University of Southern California (wbfrank@usc.edu); Taka'aki Taira, Berkeley Seismology Laboratory, University of California, Berkeley (taira@berkeley.edu); Haijiang Zhang, University of Science and Technology of China (zhang11@ustc.edu.cn)

Weathering the Earthquake Storms: Crisis Communication Following Major Events

Earthquake scientists face increasing demand to spring into action following significant earthquakes, not only with scientific response, but also as communicators. The demand for information, from media, partners and other stakeholders, can be overwhelming. Opportunities abound, not only to provide critically important information, but also for potential missteps, in particular when a local population is traumatized by the earthquake(s) they have experienced. Earthquake professionals who have weathered local earthquake storms in recent years have learned important lessons about effective crisis communication. For this session, we welcome contributions from individuals with first-hand experience with crisis communication, as well as contributions focusing on evidence-based investigations of crisis communication and contributions about best practices for "peace time" communication that can pave the wave for effective "war time" communication. We also welcome contributions that focus on operational aftershock focusing and issues associated with the communication of forecasts and their uncertainties to stakeholders and the public.

Conveners: Susan E. Hough, U.S. Geological Survey (hough@usgs.gov); Maurice Lamontagne, Geological Survey of Canada (maurice.lamontagne@canada.ca); Timothy Dawson, California Geological Survey (timothy.dawson@conservation.ca.gov)

What Can We Infer About the Earthquake Source Through Analyses of Strong Ground Motion?

Because the earthquake source cannot be directly observed, we rely on multiple analyses to infer knowledge of the parameters used to describe an earthquake. In this session we would invite presentations that describe methods and results for inferring the properties of the earthquake source, such as, rupture velocity, fracture energy, stress drop (stress parameter), slip-rate functions, critical slip weakening distance, friction, scaling laws, duration, moment rate, spatial heterogeneity, directivity, etc. We encourage presentations that discuss uncertainties in the inferred parameters. We look forward to presentations that link earthquake simulations, both kinematic and dynamic, to generation of near-source ground motions. In particular, analysis of near-source data sets using inversion, arrays or other novel methods are most welcome.

Conveners: Ralph J. Archuleta, University of California, Santa Barbara (ralph.archuleta@ucsb.edu); Greg Beroza, Stanford University (beroza@stanford.edu); Massimo Cocco, Istituto Nazionale di Geofisica e Vulcanologia (massimo.cocco@ingv.it); Joe Fletcher, U.S. Geological Survey (jfletcher@usgs.gov)

Overview of Technical Program

ORAL SESSIONS

Tuesday, 28 April

Time	*Rooms 110 + 140*	*Room 115*	*Rooms 120 + 130*	*Rooms 215 + 220*	*Rooms 230 + 235*	*Room 240*
8:30–9:45 AM	Near-Surface Effects: Advances in Site Response Estimation and Its Applications	InSight Seismology on Mars: Results from the First (Earth) Year of Data and Prospects for the Future	Applications and Technologies in Large-Scale Seismic Analysis		Back to the Future: Innovative New Research with Legacy Seismic Data	Crustal Stress and Strain and Implications for Fault Interaction and Slip
9:45-10:45 AM	Posters and Break (Ballroom)					
10:45 AM–Noon	Near-Surface Effects: Advances in Site Response Estimation and Its Applications (*continued*)	InSight Seismology on Mars: Results from the First (Earth) Year of Data and Prospects for the Future (*continued*)	Applications and Technologies in Large-Scale Seismic Analysis (*continued*)	Weathering the Earthquake Storms: Crisis Communication Following Major Events	Forthcoming Updates of the USGS NSHMs: Hawaii, Conterminous U.S. and Alaska	Crustal Stress and Strain and Implications for Fault Interaction and Slip (*continued*)
Noon–1 PM	Luncheon, Open to All Attendees (Hall Three)					
Noon–1 PM	Mentoring Luncheon, RSVP Required (Hall Three)					
1:15–2:15 PM	SSA Awards Ceremony (Kiva Auditorium)					
2:30–3:45 PM	Near-Surface Effects: Advances in Site Response Estimation and Its Applications (*continued*)	Observations from the 2019 Ridgecrest Earthquake Sequence	Understanding Non-Traditional Seismic Tsunami Hazards	Regional Earthquake Centers: Highlights and Challenges	Forthcoming Updates of the USGS NSHMs: Hawaii, Conterminous U.S. and Alaska (*continued*)	Cryptic Faults: Assessing Seismic Hazard on Slow Slipping, Blind or Distributed Fault Systems
3:45-4:30 PM	Posters and Break (Ballroom)					
4:30–5:45 PM	Near-Surface Effects: Advances in Site Response Estimation and Its Applications (*continued*)	Observations from the 2019 Ridgecrest Earthquake Sequence (*continued*)	Understanding Non-Traditional Seismic Tsunami Hazards (*continued*)	Regional Earthquake Centers: Highlights and Challenges (*continued*)	Forthcoming Updates of the USGS NSHMs: Hawaii, Conterminous U.S. and Alaska (*continued*)	Cryptic Faults: Assessing Seismic Hazard on Slow Slipping, Blind or Distributed Fault Systems (*continued*)
5:45–6:30 PM	Posters and Break (Ballroom)					
6:30–7:30 PM	Lightning Talks (Kiva Auditorium)					
7:30–8:30 PM	Early-Career and Student Reception (Ballroom B)					

Wednesday, 29 April

Time	*Rooms 110 + 140*	*Room 115*	*Rooms 120 + 130*	*Rooms 215 + 220*	*Rooms 230 + 235*	*Room 240*
8:30–9:45 AM	Environmental and Near Surface Seismology: From Glaciers and Rivers to Engineered Structures and Beyond	Earthquake Early Warning: Current Status and Latest Innovations	Advances in Seismic Imaging of Earth's Mantle and Core and Implications for Convective Processes	Mechanisms of Induced Seismicity: Pressure Diffusion, Elastic Stressing and Aseismic Slip	Numerical Modeling of Rupture Dynamics, Earthquake Ground Motion and Seismic Noise	Explosion Seismology Advances
9:45-10:45 AM	Posters and Break (Ballroom)					
10:45 AM–Noon	Environmental and Near Surface Seismology: From Glaciers and Rivers to Engineered Structures and Beyond (*continued*)	Earthquake Early Warning: Current Status and Latest Innovations (*continued*)	Advances in Seismic Imaging of Earth's Mantle and Core and Implications for Convective Processes (*continued*)	Mechanisms of Induced Seismicity: Pressure Diffusion, Elastic Stressing and Aseismic Slip (*continued*)	Numerical Modeling of Rupture Dynamics, Earthquake Ground Motion and Seismic Noise (*continued*)	Explosion Seismology Advances (*continued*)
Noon–1 PM	Luncheon, Open to All Attendees (Hall Three)					
Noon–1 PM	Women in Seismology Luncheon, RSVP Required (Hall Three)					
1:15–2:15 PM	Public Policy Address (Kiva Auditorium)					
2:30–3:45 PM	Exploring Rupture Dynamics and Seismic Wave Propagation Along Complex Fault Systems	What Can We Infer About the Earthquake Source Through Analyses of Strong Ground Motion?	Full-Waveform Inversion: Recent Advances and Applications	Seismic Imaging of Fault Zones	Numerical Modeling of Rupture Dynamics, Earthquake Ground Motion and Seismic Noise (*continued*)	Explosion Seismology Advances (*continued*)
3:45-4:30 PM	Posters and Break (Ballroom)					
4:30–5:45 PM	Exploring Rupture Dynamics and Seismic Wave Propagation Along Complex Fault Systems (*continued*)	What Can We Infer About the Earthquake Source Through Analyses of Strong Ground Motion? (*continued*)	Amphibious Seismic Studies of Plate Boundary Structure and Processes	Advances in Upper Crustal Geophysical Characterization	From Aseismic Deformation to Seismic Transient Detection, Location and Characterization	Innovative Seismo-Acoustic Applications to Forensics and Novel Monitoring Problems
5:45–6:15 PM	Posters and Break (Ballroom)					
6:15–7:15 PM	Joyner Lecture (Kiva Auditorium)					
7:15–8:45 PM	Joyner Reception (Outdoor Plaza)					
8:00–9:30 PM	SIG: Seismic Tomography 2020: What Comes Next? (Room 215 + 220)					
8:00–9:30 PM	SIG: SOS: Save Our Seismograms! (Room 230 + 235)					

Thursday, 30 April

Time	*Rooms 110 + 140*	*Room 115*	*Rooms 120 + 130*	*Rooms 215 + 220*	*Rooms 230 + 235*	*Room 240*
8:30–9:45 AM	Data Fusion and Uncertainty Quantification in Near-Surface Site Characterization	Early Results from the 2020 M6.4 Indios, Puerto Rico Earthquake Sequence	Earthquake Source Parameters: Theory, Observations and Interpretations	Photonic Seismology	Waveform Cross-Correlation-Based Methods in Observational Seismology	Seismicity and Tectonics of Stable Continental Interiors
9:45–10:45 AM	Posters and Break (Ballroom)					
10:45 AM–Noon		Early Results from the 2020 M6.4 Indios, Puerto Rico Earthquake Sequence (*continued*)	Earthquake Source Parameters: Theory, Observations and Interpretations (*continued*)	Recent Advances in Very Broadband Seismology	Advances in Seismic Interferometry: Theory, Computation and Applications	Seismicity and Tectonics of Stable Continental Interiors (*continued*)
Noon–1:15 PM	Luncheon (Hall Three)					
1:30–2:45 PM	Recent Development in Ultra-Dense Seismic Arrays with Nodes and Distributed Acoustic Sensing (DAS)	Early Results from the 2020 M6.4 Indios, Puerto Rico Earthquake Sequence (*continued*)	Earthquake Source Parameters: Theory, Observations and Interpretations (*continued*)	Alpine-Himalayan Alpide Shallow Earthquakes and the Current and the Future Hazard Assessments	Advances in Real-Time GNSS Data Analysis and Network Operations for Hazards Monitoring	Seismicity and Tectonics of Stable Continental Interiors (*continued*)
2:45-3:45 PM	Posters and Break (Ballroom)					
3:45–5:00 PM	Recent Development in Ultra-Dense Seismic Arrays with Nodes and Distributed Acoustic Sensing (DAS) (*continued*)		Leveraging Advanced Detection, Association and Source Characterization in Network Seismology			

POSTER SESSIONS

Tuesday, 28 April

- Advances in Real-Time GNSS Data Analysis and Network Operations for Hazards Monitoring
- Applications and Technologies in Large-Scale Seismic Analysis
- Back to the Future: Innovative New Research with Legacy Seismic Data
- Crustal Stress and Strain and Implications for Fault Interaction and Slip
- Cryptic Faults: Assessing Seismic Hazard on Slow Slipping, Blind or Distributed Fault Systems
- Forthcoming Updates of the USGS NSHMs: Hawaii, Conterminous U.S. and Alaska
- InSight Seismology on Mars: Results from the First (Earth) Year of Data and Prospects for the Future
- Near-Surface Effects: Advances in Site Response Estimation and Its Applications
- Observations from the 2019 Ridgecrest Earthquake Sequence
- Regional Earthquake Centers: Highlights and Challenges
- Understanding Non-Traditional Seismic Tsunami Hazards
- Weathering the Earthquake Storms: Crisis Communication Following Major Events

Wednesday, 29 April

- Advances in Seismic Imaging of Earth's Mantle and Core and Implications for Convective Processes
- Advances in Upper Crustal Geophysical Characterization
- Amphibious Seismic Studies of Plate Boundary Structure and Processes
- Earthquake Early Warning: Current Status and Latest Innovations
- Environmental and Near Surface Seismology: From Glaciers and Rivers to Engineered Structures and Beyond
- From Aseismic Deformation to Seismic Transient Detection, Location and Characterization
- Innovative Seismo-Acoustic Applications to Forensics and Novel Monitoring Problems
- Exploring Rupture Dynamics and Seismic Wave Propagation Along Complex Fault Systems
- Explosion Seismology Advances
- Full-Waveform Inversion: Recent Advances and Applications
- Mechanisms of Induced Seismicity: Pressure Diffusion, Elastic Stressing and Aseismic Slip
- Numerical Modeling of Rupture Dynamics, Earthquake Ground Motion and Seismic Noise
- Seismic Imaging of Fault Zones
- What Can We Infer About the Earthquake Source Through Analyses of Strong Ground Motion?

Thursday, 30 April

- Advances in Real-Time GNSS Data Analysis and Network Operations for Hazards Monitoring
- Advances in Seismic Interferometry: Theory, Computation and Applications
- Alpine-Himalayan Alpide Shallow Earthquakes and the Current and the Future Hazard Assessments
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- Early Results from the 2020 M6.4 Indios, Puerto Rico Earthquake Sequence
- Earthquake Ground Motion and Impacts
- Earthquake Source Parameters: Theory, Observations and Interpretations
- Late-Breaking Earthquakes
- Leveraging Advanced Detection, Association and Source Characterization in Network Seismology
- Ocean Bottom Seismology—New Data, New Sensors, New Methods
- Photonic Seismology
- Recent Advances in Very Broadband Seismology
- Recent Development in Ultra-Dense Seismic Arrays with Nodes and Distributed Acoustic Sensing (DAS)
- Research, Discovery and Education Made Possible by Low-Cost Seismic Equipment
- Science Gateways and Computational Tools for Improving Earthquake Research
- Seismicity and Tectonics of Stable Continental Interiors
- Waveform Cross-Correlation-Based Methods in Observational Seismology

Program for 2020 SSA Annual Meeting

Presenting author is indicated in bold.

Tuesday, 28 April—Oral Sessions

Time	*Rooms 110 + 140*	*Room 115*	*Rooms 120 + 130*
	Near-Surface Effects: Advances in Site Response Estimation and Its Applications (see page 1267).	**InSight Seismology on Mars: Results from the First (Earth) Year of Data and Prospects for the Future** (see page 1252).	**Applications and Technologies in Large-Scale Seismic Analysis** (see page 1178).
8:30 AM	Seismic Structure Beneath Los Angeles from the BASIN Experiment. **Persaud, P.**, Clayton, R. W., Ghose, R., Li, Y., Wang, X., Denolle, M. A., Polet, J., *et al.*	Results from the InSight Mission After a Year and a Half on Mars. **Banerdt, W. B.**, Smrekar, S. E., Lognonné, P., Giardini, D., Pike, W. T., *et al.*	MsPASS: A Parallel Processing Framework for Seismology. **Wang, Y.**, Pavlis, G.
8:45 AM	Estimating Site Velocity Characteristics for Strong Motion Stations in Anchorage, Alaska. **Thornley, J.**, Douglass, J., Dutta, U., Yang, J.	18 Months of Mars Seismic Monitoring with SEIS: First Constraints on the Interior Structure of the Crust and Interaction of Mars Interior and Surface with Mars Atmosphere. **Lognonné, P.**, Banerdt, W. B., Giardini, D., Pike, W. T., Beucler, E., *et al.*	INVITED: STUDENT: Seismology in the Cloud: Prospects and Applications. **Clements, T.**
9:00 AM	STUDENT: A Taxonomy for Site Complexity Using the HVSR: Application to the KiK-Net Database. **Pontrelli, M. A.**, Baise, L. G., Kaklamanos, J.	Seismicity of Mars. **Giardini, D.**, Lognonné, P., Banerdt, W. B., Böse, M., Ceylan, S., *et al.*	STUDENT: Expanding Accessibility and Scalability of Ambient Noise Seismic Data Processing Tools Through an Open-Source Cloud-Based Software Application. **Sukianto, T.**, Mikesell, T. D., Clements, T., Denolle, M. A.
9:15 AM	STUDENT: An H/V Geostatistical Approach to Account for Spatial Variability in 1D Seismic Site Response. **Hallal, M. M.**, Cox, B. R.	First Receiver Functions on Mars – Constraints on the Martian Crust from InSight. **Knapmeyer-Endrun, B.**, Bissig, F., Compaire, N., Joshi, R., Garcia, R., *et al.*	INVITED: STUDENT: Reducing the Time to Science of Ambient Noise Tomography with ANXCOR and Kubernetes. **Mendoza, K. A.**, Baker, B.
9:30 AM	Empirical Horizontal Site Amplification Factor (HSAF) from Observed Earthquake Horizontal-to-Vertical Ratio (EHVR) and Vertical Amplification Correction Function (VACF). Ito, E., **Kawase, H.**, Nakano, K.	Analyzing the Martian Near-Surface and HP3 Mole Condition with Seismic Data at the InSight Landing Site. **Schmelzbach, C.**, Brinkman, N., Sollberger, D., Kedar, S., Grott, M., *et al.*	Interactive Large-Scale Seismic Noise Analysis in the Cloud Using Xarray, Dask and Zarr. **MacCarthy, J. K.**, Marcillo, O. E.
9:45–10:45 AM	Posters and Break (Ballroom)		

Time	*Rooms 215 + 220*	*Rooms 230 + 235*	*Room 240*
		Back to the Future: Innovative New Research with Legacy Seismic Data (see page 1181).	**Crustal Stress and Strain and Implications for Fault Interaction and Slip** (see page 1184).
8:30 AM		STUDENT: CHIMP: A 162 Year Dataset of Consistently Reinterpreted Seismic Intensities in California and Implications for Hazard Assessment. **Salditch, L.**, Gallahue, M. M., Hough, S. E., Stein, S., Lucas, M. C., *et al.*	Earthquake Nucleation and Global Induced Stress Field by Precedent Large Earthquakes Since 1900. **Hong, T.**, Lee, J.
8:45 AM		1906 Revisited: Analyses of Shaking and Ground Failure. **Wald, D. J.**, Allstadt, K. E., Thompson, E. M., Knudsen, K. L., Schmitt, R. G.	STUDENT: Variations of Stress Parameters in the Southern California Plate Boundary Around the South Central Transverse Ranges. **Abolfathian, N.**, Martínez-Garzón, P., Ben-Zion, Y.
9:00 AM		The Importance, Challenges and Applications of Old Seismic Data for Modern Seismic Hazard Analysis. **Cassidy, J. F.**, Bent, A. L.	STUDENT: What Controls Variations in Aftershock Productivity? **Dascher-Cousineau, K.**, Brodsky, E. E., Lay, T., Goebel, T. H. W.
9:15 AM		New InSights into Fluid Injections and Induced Microseismicity from Legacy Data. **House, L.**, Fehler, M., Rodi, W. L., Phillips, W. S., Roberts, P. M.	INVITED: STUDENT: Combining Seismological Inferences to Constrain Physical Conditions Surrounding the Low Stress, Low Heat Operation of Mature Faults. **Lambert, V.**, Lapusta, N.
9:30 AM		STUDENT: Seismic Signals from Sandia National Laboratory's Z Machine and Time-Dependent Velocities in the Albuquerque Basin. **Stairs, R. K.**, Schmandt, B.	Synthetic Seismicity in New Zealand. **Fry, B.**, Nicol, A., Gerstenberger, M., Williams, C., Shaw, B. E., *et al.*
9:45–10:45 AM	Posters and Break (Ballroom)		

Time	*Rooms 110 + 140*	*Room 115*	*Rooms 120 + 130*
	Near-Surface Effects: Advances in Site Response Estimation and Its Applications (continued).	**InSight Seismology on Mars: Results from the First (Earth) Year of Data and Prospects for the Future** (continued).	**Applications and Technologies in Large-Scale Seismic Analysis** (continued).
10:45 AM	Ground-Motion Site Response and New Physics-Based Site Correction Factors for Design Response Spectrum. **Wang, Z.**, Carpenter, S., Woolery, E. W., Kalinski, M. E.	STUDENT: Searching for Seismic Sources Around the InSight Landing Site: Focus on Sol 173 and 235 Marsquakes. **Jacob, A.**, Brinkman, N., Perrin, C., Fuji, N., Stähler, S., *et al.*	Building Seismo-Acoustic Pipelines with SAPL. **Heck, S. L.**, Young, C.
11:00 AM	Sensitivity of Site Response Analyses to Input Motion Selection: Lessons Learned from Seattle and Boston. **Kaklamanos, J.**, Chowdhury, I. N., Cabas, A., Kottke, A. R., Gregor, N.	Autocorrelation Reflectivity of the Martian Interior from InSight Data. Deng, S., **Levander, A.**	Supporting Large-Scale Seismological Research. **Carter, J. A.**, Trabant, C., Benson, R., Casey, R., Sharer, G.
11:15 AM	Deep Learning for Site Response Estimation from Geotechnical Array Data. **Roten, D.**, Olsen, K. B.	Today Antarctica, Tomorrow Europa: Testing Broadband Seismometers in Icy Earthly Analogs. **Hobbs, T. E.**, Hughson, K. H. G., Quartini, E. S., Schmidt, B. E., Panning, M. P., *et al.*	Using the SCEDC Cloud Archive for Research with Big Data. **Yu, E.**, Chen, S., Bhaskaran, A., Bhadha, R., Ross, Z., *et al.*
11:30 AM	STUDENT: High-Resolution Site Response Study of the Los Angeles Basin from the 2019 Ridgecrest Earthquake Sequence. **Filippitzis, F.**, Kohler, M., Heaton, T., Clayton, R. W., Guy, R., *et al.*	Seismology on Titan: A Seismic Signal and Noise Budget in Preparation for Dragonfly. **Panning, M. P.**, Lorenz, R. D., Shiraishi, H., Yamada, R., Stähler, S., *et al.*	Orfeus Services for High-Quality Seismic Waveform Data Access in Pan-Europe. **Cauzzi, C.**, Bieńkowski, J., Custódio, S., Evangelidis, C., Guéguen, P., Haberland, C., *et al.*
11:45 AM	STUDENT: Site Response Analyses of U.S. Geological Survey Seismic Stations Deployed After the M6.4 and M7.1 Ridgecrest Earthquakes. **Hudson, K. S.**, Gospe, T., Yong, A., Fletcher, J. B., Cochran, E. S., *et al.*	The Lunar Geophysical Network Mission. **Weber, R. C.**, Neal, C., Banerdt, W. B., Beghein, C., Chi, P., *et al.*	Flexible Analysis of Earthquake Datasets Using a Modular, High-Throughput Seismic Processing System. Safarshahi, M., **Morozov, I.**
Noon–1:00 PM	Luncheon, Open to All Attendees (Hall Three)		
	Mentoring Luncheon, RSVP Required (Hall Three)		
1:15–2:15 PM	SSA Awards Ceremony (Kiva Auditorium)		
	Near-Surface Effects: Advances in Site Response Estimation and Its Applications (continued).	**Observations from the 2019 Ridgecrest Earthquake Sequence** (see page 1287).	**Understanding Non-Traditional Seismic Tsunami Hazards** (see page 1319).
2:30 PM	STUDENT: 2D Numerical Investigation on the Effect of Random Velocity Perturbations on Seismic Ground Motion: Application to Site Effect Assessment in the Nice (France) Sedimentary Basin. **Tchawe, F. N.**, Gélis, C., Bonilla, L., Rohmer, O., Bertrand, E.	Evidence of Previous Late Quaternary Faulting Along the 2019 Ridgecrest Earthquake Ruptures. **Jobe, J. A. T.**, Philibosian, B. E., Chupik, C. M., Dawson, T. E., Gold, R. D., *et al.*	Asteroids Impacting Earth's Oceans: Tsunami Generation, Consequences on Coastlines and Potential Global Climate Effects. **Ezzedine, S. M.**, Oman, L.

Time	Rooms 215 + 220	Rooms 230 + 235	Room 240
	Weathering the Earthquake Storms: Crisis Communication Following Major Events (see page 1327).	**Forthcoming Updates of the USGS NSHMs: Hawaii, Conterminous U.S. and Alaska** (see page 1233).	**Crustal Stress and Strain and Implications for Fault Interaction and Slip** (continued).
10:45 AM	Taking the Hazard Out of Hazard Communication. **Bartel, B.**, Bohon, W., Stovall, W.	Finalizing the 2020 National Seismic Hazard Model for Hawaii. **Petersen, M. D.**, Shumway, A. M., Powers, P. M., Mueller, C. S., Moschetti, M. P., *et al.*	Scales of Stress Heterogeneity Near Active Faults in the Santa Barbara Channel, Southern California. **Persaud, P.**, Pritchard, E., Stock, J.
11:00 AM	Challenges and Opportunities for Communication During an Energetic Aftershock Sequence: The 26 November 2019 M6.4 Albanian Earthquake. **Bossu, R.**, Landès, M., Roussel, F., Roch, J., Fallou, L., *et al.*	New Zealand National Seismic Hazard Model 2021 Revision. **Gerstenberger, M.**	INVITED: Complexity Breeds Complexity: Heterogeneous Stress State Around the Southern Big Bend of the Southern San Andreas Fault, California. **Cooke, M. L.**, Elston, H., Hatch, J. L.
11:15 AM	The California Earthquake Clearinghouse – Ridgecrest Earthquake Sequence July 2019. **Pridmore, C. L.**, Thomas, K., Ortiz-Millan, M.	Basin Amplification Factors and Probabilistic Seismic Hazard Maps for Seattle, Washington Based on 3D Simulations of Subduction-Zone and Crustal Earthquakes. **Frankel, A.**, Wirth, E., Marafi, N.	Antithetic Surface Deformation on Nearby Faults from the Ridgecrest Earthquakes: Compliant Faults Zones or Triggered Slip? **Xu, X.**, Ward, L., Smith-Konter, B., Milliner, C. W. D., Bock, Y., *et al.*
11:30 AM	Keeping Up with Public Demand for ANSS Earthquake Information. **Fee, J.**, Martinez, E.	Updating the U.S. Geological Survey National Seismic Hazard Model for Alaska. **Powers, P. M.**, Mueller, C. S., Haeussler, P., Witter, R., Bender, A.	Complex Dynamics of Seismic Bursts in Southern California: Is "Radial Localization" a Signature of Increasing Regional Tectonic Stress? **Rundle, J. B.**
11:45 AM	Adventures in Social Seismology: Empirical Investigations of Human Behavioral Response in Earthquakes Using Data from 'Did You Feel It?'. **Goltz, J. D.**	The Need for Alaska-Specific Ground Motion Models for Updating U.S. Geological Survey Alaska Seismic Hazard Maps. **Cramer, C. H.**, Jambo, E.	Estimation of Time-Dependent Strain-Rates with Gaussian Process Regression. **Hetland, E. A.**, Szymanski, E. D., Hines, T. T.
Noon–1:00 PM	Luncheon, Open to All Attendees (Hall Three)		
	Mentoring Luncheon, RSVP Required (Hall Three)		
1:15–2:15 PM	SSA Awards Ceremony (Kiva Auditorium)		
	Regional Earthquake Centers: Highlights and Challenges (see page 1304).	**Forthcoming Updates of the USGS NSHMs: Hawaii, Conterminous U.S. and Alaska** (continued).	**Cryptic Faults: Assessing Seismic Hazard on Slow Slipping, Blind or Distributed Fault Systems** (see page 1188).
2:30 PM	INVITED: Keeping the Promise of Earthworm. **Aikin, K. E.**	INVITED: NGA-Subduction Research Project. **Bozorgnia, Y.**, Abrahamson, N. A., Ahdi, S. K., Ancheta, T., Archuleta, R. J., *et al.*	The Doty Fault Zone: A Cryptic Fault in Southwest Washington. **Anderson, M. L.**, Lau, T., von Dassow, W., Reedy, T., Sadowski, A., *et al.*

Tuesday, 28 April (*continued*)

Time	Rooms 110 + 140	Room 115	Rooms 120 + 130
	Near-Surface Effects…	**Observations from the 2019…**	**Understanding Non-Traditional…**
2:45 PM	INVITED: A Simulation Platform to Quantify the Effects of Spatial Variability in Site Response for PSHA. **Asimaki, D.**, Ayoubi, P., Kusanovic, D. S., Kottke, A. R.	SAR Imaging of the Coseismic and Postseismic Deformation from the 2019 M7.1 and M6.4 Ridgecrest Earthquakes in California. **Fielding, E. J.**, Stephenson, O., Zhong, M., Sangha, S. S., Liang, C., *et al.*	Forecasting the Impact of Tsunamis from the Alaska-Aleutian Subduction Zone in Southern California Under Rising Sea Levels. **Dura, T.**, Garner, A., Weiss, R., Kopp, R., Engelhart, S., *et al.*
3:00 PM	Quantifying Seismic Amplification on Topography in New Zealand and Its Relationship to Landslide Occurrence: First Steps Under New Zealand's Resilience Challenge Programme. **Kaiser, A. E.**, Massey, C., Pisciutta, M., Fry, B., Nicol, A.	INVITED: Crustal Deformation Before, During and After the 2019 Ridgecrest Earthquakes from Campaign and Continuous GNSS Data. **Funning, G. J.**, Floyd, M. A., Terry, R., Fialko, Y., Hammond, W., *et al.*	INVITED: California Reviews Non-Traditional Tsunami Sources as Analogies for Future Statewide Tsunami Hazard Analyses. **Patton, J. R.**, Wilson, R. I., Dengler, L., Graehl, N., Bott, J., *et al.*
3:15 PM	Topographic Amplification of Ground Motions in Mt. Pleasant, Christchurch, New Zealand. **Jeong, S.**, Mohammadi, K., Asimaki, D., Bradley, B. A., Wotherspoon, L. M.	Development of a Geodetic-Based Probabilistic Fault Displacement Hazard Analysis Using Near-Field Geodetic Imaging Data: Examples from the 2019 Ridgecrest Earthquake Sequence. **Milliner, C. W. D.**, Chen, R., Donnellan, A., Morelan, A., Dolan, J., *et al.*	Lisbon 1755: A Tsunami Earthquake? **Fonseca, J.**
3:30 PM	Impact of Projected Climate-Driven Sea Level Rise on Liquefaction Vulnerability in Charleston, South Carolina. **Ghanat, S. T.**	Targeted High-Resolution Structure from Motion Observations Over the M6.4 and M7.1 Ruptures of the Ridgecrest Earthquake Sequence. **Donnellan, A.**, Lyzenga, G. A., Ansar, A., Goulet, C. A., Wang, J., *et al.*	On the Origin of Tsunami Energy Upon Deformation of the Ocean Floor. **Okal, E. A.**, Synolakis, C.
3:45–4:30 PM	Posters and Break (Ballroom)		
	Near-Surface Effects: Advances in Site Response Estimation and Its Applications (continued).	**Observations from the 2019 Ridgecrest Earthquake Sequence** (continued).	**Understanding Non-Traditional Seismic Tsunami Hazards** (continued).
4:30 PM	STUDENT: Simultaneous Algebraic Reconstruction Technique (SART) for Retrieving Shear-Wave Quality Factor Qs Profiles Using Seismic Noise. **Dreossi, I.**, Parolai, S.	The Complex, Multi-Fault Rupture Process of the 2019 Ridgecrest, CA Earthquakes: A Simultaneous Kinematic Model. **Goldberg, D. E.**, Melgar, D., Sahakian, V. J., Thomas, A., Xu, X., *et al.*	Detectability and Tsunami Forecasting Capabilities of GNSS Earthquake Source Products for Tsunamigenic Splay, Outer Rise and Strike-Slip Earthquakes. **Williamson, A. L.**
4:45 PM	INVITED: On the Use of the High-Frequency Spectral Decay Parameter (κ0) to Constrain Large Strain Site Response Analysis. **Rathje, E.**	Observed Surface Wave Energy in the Los Angeles Basin Induced by the 6 July 2019 M7.1 Ridgecrest Earthquake. **Meza-Fajardo, K. C.**, Aochi, H., Papageorgiou, A. S.	The 1810 Loreto Tsunami Triggered by Submarine Landslide in the Gulf of California, Mexico - Historical Evidence and Numerical Modeling. **Ramírez-Herrera, M.**, Corona, N., Castillo-Aja, R.

Time	*Rooms 215 + 220*	*Rooms 230 + 235*	*Room 240*
	Regional Earthquake Centers…	**Forthcoming Updates of the…**	**Cryptic Faults…**
2:45 PM	Modeling Seismic Network Detection Thresholds Using Production Picking Algorithms. **Wilson, D.**, Ringler, A. T., Wolin, E., Anthony, R. E., Yeck, W.	Evolution of Ground-Motion Prediction Equations Developments Based on Graizer-Kalkan Modular Filter-Based Approach. **Graizer, V.**	STUDENT: Quaternary Deformation in the Seattle Fault Zone: Insights from High-Resolution Marine Geophysical Data. **Moore, G. L.**, Roland, E., Bennett, S. E. K., Watt, J., Kluesner, J., *et al.*
3:00 PM	Important Upgrade of the ISC Bulletin and Associated Datasets. **Storchak, D. A.**, Harris, J., Di Giacomo, D., Lieser, K., Lentas, K., *et al.*	A Rupture Directivity Adjustment Model Applicable to the NGA-West2 Ground Motion Models and Complex Fault Geometries. **Bayless, J.**, Somerville, P.	Uplift of Shorelines Caused by Holocene Anticlines Formed During Late Holocene Earthquakes in Puget Sound, Washington State. **Sherrod, B. L.**
3:15 PM	Lessons Learned from the 2018 M7.1 Anchorage, Alaska Earthquake: A Network Operator's Perspective. **Ruppert, N.**, West, M. E., Gardine, M.	An Update to Probabilistic Seismic Hazard Analysis for New York City: A Case Study for the JFK Airport. **Haji-Soltani, A.**, Richins, J., Kaeck, W. E.	How Many Samples Do You Need to Date that Paleoearthquake? A Field Test of Portable OSL Using 345 Samples from a Single Colluvial-Wedge Exposure. **DuRoss, C. B.**, Gray, H. J., Gold, R. D., Nicovich, S., Mahan, S. A., *et al.*
3:30 PM	Site Response, Basin Amplification and Anelastic and Scattering Attenuation in Washington and Oregon Determined from Seismograms from the Pacific Northwest Seismic Network. **Frankel, A.**	Comparison of the Site Response in Anchorage from Mainshock and Aftershocks of 30 November 2018, Anchorage Earthquake. **Dutta, U.**, Yang, J., Chang, X., Thornley, J.	Una Falla Críptica; the East Franklin Mountains Fault, El Paso, Texas and Its Late Quaternary Behavior. **McCalpin, J. P.**, Pavlis, T. L.
3:45–4:30 PM	Posters and Break (Ballroom)		
	Regional Earthquake Centers: Highlights and Challenges (continued).	**Forthcoming Updates of the USGS NSHMs: Hawaii, Conterminous U.S. and Alaska** (continued).	**Cryptic Faults: Assessing Seismic Hazard on Slow Slipping, Blind or Distributed Fault Systems** (continued).
4:30 PM	Overview of Technical Implementation and Approaches Used in Transportable Array. **Busby, R. W.**, Woodward, R., Aderhold, K., Frassetto, A. M.	INVITED: Use of Non-Ergodic Ground-Motion Models for the National Hazard Maps. **Abrahamson, N. A.**, Al Atik, L., Bozorgnia, Y., Sung, C., Goulet, C. A., *et al.*	Challenges in Characterizing Low-Slip Rate Faults: Paleoseismic Case Study of the Late Quaternary Pajarito Fault System in the Rio Grande Rift, Los Alamos, New Mexico. **Givler, R.**, Baldwin, J., Lettis, W., Rockwell, T., Olig, S., *et al.*
4:45 PM	The Arizona Earthquake Information Center (AEIC) and the Arizona Integrated Seismic Network (AISN). **Brumbaugh, D. S.**, Ben-Horin, J. Y.	Implementing Non-Ergodic GMMs in Probabilistic Seismic Hazard Analysis. Wooddell, K. E., **Kuehn, N. M.**, Donahue, J., Abrahamson, N. A.	Holocene Earthquake History of the Meers Fault, Oklahoma: Refining Rupture Length Estimates from Subtle Tectonic Geomorphology and Modern Paleoseismology. Streig, A. R., **Bennett, S. E. K.**, Chang, J. C., Hornsby, K. T., Mahan, S. A.

Time	*Rooms 110 + 140*	*Room 115*	*Rooms 120 + 130*
	Near-Surface Effects…	**Observations from the 2019…**	**Understanding Non-Traditional…**
5:00 PM	A “Zeta” Model for the Frequency-Dependent Decay of the Fourier Amplitude Spectrum of Acceleration at High Frequencies. **Haendel, A.**, Anderson, J. G., Pilz, M., Cotton, F.	Engineering Characteristics and Damage Potential of Ground Motions Recorded in the 2019 Ridgecrest Earthquake Sequence. **Ahdi, S. K.**, Mazzoni, S., Kishida, T., Wang, P., Nweke, C. C.,	INVITED: Hazard Constraints on Potentially Tsunamigenic Submarine Crustal Faults in the Northern Cascadia Forearc. **Leonard, L. J.**, Caston, M. V., Wang, K.
5:15 PM	STUDENT: Ground Motion Model for Hard-Rock Sites by Surface Recordings Correction: Site-Response Estimation and GMPE Derivation. **Shible, H.**, Hollender, F., Traversa, P., Guéguen, P.	STUDENT: Temporal Seismic Velocity Variations: Recovery Following from the 2019 M7.1 Ridgecrest Earthquake. **Boschelli, J. D.**, Moschetti, M. P., Sens-Schönfelder, C.	Tsunamigenic Fault Sources in the Salish Sea, Washington State. **Thio, H.**, Li, W.
5:30 PM	STUDENT: Machine Learning Models for Predicting Ground Motion Amplifications in Japan. **Seo, H.**, Kim, B.	Absolute Location of 2019 Ridgecrest Seismicity Reveals Duplex M6.4 Ruptures, Migrating and Pulsing M7.1 Foreshocks and Unusually Shallow Mw7.1 Nucleation. Did the M7.1 Rupture Require Incitation by M6.4-Like Rupture? **Lomax, A.**	STUDENT: Introducing Geodetic Locking to Stochastic Slip Rupture Models: An Example Application to Tsunami Hazard Analysis in Cascadia. **Small, D.**, Melgar, D., Williamson, A. L.
5:45–6:30 PM	Posters and Break (Ballroom)		
6:30–7:30 PM	Lightning Talks (Kiva Auditorium)		
7:30–8:30 PM	Early-Career and Student Reception (Ballroom B)		

Time	Rooms 215 + 220	Rooms 230 + 235	Room 240
	Regional Earthquake Centers…	**Forthcoming Updates of the…**	**Cryptic Faults…**
5:00 PM	Comparison of U.S. Geological Survey and Montana Bureau of Mines and Geology Epicenters and Magnitudes for Recent Western Montana Earthquakes. **Stickney, M. C.**	Assessing the Value of Removing Earthquake-Hazard-Related Epistemic Uncertainties, Exemplified Using Average Annual Loss in California. **Field, E. H.**, Milner, K., Porter, K.	Earthquake Rupture of Multiple Faults and Implications for Seismic Hazard in New Zealand. **Nicol, A.**, Van Dissen, R. J., Gerstenberger, M., Stirling, M.
5:15 PM	Seismic Network Magnitude Improvement in Georgia. **Godoladze, T.**, Gok, R., Rostomashvili, T., Buzaladze, A., Gunia, I., *et al.*	Benchmarking the First Generation Canadian National Seismic Risk Assessment. **Hobbs, T. E.**, Journeay, J., Rao, A.	Cryptic Faults, Seismic Hazards and Lithospheric Controls on Crustal Reactivation in the Gobi Corridor Region, Central Asia. **Cunningham, D.**
5:30 PM	INVITED: Canada's Upgraded Earthquake Monitoring Network. McCormack, D., **Seyward, H.**, Crane, S., Adams, J., Bent, A. L.	2020 NEHRP Provisions Design Ground Motions Based on Multi-Period Response Spectra (MPRS) and Their Implications for USGS Hazard Models. **Rezaeian, S.**, Luco, N.	New (And Fast) Geologic Slip Rates Along Patagonia's Major and Oftentimes Concealed Crustal Strike-Slip Faults. **De Pascale, G. P.**, Sandoval, F. B., Perroud, S., Persico, M., Villalobos, A., *et al.*
5:45–6:30 PM	Posters and Break (Ballroom)		
6:30–7:30 PM	Lightning Talks (Kiva Auditorium)		
7:30–8:30 PM	Early-Career and Student Reception (Ballroom B)		

Poster Sessions

Please note: Poster numbers may not be listed sequentially.

Applications and Technologies in Large-Scale Seismic Analysis (see page 1161).

47. Gleaning Insights from Sequencing Geophysical Timeseries. **Lekic, V.**, Kim, D., Huang, M., Menard, B.
48. A New Operational Model That Increases Experiment Diversity and Shortens Time to Publication for Research Seismology. **Baturan, D.**, Moores, A., Townsend, B. L., Hosseini, M.

Back to the Future: Innovative New Research with Legacy Seismic Data (see page 1182).

49. Creating FAIR Legacy Seismic Data. Ahern, T., **Hwang, L. J.**
50. Student: Using the Noise Correlation Function to Determine Relative Timing of Analog Seismograms. **Lee, T. A.**, Ishii, M., Okubo, P.
51. Securing Seismic Legacy Data. **Hwang, L. J.**, Ahern, T., Ebinger, C., Ellsworth, W., Euler, G., Okal, E. A., Okubo, P., Walter, W. R.
52. Re-Analysis of Pre-Digital Earthquakes in the Mendocino Triple Junction Region. **Doser, D. I.**
53. Preserving Analogue Seismograms of Regional Networks in Northeastern Iberia. **Villasenor, A.**, Batllo, J., López Muga, M., Izquierdo Alvarez, M., Gaite, B., Ugalde, A., Frontera, T.
54. Geophysical Information at the Spanish Geophysical Data National Archive. **López Muga, M.**, Tordesillas, J., Benayas, I., Villasenor, A.
55. Nuclear Explosions Records from Lop Nor Test Site Recorded by Central Asia Stations. **Sokolova, I.**, Mackey, K., Aristova, I., Velikanov, A.
56. Student: Application of Pool-Based Active Learning Methodology in Ground Motion Selection. **Kiani, J.**, Pezeshk, S.

Crustal Stress and Strain and Implications for Fault Interaction and Slip (see page 1186).

13. Student: Structure and Stress-Induced Anisotropy in the Central USA Spatial Variations of Shear Wave Splitting Measurements from Nine Years of Data. **Ortega Romo, A. D.**, Walter, J. I.
14. Seismicity of Major Earthquakes in a Minimalist Physical Model. **Hongliu, R.**
15. Student: Analysis of Shear Wave Splitting Parameters in Los Humeros Geothermal Field, Puebla, Mexico. **Chacon, F.**, Zúñiga, R., Lermo-Samaniego, J.
16. Pre- and Post-Seismic Displacements Associated with M7.8 Pedernales Earthquake Derived from Ecuadorian GNSS Data. **Serrano-Agila, R.**, Duque-Yaguache, E.
17. A Pump-Probe Analysis of Nonlinear Elastic Behavior on the San Andreas Fault. **Delorey, A. A.**
18. Student: Estimation of Seismogenic Stress from the 2010 Darfield, 2011 Christchurch and 2016 Kaikoura, New Zealand Earthquakes and Implications for Strain Accumulation. **Helprin, O. L.**, Hetland, E. A.
19. The Stress-Similarity Triggering Model for Aftershocks Applied to the Ridgecrest, California Earthquake Sequence. **Hardebeck, J.**
20. Towards a Better Understanding of Non-Planar Geometrical Complexities of Faults: Including Geometrical Complexities Using the Flat Fault Approximation in Boundary Element Equation. **Romanet, P.**
21. Stratigraphic Evidence of Close Temporal Occurrence of Northern San Andreas and Southern Cascadia Earthquakes: Partial Synchronization? **Goldfinger, C.**

Cryptic Faults: Assessing Seismic Hazard on Slow Slipping, Blind or Distributed Fault Systems (see page 1190).

22. Geology, Seismotectonics and Surface Deformation of the 25 February 2018 (UTC) M7.5 Earthquake (EQ) in the Papua New Guinea (PNG) Highlands. **Molinari, M. P.**, Youngs, R., Montaldo Falero, V., Albrecht, B.
23. Student: Documenting the Earthquake History of the Thousand Springs Fault in the Summer Lake Basin, Oregon, USA. **Curtiss, E. R.**, Egger, A. E., Weldon, R., Neer, J.
24. Shallow Deformation Features of the Imperial Fault System from Subsurface Imaging. **Sahakian, V. J.**, Derosier, B., Stock, J., Driscoll, N.
25. Revisiting Wyoming's Greys River Fault: A Newly Recognized Northern Extent. **Mauch, J. P.**, Wittke, S. J., Lichtner, D. T.
26. Evidence for Strong Holocene Ground Shaking on the Wallula Fault: Nice Scarp, Where's the Fault…? **Angster, S.**, Sherrod, B. L., Lasher, J.
27. Distributed Active Faulting in High-Relief Volcanic Topography in Northeastern California. **Jobe, J. A. T.**, Briggs, R. W., Gold, R. D., DeLong, S. B., Hille, M., Johnstone, S. A., Pickering, A. J., Phillips, R. F., Muffler, P., Clynne, M. A., Calvert, A. T.
28. Does the Phillips Valley Fault Rupture with the Teton Fault? **Zellman, M.**, DuRoss, C. B., Gold, R. D., Thackray, G. D., Delano, J. E., Wittke, S. J., Mauch, J. P., Medina, I., Phillips, R. F., Collins, E. S., Mahan, S. A.
29. Elucidating the Mead Slope Fault with Drone-Sourced Imagery and Dems. **Ben-Horin, J. Y.**, Gootee, B. F., Pearthree, P. A., Rittenour, T.

30. Active Faulting in the Region of the Mendocino Triple Junction: Field Investigations of the Lahsāséte Fault. **Patton, J. R.**, Streig, A. R., Leroy, T. H., Levinson, R.

Forthcoming Updates of the USGS NSHMs: Hawaii, Conterminous U.S. and Alaska (see page 1237).

57. Seismic Hazard Analyses of the MWD Emergency Freshwater Pathway, Sacramento-San Joaquin Delta, California. **Wong, I.**, Thomas, P., Lewandowski, N., Unruh, J., Darragh, R., Silva, W., Majors, D.
58. Widespread Failure of Delta Levees in a Hypothetical M7.0 Hayward Fault Earthquake. **Porter, K.**, Dashti, S.
59. 2023 Update of the USGS National Seismic Hazard Model for the Conterminous US. **Shumway, A. M.**, Petersen, M. D., Powers, P. M., Luco, N.
60. Student: Non-Ergodic FAS Ground-Motion Model for California. **Lavrentiadis, G.**, Abrahamson, N. A., Kuehn, N. M.
61. Observations of Ground Motion Amplification in the Seattle and Tacoma Sedimentary Basins from Local and Regional Earthquakes. **Wirth, E.**, Czech, T. L., Hutko, A. R., Frankel, A.
62. Cycles of Earthquake Deformation on the Patton Bay Splay-Fault System Implied by Late Holocene Shoreline Evolution on Montague Island, Alaska. **Witter, R.**, DePaolis, J., Haeussler, P., Bender, A., Curran, J., Hemphill-Haley, E., Leoni, M., LeWinter, A., Filiano, D.
63. Should Site Response Be Incorporated into Central and Eastern US Hazard Maps? **Carpenter, S.**, Wang, Z., Woolery, E. W.
64. Student: Working Group for Development and Application of Methods for Non-Ergodic Ground-Motion Models. **Lavrentiadis, G.**, Abrahamson, N. A., Al Atik, L., Bozorgnia, Y., Sung, C., Goulet, C. A., Gregor, N., Kottke, A. R., Kuehn, N. M., Lacour, M., Liu, C., Macedo, J., Meng, X., von Specht, S., Walling, M., Wooddell, K. E.
65. Student: The Application of Diatom Analysis to Reconstruct Coseismic Uplift on Montague Island, Alaska. **DePaolis, J.**, Witter, R., Dura, T., Haeussler, P., Bender, A., Curran, J., Leoni, M.
66. Development of a Non-Ergodic GMPE for France. **Sung, C.**, Abrahamson, N. A., Kuehn, N. M., Traversa, P., Zentner, I.
67. A Referenced Empirical Ground Motion Model for Arias Intensity and Cumulative Absolute Velocity Based on the NGA-East Database. **Farhadi, A.**, Pezeshk, S.
68. Student: Stratigraphic and Microfossil Evidence of Repeated Late Holocene Tsunami Inundation at Sitkalidak Island, AK. **Prater, A.**, Dura, T., Briggs, R. W., Witter, R., Engelhart, S., Koehler, R., Padgett, J.
69. Numerically Efficient Methodology for Developing Non-Ergodic Ground-Motion Models Using Large Datasets. **Lacour, M.**, Abrahamson, N. A.
70. Challenges in Assessing Earthquake Rates for Seismic Hazard in Hawaii. **Llenos, A. L.**, Michael, A. J.
71. Development of a Fault Source Parameters Database and Updates of the Fault Source Model for the US National Seismic Hazard Model. **Hatem, A.**, Gold, R. D., Briggs, R. W., Field, E. H., Powers, P. M., Collett, C. M., Delano, J. E.
72. Cross-Border Comparison Between Canada's 6th Generation and the United States' 2018 Seismic Hazard Models. **Halchuk, S. C.**, Kolaj, M., Powers, P. M., Adams, J.
73. The 6th Generation Seismic Hazard Model of Canada. Kolaj, M., **Halchuk, S. C.**, Adams, J.
74. Non-Ergodic Scenario Maps for Performance Evaluation of Distributed Infrastructure. **Kottke, A. R.**, Kuehn, N. M., Walling, M.
75. An Induced Seismicity Non-Ergodic Ground Motion Prediction Equation (GMPE) in the Oklahoma Region. Walling, M., **Kuehn, N. M.**, Abrahamson, N. A.
76. Using Bayesian Updating to Apply a Regionalized, Partially Nonergodic Ground-Motion Model to a New Region: Subduction Region as an Example. **Kuehn, N. M.**, Bozorgnia, Y., Campbell, K. W., Gregor, N.
77. Student: Liquefaction Loss Estimation in the United States. **Chansky, A.**, Baise, L. G., Meyer, M.
78. Impacts on Network Infrastructure Performance Assessments from Multi-Segment and Multi-Fault Ruptures in UCERF3. **Lee, Y.**
79. Ground Motion Models for the Island of Hawaii Using the Hybrid Empirical Method. **Haji-Soltani, A.**, Pezeshk, S.
80. Risk Assessment of Building Structural Vulnerability in California Based on Non-Ergodic and Ergodic Probabilistic Seismic Hazard Analysis. Liu, C., **Macedo, J.**, Abrahamson, N. A.
81. Regional Ground-Motion Effects from Intraslab Earthquakes in Northern Cascadia. **Moschetti, M. P.**, Thompson, E. M., Rekoske, J., Ramirez-Guzman, L.
82. Migrating U.S. Geological Survey National Seismic Hazard Models to the Cloud. Powers, P. M., **Clayton, B. S.**
83. Spatial Correlation of Losses: Impact of Earthquake and Tsunami Source Model Assumptions. **Fitzenz, D. D.**, Woessner, J., Jalali Farahani, R., Damiao, L., Levy, S.
84. U.S. Geological Survey National Seismic Hazard Model Fault Section Database. Powers, P. M., **Altekruse, J. M.**
85. Alaska Transportable Array Seismic Attenuation Tomography from Local Earthquake P- and S-Waves: Tracing Faults from Southeast to Interior Alaska. **Nakai, J.**, Lowe-Worthington, L.

InSight Seismology on Mars: Results from the First (Earth) Year of Data and Prospects for the Future (see page 1255).

86. On-Deck Seismology: Lessons from InSight for Future Planetary Seismology. **Panning, M. P.**, Pike, W. T., Lognonné, P., Banerdt, W. B., Murdoch, N., Banfield, D., Charalambous, C., Kedar, S., Lorenz, R. D., Marusiak, A. G., McClean, J. B., Nunn, C., Stähler, S., Stott, A., Warren, T.
87. Student: Finite-Discrete Element Modeling of Impacts Experiments on Mars Regolith Proxies. **Froment, M.**, Rougier, E., Larmat, C., Lei, Z., Euser, B. J., Kedar, S., Richardson, J. E., Kawamura, T., Lognonné, P.
88. Constructing a Probabilistic Seismic Hazard Analysis Framework for the Moon. **Schleicher, L. S.**, Schmerr, N. C., Watters, T., Banks, M. E., Bensi, M. T., Weber, R. C.
89. Can Mars Seismic Events Be Successfully Modeled as Flow Induced Seismicity? **Kedar, S.**, Panning, M. P., Smrekar, S. E., King, S. D., Golombek, M. P., Manga, M., Julian, B. R., Shiro, B. R., Perrin, C., Michaut, C., Lognonné, P., Banerdt, W. B.
90. Monitoring Seismicity on Mars - The Marsquake Service for Inight. **Clinton, J.**, Giardini, D., Ceylan, S., van Driel, M., Stähler, S., Banerdt, W. B., Banfield, D., Beucler, E., Böse, M., Charalambous, C., Euchner, F., Garcia, R., Horleston, A. C., Kawamura, T., Kedar, S., Khan, A., Lognonné, P., Mainsant, G., Panning, M. P., Perrin, C., Pike, W. T., Scholz, J., Smrekar, S. E., Spiga, A.
91. Resonances from the InSight Seismometer on Mars. **Hurst, K. J.**, Banerdt, W. B., Bierwirth, M., Brinkman, N., Ceylan, S., Charalambous, C., Delage, P., van Driel, M., Fayon, L., Garcia, R., Giardini, D., Knapmeyer-Endrun, B., Kedar, S., Lognonné, P., McClean, J. B., Mimoun, D., Murdoch, N., Pike, W. T., Robertsson, J. O. A., Schmelzbach, C., Schmerr, N. C., Stott, A., Sollberger, D., Stevanovic, J., Staehler, S., Teanby, N., Tillier, S., Verdier, N., Vrettos, C., Warren, T.

Near-Surface Effects: Advances in Site Response Estimation and Its Applications (see page 1272).

92. A Novel Application of Earthquake Horizontal-to-Vertical Spectral Ratio. **Zhu, C.**, Pilz, M., Cotton, F.
93. Detecting Site Resonant Frequency Using HVSR: FAS vs PSA and f0 vs fp. **Zhu, C.**, Cotton, F., Pilz, M.
94. Characteristic of the Marine Site Soil Condition in Bohai Sea, China. **Peng, Y.**, Lyu, Y., Fang, Y., Huang, S.
95. Student: Estimation of Vs30 Using P-Wave Seismograms in South Korea. **Kim, J.**, Kim, B.
96. Modeling of the Subsurface Structure from the Seismic Bedrock to the Ground Surface for a Broadband Strong Motion Evaluation in Japan. **Senna, S.**
97. Nonlinear Soil Response in the Anchorage Area During the 2018 M7.1 Anchorage, Alaska Earthquake. **Cramer, C. H.**, Dutta, U.
98. Characteristics of Shallow Structure Obtained from the Inversion of Colocated Pressure and Seismic Data for Frequencies below 0.05 Hz. **Tanimoto, T.**, Wang, J.
99. Student: A Regional Vs30 Map for Texas and Its Effect on Ground Shaking Estimates from ShakeMap. **Li, M.**, Rathje, E., Cox, B. R., Yust, M. B.
100. Development of Two-State Nonlinear Site Amplification Model for Japan Dependent on Vs30 and Fundamental Period of Soil. **Kwak, D.**, Seyhan, E.
101. Student: Shear Wave Velocity-Based Liquefaction Potential in Pohang, South Korea. **Ji, Y.**, Kim, B.
102. The Finite-Frequency-Range Spectral Power – A Tool for Identification of Underground Cavities. Kristekova, M., **Kristek, J.**, Moczo, P.
103. Near Surface Seismic Velocity Measurement and Profiling of the East San Francisco Bay Shoreline. **Craig, M.**, Pandit, P., Anderson, S., Hayashi, K.
104. Student: RUMShake: A Pilot Amplification Study in Western Puerto Rico. **Brunat, P.**, Pratt, T., Vanacore, E. A., Martínez-Cruzado, J. A.
105. Modeling and Inversion of Site Effects Using Physical Properties of Layered Subsurface. Safarshahi, M., **Morozov, I.**
106. Effect of the Los Angeles Basin Revealed by the Ridgecrest Earthquakes Recorded on the Community Seismic Network. **Clayton, R. W.**, Muir, J., Graves, R.
107. The Comprehensive Isoseismal Map of North China. **Lyu, Y.**, Sha, H.
108. Fingerprint Identification Using Noise in the Horizontal-to-Vertical Spectral Ratio: Retrieving the Impedance Contrast Structure for the Almaty Basin (Kazakhstan). **Parolai, S.**, Maesano, F. E., Basili, R., Silacheva, N., Boxberger, T., Pilz, M.
109. Three-Dimensional Deep S-Wave Velocity Model of the South and East San Francisco Bay Area Obtained from Microtremor Array Measurements and Three-Component Microtremor Measurements. **Hayashi, K.**
110. Azimuth Dependence of Basin Response in Southern California. **Parker, G. A.**, Baltay, A. S.
111. Site-Specific Characterization of Earthquake Ground Motions: Papua New Guinea Case Study. **Novakovic, M.**, Yenier, E., Hovey, A., Quinn, J.
112. Fundamental Site Period and Peak Amplification Maps for the Jackson Purchase Region in the New Madrid Seismic Zone. **Zhu, Y.**, Wang, Z., Carpenter, S., Woolery, E. W., Haneberg, W. C.
113. Student: A Simplified Soil Model for Seismic Site Response Analysis of Liquefaction. **Xing, G.**
114. Relation of Kappa to Coda Q and Their Differences from "In-Situ" Q. **Morozov, I.**, Safarshahi, M.

115. Seismic Wave Propagation and Site Response in Mexico City Due to 19 September 2017 Earthquake. **Cardenas-Soto, M.**, Chávez-García, F., Natarajan, T.
116. Review of Best Practices to Calculate the Fundamental Frequency of a Site Based on H/V Spectral Ratio: Case Study of Garner Valley Downhole Array. Yazdi, M., **Motamed, R.**, Anderson, J. G.
117. Empirical Evaluation of Kinematic Soil-Structure Interaction Effects in Structures with Large Foundation Footprint and Deep Embedment Depth. Zogh, P., **Motamed, R.**
118. Damping in Civil Engineering Building through the Fluctuation-Dissipation Concept. **Guéguen, P.**, Roux, P.
119. Site Effects in the Val D'agri Basin, Southern Italy. **Famiani, D.**, Danesi, S., Braun, T.
120. Rotation in Civil Engineering Structures: Analysis of the City-Hall (Grenoble) Building Using 3C and 6C Sensors. Guéguen, P., **Guattari, F.**, Aubert, C., Laudat, T.
121. STUDENT: Does Nonlinear Soil Behavior Affect Kappa Estimates? **Ji, C.**, Cabas, A., Bonilla, L., Gélis, C.
122. STUDENT: Variations in Site Response Across Urban High Impedance Contrast Basins. **Salerno, J.**
123. Seismic and Liquefaction Hazard Maps for the Charleston, South Carolina Area. **Cramer, C. H.**, Jaume, S. C., Levine, N. S.
124. Seismic and Liquefaction Hazard Maps for Lauderdale County, Western Tennessee. **Cramer, C. H.**, Van Arsdale, R. B., Arellano, D., Pezeshk, S., Horton, S. P., Weathers, T., Nazemi, N., Tohidi, H., Bhattarai, R. R., Reichenbacher, R. M., Bouzeid, K.
125. Preliminary Shear-Wave Velocity Profiles of Deep Soils (Depth > 600 M) in the Mississippi Embayment, USA. **Horton, S. P.**
126. Near-Surface Shear Wave Velocities for the Charleston Area: Models Derived from Seismic Land Streamer Data Using a Grid Search Approach. **Liberty, L. M.**, Schermerhorn, W.
127. Passive Site Response Characterization Using Teleseismic Receiver Functions from Wideband Optical Accelerometers. **Ball, J. S.**, Schulte-Pelkum, V., Meremonte, M., Schwarzer, J., Besana-Ostman, G., Levish, D., McCaffery, E.
128. Data-Driven Ground Motion Synthesis Using Deep Generative Models. **Florez, M. A.**, Buabthong, P. P., Caporale, M., Meier, M., Ross, Z., Asimaki, D.
129. Using H/V Spectral Ratio in Gravelly Soil Near Grand Teton National Park. **Griffiths, S.**
130. Site Characterization of Alaska Transportable Array Stations in the Yukon, Canada Using H/V Ratios from Noise and Earthquake. **Clizzie, N. L.**, Nakai, J., Lowe-Worthington, L.
131. Influence of Incidence Angle on Low-Frequency (0.2 to 1 Hz) Site Responses: An Analysis of Site Response From the Atlantic Coastal Plain of the Eastern US. **Pratt, T.**

Observations from the 2019 Ridgecrest Earthquake Sequence (see page 1289).

31. Highlights of Tall Buildings in Los Angeles and San Diego Shaken at Epicentral Distances ~200 Km or More by the 5 July 2019 M7.1 Ridgecrest, California Earthquake. **Celebi, M.**
32. STUDENT: Jumping Rocks as an Indicator of Ground Motion During the 4 July 2019 M6.4 Ridgecrest Earthquake. **Zuckerman, M. G.**, Amos, C. B., Madugo, C., Elliott, A. J., Kottke, A. R., Goulet, C. A., Meng, X., Caplan-Auerbach, J.
33. Revised GNSS-Only Dislocation Models and Residual Analysis for Ridgecrest Sequence, San Simeon, Parkfield and La Habra Events. **Parker, J.**, Heflin, M., Moore, A., Donnellan, A.
34. Dynamic Triggering of the 2019 M7.1 Ridgecrest Earthquake Sequence. **Meng, H.**, Fan, W., Lin, G.
35. Near-Source Ground Motion Characteristics of the Ridgecrest Earthquake Sequence. **McNamara, D. E.**, Wolin, E., Moschetti, M. P., Hough, S. E., Petersen, M. D., Benz, H.
36. STUDENT: Stress Changes on the Garlock Fault During and After the 2019 Ridgecrest Earthquake Sequence. **Ramos, M.**, Neo, J., Thakur, P., Huang, Y., Wei, S.
37. On the Consistency of Instrumental, Macroseismic Intensity and Remote Sensing Data: Lessons from the 2019 Ridgecrest, California Earthquake Sequence. **Hough, S. E.**, Yun, S., Jung, J., Thompson, E. M., Parker, G. A., Stephenson, O.
38. Surface Slip Distribution for the 2019 M7.1 Ridgecrest, California Earthquake Rupture. **DuRoss, C. B.**, Gold, R. D., Scharer, K. M., Dawson, T. E., Kendrick, K. J.
39. Aftershock Forecasts Following the M6.4 and M7.1 Ridgecrest, California Earthquakes of July 2019. **Hardebeck, J.**, Michael, A. J., Page, M., van der Elst, N., Barall, M., Llenos, A. L., Martinez, E., McBride, S.
40. Mild Displacements of Boulders during the 2019 Ridgecrest Earthquakes. **Sleep, N. H.**, Hough, S. E.
41. Pseudo-Prospective Testing of UCERF3-ETAS Aftershock Forecasts During the 2019 Ridgecrest, California Earthquake Sequence. **Savran, W.**, Werner, M., Marzocchi, W., Rhoades, D., Jackson, D., Milner, K., Jordan, T. H., Field, E. H.
42. Variations in Ground Motion Amplification in the Los Angeles Basin During the 2019 M7.1 Ridgecrest Earthquake: Implications for Mid-Rise and High-Rise Structure Response. **Kohler, M.**, Filippitzis, F., Graves, R., Massari, A., Heaton, T., Clayton, R. W.

43. Source Time Functions for a M4.5 Aftershock within the 2019 Ridgecrest, California Earthquake Sequence. **Erdem, J. E.**, Fletcher, J. B., Baker, L. M.
44. Survey of Damaged Tufa Pinnacles in Trona Following the 2019 Ridgecrest Earthquake Sequence. **Goulet, C. A.**, Meng, X., Donnellan, A., Lyzenga, G. A.
45. Fault Slip Distribution Along the Southern 15 Km of the M7.1 Ridgecrest Earthquake Surface Rupture. **Akciz, S.**, Padilla, S., Hatem, A., Dolan, J.

Regional Earthquake Centers: Highlights and Challenges (see page 1306)**.**

1. Care and Feeding of Analog-Telemetry Seismic Stations. **Rusho, J.**, Hatch, C., O'Keefe, W., Farrell, J., Pechmann, J. C.
2. Monitoring of Oregon and Washington's Cascade Volcanoes: In light of NVEWS. **Darold, A. P.**, Pauk, B., Thelen, W. A.
3. The University of Utah Seismograph Stations: A Multifaceted Regional Earthquake Center. **Pankow, K. L.**, Koper, K. D., Burlacu, R., Baker, B., Pechmann, J. C., Farrell, J., Holt, J.
4. Updated Determination of Earthquake Magnitudes at the Swiss Seismological Service. **Cauzzi, C.**, Racine, R., Clinton, J., Fäh, D., Edwards, B., Diehl, T., Heimers, S., Deichmann, N., Kästli, P., Haslinger, F., Wiemer, S.
5. Student: Lessons and Goals of the Colorado Geological Survey Seismic Network. **Bogolub, K. R.**, Morgan, M., Fitzgerald, F. S., Palkovic, M. J., Broes, L. D.
6. Caltech/USGS Southern California Seismic Network (SCSN): Modernization of Regional Earthquake Center Operations. **Bhadha, R.**, Hauksson, E., Thomas, V., Alvarez, M., Black, M. L., Bruton, C., Watkins, M., Stubailo, I., Andrews, J. R., Yu, E., Yoon, C.
7. Signals in the Noise – Resolving Small Seismic Signals at Very Long Periods. **Hellweg, M.**, Doody, C., Rademacher, H., Taira, T., Uhrhammer, R.
8. Idaho National Laboratory Seismic Monitoring Program. **Bockholt, B.**, Payne, S., Sandru, J.
9. Challenges on Characterizing a Low-Magnitude Seismic Sequence with a Sparse National Network. **Perez-Campos, X.**, Espídola, V. H., González Ávila, D., Martínez, L. D., López, G., Montalvo-Arrieta, J. C., Zamora-Camacho, A.
10. Reclamation Strong Motion Program. **Meremonte, M.**, Ball, J. S., Besana-Ostman, G., Schwarzer, J., Levish, D., McCaffery, E.
11. Quality Control of the Alaska Earthquake Center's ShakeMap Product. **Macpherson, K. A.**, West, M. E., Ruppert, N., Gardine, M.
12. Improvements to Multi-Hazard Monitoring Networks in Response to Public Safety Power Shutoff (PSPS) Events in California. **Bormann, J. M.**, Kent, G., Driscoll, N., Slater, D., Williams, M., Plank, G.

Understanding Non-Traditional Seismic Tsunami Hazards **(see page 1321)****.**

132. Student: Mapping and Modeling the Seattle Fault Tsunami Inundation in Puget Sound. **Bruce, D.**, MacInnes, B., Bourgeois, J., LeVeque, R. J.
133. Student: Modeling Tsunami Wave Heights Around the Pacific Basin from an Izu-Bonin Mariana Earthquake and the Potential for Rewriting Earthquake History. **Reisinger, R.**, Szeliga, W., MacInnes, B.
134. Consideration of Non-Seismic Tsunami Sources for the US East Coast and Caribbean. **Eble, M. C.**, Ross, S. L., Kyriakopoulos, C., Lynett, P. J., Nicolsky, D. J., Ryan, K., Thio, H., Wilson, R. I.
135. New Field Insights Into the 2018 M7.5 Palu, Indonesia Earthquake and Tsunami and a Comparison with the 2009 M8.1 Samoa Event. **Cilia, M.**, Mooney, W. D.
136. Analytical Model for Tsunami Propagation Including Source Kinematics. **Riquelme, S.**, Fuentes, M.
137. Student: Can Inelastic Wedge Deformation Explain the Large Tsunami Runup of the 1896 Sanriku Earthquake? **Du, Y.**, Ma, S., Kubota, T., Saito, T.
138. Progress of the Powell Center Working Group on Tsunami Sources. **Ross, S. L.**, Eble, M. C., Kyriakopoulos, C., Lynett, P. J., Nicolsky, D. J., Ryan, K., Thio, H., Wilson, R. I.

Weathering the Earthquake Storms: Crisis Communication Following Major Events (see page 1328).

46. Stop the Presses: Aftershock Forecasts in the Media from Bombay Beach to Anchorage to Ridgecrest. McBride, S., Llenos, A. L., Hardebeck, J., Michael, A. J., Page, M., van der Elst, N., Wein, A. M., Barall, M., Martinez, E., **Blanpied, M. L.**

Wednesday, 29 April—Oral Sessions

Time	*Rooms 110 + 140*	*Room 115*	*Rooms 120 + 130*
	Environmental and Near Surface Seismology: From Glaciers and Rivers to Engineered Structures and Beyond (see page 1218).	**Earthquake Early Warning: Current Status and Latest Innovations** (see page 1202).	**Advances in Seismic Imaging of Earth's Mantle and Core and Implications for Convective Processes** (see page 1162).
8:30 AM	Multi-Phase Seismic Sources of Tropical Cyclones. Retailleau, L., **Gualtieri, L.**	Earthquake Early Warning Delivery Using Smartphones. **Kong, Q.**, Strauss, J. A., Allen, R. M.	INVITED: Upper Mantle Heterogeneity Beneath Continental Africa and Its Implications for Lithospheric and Asthenospheric Processes. **Emry, E. L.**, Shen, Y., Nyblade, A.
8:45 AM	STUDENT: Monitoring Rock Slope Instabilities Using Frequency Domain Decomposition Modal Analysis. **Häusler, M.**, Michel, C., Burjánek, J., Fäh, D.	Is Crowdsourced Earthquake Early Warning Already a Reality? **Bossu, R.**, Finazzi, F., Steed, R., Fallou, L.	Evolution of Arc-Continent Collision Controlled by Inherited Lithospheric Scale Structures. **Miller, M. S.**, Becker, T. W., Dahlquist, M., Harris, C., O'Driscoll, *et al.*
9:00 AM	Thunderquakes by Fiber-Optic Distributed Acoustic Sensing Array. **Zhu, T.**, Stensrud, D. J.	STUDENT: A Catalog Search Algorithm for Interpreting Complex Sequences. **Roh, B. H.**, Heaton, T.	Lithospheric and Asthenospheric Structure Beneath Alaska from Bayesian Inversion of Sp and Rayleigh Wave Data. **Fischer, K. M.**, Gama, I., Eilon, Z. C., Krueger, H. E., Dalton, C. A., *et al.*
9:15 AM	Subsurface Void Imaging and Mapping Using 3D Multi Component Ultra High Resolution 3D Shallow Seismic Imaging, Reverse Time Migration and Multi-Attribute Calculations. **Turner, J.**, O'Connell, D. R. H., Levandowski, W.	STUDENT: Deepshake: Earthquake Early Warning with a Deep Generative Spatiotemporal Recursive Neural Network. Datta, A., **Wu, D. J.**, Cai, M. L., Zhu, W., Ellsworth, W.	STUDENT: Weak Upper Mantle Anisotropy Revealed by Teleseismic P Wave Receiver Functions from the USArray. **Zhang, H.**, Schmandt, B., Zhang, J.
9:30 AM	Seismic Signals from the Hydrosphere Occurring Beyond the Microseism Band. **Anthony, R. E.**, Ringler, A. T., Wilson, D.	Seismic Event Parameter Inference from Sparse Early Warning Stations Using Bayesian Networks. **Zaicenco, A. G.**, Weir-Jones, I.	Alteration of the Pacific Lithosphere and Asthenosphere by the Hawaiian Hotspot: A Re-Examination. **Forsyth, D. W.**, Chen, K., Gardner, G.
9:45–10:45 AM	Posters and Break (Ballroom)		

Time	Rooms 215 + 220	Rooms 230 + 235	Room 240
	Mechanisms of Induced Seismicity: Pressure Diffusion, Elastic Stressing and Aseismic Slip (see page 1261).	**Numerical Modeling of Rupture Dynamics, Earthquake Ground Motion and Seismic Noise** (see page 1281).	**Explosion Seismology Advances** (see page 1226).
8:30 AM	Invited: The Interplay Between Fluid Injection, Aseismic Slip and Induced Microearthquakes Unveiled by Seismic Wave Analysis. **Huang, Y.**, De Barros, L., Cappa, F.	Student: 3D 0-5 Hz Wave Propagation Simulations of the 2014 M5.1 La Habra Earthquake with Small-Scale Heterogeneities, Q(f) and Topography. **Hu, Z.**, Olsen, K. B.	Seismic Magnitudes of Underground Nuclear Explosion Signals and Their Uses. Howe, M., Ekström, G., **Richards, P. G.**
8:45 AM	Student: Seismic Moment Evolution During Hydraulic Stimulations. **Bentz, S.**, Kwiatek, G., Martínez-Garzón, P., Bohnhoff, M., Dresen, G.	Student: Sensitivity of Modeled Topographic Effects to Kinematic Source Parameters in 3D Simulations of M6.5-7.0 Earthquakes. **Stone, I.**, Wirth, E., Frankel, A.	Detection and Characterization of Mining Activity at a National Level. **Earle, P.**, Benz, H., Yeck, W., Ambruz, N.
9:00 AM	Pecos Array in West Texas: The Importance of Local Arrays in Identifying and Monitoring Induced Seismicity in Complex Areas. **Savvaidis, A.**, Lomax, A., Karplus, M., Hennings, P., Martone, P., Shirley, M., *et al.*	Strategies for Implementing the Traction-Free Condition at the Free-Surface Topography. **Moczo, P.**, Syvret, F., Kristek, J., Al-Attar, D., Fecko, M.	Seismology Observations on the 21 March 2019 Accidental Explosion at Xiangshui Chemical Plant in Jiangsu, China. **Zhao, L.**, Xie, X., Song, Y., Du, G., Yao, Z.
9:15 AM	Student: Revisiting the Timpson Induced Earthquake Sequence with Deep-Learning. **Wang, K.**, Ellsworth, W., Beroza, G. C.	Student: Characterizing the Effect of Topography on Ground Shaking and Coseismic Landslides During the 25 April 2015 M7.8 Gorkha Earthquake in Nepal Through Full Wavefield Simulations. **Dunham, A.**, Kiser, E., Kargel, J., Haritashya, U., Shugar, D., *et al.*	Insights from the Source Physics Experiments on Seismic Waves Generated by Explosions. **Walter, W. R.**, Ford, S. R., Pitarka, A., Pyle, M. L., Pasyanos, M. E., *et al.*
9:30 AM	Unveiling the Faults in the Southern Raton Basin Using Nodal Array. **Wang, R.**, Schmandt, B., Glasgow, M. E., Rysanek, S., Stairs, R. K., *et al.*	Student: Numerical Simulation of Topographic and Crustal Scattering—Case Study of the 2009 DPRK Nuclear Explosion. **Yeh, T.**, Olsen, K. B.	Simulation of the Far-Field Signatures of Underground Chemical Explosions in Anisotropic Media: Application to SPE Phase I DAG Series. **Ezzedine, S. M.**, Vorobiev, O. Y., Hirakawa, E. T., Pitarka, A., Antoun, T. H., *et al.*
9:45–10:45 AM	Posters and Break (Ballroom)		

Time	*Rooms 110 + 140*	*Room 115*	*Rooms 120 + 130*
	Environmental and Near Surface Seismology: From Glaciers and Rivers to Engineered Structures and Beyond (continued).	**Earthquake Early Warning: Current Status and Latest Innovations** (continued).	**Advances in Seismic Imaging of Earth's Mantle and Core and Implications for Convective Processes** (continued).
10:45 AM	Using Passive Seismology to Investigate Hydrological Forcing of Fast Glacier Flow in Greenland. **Schoonman, C. M.**, Christoffersen, P., Doyle, S. H., Hubbard, B., Hofstede, C., *et al.*	How Often Can Earthquake Early Warning Systems Alert Sites with High Intensity Ground Motion? **Meier, M.**, Kodera, Y., Böse, M., Chung, A. I., Hoshiba, M., *et al.*	INVITED: Imaging and Modeling the Yellowstone Plume. **Grand, S. P.**, Nelson, P. L., Steinberger, B.
11:00 AM	Identification and Characterization of Abandoned Mines with Partial-Waveform Methods, Transmitted-Wave Tomography, Gravity and Seismic Reflection. **Levandowski, W.**, O'Connell, D. R. H., Turner, J., Nuttall, J., Steele, L., *et al.*	The PLUM Earthquake Early Warning Algorithm: Application to Real-Time, USA, Data. **Kilb, D.**, Cochran, E. S., Bunn, J., Saunders, J. K., Minson, S. E., *et al.*	Seismic Discontinuities and Compositional Heterogeneities in the Mid-Mantle. **Wei, S.**, Tian, D., Shearer, P. M.
11:15 AM	Aquifer Susceptibility to Earthquake-Induced Water-Level Changes: Towards a Probabilistic Model of Fluid Pressure Changes During Earthquakes. Weaver, K. C., Holden, C., Arnold, R., **Townend, J.**, Cox, S. C.	Could a Decentralized Onsite Earthquake Early Warning System Help in Mitigating Seismic Risk in North-Eastern Italy? The Case of the Ms 6.5 1976 Friuli Earthquake. **Parolai, S.**, Moratto, L., Bertoni, M., Scaini, C., Rebez, A.	Shear Attenuation Beneath the Central Pacific and Implications for Anelasticity and Hydration in the Oceanic Upper Mantle. **Dalton, C. A.**, Ma, Z., Russell, J., Gaherty, J. B., Hirth, G., *et al.*
11:30 AM	Seismic Attenuation Illuminates Fluid Pathways in Glacial Ice. **Matzel, E.**, Morency, C.	Incorporating Ground-Motion Uncertainties into Earthquake Early Warning Alert Distance Strategies Using the July 2019 M6.4 and M7.1 Ridgecrest, California, Earthquakes. **Saunders, J. K.**, Aagaard, B. T., Baltay, A. S., Minson, S. E.	SKS Shear Wave Splitting Based on 3D Seismic Wave Simulations. **Creasy, N.**, Bozdag, E.
11:45 AM	Monitoring Groundwater and Flood Effects on Shallow Seismic Properties in Jakarta, Indonesia. **Denolle, M. A.**, Jiang, C., Yuan, C., Cummins, P.	Including Three-Dimensional Finite Fault and Distributed Slip Models in Ground Motion Forecasting for Earthquake Early Warning. **Murray, J. R.**, Minson, S. E., Baltay, A. S., Thompson, E. M.	Resolution and Covariance of the LLNL-G3D-JPS Global Seismic Tomography Model. **Simmons, N. A.**, Schuberth, B. S. A., Myers, S. C., Knapp, D. R.
Noon–1:00 PM	Luncheon, Open to All Attendees (Hall Three)		
	Women in Seismology Luncheon, RSVP Required (Hall Three)		
1:15–2:15 PM	Public Policy Address (Kiva Auditorium)		

Time	Rooms 215 + 220	Rooms 230 + 235	Room 240
	Mechanisms of Induced Seismicity: Pressure Diffusion, Elastic Stressing and Aseismic Slip (continued).	**Numerical Modeling of Rupture Dynamics, Earthquake Ground Motion and Seismic Noise** (continued).	**Explosion Seismology Advances** (continued).
10:45 AM	INVITED: Fluid-Rock Mechanical Interaction with Applications for Inducing and Triggering Earthquakes. **Zhai, G.**, Shirzaei, M., Manga, M., Chen, X., Xu, W., *et al.*	Numerical Modeling of Three-Component Seismic Ambient Noise: Insights into the Generation of Secondary-Microseism Love Waves. **Gualtieri, L.**, Bachmann, E., Simons, F. J., Tromp, J.	Damage Quantification for SPE-DAG Explosions by Spall and Elevation Change. **Larmat, C.**, Swanson, E., Schultz-Fellenz, E., Lei, Z., Phillips, W. S.
11:00 AM	Stress Drops and Ground Motions from Induced Earthquakes in Oklahoma and Kansas: Are They Different from Tectonic Earthquakes? **Wong, I.**, Darragh, R., Silva, W., Smith, S., Kishida, T.	Modeling Ground Motions in Northern Israel: The Role of 3D Crustal Heterogeneities of the Dead Sea Transform Fault System. **Tsesarsky, M.**, Shimony, R., Glechmam, Y., Gvirtzman, Z.	Analysis of Source Physics Experiment Explosion Triggered Aftershocks at the Nevada National Security Site. **Ichinose, G.**, Ford, S. R., Kroll, K. A., Dodge, D. A., Pitarka, A., *et al.*
11:15 AM	What Induced Seismicity from CO_2 Injection Can Tell Us About Fluid Migration Pathways. **Williams-Stroud, S.**, Leetaru, H., Bauer, R., Greenberg, S., Langet, N.	Modeling of Ground Motion in the National Capital Region, India for a Recorded 4.9 Magnitude Earthquake and for a Future, Large 8.5 Magnitude Earthquake in the Himalayan Central Seismic Gap. **Krishnavajjhala, S.**, Gupta, S.	Acoustic Wave Generation and Propagation from the Source Physics Experiments Investigated by Full 3D Finite-Difference Simulation. **Kim, K.**, Bowman, D. C., Fee, D.
11:30 AM	Fracture Stimulation as Seen Through Picoseismicity, Borehole Displacement Probes and Distributed Fiber-Optic Sensing: The EGS Collab Experiment. **Hopp, C.**, Schoenball, M., Rodríguez Tribaldos, V., Ajo-Franklin, J. B., Guglielmi, Y.	Modeling Dynamic Earthquake Ruptures Towards Identifying Seismological Observables of Co-Seismic Off-Fault Damage. **Okubo, K.**, Bhat, H. S., Rougier, E., Denolle, M. A.	Numerical Simulations of Surface and Acoustic Wave Generation from Underground Explosions in Hard Rock Geologies. **Vorobiev, O. Y.**, Stroujkova, A.
11:45 AM	Complexity of the Fracture Network Development During Stimulation of a 6.1-Km-Deep Enhanced Geothermal System in Finland. Leonhardt, M., **Kwiatek, G.**, Saarno, T., Heikkinen, P., Martínez-Garzón, P., *et al.*	Path and Site-Effects Revealed by Source-Normalized Intensities from a Suite of Three-Dimensional Simulations of M7.0 Hayward Fault Ruptures Resolved to 5 Hz. **Rodgers, A. J.**, Abrahamson, N. A., Pitarka, A.	Infrasound from Ground Motion Sources Recorded by Airborne Microbarometers. **Bowman, D. C.**, Krishnamoorthy, S., Martire, L., Chaigneau, Y., Garcia, R., *et al.*
Noon–1:00 PM	Luncheon, Open to All Attendees (Hall Three)		
	Women in Seismology Luncheon, RSVP Required (Hall Three)		
1:15–2:15 PM	Public Policy Address (Kiva Auditorium)		

Time	*Rooms 110 + 140*	*Room 115*	*Rooms 120 + 130*
	Exploring Rupture Dynamics and Seismic Wave Propagation Along Complex Fault Systems (see page 1223).	**What Can We Infer About the Earthquake Source Through Analyses of Strong Ground Motion?** (see page 1328).	**Full-Waveform Inversion: Recent Advances and Applications** (see page 1246).
2:30 PM	Dynamic Models of Earthquake Rupture Along Branch Faults of the Eastern San Gorgonio Pass Region in CA using Complex Fault Structure. **Douilly, R.**, Oglesby, D. D., Cooke, M. L., Hatch, J. L.	Robust Results, Elegant Analyses, Data Driven Science. **Archuleta, R. J.**	Global Adjoint Tomography - Model GLAD-M25. **Lei, W.**, Tromp, J., Ruan, Y., Bozdag, E., Komatitsch, D., *et al.*
2:45 PM	Dynamic Rupture Scenarios of Large Earthquakes on the Hayward Calaveras Rodgers Creek Fault System, California Using Observations from Geology and Geodesy. **Harris, R.**, Barall, M., Ponce, D., Moore, D., Graymer, R., *et al.*	INVITED: Finite-Fault Source Inversion Including Surface Topography Effects and 3D Velocity Structure: Application to the Norcia, M6.5, 30 October 2016, Central Italy Earthquake. **Scognamiglio, L.**, Casarotti, E., Tinti, E., Magnoni, F.	Uncertainty Quantification in Full Waveform Tomography with Ensemble Data-Assimilation. **Thurin, J.**, Brossier, R., Métivier, L.
3:00 PM	Effects of Multi-Scale Fault Complexity on Earthquake Rupture and Radiation. **Mai, P.**	Estimation of the Stress Breakdown Slip from Strong-Motion Seismograms. **Olsen, K. B.**, Cruz Atienza, V. M.	STUDENT: Large-Scale Multi-Parameter Probabilistic Full-Waveform Inversion Using Hamiltonian Monte Carlo. **Gebraad, L.**, Boehm, C., van Driel, M., Thrastarson, S., Fichtner, A.
3:15 PM	Dynamic Rupture Simulations of the M6.4 and M7.1 July 2019 Ridgecrest, California Earthquakes. **Lozos, J.**, Harris, R.	A Breakdown of Source Self-Similarity at M5.3 Inferred from Strong Ground Motion Parameters. **Ji, C.**, Archuleta, R. J.	New Insights on the Crustal Lithology and Seismo-Tectonics of Southern California from Joint Gravity and Full-Wave Inversion. **Shen, Y.**, Bao, X., Gao, L.
3:30 PM	INVITED: Untangling the Dynamics of the 2019 Ridgecrest Sequence by Integrated Dynamic Rupture and Coulomb Stress Modeling Across an Immature 3D Conjugate Fault Network. **Taufiqurrahman, T.**, Gabriel, A., Carena, S., Verdecchia, A., Li, B., *et al.*	Stress Drop and Ground-Motion Source Comparison of the July 2019 Ridgecrest Earthquake Sequence. **Baltay, A. S.**, Parker, G. A., Abercrombie, R. E., Ruhl, C. J., Neupane, A., *et al.*	INVITED: STUDENT: Full-Waveform Inversion by Model Extension. **Biondi, E.**, Barnier, G.
3:45–4:30 PM	Posters and Break (Ballroom)		

Time	*Rooms 215 + 220*	*Rooms 230 + 235*	*Room 240*
	Seismic Imaging of Fault Zones (see page 1311).	**Numerical Modeling of Rupture Dynamics, Earthquake Ground Motion and Seismic Noise** (continued).	**Explosion Seismology Advances** (continued).
2:30 PM	INVITED: Characterizing the Uppermost 100 M Structure of the San Jacinto Fault Zone Southeast of Anza, California through Joint Analysis of Geologic, Topographic, Seismic and Resistivity Data. **Share, P.**, Tábořík, P., Štěpančíková, P., Stemberk, J., Rockwell, T. K., *et al.*	STUDENT: Seismic Phononic Crystals Driven by Elastodynamic Navier Equation. **Lee, D.**, Rho, J.	Assessing Explosions at Regional Scales Using Small Seismic Arrays. **West, M. E.**, Karasozen, E.
2:45 PM	Tomographic Images of the 2016 Central Italy M6.5 and M6.1 Normal Faults by Massive Local Earthquakes Tomography. **Chiarabba, C.**, De Gori, P., Michele, M., Chiaraluce, L.	CyberShake PSHA with Updated Rupture Models. **Callaghan, S.**, Maechling, P. J., Goulet, C. A., Milner, K., Graves, R., *et al.*	Phased Array Analysis Incorporating the Continuous Wavelet Transform. **Langston, C. A.**
3:00 PM	STUDENT: Hierarchical Seismic Imaging of the Crust in Southern California. **White, M. C. A.**, Fang, H., Lu, Y., Ben-Zion, Y.	STUDENT: A Frequency-Dependent Spatial Correlation Model of Within-Event Residuals for Fourier Amplitude Spectra. **Wang, N.**, Olsen, K. B., Day, S. M.	Modeling Distributed Acoustic Sensing Signals from an Explosion. **Mellors, R. J.**, Pitarka, A., Abbott, R.
3:15 PM	Seismic Structure Imaging of San Andreas Fault Zone by Scattered Waves from Local Earthquakes at Parkfield, California. **Zhang, H.**, Lin, Y., Chang, K.	STUDENT: Ground Motion Radiation Patterns from a Deterministic Earthquake Sequence Simulator. **Milner, K.**, Shaw, B. E., Richards-Dinger, K. B., Goulet, C. A., Jordan, T. H.	Structure at the Source Physics Experiment Site Revealed by Large-N Arrays. **Chen, T.**, Snelson, C.
3:30 PM	INVITED: Fault Zone Imaging: Past, Recent, Future. **Thurber, C. H.**	Beware of the Broken Faults! **Elbanna, A.**, Ma, X.	How Low Can You Go? Source Analysis of Low Yield Chemical Explosions. **Pasyanos, M. E.**, Dickey, J. T., Kim, K.
3:45–4:30 PM	Posters and Break (Ballroom)		

Time	Rooms 110 + 140	Room 115	Rooms 120 + 130
	Exploring Rupture Dynamics and Seismic Wave Propagation Along Complex Fault Systems (continued).	**What Can We Infer About the Earthquake Source Through Analyses of Strong Ground Motion?** (continued).	**Amphibious Seismic Studies of Plate Boundary Structure and Processes** (see page 1175).
4:30 PM	STUDENT: Shallow Slip Deficit, Slip Pulses and Event Complexity in a Model of Seismic Cycle with Low Velocity Fault Zones. **Abdelmeguid, M.**, Ma, X., Elbanna, A.	Imaging Hierarchical Seismic Sources by Seismic Waves. **Ide, S.**	Deflection of the Juan de Fuca Plate Beneath the Cascadia Continental Margin Beneath an Upper Plate Load: Direct Evidence for a Compliant Subducting Plate. **Tréhu, A.**, Davenport, K., Kenyon, C., Nabelek, J., Toomey, D., Wilcock, W.
4:45 PM	INVITED: Geometric Controls on Pulse-Like Rupture in a Dynamic Model of the 2015 Gorkha Earthquake. **Wang, Y.**, Day, S. M., Denolle, M. A.	Source Time Functions for the Anchorage Earthquake of 30 November 2018. **Fletcher, J. B.**, Baker, L. M., Erdem, J. E.	INVITED: Surface Wave Tomography Across the Eastern North American Margin from Amphibious Data. **Lynner, C.**, Janiszewski, H., Eilon, Z. C.
5:00 PM	INVITED: STUDENT: Elastoplastic Modeling of the Unusual Uplift of the Papatea Block in the 2016 M7.8 Kaikoura Earthquake. **Donnelly, W.**, Ma, S.	Roughness, Rupture, Radiation and High-Frequency Seismic Waves. **Mai, P.**	Elastic Wave Constraints on the Slow-Slip Inter-Plate Boundary in the Northern Cascadia Subduction Zone. **Calvert, A. J.**, Bostock, M. G., Savard, G., Unsworth, M. J.
5:15 PM	Back-Propagating Super-Shear Rupture in the 2016 M7.1 Romanche Transform Fault Earthquake. **Hicks, S. P.**, Okuwaki, R., Steinberg, A., Rychert, C., Harmon, N., *et al.*	3D Modeling of Ground Motions for Events in the 2019 Ridgecrest Sequence. **Graves, R.**, Pitarka, A.	INVITED: Evidence for Geologic Influence on Subduction Zone Seismicity During the 2014 M8.2 Pisagua, Chile Earthquake Sequence from Amphibious Controlled-Source Seismic Data. **Davenport, K.**, Tréhu, A., Rietbrock, A., González Rojas, F., Ma, B.
5:30 PM	Seismological and Thermochronological Constraints on the Thermal State and Present-Day Seismogenic Depths of the Central Alpine Fault, New Zealand. Michailos, K., Savage, M. K., **Townend, J.**, Sutherland, R.	Searching for Supershear Rupture at Parkfield. **Ellsworth, W.**, Sleep, N. H.	Onshore-Offshore Body Wave Tomography of the Cascadia Subduction Zone: Identifying Challenges and Solutions for Shore-Crossing Data. **Bodmer, M.**, Toomey, D., Hooft, E., Schmandt, B.
5:45–6:15 PM	Posters and Break (Ballroom)		
6:15–7:15 PM	Joyner Lecture (Kiva Auditorium)		
7:15–8:45 PM	Joyner Reception (Outdoor Plaza)		
8:00–9:30 PM	SIG: Seismic Tomography 2020: What Comes Next? (Room 215 + 220)		
8:00–9:30 PM	SIG: SOS: Save Our Seismograms! (Room 230 + 235)		

Time	Rooms 215 + 220	Rooms 230 + 235	Room 240
	Advances in Upper Crustal Geophysical Characterization (see page 1168).	**From Aseismic Deformation to Seismic Transient Detection, Location and Characterization** (see page 1243).	**Innovative Seismo-Acoustic Applications to Forensics and Novel Monitoring Problems** (see page 1250).
4:30 PM	STUDENT: Seismic Response of Nenana Sedimentary Basin, Central Alaska. **Smith, K.**, Tape, C.	INVITED: STUDENT: Neural Network Interpretation as a Denoising Tool for Automated Tremor Location. **Hulbert, C.**, Rouet-Leduc, B., Dalaison, M., Johnson, P., Bhat, H. S., *et al.*	Monitoring Power Levels of a Nuclear Reactor with Seismo-Acoustic Signals Using Machine Learning. **Chai, C.**, Maceira, M., Marcillo, O. E.
4:45 PM	The Application of Seismic Double-Difference Attenuation Tomography Method to the Geysers Geothermal Field, California. **Guo, H.**, Thurber, C. H., Nayak, A.	STUDENT: The Relationship Between Slow Earthquake Activity and Frictional Property on the Plate Boundary Around Japan. **Baba, S.**, Takemura, S., Obara, K., Noda, A.	A Dataset That Samples the Atmosphere with Thousands of Explosion-Triggered Waveforms on Multiple Scales. **Carmichael, J. D.**, Thiel, A., Walter, J. I., Blom, P., Dannemann, F. K.
5:00 PM	Identification of Seismic Reference Stations in Europe. **Pilz, M.**, Cotton, F., Kotha, S. R.	Event Size Distribution and Moment-Duration Scaling of Low-Frequency Earthquakes in the Nankai Trough, Japan. **Supino, M.**, Shapiro, N., Vilotte, J., Poiata, N., Obara, K.	Observations of Anthropogenic Acoustic Waves in the Stratosphere. **Bowman, D. C.**, Garces, M.
5:15 PM	INVITED: Spatial Statistics of Densely Measured Seismic-Velocity Variations. **Louie, J. N.**, Dunn, M. E., Eckert, E.	INVITED: The Intricate Relationship of the M7.8 Kaikoura Earthquake and Tremors. **Romanet, P.**, Aden-Antoniow, F., Ide, S.	Seismo-Acoustic Responses of Explosions in Different Geological Materials: A Parametric Study of Different Emplacements and Different Energy Depositions. **Ezzedine, S. M.**, Vorobiev, O. Y., Rodgers, A. J., Antoun, T. H., Walter, W. R.
5:30 PM	Growing Capabilities of the SAGE/IRIS Facility for Conducting Near Surface and Upper Crustal Geophysical Studies. **Frassetto, A. M.**, Sweet, J. R., Beaudoin, B. C., Anderson, K. R., Woodward, R.	STUDENT: Interaction Between Slow Slip Event and Earthquakes: The Case of the 2017-2018 Guerrero SSE (Mexican Subduction) Seen by Remote Sensing. **Maubant, L.**, Pathier, E., Radiguet, M., Daout, S., Doin, M., *et al.*	Earth's Trembling for Economic Growth. **Hong, T.**, Lee, J., Lee, G., Lee, J., Park, S.
5:45–6:15 PM	Posters and Break (Ballroom)		
6:15–7:15 PM	Joyner Lecture (Kiva Auditorium)		
7:15–8:45 PM	Joyner Reception (Outdoor Plaza)		
8:00–9:30 PM	SIG: Seismic Tomography 2020: What Comes Next? (Room 215 + 220)		
8:00–9:30 PM	SIG: SOS: Save Our Seismograms! (Room 230 + 235)		

Poster Sessions

Please note: Poster numbers may not be listed sequentially.

Advances in Seismic Imaging of Earth's Mantle and Core and Implications for Convective Processes (see page 1165).

1. Student: Shear Wave Splitting in the Caucasus Mountains. **Martinetti, L. B.**, Mackey, K., Sandvol, E., Nabelek, J., Godoladze, T., Vinogradov, Y., Babayan, H., Yeterirmishlii, G.
2. Student: Revisiting the High-Velocity Anomalies in the Great Basin, Exploring the Role of Seismic Anisotropy. **Zhu, Z.**
3. SH-SV Polarization Anisotropy: Isotropic Interpretation of Experimentally Measured Love and Rayleigh Wave Phase Velocities and Amplitude Attenuations. Schwab, F., **Gurung, G.**, Lee, W., Jo, B.
4. Crustal Characteristics in the Subduction Zone of Mexico: Implication of the Tectonostratigraphic Terranes on Slab Tearing. **Ortega, R.**, Carciumaru, D., Castillo-Castellanos, J.
5. Slow Earth's Inner Core Motion. **Wang, W.**, Vidale, J.

Advances in Upper Crustal Geophysical Characterization (see page 1169).

6. Calibration of the U.S. Geological Survey National Crustal Model for Seismic Hazard Studies. **Boyd, O. S.**
7. Comparison of Teleseismic Responses at a Co-Located High-Rate and High-Density Tilt and Seismic Array in Florida. **Grapenthin, R.**, Bilek, S., Luhmann, A., Gochenour, J.
8. Student: Crustal Rheology and Links to Possible Uplift Mechanisms Revealed by Lg-Wave Attenuation Tomography in the Anatolia Plateau. **Zhu, W.**, Zhao, L., Xie, X., Yao, Z.
9. Crustal Structure, Imaged by 3D Seismic Attenuation, Exerts Influence on Multiple Fault Rupture of the Kaikoura M7.8 Earthquake, New Zealand. **Eberhart-Phillips, D.**, Bannister, S., Lanza, F.
10. ML Amplitude Tomography from US Array Data for the Continental US. **Hearn, T. M.**
11. Multi-Mode Surface Wave Inversion of the Kanto Sedimentary Basin. **Jiang, C.**, Denolle, M. A.
12. Numerical Simulation of Flow, Heat and Chemical Transport Processes in Volcanic Chambers Partially Filled with Molten Rock. **Ezzedine, S. M.**, Antoun, T. H., Walter, W. R.
13. Passive Seismic Investigations of the Valles Caldera during SAGE 2019. **Mostafanejad, A.**, Lumley, D., Bedrosian, P., James, S.
14. Quantitative Analysis of Surface Wave Propagation from Recorded Seismograms in the Mexico City Valley. **Meza-Fajardo, K. C.**, Cruz-Jiménez, H., Ruelas, A., Nagashima, F., Roullé, A., Sánchez-Sesma, F. J., Papageorgiou, A. S.
15. Student: Seismic Probing of an Asteroid Using One Source and One Receiver. **Tian, Y.**, Zheng, Y.
16. Student: Sensitivity Analysis and Testing of Joint Inversion with Gravity and Cosmic Ray Muon Data for Prediction of Shallow Subsurface Density Variations. **Cosburn, K. S. B.**, Spears, B., Roy, M.
17. Shallow Shear-Wave Velocity and Crustal Structure in the Seattle and Tacoma Basins from Microtremor Array Analysis. **Stephenson, W. J.**, Odum, J. K., Leeds, A.
18. Student: Surface Wave Methods in Inversely Dispersive and Non-1D Sites. **Boucher, C.**
19. The Deformation Front of the Seattle Fault Near Downtown Seattle: Constraints from New Active Source Seismic Data. **Liberty, L. M.**
20. Updating the USGS San Francisco Bay Area 3D Seismic Velocity Model: Special Focus on the North Bay. **Hirakawa, E. T.**, Aagaard, B. T.

Amphibious Seismic Studies of Plate Boundary Structure and Processes (see page 1176).

111. Student: Using Surface Waves to Detect Seismic Sources in Alaska. **Luo, X.**, Fan, W.
112. Results from 60 Years of Crustal-Scale Active-Source Wide-Angle Seismic Profiling in Cascadia. **Brocher, T.**
113. Student: Along-Strike Crustal Structure of the Eastern North American Margin within the East Coast Magnetic Anomaly. **Brandl, C. C.**, Lowe-Worthington, L., Magnani, M., Shillington, D. J.
114. Student: Imaging the Subducted Gorda Plate with Converted Phases and Trapped Waves. **Gong, J.**, McGuire, J. J.
115. Dendrochronological Dating of Co-Seismic Land-Level Changes Along the Washington Coast. **Pearl, J. K.**, Black, B. A., Pringle, P., Sherrod, B. L.
116. Characterize Earthquake Ground Motions along the Cascadia Margin Using Seismic Interferometry. **Yang, X.**, Ma, Z., Denolle, M. A.
117. Raised Shorelines Along the Pacific and Juan De Fuca Coasts of the Olympic Peninsula, Washington State, USA. **Sherrod, B. L.**, Kelsey, H. M.
118. Paleoseismic Segmentation in Cascadia: Possible Link to Juan De Fuca/Gorda Rift Propagator Wakes. **Goldfinger, C.**

Earthquake Early Warning: Current Status and Latest Innovations (see page 1204).

119. Performance Evaluation of a Dense MEMS-Based Seismic Sensor Array Deployed in the Sichuan-Yunnan

Border Region for Earthquake Early Warning. **Peng, C.**, Jiang, P., Chen, Q., Ma, Q.

120. Earthquake Magnitudes and Ground Motions Derived from Borehole Strainmeter Data. **Farghal, N. S.**, Baltay, A. S., Barbour, A., Langbein, J.
121. Validating Ground Motion Predictions from Peak Ground Displacement Scaling in Cascadia Simulations. **Crowell, B. W.**, Melgar, D., Kwong, K. B., Williamson, A. L.
122. ShakeAlert Earthquake Early Warning Time-to-Alert Improvements in California and the Push for Seismic Network Build-Out. **Biasi, G.**, Stubailo, I.
123. An EPIC Machine Learning Implementation. **Chung, A. I.**, Meier, M., Henson, I., Allen, R. M.
124. The Limits of Effective Earthquake Early Warning by Estimating Mw: From Viewpoint of Real-Time Prediction of Strong Motion. **Hoshiba, M.**
125. Optimization of ElarmS3 in Korean Peninsula Using Simulation. Ahn, J., **Lim, D.**
126. Investigating Earthquake Early Warning Feasibility across Europe. **Cremen, G.**, Zuccolo, E., Galasso, C.
127. The Future Strong Motion National Seismic Networks in Central America Designed for Earthquake Early Warning. **Massin, F.**, Clinton, J., Racine, R., Rossi, Y., Böse, M., Strauch, W., Maroquin, G., Linkimer, L., Protti, M., Yani, R., Chavez, E.
128. 25-Second Determination of 2019 M7.1 Ridgecrest Earthquake Coseismic Deformation from Global GNSS Seismic Monitoring. **Melbourne, T. I.**, Szeliga, W., Santillan, M., Scrivner, C.
129. SCSN Advanced Telemetry Planning Tools and Real-Time System Monitoring. **Stubailo, I.**, Alvarez, M., Biasi, G., Bhadha, R., Bruton, C., Watkins, M., Hauksson, E., Thomas, V.
130. Considerations for a National Earthquake Early Warning System for Canada. Crane, S., **Seywerd, H.**, Adams, J., McCormack, D.
131. Ground Acceleration Induced GNSS Satellite Loss-of-Lock During the 2016 M7.8 Kaikōura Earthquake, New Zealand. **Grapenthin, R.**, D'Anastasio, E.
132. Earthquake Early Warning Testing Developments: Generation of Realistic Warning Times for Large Magnitude Events. **Smith, D. E.**, Good, A., McGuire, J. J., O'Rourke, C. T., Meier, M., Böse, M.
133. Using the Caltech Community Seismic Network for Early Warning. **Heaton, T.**, Böse, M., Meier, M., Bunn, J., Felizardo, C., Kohler, M., Clayton, R. W., Guy, R., Chandy, K. M., Filippitzis, F.
134. Examination of Event Dependent Latency Values for the Earthquakes Recorded by the Northern California Earthquake Data Center for Use in ShakeAlert. Terra, F., **Hellweg, M.**, Neuhauser, D., Henson, I., Milligan, P.

Environmental and Near Surface Seismology: From Glaciers and Rivers to Engineered Structures and Beyond (see page 1220).

37. The Influence of Environmental Microseismicity on Detection and Interpretation of Small-Magnitude Events in a Polar Glacier Setting. **Carmichael, J. D.**, Carr, C. G., Pettit, E. C., Truffer, M.
38. Student: Monte Carlo Simulations of Multiple Scattered Body and Rayleigh Waves in Elastic Media. **Xu, Z.**, Margerin, L., Mikesell, T. D.
39. Student: Tidally Induced Icequake Swarms at the Grounded Margins of the Ross Ice Shelf, Antarctica. **Cole, H. M.**, Aster, R. C., Baker, M. G., Chaput, J., Bromirski, P. D., Gerstoft, P., Stephen, R. A., Nyblade, A., Wiens, D. A.
40. An Improved Method to Compute the High-Frequency Seismograms for Near-Surface Sources, Application to the 2017 Xinmo Landslide. **Qian, Y.**, Li, Z., Chen, X., Wang, W.
41. Earthquakes and Low-Frequency Signals Recorded from the Great Lakes. **Yao, D.**, Huang, Y.
42. Time-Lapse Seismic Characterization of Calving Events at Helheim Glacier. **Behm, M.**, Walter, J. I., Yan, P., Holland, D. M.
43. Detecting Characteristic Microseismic Signals and Precursory Signals Related to the Cavity Roof Stability for Solution Salt Mining in Dingyuan, China. **Zhang, H.**, Qian, J., Wang, K., Tan, Y.
44. Abundant Spontaneous and Dynamically Triggered Submarine Landslides in the Gulf of Mexico. **Fan, W.**, Shearer, P. M.
45. Student: Propagation of Symmetric Mode Lamb Waves from the Grounded Margins of the Ross Ice Shelf in Response to Teleseismic S-Wave Arrivals. **Baker, M. G.**, Aster, R. C., Nyblade, A., Wiens, D. A., Bromirski, P. D., Gerstoft, P., Stephen, R. A.
46. Ocean Seismic Thermometry. **Wu, W.**
47. Sacramento Levee Failure Risk Study. **Nyst, M.**, Eads, L., Fitzenz, D. D., Seyhan, E., Velasquez, J.

Exploring Rupture Dynamics and Seismic Wave Propagation Along Complex Fault Systems (see page 1225).

68. Estimation of Rupture Zones for Large, Aleutian–Alaska Megathrust Earthquakes Using Relocated Aftershocks. **Lomax, A.**, Tape, C.
69. Student: Cascadia Earthquake and Tsunami Scenarios Based on 3D Dynamic Rupture Simulations. **Ramos, M.**, Salaree, A., Huang, Y., Li, D., Ulrich, T., Gabriel, A., Thomas, A.
70. Fault Opening Related to Free Surface Interaction on Reverse Faults: Insights from Numerical Modeling. Bruhat, L., **Rougier, E.**, Okubo, K., Bhat, H. S.

71. Three Dimensional Dynamic Earthquake Rupture Simulations of the Cascadia Subduction Zone Incorporating Its Along-Strike Variation in the Fore-Arc Deformation Style. **Aslam, K.**, Thomas, A.
72. The Holocene Paleoseismic History of a Complex Normal Fault System: The Pajarito Fault System Near Los Alamos, New Mexico and Its Implications for Seismic Hazard. **Schultz-Fellenz, E.**, Swanson, E., Crawford, B., Givler, R., Baldwin, J., Lettis, W., Rockwell, T., Olig, S., Machette, M., McDonald, E., Bloszies, C., Gray, B., Hartleb, R.

Explosion Seismology Advances (see page 1230).

48. A Method to Fuse Multi-Physics Waveforms and Improve Predictive Explosion Detection: Theory, Experiment and Performance. **Carmichael, J. D.**, Symons, N. P., Begnaud, M. L.
49. Explosion Yield Estimation by Distributed Acoustic Sensing: Insights from the Source Physics Experiments. **Ford, S. R.**, Mellors, R. J., Gok, R.
50. Comparison of Distributed Acoustic Sensing and Co-Located Geophones of a Chemical Explosion in a Borehole at Blue Canyon Dome. **Young, B. A.**, Chojnicki, K. N., Knox, H. A., Lowrey, J. D.
51. The Effects of Minute-Scale Atmospheric Variability on the Acoustic Signature of Surface Explosions. **Bowman, D. C.**, Kim, K.
52. Seismic Source Inversions from Simulations of Underground Chemical Explosions in Cavities. **Preston, L. A.**, Eliassi, M., Gullerud, A.
53. Finite-Difference Algorithm for 3D Orthorhombic Elastic Wave Propagation. **Jensen, R. P.**, Preston, L. A.
54. Far-Field Ground Motion Characteristics from Underground Chemical Explosions in Dry Alluvium. **Pitarka, A.**, Ichinose, G., Walter, W. R.
55. Estimation of Explosion-Induced Spall Surface Using a Parametric Inversion of Infrasound Data. **Poppeliers, C.**
56. A Unified Direct-Plus-Coda Amplitude Model for Explosion Monitoring. **Phillips, W. S.**
57. Imaging the Shallow Structure of the Yucca Flat at the Source Physics Experiment Phase II Site with Horizontal-to-Vertical Spectral Ratio Inversion and a Large-N Seismic Array. **Alfaro-Diaz, R. A.**, Chen, T.
58. Local Distance P/S Amplitude Ratios for Event Discrimination. **Pyle, M. L.**, Walter, W. R.
59. Student: Machine Learning Methods to Catalog Nuclear Sources from Diverse, Widely Distributed Sensors. **Barama, L.**, Williams, J., Peng, Z.
60. Waveform Classification Using Machine Learning. **Aleqabi, G.**, Wysession, M.
61. Large-N Array Seismology at the Source Physics Experiment. **Matzel, E.**, Mellors, R. J., Magana-Zook, S.
62. Student: Phase Attenuation in Eastern Russia Using Peaceful Nuclear Explosion Seismograms. **Burkhard, K.**, Phillips, W. S., Mackey, K., Dobrynina, A.
63. Simulation of Near-Field Ground Motion in Anisotropic Jointed Rock Masses Triggered by Underground Chemical Explosions. **Vorobiev, O. Y.**, Ezzedine, S. M., Antoun, T. H.

From Aseismic Deformation to Seismic Transient Detection, Location and Characterization (see page 1245).

73. Student: 2017-2019 SSE Sequence and Its Interaction with Large Earthquakes in Mexico. **Kazachkina, E.**, Radiguet, M., Cotte, N., Jara, J., Walpersdorf, A., Kostoglodov, V.
74. Stress Modeling and Active Tectonics in the Northwest Himalayan Region, India: Implications for Incomplete Ruptures of MHT and Seismic Hazard Assessment. **Kumar, S.**, Parija, M.
75. Student: Diversity of Earthquake Source Processes in Minto Flats Fault Zone, Central Alaska. **Sims, N.**, Tape, C., Kaneko, Y.
76. Student: Analysis of the Atypical 2018 and 2019 Episodic Tremor and Slip Events in Northern Cascadia. **Bombardier, M.**, Hobbs, T. E., Cassidy, J. F., Kao, H., Dosso, S. E.
77. Low-Frequency Earthquakes Accompany Deep Slow-Slip Beneath the North Island of New-Zealand. **Aden-Antoniow, F.**, Frank, W. B., Chamberlain, C. J., Townend, J., Wallace, L. M., Bannister, S.
78. Student: Overlapping Regions of Coseismic and Transient Slow Slip on the Hawaiian Décollement. **Lin, J.**, Aslam, K., Thomas, A., Melgar, D.

Full-Waveform Inversion: Recent Advances and Applications (see page 1247).

21. Student: Anelastic Global Adjoint Tomography: Initial Results. **Orsvuran, R.**, Bozdag, E., Peter, D. B.
22. Adjoint Tomography Based on the Differential Measurements of Ambient Noise Correlations. **Liu, X.**, Beroza, G. C.
23. Full-Waveform Inversion of the Middle East and Its Surrounding Region. **Desilva, S.**, Bozdag, E., Nolet, G., Gok, R.
24. Student: Sensitivity Study of Local Shear-Wave Splitting to 3D Anisotropic Structures. **Gupta, A.**, Richards, C., Modrak, R., Tape, C., Abers, G. A.
25. Student: Accelerating Full-Waveform Inversion by Stochastic and Adaptive Event Subsampling. **van Herwaarden, D.**, Boehm, C., Afanasiev, M., Thrastarson, S., Krischer, L., Trampert, J., Fichtner, A.

26. Student: Isolating the Structural Contributions to the Pn Shadow Zone of the Sierra Nevada, California. **Bogolub, K. R.**, Jones, C., Roecker, S.
27. Student: Using Wavefield Adapted Meshes in a Global Scale Full-Waveform Inversion. **Thrastarson, S.**, van Herwaarden, D., Krischer, L., Boehm, C., van Driel, M., Afanasiev, M., Fichtner, A.
28. Towards Imaging Yellowstone's Crustal Magmatic System with Ambient Noise Adjoint Tomography. **Maguire, R.**, Schmandt, B., Chen, M.
29. Characterization of the Blue Mountain Geothermal Field Using Anisotropic Elastic-Waveform Inversion. **Gao, K.**, Huang, L.
30. Time-Lapse Reservoir Monitoring at the Farnsworth CO_2-EOR Field Using 3D Elastic-Waveform Inversion in Anisotropic Media. **Liu, X.**, Huang, L., Gao, K., El-kaseeh, G., Czoski, P., Will, R.
31. Seismic Attenuation at the Blue Mountain Geothermal Field. **Feng, Z.**, Huang, L.

Innovative Seismo-Acoustic Applications to Forensics and Novel Monitoring Problems (see page 1251).

64. Structural Health Monitoring Using Multi-Parameter Information: Case of the Kurpsai Dam in the Kyrgyz Republic. **Pilz, M.**, Fleming, K., Orunbaev, S.
65. Leveraging Full-Waveform Simulations to Learn Featured-Based Models for Bayesian Seismic Monitoring. **Catanach, T. A.**, Downey, N. J., Young, C.
66. An Acoustic Metamaterial Sensing Unit for Infrasound Direction of Arrival Detection. **Rouse, J. W.**, Bowman, D. C., Walsh, T.
67. Student: A Direct Comparison Between Established Infrasonic Data Processing Pipelines from the DNE18 Virtual Experiment. **Dannemann Dugick, F. K.**, Albert, S., Blom, P., Ronac Giannone, M.

Mechanisms of Induced Seismicity: Pressure Diffusion, Elastic Stressing and Aseismic Slip (see page 1263).

79. Student: Verification of Pressure Surge Effect in the Fracture. **Jin, Y.**, Zheng, Y., Dyaur, N.
80. Student: Risk-Informed Recommendations for Managing Hydraulic Fracturing Induced Seismicity via Traffic Light Protocols. **Schultz, R.**, Beroza, G. C., Ellsworth, W., Baker, J.
81. Student: Characterizing Seismicity in the Raton Basin from 2016–2019. **Glasgow, M. E.**, Wang, R., Schmandt, B., Rysanek, S., Stairs, R. K.
82. Seismogenic Structure and Mechanism of the Ms6.0/Mw5.8 Sichuan Changning Earthquake. **Fang, L.**, Yang, T.
83. Toward a Regional 3D Velocity Model for the Fort Worth Basin Using Local and Regional Arrival Times and Converted Waves. **DeShon, H. R.**, Hayward, C.
84. Student: Effects of Seismicity Mitigation Practices Captured in Time-Lapse of Induced Earthquake Fault Activation. **Chon, E. R.**, Sheehan, A.
85. Modeling Hazard from Induced Seismicity in Oklahoma. **Kraner, M.**, Wang, F., Shen-Tu, B.
86. Stress Drop Measurements of Induced Earthquakes in Delaware Basin, Texas. **Yao, D.**, Huang, Y., Chen, J. A.
87. Student: Temporal Variations in Seismic Velocity via Ambient Noise Interferometry: Application to Wastewater Injection and Induced Seismicity. **Clifford, T. M.**, Sheehan, A., Ball, J. S.
88. Seismicity in Southeastern New Mexico. **Rubinstein, J.**, Litherland, M.
89. Student: Forecasting Induced Seismicity in Oklahoma Using Machine Learning Methods. **Qin, Y.**, Chen, T., Ma, X.
90. Efficiency Evaluation of the Seismic Monitoring Systems in the Italian Off-Shore as a Feedback for Induced Seismicity Detection Capability within Oil-Gas Exploitation Plants. **Anselmi, M.**, De Gori, P., Buttinelli, M., Chiarabba, C.
91. Induced Acoustic Emission Activity Associated with the STIMTEC In-Situ Hydraulic-Fracturing Experiment. Boese, C., **Kwiatek, G.**, Dresen, G., Renner, J., Fischer, T., Plenkers, K., Adero, B., Becker, F., Fruehwirt, T., Janssen, C., Jimenez-Martinez, V. A., Klee, G., Rehde, S., Wonik, T.
92. Investigating Large-Scale Physical and Statistical Correlations Associated with Induced Seismicity. **Hicks, S. P.**, Goes, S., Stafford, P., Whittaker, A.
93. Student: Microseismic Monitoring at Farnsworth CO2-EOR Field Using Borehole and Surface Geophones. **Li, J.**, Huang, L., Li, D., Czoski, P., El-kaseeh, G., Horton, A., Will, R.
94. Value at Induced Risk: Injection-Induced Seismic Risk from Low-Probability, High-Impact Events. **Langenbruch, C.**, Ellsworth, W., Woo, J., Wald, D. J.
95. What Can Microseismicity at the First Collab EGS Site Tell Us About the Subsurface Fracture Network? **Templeton, D.**, Morris, J., Schoenball, M., Wood, T., Robertson, M., Cook, P., Dobson, P., Ulrich, C., Ajo-Franklin, J. B., Kneafsey, T., Petrov, P., Schwering, P., Blankenship, D., Knox, H., Huang, L.

Numerical Modeling of Rupture Dynamics, Earthquake Ground Motion and Seismic Noise (see page 1284).

96. Student: Deterministic Large-Scale Wavefield Simulations Carried Out at Service Hall Array and Their Validation Using NGA-West2 Suit of GMPEs. **Saxena, S.**, Motamed, R., Ryan, K.

97. Source and Path Effects Analysis from a Series of SW4 Simulations of M7.0 Earthquake Ground-Motions in Three-Dimensional Earth Models. **Aguiar, A. C.**, Pitarka, A., Rodgers, A. J.
98. Assessment of the Variability of Basin Nonlinearity and Near-Field Ground Motion in Kathmandu, Nepal Due to Obliquely Incident Seismic Waves. **Oral, E.**, Ayoubi, P., Ampuero, J., Asimaki, D., Bonilla, L.
99. A Machine Learning Approach to Developing Ground Motion Models from Simulated Ground Motions. **Withers, K.**, Moschetti, M. P., Thompson, E. M.
100. Validation of Broadband Ground Motion from Dynamic Rupture Simulations: Towards Better Characterizing Seismic Hazard for Engineering Applications. **Withers, K.**, Ma, S., Ampuero, J., Dalguer, L., Wang, Y., Oral, E., Goulet, C. A.
101. A High Order End to End Octree-Based Finite Element Solver. **Ramirez-Guzman, L.**, Ayala Milian, G.
102. Relationships Between Dynamic Strains and Ground Motions from Numerical Simulations of Elastic Wave Propagation. **Hirakawa, E. T.**, Farghal, N. S., Barbour, A., Baltay, A. S.
103. STUDENT: An Empirical Ground-Motion Prediction Model for Induced Earthquakes in Central and Eastern United States. **Farajpour, Z.**, Pezeshk, S.
104. STUDENT: Updating the Reno Community Velocity Model. **Dunn, M. E.**, Eckert, E., Louie, J. N., Smith, K. D.
105. Generation and Validation of Broadband P-Waves in Semi-Stochastic Models of Large Earthquakes. **Goldberg, D. E.**, Melgar, D.
106. Fully Nonergodic Ground Motion Models in Central and Northern California Using NGA-West2 and SCEC Cybershake Datasets. **Meng, X.**, Goulet, C. A., Milner, K., Callaghan, S.

Seismic Imaging of Fault Zones (see page 1312).

32. STUDENT: Crustal Structure Beneath the Kumaon Himalaya and Its Linkage with Local Seismicity. **Hazra, S.**, Hazarika, D., Kumar, N., Pal, S. K.
33. STUDENT: Insight into Metallogenic Mechanism of the Kalatongke Orefield in Northwest China from a High-Resolution Deep Seismic Reflection Image. **Zhang, L.**, Zhao, L., Xie, X., Yao, Z.
34. Internal Structure of the San Jacinto Fault Zone at the Ramona Reservation, North of Anza, California from Data of Dense Seismic Arrays. Qin, L., **Share, P.**, Qiu, H., Allam, A. A., Vernon, F. L., Ben-Zion, Y.
35. STUDENT: Iterative Deterministic and Bayesian Seismic Imaging of the Wasatch Fault Zone, Utah. **Berg, E. M.**, Allam, A. A., Burlacu, R., Koper, K. D., Pankow, K.
36. STUDENT: Fault Damage Zones in 3D With Active-Source Seismic Data. **Alongi, T.**, Brodsky, E. E., Kluesner, J., Brothers, D.

What Can We Infer About the Earthquake Source Through Analyses of Strong Ground Motion? (see page 1331).

107. STUDENT: Variability of Seismic Radiation of Repeating Events as a Clue for Understanding Intermediate-Depth Earthquake Rupture. **Cubillos, S.**, Prieto, G. A.
108. Variability in Synthetic Earthquake Ground Motions Caused by Source Variability and Errors in Wave Propagation Models. Spudich, P. A., Cirella, A., **Scognamiglio, L.**, Tinti, E.
109. Dynamic Rupture and Ground Motion Modeling of the 2016 M6.2 Amatrice and M6.5 Norcia, Central Italy, Earthquakes Constrained by Bayesian Dynamic Source Inversion. **Taufiqurrahman, T.**, Gabriel, A., Gallovic, F., Valentova, L.
110. Numerical Simulation of Pulse-Like Ground Motions During the 2011 Tohoku Earthquake. **Nozu, A.**

Thursday, 30 April—Oral Sessions

Time	*Rooms 110 + 140*	*Room 115*	*Rooms 120 + 130*
	Data Fusion and Uncertainty Quantification in Near-Surface Site Characterization (see page 1193).	**Early Results from the 2020 M6.4 Indios, Puerto Rico Earthquake Sequence** (see page 1194).	**Earthquake Source Parameters: Theory, Observations and Interpretations** (see page 1210).
8:30 AM	INVITED: Modeling the Horizontal-to-Vertical Spectral Ratio and the Inversion of Subsoil Properties Using the Diffuse Field Theory. **Sánchez-Sesma, F. J.**	Local Tomography of the Puerto Rico-Virgin Islands Microplate. **Vanacore, E. A.**	Aftershock Deficiency of Induced Earthquake Sequences During Rapid Mitigation Efforts in Oklahoma. **Goebel, T. H. W.**, Rosson, Z., Brodsky, E. E., Walter, J. I.
8:45 AM	Heterogeneous Data Assimilation for Site Characterization Using the Ensemble Kalman Method. **Seylabi, E.**, Stuart, A., Asimaki, D.	The U.S. Geological Survey Response and Research Related to the January 2020, M6.4 Southwest Puerto Rico Earthquake Sequence. **Hayes, G. P.**, Yeck, W., Shelly, D. R., Earle, P., Benz, H., *et al.*	Aftershock Evolution of the 2017 M5.5 Pohang Earthquake: A Possible Post-Seismic Relaxation within Heterogeneous Fault System. **Woo, J.**, Kim, M., Rhie, J., Kang, T.
9:00 AM	Velocity Structure Inversion Based on Diffuse Field Concept for Earthquake Together with the Earthquake-to-Microtremor Ratio (EMR) Method for Microtremors. **Nagashima, F.**, Kawase, H., Ito, E., Mori, Y.	The Puerto Rico Seismic Network Response to the Southwestern Puerto Rico Seismic Sequence. **Baez-Sanchez, G.**, Miranda Berrocales, V., Colón Rodríguez, B., Huérfano, V. A., Vanacore, E. A., *et al.*	Monitoring Induced Earthquakes at the Preston New Road Shale Gas Site, Blackpool, UK. **Holt, J.**, Mesimeri, M., Edwards, B., Suroyo, P., Koper, K. D.
9:15 AM	INVITED: Urban Seismic Site Characterization with Fiber-Optic Seismology. **Beroza, G. C.**, Spica, Z. J., Perton, M., Martin, E. R., Biondi, B.	The Pacific Tsunami Warning Center's Response to the Intensive Earthquake Sequence South of Puerto Rico in January 2020. **Sardina, V.**, Koyanagi, K., Wang, D., Preller, C., Walsh, D., *et al.*	STUDENT: Using Frequency Domain Anomalies to Mark the Onset of Fault Activation Due to Hydraulic Fracturing. **Igonin, N.**, Gonzalez, K., Eaton, D.
9:30 AM	Uncertainty Propagation and Stochastic Interpretation of Shear Motion Generation Due to Underground Chemical Explosions in Jointed Rock. **Ezzedine, S. M.**, Vorobiev, O. Y., Antoun, T. H., Walter, W. R.	Statistical Seismology and Communication of the U.S. Geological Survey Aftershock Forecasts for the Southwest Puerto Rico Earthquake Sequence of 2019–2020. **Michael, A. J.**, Barall, M., Hardebeck, J., Llenos, A. L., Martinez, E., *et al.*	STUDENT: Large Uncertainties in Stress Drop Estimates and Their Tectonic Consequences. **Neely, J. S.**, Stein, S., Spencer, B. D.
9:45–10:45 AM	Posters and Break (Ballroom)		

Time	*Rooms 215 + 220*	*Rooms 230 + 235*	*Room 240*
	Photonic Seismology (see page 1295).	**Waveform Cross-Correlation-Based Methods in Observational Seismology** (see page 1323).	**Seismicity and Tectonics of Stable Continental Interiors** (see page 1314).
8:30 AM	INVITED: Utilizing Distributed Acoustic Sensing and Ocean Bottom Fiber Optic Cables for Fault Zone Characterization. **Ajo-Franklin, J. B.**, Cheng, F., Shang, Y., Lindsey, N. J., Dawe, C.	STUDENT: Burst-Type Repeating Earthquakes as a Proxy for Transient Aseismic Slip. **Shaddox, H. R.**, Schwartz, S. Y., Bartlow, N. M.	STUDENT: Seismotectonic Regions for Germany - Concept and Results. **Hahn, T.**
8:45 AM	STUDENT: Distributed Acoustic Sensing Monitoring at the First EGS Collab Testbed. **Li, D.**, Huang, L., Chi, B., Ajo-Franklin, J. B., Schoenball, M., *et al.*	INVITED: Earthquake Waveform Similarity as a Tool to Image Stress and Fault Complexity: Application to the 2019 Ridgecrest Earthquake Sequence. **Trugman, D.**	Australia's AUS7 Seismotectonic Model - A Product of 30 Years of Continuous Improvements of Earthquake Hazard Data, Concepts and Techniques. **Borleis, E.**, Peck, W., Ninis, D., Gibson, G., Cuthbertson, R.
9:00 AM	Towards Good Practice of Cable Layout for Surface Distributed Acoustic Sensing. **Edme, P.**, Paitz, P., Nap, A., Metraux, V., Martin, F., *et al.*	STUDENT: Seismo: Semi-Supervised Time Series Motif Discovery for Seismic Signal Detection. **Siddiquee, M.**, Akhavan, Z., Mueen, A.	A Far-Field Ground-Motion Model for Northern Australia from Plate Margin Earthquakes. **Allen, T. I.**
9:15 AM	Coda Amplitude Measurements Using Distributed Acoustic Sensing (DAS) Data. **Gok, R.**, Mellors, R. J.	Revisiting the Earthquake Catalog of Mount St. Helens 2004-2008 Eruption. **Wang, R.**, Schmandt, B., Zhang, H.	Miocene-Recent Crustal Reactivation of the North Tibetan Foreland, Western Hexi Corridor and Southern Beishan, China: Implications for Intraplate Earthquake Hazards in Slowly Deforming Regions of Central Asia. **Cunningham, D.**
9:30 AM	Fiber Optics for Environmental Sense-Ing (Foresee) at Pennsylvania State University. **Zhu, T.**, Martin, E. R., Shen, J., Hone, S.	INVITED: Successes, Challenges and Opportunities in Using Waveform Cross-Correlation for Volcano Monitoring. **Hotovec-Ellis, A. J.**, Thelen, W. A., Dawson, P. B., Shiro, B. R., Wellik, J. J., *et al.*	STUDENT: The Oldest Continental Nucleus Beneath the South China Block, Constrained by Regional Lg-Wave Attenuation Tomography. **Shen, L.**, Zhao, L., Xie, X., Yao, Z.
9:45–10:45 AM	Posters and Break (Ballroom)		

Time	*Rooms 110 + 140*	*Room 115*	*Rooms 120 + 130*
		Early Results from the 2020 M6.4 Indios, Puerto Rico Earthquake Sequence (continued).	**Earthquake Source Parameters: Theory, Observations and Interpretations** (continued).
10:45 AM		STUDENT: Two Earthquake Foreshock Sequences Post Gulia and Wiemer (2019). **Dascher-Cousineau, K.**, Lay, T., Brodsky, E. E.	INVITED: Analysis of the Foreshock Sequences Preceding Two Moderate (M4.7 and M5.8) Earthquakes in the Sea of Marmara Offshore Istanbul, Turkey. **Bohnhoff, M.**, Durand, V., Bentz, S., Kwiatek, G., Dresen, G., *et al.*
11:00 AM		Puerto Rico 2019-2020 Earthquake Sequence: The Challenge of Low Frequency, High Impact Events. **Von Hillebrandt-Andrade, C.**	From Elastic Deformation Loading Rates to Heat Flow Anomalies: Constraints on Seismic Efficiency and Friction Coefficient. Ziebarth, M. J., **Anderson, J. G.**, von Specht, S., Heidbach, O., Cotton, F.
11:15 AM		Preliminary ShakeMap Computation for the Indios M6.4 Earthquake, 7 January 2020, Puerto Rico. **Huérfano, V. A.**, Martínez-Cruzado, J. A., Torres, M., Hernandez, F., Staff and Students, P.	STUDENT: Quantifying Rupture Characteristics of Microearthquakes in the Parkfield Region Using a High-Resolution Borehole Network. **Pennington, C. N.**, Chen, X., Wu, Q., Zhang, J.
11:30 AM		A Comparison of Predicted and Observed Ground Motions and Additional Parameters for the 7 January 2020 Indios, Puerto Rico Earthquake. **Watson-Lamprey, J.**, Murphy, D., Johnson, C., Saqui, M., Zheng, B., *et al.*	STUDENT: A Focal Mechanism Catalog for Southern California Derived with Deep Learning Algorithms. **Cheng, Y.**, Ross, Z., Hauksson, E., Ben-Zion, Y.
11:45 AM		Highlights of Responses of Instrumented Buildings During the M6.4 Puerto Rico Earthquake of 7 January 2020. **Celebi, M.**, DeCristofaro, J., Smith, J., Martínez-Cruzado, J. A., Alicea, A., *et al.*	Tensile Fault Steps Indicated by Positive Non-Double-Couple Components of Seismic Moment Tensors in West Bohemia Swarm Earthquakes. **Vavrycuk, V.**, Adamova, P., Doubravova, J.
Noon–1:15 PM	Luncheon (Hall Three)		
	Recent Development in Ultra-Dense Seismic Arrays with Nodes and Distributed Acoustic Sensing (DAS) (see page 1300).	**Early Results from the 2020 M6.4 Indios, Puerto Rico Earthquake Sequence** (continued).	**Earthquake Source Parameters: Theory, Observations and Interpretations** (continued).
1:30 PM	Combining DAS and Air-Gun: A Cost-Effective Medium Change Monitoring System. **Zeng, X.**, Wang, B., Yang, J., Zhang, Y., Song, Z., *et al.*	Observations of Ground Failure in the 2020 M6.4 Indios, Puerto Rico Earthquake Sequence. **Thompson, E. M.**, Allstadt, K. E., Hughes, S., Bayouth, D., Cruz, E., *et al.*	A High-Resolution 4D Source Image of the 2015 M7.9 Bonin Deep-Focus Earthquake. **Kiser, E.**, Kehoe, H., Chen, M.

Time	*Rooms 215 + 220*	*Rooms 230 + 235*	*Room 240*
	Recent Advances in Very Broadband Seismology (see page 1297).	**Advances in Seismic Interferometry: Theory, Computation and Applications** (see page 1166).	**Seismicity and Tectonics of Stable Continental Interiors** (continued).
10:45 AM	Performance of Earthscope Transportable Array in Alaska. **Aderhold, K.**, Busby, R. W., Woodward, R., Frassetto, A. M.	Co- and Post-Seismic Responses in Ambient Seismic Velocity to the 1999 M7.6 Chi-Chi Earthquake in Central Taiwan. **Huang, M.**, Nayak, A., Randolph-Flagg, N.	INVITED: Integrating Seismic and Magnetotelluric Constraints on Lithospheric Properties to Explore the Geodynamic Origin of the Southeastern US Stress Field. **Murphy, B. S.**, Liu, L., Egbert, G. D.
11:00 AM	Magnetic Field Variations in Alaska: Recording Space Weather Events on the Transportable Array. **Ringler, A. T.**, Anthony, R. E., Claycomb, A., Spritzer, J., Tape, C., *et al.*	STUDENT: Processing Seismic Ambient Noise Data with the Continuous Wavelet Transform to Obtain Reliable Empirical Green's Function. **Yang, Y.**, Liu, C., Langston, C. A.	INVITED: Relationship between Crustal Structure and Intraplate Seismicity beneath the Southeastern United States. **Cunningham, E.**, Wagner, L. S., Lekic, V.
11:15 AM	INVITED: An Unwanted Long-Period Step-Response Signal Recorded During Local Alaska Earthquakes. **Tape, C.**, Parker, T., Bainbridge, G., Smith, K.	STUDENT: Noise Characteristics of One Year of DAS Monitoring Data from Penn State Foresee Array. **Shen, J.**, Zhu, T., Martin, E. R.	Is the Mainshock Rupture and Aftershock Sequence of the 2011 Mineral, Virginia Earthquake Typical of Moderate Intraplate Shocks? **Chapman, M. C.**
11:30 AM	A Holelock for Deployment of Two Streckeisen Long-Period Seismometers in a Single Borehole. **Ebeling, C. W.**, Naranjo, G., Steim, J. M., Standley, I. M., Brook, K., *et al.*	Using Seismic Interferometry to Identify and Monitor Fluids in Geothermal Systems. **Matzel, E.**, Morency, C., Templeton, D.	Geophysical Imaging of Subsurface Structures in the Charleston-Summerville, South Carolina Intraplate Seismic Zone. **Shah, A. K.**, Pratt, T., Horton, Jr., J., Counts, R.
11:45 AM	INVITED: Tiltmeters: Rotation, Horizontal Acceleration and Insensitivity to Gravity Waves. **Bilham, R.**	The Magma Plumbing System Under Mount St. Helens from iMUSH Active Seismic and Autocorrelation Reflectivity Imaging. **Levander, A.**, Kiser, E.	Characteristics of Swarms of Small Earthquakes in the Stable Craton of Northeastern North America. **Ebel, J. E.**
Noon–1:15 PM	Luncheon (Hall Three)		
	Alpine-Himalayan Alpide Shallow Earthquakes and the Current and the Future Hazard Assessments (see page 1173).	**Advances in Real-Time GNSS Data Analysis and Network Operations for Hazards Monitoring** (see page 1160).	**Seismicity and Tectonics of Stable Continental Interiors** (continued).
1:30 PM	Himalayan Surface Rupture in the 1934 Bihar-Nepal M8.3 Earthquake - Did It or Didn't It, and Does It Matter? **Bilham, R.**, Wesnousky, S. G.	INVITED: The Case for Collocation of GNSS and Seismic Networks for Earthquake and Tsunami Early Warning. **Bock, Y.**, Golriz, D., Hodgkinson, K., Sievers, C., Mencin, D. J., *et al.*	Azimuthal Effects on Magnitude Calculations for a Sparse Network: Eastern Canada. **Bent, A. L.**

Time	Rooms 110 + 140	Room 115	Rooms 120 + 130
	Recent Development in Ultra-Dense Seismic Arrays…	**Early Results from the 2020 M6.4 Indios, Puerto Rico Earthquake…**	**Earthquake Source Parameters…**
1:45 PM	Towards Long-Range Distributed Acoustic Sensing in Subsea Applications. **Karrenbach, M.** 9., Laing, C.	Impact of the M6.4 7 January 2020 Earthquake to Communities and Population of Southwestern Puerto Rico. **Vanacore, E. A.**, Lopez, A. M., Huérfano, V. A., Martínez-Cruzado, J. A.	STUDENT: Aftershock Productivity Variation in Intermediate-Depth Earthquakes. **Chu, S.**, Beroza, G. C., Ellsworth, W.
2:00 PM	Applications of a Transportable Nodal Array for Earthquake Response and Subsurface Imaging in SE Asia. **Lythgoe, K. H.**, Wei, S., Muzli, M.	Seismic Source Models for Southwest Puerto Rico in Light of the 2020 Indios Earthquake Sequence. **LaForge, R.**	Detection Limits and Near-Field Ground Motions of Fast and Slow Earthquakes. **Kwiatek, G.**, Ben-Zion, Y.
2:15 PM	STUDENT: Arcuate Moho Fragments Revealed by Dense Seismic Nodal Array in the World's Largest Continental Center. **Yang, X.**, Tian, X.	Preliminary Results from a Multichannel Seismic Reflection Survey to Identify the Fault Source of the Indios Earthquake Sequence, Puerto Rico. **ten Brink, U.**, Chaytor, J., Vanacore, E. A., Huérfano, V. A., Lopez, A. M., *et al.*	Constraining Earthquake Depth, Source Time Function and Focal Mechanism and Their Associated Uncertainties. **Garth, T. I. M.**, Sigloch, K., Storchack, D. A.
2:30 PM	STUDENT: Small Branches of Possible Crustal Flow in SE Tibetan Plateau Revealed by High-Resolution Attenuation Tomography with Chinarray Lg Data. **Song, Y.**, Zhao, L., Xie, X., Yao, Z.	SAR Imaging of the Coseismic Deformation from the 2020 Southwest Puerto Rico Seismic Sequence. **Fielding, E. J.**, Lopez, A. M., Vanacore, E. A.	STUDENT: Distinguishing the Coseismic Phase of the Earthquake Cycle with Seismogeodesy. **Golriz, D.**, Bock, Y., Agnew, D.
2:45–3:45 PM	Posters and Break (Ballroom)		
	Recent Development in Ultra-Dense Seismic Arrays with Nodes and Distributed Acoustic Sensing (DAS) (continued).		**Leveraging Advanced Detection, Association and Source Characterization in Network Seismology** (see page 1257).
3:45 PM	INVITED: Linking Active Source and Passive Ambient Noise Using Dense Array – Results from Several Experiments in China. **Wang, W.**, Zhang, Y., Xu, Y., Yang, W., Xu, S., Wang, B.		INVITED: STUDENT: Developing Convolutional Neural Networks as Efficient Tools for Earthquake Detection, Localization and Source Characterization - Work in Progress and Key Challenges. **Petersen, G. M.**, Kriegerowski, M., Nooshiri, N., Ohrnberger, M.
4:00 PM	An Active/Passive Nodal Survey in Support of Earth Source Heating at Cornell University. **Brown, L. D.**, May, D., Gustafson, O., Khan, T.		STUDENT: Source-Scanning based on Navigated Automatic Phase-Picking (S-SNAP) for Delineating the Spatiotemporal Distribution of Earthquake Sequence in Real Time: Application to the 2019 Ridgecrest, California Sequence. **Tan, F.**, Kao, H., Nissen, E.

Time	*Rooms 215 + 220*	*Rooms 230 + 235*	*Room 240*
	Alpine-Himalayan Alpide Shallow Earthquakes…	**Advances in Real-Time GNSS Data Analysis…**	**Seismicity and Tectonics of Stable Continental Interiors**
1:45 PM	Shallow Earthquake Sources in Iran. **Braunmiller, J.**, Graybeal, D., Hosseini, S.	INVITED: Implementing Real-Time GNSS Monitoring with the Earthcube Cyberinfrastructure Chords for Ol Doinyo Lengai, Tanzania. **Stamps, D.**, Saria, E., Daniels, M., Mencin, D. J., Jones, J. R., *et al.*	STUDENT: Focal Mechanisms of Relocated Earthquakes and New Stress Orientations in the Charlevoix Seismic Zone. **Fadugba, O. I.**, Langston, C. A., Powell, C. A.
2:00 PM	Implementation of New Seismic Hazard Maps into the Building Code Update in Georgia. **Onur, T.**, Gok, R., Godoladze, T., Urushadze, I., Javakhishvili, Z.	Real Time GNSS Network Operating Along Strongly Coupled Segment of Ecuador Subduction Interface. **Mothes, P. A.**, Herrera, A., Melbourne, T. I., Hodgkinson, K., Acero, W., *et al.*	STUDENT: Joint Local and Teleseismic Tomography in the Central United States and Implications for the Origin of Intraplate Seismicity. **Geng, Y.**, Powell, C. A.
2:15 PM	An Empirical Earthquake Ground-Motion Model Based on Truncated Regression: A Case Study in the Middle East. **Kuehn, N. M.**, Kishida, T., AlHamaydeh, M., Bozorgnia, Y., Ahdi, S. K.	Noise Characteristics of Operational Real-Time High-Rate GNSS Positions in a Large Aperture Network. **Melgar, D.**, Crowell, B. W., Melbourne, T. I., Szeliga, W., Santillan, M., *et al.*	Synergy of Inherited Structures and Modern Processes in the Eastern Tennessee Seismic Zone. **Levandowski, W.**, Powell, C. A.
2:30 PM	Estimation of Vs30 Based on the Japanese KiK-Net P-Wave Seismograms. **Kang, S.**, Kim, B., Lee, J.	STUDENT: Structural Health Monitoring During Induced Seismic Events in Oklahoma Using Real-Time Seismogeodetic Data. **Yin, H. Z.**, Saunders, J. K., Haase, J. S., Sheikh, I. A., Soliman, M., *et al.*	STUDENT: Deep Crustal Investigation of Central Oklahoma Using Local Earthquake Waveforms and Teleseismic Receiver Function Analysis. **Ratre, P.**, Wang, Z., Behm, M.
2:45–3:45 PM	Posters and Break (Ballroom)		
3:45 PM			
4:00 PM			

Time	Rooms 110 + 140	Room 115	Rooms 120 + 130
	Recent Development in Ultra-Dense Seismic Arrays…		**Leveraging Advanced Detection, Association…**
4:15 PM	A Dense Nodal 3C Deployment in the Cushing Fault Area, North Oklahoma. **Behm, M.**, Chen, X., Ng, R., Wang, Z.		INVITED: STUDENT: Towards an Improved Earthquake Catalog for Northern California Using Deep-Learning-Based Arrival Time Picking and Graph-Based Phase Association. **McBrearty, I. W.**, Beroza, G. C., Allen, R. M.
4:30 PM	Deep-Learning-Based Noise Suppression for Earthquake Monitoring in an Urban Setting with Dense Array Data. **Yang, L.**, Liu, X., Zhu, W., Beroza, G. C.		A Matched Filtering-Based Workflow for Characterizing Swarm and Aftershock Sequences. **Baker, B.**, Conner, A., Koper, K. D., Pankow, K.
4:45 PM	STUDENT: Classification of Urban Seismic Noise Using Unsupervised Machine Learning. **Snover, D. B.**, Johnson, C. W., Bianco, M. J., Gerstoft, P.		Source Parameters and Moment Magnitudes from Seismogram Envelopes—The Coda Calibration Tool. **Walter, W. R.**, Mayeda, K., Gok, R., Barno, J., Roman-Nieves, J. I.

Poster Sessions

Please note: Poster numbers may not be listed sequentially.

Advances in Real-Time GNSS Data Analysis and Network Operations for Hazards Monitoring (see page 1161).

62. Augmenting GNSS and Teleseismic Networks for Improved Tsunami Early Warning. **Song, Y.**
63. The 2019 Ridgecrest Earthquake Sequence Tests Integration of Real-Time GNSS for Earthquake Early Warning. **Hodgkinson, K.**, Mencin, D. J., Walls, C., Mann, D., Austin, K., Feaux, K., Sievers, C., Dittmann, T., Mattioli, G. S.
64. Higher Rate Real-Time GNSS Performance Metrics in the Network of the Americas. **Dittmann, T.**, Hodgkinson, K., Mencin, D. J., Sievers, C.
65. The Impact of GNSS Derived Finite-Fault Rupture Models on Ground Motion Predictions Based on Cascadia Megathrust Rupture Scenarios. **Kwong, K. B.**, Crowell, B. W., Melgar, D., Williamson, A. L.
66. Acquisition Protocol - Its Impact on Real-Time Data Acquisition System Performance. Hosseini, M., **Karimi, S.**, Laporte, M., Cox, M., Tatham, B.
67. The U.S. Geological Survey Southern California GNSS Network: Improving Real-time Data Acquisition and Analysis for Hazard Monitoring and Earthquake Early Warning. **Murray, M. H.**, Turner, R., Guillemot, C., Aspiotes, A., Parsi, J., Roeloffs, E. A., Brooks, B. A.

Advances in Seismic Interferometry: Theory, Computation and Applications (see page 1167).

1. Ambient Noise Based Ellipticity Observations in Southern California and Their Relation to Ground Water Changes and Seismic Velocity. **Kintner, J.**, Syracuse, E., Gao, K., Larmat, C., Delorey, A. A.
2. STUDENT: Mapping Between Frequency-Domain and Depth-Domain Velocity Perturbations in Coda Wave Interferometry. **Yuan, C.**, Jiang, C., Denolle, M. A.
3. Optimize the Stacking of Noise Correlation Functions. **Yang, X.**, Bryan, J., Okubo, K., Jiang, C., Clements, T., Denolle, M. A.
4. Toward Large-Scale Groundwater Monitoring with Seismic and Geodetic Data: Case Study and Future Directions. **Kim, D.**, Lekic, V., Huang, M., Taira, T.
5. STUDENT: Investigating Time Dependent Velocity Structure in the Shallow Subsurface of the Raton Basin. **Wilgus, J.**, Schmandt, B.

Alpine-Himalayan Alpide Shallow Earthquakes and the Current and the Future Hazard Assessments (see page 1174).

68. Long-Term Probabilistic Forecast for $M \geq 5.0$ Earthquakes in the Eastern Tibetan Plateau from Adaptively Smoothed Seismicity. **Wu, G.**

Time	Rooms 215 + 220	Rooms 230 + 235	Room 240
4:15 PM			
4:30 PM			
4:45 PM			

69. Ambient Noise Analysis by the Technology of PSD and PDF in Hotan. **Yang, Q.**
70. Student: Assessment of Continuous Soil Radon Data for the Identification of Anomalous Changes During Moderate Earthquakes of the Garhwal Himalaya. **Shukla, V.**, Chauhan, V., Kumar, N.
71. New Velocity Model of the Novy Kostel Intraplate Earthquake-Swarm Region, West Bohemia. **Malek, J.**, Brokesova, J., Novotny, O.

Data Fusion and Uncertainty Quantification in Near-Surface Site Characterization (see page 1194).

33. Comparison of V_{S30} and f_0 Values by the Single Station Earthquake-to-Microtremor Ratio (EMR) Method to Those by Traditional Multi-Station Array-Based Site Characterization Methods. **Yong, A.**, Nagashima, F., Ito, E., Kawase, H., Fletcher, J. B., Hayashi, K., Martin, A., Grant, A., McPhillips, D.
34. Student: A Statistical Representation and Frequency-Domain Window-Rejection Algorithm to Account for Azimuthal Variability in Single-Station HVSR Measurements. Cox, B. R., Cheng, T., **Vantassel, J. P.**

Early Results from the 2020 M6.4 Indios, Puerto Rico Earthquake Sequence (see page 1198).

72. PGA and MMI Instrumental Intensity Distribution in the Puerto Rico Island Upon the 2020 Puerto Rico M6.4 Earthquake. **Huerta-Lopez, C. I.**, Martínez-Cruzado, J. A., Vidal-Villegas, J. A., Suarez-Colche, L. E., Vidal-Villegas, J. A., Rivera-Figueroa, A. A., Rivera-Figueroa, A. A., Santana-Torres, E.
73. Towards a Local-Regional Coda Source Calibration for Puerto Rico: Apparent Stress Estimation and Magnitude Scaling from the 2019–2020 Earthquake Sequence and Application of LLNL's Coda Calibration Tool (CCT). **Roman-Nieves, J. I.**, Mayeda, K., Soto-Cordero, L.
74. Post-Seismic Offsets in Southwestern Puerto Rico After the M6.4 7 January 2020. **Solares-Colón, M. M.**, Lopez, A. M., Jansma, P. E., Mattioli, G. S., Mencin, D. J.
75. Student: Validation of Soil-Based Liquefaction Susceptibility Map for Puerto Rico with Observations from 7 January 2020 M6.4 Earthquake. **Irizarry Brugman, E. O.**, Lopez, A. M., Matos, M., Vanacore, E. A., Allstadt, K. E., Thompson, E. M.
76. Student: Tsunami Simulation of the M6.4 7 January 2020 of Southwestern Puerto Rico. **Lorenzo Paulino, H. A.**, Lopez, A. M.
77. Puerto Rico 2019–2020 Earthquake Sequence and Tsunami Impact. **Von Hillebrandt-Andrade, C.**, Rivera, V., Ruiz-Vélez, R., Huérfano, V. A.

78. 3D Displacement Maps of the 2019–2020 Puerto Rico Earthquake Sequence from DInSAR and MAI and Comparison with Mapped on Land Faults. **Demissie, Z.**, Lao Davila, D.
79. Double-Difference Relocations of Foreshocks, Mainshock and Aftershocks Associated to the 2019–2020 Southwestern Puerto Rico Seismic Sequence. **Lopez, A. M.**, Vanacore, E. A.
80. Assessment of the Aftershock Probability Estimates of the 2019–2020 Southwestern Puerto Rico Earthquake Sequence. **Lopez, A. M.**, Santana, D.
81. Performance of Earthworm/AQMS in the Puerto Rico Seismic Network During the January 2020 Southwestern Puerto Rico Earthquake Sequence. **Olivencia, M.**, Barbosa, J., Friberg, P. A., Huérfano, V. A., Vanacore, E. A., Baez-Sanchez, G., Feliciano, A., Macbeth, H. Gee, L.
82. Student: Enhanced Detection and Swarm Behavior of the Indios, Puerto Rico Earthquake Sequence. **Ventura-Valentin, W. A.**, Brudzinski, M. R.
83. Improving Monitoring, Hazard Assessment and Public Information for Ongoing Seismicity with Calibrated, Absolute Earthquake Location: The 2020 Indios, Puerto Rico Earthquake Sequence. **Lomax, A.**, Vanacore, E. A., Huérfano, V. A., Lopez, A. M.
84. Ground Motion Characteristics of the 2020 M6.4 Indios, Puerto Rico Earthquake Sequence. **McNamara, D. E.**, Vanacore, E. A., Lopez, A. M., Huérfano, V. A., Martínez-Cruzado, J. A., Leeds, A., Pratt, T., Wolin, E., Moschetti, M. P., Thompson, E. M., Kleckner, J., Rekoske, J., Powers, P. M., Petersen, M. D., Mueller, C. S., Benz, H., Wilson, D., Hayes, G. P., Earle, P.
85. Student: Analysis of Acceleration Time Series Recorded at El Castillo Building Upon the 7 January 2020 Puerto Rico M6.4 Indios Earthquake. **Rivera-Figueroa, A. A.**, Huerta-Lopez, C. I., Martínez-Cruzado, J. A., Suarez-Colche, L. E., Tapia-Herrera, R., Martínez-Pagan, J., Santana-Torres, E.
86. GNSS Measurements of the January 2020 Puerto Rico Earthquake Sequence. **Lopez, A. M.**, Mencin, D. J., Hodgkinson, K., Mattioli, G. S.
87. Geotechnical Failures during the Puerto Rico 2020 M6.4 Earthquake and Sequence. **Pando, M. A.**, Morales-Vélez, A. C., Hughes, K. S.

Earthquake Ground Motion and Impacts (see page 1208).

35. Student: Simulating Conditional Ground Motions for Time-History Analyses. **Bahrampouri, M.**, Rodriguez-Marek, A.
36. First-Time Use of Precariously-Balanced Rocks to Constrain Seismic Hazard Estimates for a Major Engineered Structure: Clyde Dam, New Zealand. **Stirling, M.**, McVerry, G. H., Abbott, L. R., Rood, D. H., Van Houtte, C., Huso, R., Luna, L., Barrell, D. J. A., Van Dissen, R. J., Silvester, P.
37. Regional Ground Motion Duration Prediction Model for Subduction Regions. Walling, M., **Kuehn, N. M.**, Abrahamson, N. A.
38. Consequence-Driven Earthquake Scenario Selection. **Thompson, E. M.**, Lin, Y., Wald, D. J.
39. Automated Damage Detection After Earthquakes: Algorithms and Image Catalogs. Sodeinde, L., Rashidian, V., Koch, M., **Baise, L. G.**
40. Student: Comparison of Seismic Collapse Risk of Structures by Considering Four Different NGA-West2 Ground Motion Prediction Equations. **Akhani Senejani, M.**, Pezeshk, S.
41. Student: Developing Data-Driven Stochastic Seismological Parameters of CENA from the NGA-East Database. **Nazemi, N.**, Pezeshk, S., Zandieh, A.

Earthquake Source Parameters: Theory, Observations and Interpretations (see page 1213).

88. Unmixing the Gutenberg-Richter Law. **Page, M.**, Felzer, K.
89. Earthquake Catalog from a Year+ of Seismic Monitoring on Bioko Island, Equatorial Guinea. **Lough, A. C.**
90. Student: Empirical Earthquake Scaling Relationships Derived from Geodetic Slip Distributions. **Brengman, C.**, Barnhart, W. D., Mankin, E. H., Miller, C. N.
91. Student: Comparing Artificial Neural Networks with Traditional Ground-Motion Models for Small Magnitude Earthquake in Southern California. **Klimasewski, A.**, Sahakian, V. J., Thomas, A.
92. Student: Lessons Learned from Regional MT Inversion of Small to Moderate Earthquakes Using the Dense Alparray Seismic Network (AASN). **Petersen, G. M.**, Cesca, S., Heimann, S., Niemz, P., Dahm, T.
93. Seismic Risk Due to Induced Earthquakes at the Preston New Road (UK) Shale Gas Site. **Edwards, B.**, Crowley, H., Pinho, R., Bommer, J.
94. Student: Effect of Rupture Directivity on PSHA for New Madrid Seismic Zone. **Kayastha, M.**, Pezeshk, S.
95. Student: Evolving Seismic and Aseismic Slip on a Heterogeneous Frictional Fault with Heat Generation and Temperature-Dependent Creep. **Zhou, B.**, Ben-Zion, Y.
96. Student: Analyses of Microseismicity and Induced Earthquakes During Hydraulic Fraction to Infer Tress Changes and Interactions from Case Studies. **Zhang, J.**, Chen, X.
97. Local Magnitude (ML) Determination for Earthquakes in the Yellowstone National Park Region, USA. **Holt, J.**, Pechmann, J. C., Edwards, B., Koper, K. D.

98. Student: Lithospheric Mantle Earthquakes in the Wind River Range, Wyoming. **Devin, E. G.**, Sheehan, A., Chon, E. R., Bell, J.
99. Student: A Crustal Focal Mechanism Catalog for Northern Chile: Initial Results. **Herrera, C.**, Cassidy, J. F., Dosso, S. E., Bloch, W., Sippl, C.
100. Scaling Relationships for Seismic Moment and Average Slip of Strike-Slip Earthquakes Incorporating Fault Slip Rate and Maximum Likelihood Values of Fault Width and Stress Drop. **Anderson, J. G.**, Wesnousky, S. G., Biasi, G., Angster, S.
101. Calibrating Median and Uncertainty Estimates for Ground Motion Prediction in Low-to-Moderate Seismicity Region: Application to the Middle Durance Fault (France). **El Haber, E.**, Causse, M., Hollender, F., Chaljub, E.
102. Full Source Characterization of the M5.4 11 November 2019 Le Teil, France Earthquake Based on a Multi-Technology Approach. **Guilhem Trilla, A.**, Bollinger, L., Cano, Y., Champenois, J., Duverger, C., Hernandez, B., Le Pichon, A., Listowski, C., Mazet-Roux, G., Menager, M., Merrer, S., Puyssegur, B., Rusch, R., Sèbe, O., Vallage, A.
103. Detailed Analysis of Tectonic Stress in West Bohemia Swarm Area, Czech Republic. **Adamova, P.**, Vavrycuk, V., Doubravova, J.
104. Student: Earthquake Clustering in Southcentral Utah. **Record, A. S.**, Mesimeri, M., Pankow, K.
105. Student: Mw vs. Ml Evaluation for Small Earthquakes in Oklahoma and Kansas. **Seydoux, Q.**, Herrmann, R. B.
106. Earthquake Catalog Completeness Analysis for California and Nevada. **Zeng, Y.**, Petersen, M. D., Wang, W.
107. Geometric Controls on Megathrust Earthquakes. **Hayes, G. P.**, Plescia, S. M.
108. Seismic Intensity Field Surveys and a Comparison with Strong Motion Data for the 2018 M8.2 Chiapas and the 2016 M7.8 Ecuador Events. **Smith, E. M.**, Mooney, W. D.
109. How Seamount Subduction Affects Seismicity in Guerrero, Mexico? **Cerny, J.**, Ramírez-Herrera, M., Garcia, E., Ito, Y., Tomek, F.

Leveraging Advanced Detection, Association and Source Characterization in Network Seismology (see page 1259).

6. Student: Detection and Location of Small Seismic Events Surrounding Yellowstone Lake, WY. **Forbes, N. M.**, Koper, K. D., Farrell, J., Mesimeri, M., Burlacu, R.
7. Expanding the Value of Confidence Estimates from Neural Network Classifiers. **Linville, L.**
8. A Frequency-Domain-Based Algorithm for Detecting Induced Seismicity Using Dense Surface N-Arrays. Mesimeri, M., **Pankow, K.**
9. White Box Comparison of Different Algorithmic Approaches to Event Detection and Association. **Heck, S. L.**, Young, C., Brogan, R.
10. Using Waveform Correlation to Reduce Analyst Workload Due to Repeating Mining Blasts. **Sundermier, A.**, Tibi, R., Young, C.
11. Local Earthquake Detection and Location from Continuous Seismic Waveforms in Xichang Seismic Array with U-Net. **Fang, L.**, Fan, L., Liao, S.
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47. The Los Alamos Seismic Network: History, Status and Updated Monitoring of North-Central New Mexico Seismicity. **Roberts, P. M.**, Ten Cate, J. A., House, L.
48. Advancements in the Chilean Seismic Network. **Barrientos, S. E.**
49. Güralp Certimus, A Seismic Station Optimized for Rapid Deployment in Rugged Terrain. **Reis, W.**, Hill, P., Watkiss, N., Lindsey, J., Balon, M.
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53. Student: Towards Understanding Relationships Between Atmospheric Pressure Variations and Long-Period Horizontal Seismic Data: A Case Study. **Alejandro, A. C. B.**, Ringler, A. T., Wilson, D., Anthony, R. E., Moore, S. V.

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54. Student: Surface-Wave Dispersion Spectrum Inversion Method Applied to Love and Rayleigh Waves Recorded by DAS. **Song, Z.**, Zeng, X., Thurber, C. H.
55. Student: Ambient Noise Tomography of the Near Surface Using the Ridgecrest DAS Array. **Yang, Y.**, Williams, E., Zhan, Z.
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59. Student: Earthquake Locations in the Pecos, TX Region of the Delaware Basin. **Faith, J. L.**, Karplus, M., Veitch, S., Ellsworth, W., Doser, D. I., Savvaidis, A.
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110. Student: Receiver Function Deconvolution with Noisy Seafloor Seismic Data: Amplifying Conversions from the Lithosphere. **Zhang, Z.**, Olugboji, T.
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115. Güralp Aquarius: A New Generation of Free-Fall Ocean Bottom Seismometers with Acoustic Telemetry. **Reis, W.**, Hill, P., Watkiss, N., Mangano, G.
116. A Versatile and Complete Technology Platform for Autonomous Ocean Bottom Seismometry. **Townsend, B. L.**, Moores, A., Somerville, T., Pigeon, S.

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