2022 Annual Meeting

Seismological Society of America
Technical Sessions
19–23 April • Bellevue, Washington

The SSA 2022 Annual Meeting is its first in-person gathering since 2019 and will convene at the Hyatt Regency Bellevue, featuring more than 750 technical oral and poster presentations, plenary sessions, workshops, special interest groups and field trips.

The following schedule of events and abstracts are valid until 22 March 2022 and subject to change.

Annual Meeting Co-chairs

The Society is grateful to the SSA 2022 Co-chairs Jackie Caplan-Auerbach, Western Washington University, and David Schmidt, University of Washington.

Contact

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Technical Program

Plenary Sessions

Keynote Address: The Cascadia Margin Revealed

Tuesday, 19 April, 5:30–6:30 PM

Suzanne Carbotte of Lamont-Doherty Earth Observatory

The keynote lecture by Suzanne Carbotte will focus on new research being conducted in Cascadia and will feature recent active source surveys of the Juan de Fuca plate and Cascadia margin and the new scientific insights that these data provide.

Science and Technology from a Makah Perspective—Incorporation of Native American Knowledge Systems

Wednesday, 20 April, 11:30 AM–12:30 PM

Janine Ledford, Executive Director of the Makah Cultural and Research Center

The Future of Subduction Zone Science

Wednesday, 20 April, 6–7 PM

Panelists: John Power, U.S. Geological Survey; Laura Wallace, GNS Science, University of Texas, Austin; S. Shawn Wei, Michigan State University. Moderated by Anne Sheehan, University of Colorado, Boulder

Subduction zones host a range of seismic phenomena, including the world's largest earthquakes along the megathrust, in-slab and deep-focus earthquakes, shallow crustal events, tremor and volcanic seismicity. The structure and behavior of subduction systems provides insight into Earth's evolution and plate tectonic processes. A panel will present their vision for the future of subduction zone science and discuss the important next steps to expand our understanding of subduction processes.

SSA President's Address and Awards Ceremony

Thursday, 21 April, 11:30 AM–12:30 PM

SSA President Peggy Hellweg will preside over the awards ceremony and provide an update on the Society. Immediate Past President John Townend (2021-22) will deliver the presidential address. The 2021 honorees:

- William Ellsworth, Harry Fielding Reid Medal
- Seyed Mostafa Mousavi, Charles F. Richter Early Career Award
- Timothy Ahern, Frank Press Public Service Award

Joyner Lecture: A Futurist's View of Earthquake Impact Estimation

Thursday, 21 April, 6–7 PM

David J. Wald, U.S. Geological Survey

Estimating impacts due to earthquakes—whether rapidly for emerging disasters or planning for future scenarios—entails the direct interface of seismological and civil engineering expertise and tools. Both endeavors require considering uncertain models and data since the main components of loss estimation—namely shaking, exposure and vulnerabilities—entail inherent uncertainties. Since actionable response or planning requires confidence in our results, improvements in our loss calculations require continued collaboration. Fortunately, advancements in remote sensing, rapid in-situ monitoring and impact reporting, and machine learning—combined with new datasets such as global building footprints and inventories—allow for innovative data-fusion strategies that integrate with existing models and should significantly improve the accuracy and spatial resolution of rapid shaking

Modeling, Collecting and Communicating Post-earthquake Hazard and Impact Information

Oral Session · Wednesday 20 April · 4:30 PM Pacific

Conveners: David J. Wald, U.S. Geological Survey (wald@usgs.gov); Heidi Stenner, Geohazards International (stenner@geohaz.org); Eric Fielding, NASA Jet Propulsion Laboratory (eric.j.fielding@jpl.nasa.gov); Haeyoung Noh, Stanford University (noh@stanford.edu); Susu Xu, SUNY Stonybrook (susu.xu@stonybrook.edu); Kate E. Allstadt, U.S. Geological Survey (kallstadt@usgs.gov)

Enhanced Rapid Earthquake Ground Failure and Impact Estimates With Remotely Sensed and Ground Truth Constraints

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Estimating earthquake impacts using physical or empirical models is challenging because the main components of loss estimation—namely shaking, exposure and vulnerabilities—entail inherent uncertainties. Loss modeling in near-real-time adds additional challenges, yet expectations for actionable information with a reasonable level of confidence in the results are real. Fortunately, advancements in remote sensing, rapid in-situ impact reporting and machine learning—combined with new datasets such as global building footprints—will allow for innovative data-fusion strategies that integrate with existing models and should greatly improve the accuracy and spatial resolution of rapid shaking and loss estimates. We are exploring two approaches.

First, early reports of casualties are used in a Bayesian updating fashion to constrain the possible range of fatalities and lower the prior models' uncertainties (see Engler et al., this meeting). Second, in the form of Damage Proxy Maps, remotely sensed satellite radar data are used in a Bayesian causal graph framework combined with machine learning to optimize the mapping among the physical processes that cause shaking-based building damage, landslides and liquefaction to prior expectation models. The casual graph framework also affords the potential for removing anthropogenetic noise contained in the imagery. Our main findings to date are that (1) updating the PAGER fatality model can prevent cases where PAGER losses are initially significantly off (e.g., the incorrect alert level) by quickly allowing updates, and that (2) the imagery—while slower than ground-truth observations—provide more spatially accurate impact assessments, well beyond the capabilities of the generalized loss and ground failure models. Ultimately, our two-fold model updating strategy will accommodate key ground-truth observations such as fatality reports, locations of building damage and ground failure reports to converge on actual losses more rapidly.

Local-international Collaboration Following the 2021 Haiti Earthquake for Rapid Building Damage Data Collection and Public Awareness Messaging

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Collaborations between local teams in Haiti and international researchers working remotely led to an efficient hybrid model for rapid data collection that provided open building damage data to the humanitarian community, as well as widely disseminated safety messages about aftershocks. These efforts demonstrate the effectiveness of local-international collaborative models in challenging post-earthquake operational contexts. This project leveraged a hybrid response model in which Haitian data collectors use a mobile app to acquire images and basic data on local buildings. Records are synchronized to the cloud where international volunteer virtual assessors later assign a damage rating and classify the structural system. The model was ultimately deployed across the Sud, Nippes and Grand'Anse departments by University of Notre Dame and nonprofit organization GeoHazards International (GHI) with funding from the U.S. Geological Survey (USGS) and the US Agency for International Development (USAID) and included the addition of a Haitian Creole version of the USGS Did You Feel It? survey in a mobile app to obtain data for future development of macroseismic intensities. This effort produced 12,699 building records and 2,163 Did You Feel It? surveys within 10 weeks of the earthquake. The dataset and technical resources were made freely available to the humanitarian community and can be viewed at https://www.steer.network/haiti-response.

USGS and GHI collaborated to develop Haitian Creole and English messaging about aftershocks, including guidance on staying safe. Messaging was developed using wording from the domestic USGS aftershock forecast template combined with protective action messages developed by GHI in a prior project. Messages received several rounds of informal reviews, with two Haitian translators ensuring correct use of Haitian Creole and message efficacy, among others. These messages were disseminated in both languages on USGS's main website page, the earthquake event website and Twitter feed and by GHI staff members in Haiti through local awareness campaigns.

NASA Urgent Response Products for the 2021 Mw 7.2 Earthquake in Haiti

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The 14 August 2021 Mw 7.2 earthquake in southwest Haiti caused extensive damage, which was compounded several days later when a tropical storm hit the same area. The NASA Applied Sciences Disasters Program activated a response to the disaster in cooperation with other organizations. We generated early response products from optical and radar satellite imagery, including surface displacement maps, Damage Proxy Maps (DPMs) and landslide distributions. The first high-resolution satellite images available for the area were from the Planet optical satellite constellation and the Copernicus Sentinel-1 synthetic aperture radar (SAR) satellites. Additional SAR data from JAXA ALOS-2 and Sentinel-1 and additional optical imagery was acquired later. We provided a series of products to characterize landslide impacts in the immediate aftermath of the event. High-resolution, low-latency Planet data was exploited to generate landslide inventories in the Pic Macaya national park within 24 hours of the earthquake. Experimental SAR-based landslide density estimates were also generated from Sentinel-1 amplitude images in Google Earth Engine across the entire area as a rapid way to establish areas affected by landslides even while cloud cover obscured optical mapping approaches. The surface displacement maps and DPMs were also calculated from the Sentinel-1 SAR with interferometric analysis. The surface displacement maps showed the fault rupture extended far to the west from the epicenter, consistent with the landslides in that area.

We used both ad-hoc email chains and the NASA Disasters Mapping Portal to provide urgent response products to stakeholders and other responding groups in a variety of locations. We received a few requests directly from stakeholders working with colleagues inside Haiti and provided products that way. The Mapping Portal provided an open interface to view and download data products through web browsers. A few products had licensing restrictions on due to the data sources and had to be provided only to a subset of groups.

Best Practices for Collecting and Using Post-earthquake Damage Data: Lessons From Haiti and Other Past Events

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