Proceedings Volume
2022 Basin and Range Earthquake Summit

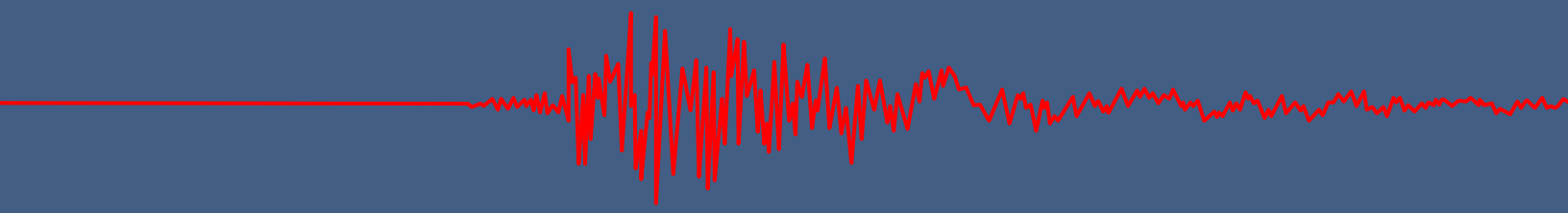
Utah Geological Survey

October 17–20, 2022

Utah Department of Natural Resources Building, Auditorium

Salt Lake City, Utah

Edited by
Adam I. Hiscock, Elizabeth Williams, Emily J. Kleber,
and Steve D. Bowman



MISCELLANEOUS PUBLICATION 177
UTAH GEOLOGICAL SURVEY
UTAH DEPARTMENT OF NATURAL RESOURCES
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PREFACE

This proceedings volume documents the results of the 2022 Basin and Range Earthquake Summit (BRES22) convened by the Utah Geological Survey in Salt Lake City, Utah, on October 17–20, 2022. The summit was sponsored by the Utah Geological Survey, the Utah Division of Emergency Management, the University of Utah Seismograph Stations, and the Utah Division of Professional and Occupational Licensing. The summit was held in the auditorium of the Utah Department of Natural Resources building in Salt Lake City, Utah, and was a hybrid meeting, with a virtual attendance option.

BRES22 consisted of six technical sessions that featured 29 subject-matter-expert speakers, and 25 poster presentations. This proceedings volume includes available technical session abstracts, oral slide presentations, posters, and links to video recordings of oral presentations.

The editors would like to thank the summit conveners, speakers, poster presenters, and summit organizers for their contributions to making BRES22 a resounding success.

Adam I. Hiscock

Proceedings Volume Lead Editor

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INTRODUCTION

The 2022 Basin and Range Earthquake Summit (BRES22) builds directly upon the results of Basin and Range Province Seismic Hazards Summits (BRPSHS) held in Reno, Nevada in May 1997 (BRPSHSI); Reno, Nevada in May 2004 (BRPSHSII); and Salt Lake City, Utah, in January 2015 (BRPSHSIII). Historically, these summits have been held at approximately decadal intervals to provide a forum for presentation and discussion of new earthquake-hazard research and mitigation in the Basin and Range Province, and to explore issues and provide recommendations related to future earthquake-hazard research, mitigation, and public policy. Due to the COVID-19 pandemic, BRES22 was delayed several times until October 2022. For the first time, the meeting also included a hybrid, remote-participation option for attendees who were unable to travel to Salt Lake City.

A committee of multi-disciplinary scientists and emergency managers from multiple agencies from across the Basin and Range states was convened to plan BRES22. The planning committee members and associated agencies are as follows:

- Idaho Geological Survey – Zach Lifton (zlifton@uidaho.edu)
- Nevada Seismological Laboratory – Jayne Bormann (jbormann@unr.edu)
- University of Nevada, Reno/Nevada Bureau of Mines and Geology – Rich Koehler (rkoehler@unr.edu)
- University of Utah Seismograph Stations – Keith Koper (koper@seis.utah.edu), Kristine Pankow (pankow@seis.utah.edu), and James Pechmann (pechmann@seis.utah.edu)
- U.S. Geological Survey – Christopher DuRoss (cduross@usgs.edu) and Alex Hatem (ahatem@usgs.gov)
- Utah Division of Emergency Management – John Crofts (jcrofts@utah.gov)
- Utah Geological Survey – Steve Bowman (stevebowman@utah.gov), Adam Hiscock (adamhiscock@utah.gov), Emily Kleber (ekleber@utah.gov), and Elizabeth Williams (former UGS employee)

As in the previous BRPSHS summits, BRES22 continued the trend of bringing together geologists, seismologists, geodesists, engineers, emergency managers, and policy makers to present and discuss new earthquake-hazards research and implications for hazard reduction and public policy in the Basin and Range Province. BRES22 consisted of four days and six sessions with separate focuses, and daily poster sessions. Each technical session was chaired by a moderator experienced in the session topic and who was also from a Basin and Range Province state and partner organization. Time for discussion and questions and answers was built into the daily schedules, allowing for important ideas and issues to be discussed in the context of that day's topic and technical sessions. In addition to the technical sessions, each day included a poster session, with various posters related to that day's topic. Posters were displayed for the entire four-day summit to provide the maximum amount of time for attendees to view all the posters and discuss the presented research. Daily topics, technical sessions, and session conveners are as follows:

Geology (Day 1, October 17, 2022)

- Technical Session 1: Significant Recent Earthquakes in the Basin and Range
  - Session Conveners: Alex Hatem (U.S. Geological Survey), Rich Koehler (University of Nevada, Reno/Nevada Bureau of Mines and Geology), and Zach Lifton (Idaho Geological Survey)
- Technical Session 2: Investigations of Low Slip-Rate Faults in the Basin and Range
  - Session Conveners: Alex Hatem (U.S. Geological Survey), Rich Koehler (University of Nevada, Reno/Nevada Bureau of Mines and Geology), and Zach Lifton (Idaho Geological Survey)

Seismology (Day 2, October 18, 2022)

- Technical Session 1: The 2020-2021 Basin and Range Province Earthquakes
  - Session Conveners: Kristine Pankow (University of Utah Seismograph Stations), and James Pechmann (University of Utah Seismograph Stations)
- Technical Session 2: Short- and Long-Term Seismic Hazard Analysis in the Basin and Range Province
  - Session Conveners: James Pechmann (University of Utah Seismograph Stations) and Kristine Pankow (University of Utah Seismograph Stations)

Earthquake Early Warning (Day 3, October 19, 2022)

- Session Convener: Keith Koper (University of Utah Seismograph Stations)

Emergency Management (Day 4, October 20, 2022)

- Session Convener: John Crofts (Utah Division of Emergency Management)

This proceedings volume includes most of the abstracts, PowerPoint presentations given in the technical sessions, and posters displayed at the summit. Additionally, links to video recordings of most of the talks given in the technical sessions on the UGS's GeoData Archive system are given in this volume. Some presenters did not give the UGS permission to publish their associated abstract, presentation, video recording, or poster, so this proceedings volume does not include all the research presented at BRES22.

AGENDA

BASIN AND RANGE EARTHQUAKE SUMMIT

October 17–20, 2022

Utah Department of Natural Resources Building, Auditorium

Salt Lake City, Utah

The Utah Geological Survey, with support from the Utah Division of Emergency Management, the Utah Professional Geologists and Professional Engineers Licensing Board, and the University of Utah Seismograph Stations will convene a Basin and Range Earthquake Summit (BRES) to bring together stakeholders in the earthquake science, policy, and emergency management communities to present and discuss the latest seismic-hazard research in the Basin and Range Province (BRP) and to evaluate the implications of that research for earthquake-hazard reduction and public policy. BRES will build on previously held Basin and Range Province Seismic Hazard Summits held in 1997, 2005, and 2015.

Monday, October 17 - GEOLOGY

7:45 a.m. Registration

8:00 a.m. Welcome

Session 1: Significant Recent Earthquakes in the Basin and Range

Session Conveners: Alex Hatem, Rich Koehler, and Zach Lifton

8:15 a.m. *Geologic Setting and Geologic Effects of the March 2020 M_w 5.7 Magna, Utah, Earthquake*; Adam Hiscock and Adam McKean, Utah Geological Survey

8:35 a.m. *Field Response and Surface-Rupture Characteristics of the 2020 M6.5 Monte Cristo Range Earthquake, Central Walker Lane, Nevada*; Rich Koehler, University of Nevada, Reno/Nevada Bureau of Mines and Geology

8:55 a.m. *Tectonic Background of the 2020 M_w 6.5 Stanley, Idaho Earthquake and a Summary of Current Work*; Zach Lifton, Idaho Geological Survey

9:15 a.m. Break (15 min)

9:30 a.m. *The 2020 M_w 5.8 Lone Pine, Eastern California, Normal-Faulting Earthquake Sequence*; Egill Hauksson, Caltech

9:50 a.m. *Mapping of Potentially Active Faults in the vicinity of the 2019 Ridgecrest Earthquake Ruptures, California*; Jessica Thompson Jobe, U.S. Geological Survey

10:10 a.m. Discussion

10:20 a.m. Poster Session

12:00 p.m. Lunch (1 hour)

Session 2: Investigations of Low Slip-Rate Faults in the Basin and Range

Session Conveners: Alex Hatem, Rich Koehler, and Zach Lifton

1:00 p.m. *Timing of Mead Slope Fault Ruptures, Lake Mead Area, Arizona*; Jeri Young Ben-Horin, Arizona Geological Survey

1:20 p.m. *Late Quaternary Slip Rates and Surface Rupture of the Bitterroot Fault, Western Montana*; Yann Gavillot, Montana Bureau of Mines and Geology

1:40 p.m. *Paleoseismic Investigation of the South Granite Mountains Fault, Central Wyoming*; Seth Wittke, Wyoming State Geological Survey

2:00 p.m. Break (10 min)

2:10 p.m. *Faults on the Fringe: New Mapping of Discreet Faults in Northwest Wyoming*; James Mauch, Wyoming State Geological Survey

2:30 p.m. *Evidence For Quaternary Activity on the Deadwood-Reeves Creek Fault, West-Central Idaho*; Lucy Piety, U.S. Bureau of Reclamation

2:50 p.m. *Geologic Mapping, Geochronology, and Fault Characterization in the Las Vegas Basin*; Seth Dee, Nevada Bureau of Mines and Geology

3:10 p.m. Discussion

3:20 p.m. Poster Session

5:00 p.m. Adjourn

Tuesday, October 18 – SEISMOLOGY

7:45 a.m. Registration

8:00 a.m. Welcome

Session 1: The 2020–2021 Basin and Range Province Earthquakes

Session Conveners: Kristine Pankow and James Pechmann

8:15 a.m. *Bringing Recent Basin and Range Earthquakes and the Seismic Cycle into Focus with Geodetic Networks*; William Hammond, University of Nevada, Reno

9:15 a.m. *Kinematic Slip Models of Four Moderate Intermountain West Earthquakes of 2020 and 2021*; Fred Pollitz, U.S. Geological Survey

10:15 a.m. Discussion

10:30 a.m. Break, Poster Session

12:00 p.m. Lunch (1 hour)

Session 2: Short- and Long-Term Seismic Hazard Analysis in the Basin and Range Province

Session Conveners: James Pechmann and Kris Pankow

1:00 p.m. *Move to Non-Ergodic Ground-Motion Models for PSHA in Utah*; Norman Abrahamson, University of California, Berkeley

1:30 p.m. *Aftershock Forecasting in the Basin and Range*; Jeanne Hardebeck, U.S. Geological Survey

2:00 p.m. Discussion

2:15 p.m. Break (15 minutes)

2:30 p.m. *U.S. National Seismic Hazard 50-State Model: Science Objectives and Products*; Mark Petersen, U.S. Geological Survey

3:30 p.m. Discussion

4:00 p.m. Break, Poster Session

5:00 p.m. Adjourn

Wednesday, October 19 – EARTHQUAKE EARLY WARNING

7:45 a.m. Registration

8:00 a.m. Welcome

Session Conveners: Keith Koper and Jayne Borman

8:05 a.m. *Real-Time Performance of the Propagation of Locally Undamped Motion (PLUM) Earthquake Early Warning Algorithm for the West Coast, U.S.A.*; Debi Kilb, University of California, San Diego

8:50 a.m. Questions and Discussion

9:00 a.m. *Future Expansion of the EEW Platform into Nevada Using an Internet of Things (IOT) Approach*; Graham Kent, Emily Morton, Daniel Trugman, Seth Saltiel, & Jayne Bormann, University of Nevada Reno

9:50 a.m. Questions and Discussion

10:00 a.m. *Towards Earthquake Early Warning in Alaska*; Natalia Ruppert, Alaska Earthquake Center, University of Alaska

10:50 a.m. Questions and Discussion

11:00 a.m. Break / Poster session

12:00 p.m. Lunch (1 hour)

1:00 p.m. *Fixed Network Smartphone-Based Earthquake Early Warning*; Ben Brooks, U.S. Geological Survey

1:50 p.m. Questions and Discussion

2:00 p.m. *Social Science and Shakealert*; Sara McBride, U.S. Geological Survey

2:50 p.m. Questions and Discussion

3:00 p.m. *Panel Discussion on Earthquake Early Warning*

3:30 p.m. Break / Poster Session

5:00 p.m. Adjourn

Thursday, October 20 – EMERGENCY MANAGEMENT

7:45 a.m. Registration

8:00 a.m. Welcome

Session Convener: John Crofts

8:05 a.m. *The Magna Earthquake from a Public Works Perspective*; Leon Berrett, Salt Lake County Public Works

8:55 a.m. Questions and Discussion

9:00 a.m. *Building Codes and Seismic Provisions, ACT-20 and USAP*; Jim McClintic, Sandy City, Chief Building Official and SAP Chair

9:50 a.m. Questions and Discussion

10:00 a.m. Break, Poster Session

10:15 a.m. *Small Tremors, Big Gaps: Identifying the need for Robust Recovery for Smaller Disasters*; Emma McFee, Utah Division of Emergency Management,

11:15 a.m. Questions and Discussion

11:25 a.m. *Stanley Earthquake Response and COVID*; Susan Cleverley, Idaho State Hazard Mitigation Manager

11:45 a.m. Questions and Discussion

12:00 p.m. Lunch (1 Hour)

1:00 p.m. *State Earthquake Clearinghouse*; Zack Lifton, Idaho Geological Survey, University of Idaho

1:30 p.m. Questions and Discussion

1:45 p.m. *Utah K-12 Public Schools Unreinforced Masonry Inventory Report, Subsequent Steps, and Outreach Efforts: Saving Life, Property, Environment, and Commerce*; John Crofts, Earthquake Program Manager for the Utah Division of Emergency Management

2:50 p.m. Questions and Discussion

3:00 p.m. Break

3:15 p.m. *Impact of 1993 Klamath Falls Earthquakes*; Althea Rizzo, Geologic Hazards Program Coordinator for Oregon Emergency Management

4:05 p.m. Questions and Discussion

4:15 p.m. *Utah Seismic Safety Commission and Their Role in Emergency Management*, John Crofts, Earthquake Program Manager for the Utah Division of Emergency Management

5:00 p.m. Adjourn

ACKNOWLEDGMENTS

The 2022 Basin and Range Earthquake Summit was made possible through the collaborative efforts of many individuals and organizations. The success of BRES22 is a direct result of their hard work. Special thanks to the organizations that co-sponsored BRES22 by providing financial and logistical support: the Utah Geological Survey, University of Utah Seismograph Stations, Utah Division of Emergency Management, U.S. Geological Survey, Utah Division of Occupational and Professional Licensing (Professional Geologists and Professional Engineers licensing boards), and the Utah Seismic Safety Commission. Many thanks to the summit organizing committee and technical session moderators (Jayne Bormann, Steve Bowman, John Crofts, Bob Carey, Christopher DuRoss, Alex Hatem, Adam Hiscock, Emily Kleber, Rich Koehler, Keith Koper, Zach Lifton, Kristine Pankow, James Pechmann, and Elizabeth Williams) and invited subject-matter experts who made oral and poster presentations. Finally, thanks to the many UGS staff who assisted with summit logistics (including Justin Dunfield, Stormie Elmer, Adam Hiscock, Emily Kleber, Kristi Rasmussen, Starr Soliz, Elizabeth Williams, and Cheryl Wing) and contributed greatly to the success of the summit.