

# Southern California Earthquake Center

SCEC5 Annual Report (Year 1) Reporting Period: Feb 1 - Dec 1, 2017

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# Southern California Earthquake Center: Research Program in Earthquake System Science, 2017-2022

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# 1. Overview

The Southern California Earthquake Center (SCEC) was founded as a Science & Technology Center on February 1, 1991, with joint funding by the National Science Foundation (NSF) and the U. S. Geological Survey (USGS). Since 2002, SCEC has been sustained as a stand-alone center under cooperative agreements with both agencies in three consecutive, five-year phases (SCEC2 through SCEC4). This project is an extension of those agreements for the fourth 5-year period from 1 Feb 2017 to 31 Jan 2022 (SCEC5 USGS) and 1 May 2017 to 30 Apr 2022 (SCEC5 NSF). SCEC coordinates fundamental research on earthquake processes using Southern California as its main natural laboratory. Currently, over 1000 earthquake professionals are participating in SCEC projects. This research program is investigator-driven and supports core research and education in seismology, tectonic geodesy, earthquake geology, and computational science. The SCEC community advances earthquake system science by gathering information from seismic and geodetic sensors, geologic field observations, and laboratory experiments; synthesizing knowledge of earthquake phenomena through system-level, physics-based modeling; and communicating understanding of seismic hazards to reduce earthquake risk and promote community resilience.

## **SCEC5 Research Vision**

Earthquakes are emergent phenomena of active fault systems, confoundingly simple in their gross statistical features but amazingly complex as individual events. SCEC's long-range science vision is to develop dynamical models of earthquake processes that are comprehensive, integrative, verified, predictive, and validated against observations. The science goal of the SCEC5 core program is to *provide new concepts that can improve the predictability of the earthquake system models, new data for testing the models, and a better understanding of model uncertainties.* 

The validation of model-based predictions against data is a key SCEC activity, because empirical testing is the most powerful guide for assessing model uncertainties and moving models towards better representations of reality. SCEC validation efforts tightly couple basic earthquake research to the practical needs of probabilistic seismic hazard analysis, operational earthquake forecasting, earthquake early warning, and rapid earthquake response. Moreover, the risk-reduction problem—which requires actions motivated by *useful* information—strongly couples SCEC science to earthquake engineering. SCEC collaborations with engineering organizations are directed towards end-to-end, physics-based modeling capabilities that span system processes from "ruptures-to-rafters."

SCEC connects to the social sciences through its mission to convey authoritative information to stakeholders in ways that result in lowered risk and enhanced resilience. SCEC's vision is to engage end users and the public at large in ongoing, community-centric conversations about how to manage particular risks by taking specific actions. The SCEC Communication, Education, and Outreach (CEO) program seeks to promote this dialog on many levels, through many different channels, and inform the conversations with authoritative earthquake information. Towards this goal, the SCEC5 CEO program will continue to build networks of organizational partners that can act in concert to prepare millions of people of all ages and socioeconomic levels for inevitable earthquake disasters.

# Intellectual Merit of SCEC5 Research

Southern California is SCEC's principal natural laboratory for the study of earthquake physics and geology. Earthquake processes in this tectonically diverse stretch of the Pacific-North America plate boundary are closely monitored by instrumental systems of increasing density and resolution. Recent research has posed crucial questions about the current earthquake hazard of the San Andreas fault system. In particular, the observed open intervals (times since the last large ruptures) on major faults are skewed to higher values than expected from the latest Uniform California Earthquake Rupture Forecast (UCERF3). Random chance or subtle data or model bias are potential explanations, but another

hypothesis of basic-research interest is the synchronization of fault ruptures into "seismic super-cycles" modulated by the largest ruptures. Understanding the earthquake behavior of the San Andreas system is a fundamental problem for SCEC5 that has considerable practical implications.

The SCEC5 Science Plan was developed by the SCEC Planning Committee and Board of Directors with extensive input from issue-oriented "tiger teams" and the community at large. The strategic framework for the SCEC5 Science Plan was cast in the form of five basic questions of earthquake science: (1) How are faults loaded on different temporal and spatial scales? (2) What is the role of off-fault inelastic deformation on strain accumulation, dynamic rupture, and radiated seismic energy? (3) How do the evolving structure, composition and physical properties of fault zones and surrounding rock affect shear resistance to seismic and aseismic slip? (4) How do strong ground motions depend on the complexities and nonlinearities of dynamic earth-quake systems? (5) In what ways can system-specific studies enhance the general understanding of earthquake predictability? These questions cover the key issues driving earthquake research in California, and they provide a basis for gauging the intellectual merit of SCEC5 research activities.

# Science Plan

Research priorities were developed to address these five basic questions. Tied to the priorities are fourteen science topics distributed across four main thematic areas.

<u>Modeling the fault system</u>: We seek to know more about the geometry of the San Andreas system as a complex network of faults, how stresses acting within this network drive the deformation that leads to fault rupture, and how this system evolves on time scales ranging from milliseconds to millions of years.

- **Stress and Deformation Over Time.** We will build alternative models of the stress state and its evolution during seismic cycles, compare the models with observations, and assess their epistemic uncertainties, particularly in the representation of fault-system rheology and tectonic forcing.
- **Special Fault Study Areas.** Focus on Earthquake Gates. Earthquake gates are regions of fault complexity conjectured to inhibit propagating ruptures, owing to dynamic conditions set up by proximal fault geometry, distributed deformation, and earthquake history. We will test the hypothesis that earthquake gates control the probability of large, multi-segment and multi-fault ruptures.
- **Community Models.** We will enhance the accessibility of the SCEC Community Models, including the model uncertainties. Community thermal and rheological models will be developed.
- **Data Intensive Computing.** We will develop methods for signal detection and identification that scale efficiently with data size, which we will apply to key problems of Earth structure and nanoseismic activity.

<u>Understanding earthquake processes</u>: Many important achievements in understanding fault-system stresses, fault ruptures, and seismic waves have been based on the elastic approximation, but new problems motivate us to move beyond elasticity in the investigation of earthquake processes.

- **Beyond Elasticity.** We will test hypotheses about inelastic fault-system behavior against geologic, geodetic, and seismic data, refine them through dynamic modeling across a wide range of spatio-temporal scales, and assess their implications for seismic hazard analysis.
- **Modeling Earthquake Source Processes.** We will combine co-seismic dynamic rupture models with inter-seismic earthquake simulators to achieve a multi-cycle simulation capability that can account for slip history, inertial effects, fault-zone complexity, realistic fault geometry, and realistic loading.
- **Ground Motion Simulation.** We will validate ground-motion simulations, improve their accuracy by incorporating nonlinear rock and soil response, and integrate dynamic rupture models with

wave-scattering and attenuation models. We seek simulation capabilities that span the main engineering band, 0.1-10 Hz.

• **Induced Seismicity.** We will develop detection methods for low magnitude earthquakes, participate in the building of hydrological models for special study sites, and develop and test mechanistic and empirical models of anthropogenic earthquakes within Southern California.

<u>Characterizing seismic hazards</u>: We seek to characterize seismic hazards across a wide spectrum of anticipation and response times, with emphasis on the proper assessment of model uncertainties and the use of physics-based methods to lower those uncertainties.

- **Probabilistic Seismic Hazard Analysis.** We will attempt to reduce the uncertainty in PSHA through physics-based earthquake rupture forecasts and ground-motion models. A special focus will be on reducing the epistemic uncertainty in shaking intensities due to 3D along-path structure.
- **Operational Earthquake Forecasting.** We will conduct fundamental research on earthquake predictability, develop physics-based forecasting models in the new Collaboratory for Interseismic Simulation and Modeling, and coordinate the Working Group on California Earthquake Probabilities.
- **Earthquake Early Warning.** We will develop methods to infer rupture parameters from time-limited data, ground-motion predictions that account for directivity, basin, and other 3D effects, and better long-term and short-term earthquake rupture forecasts for conditioning of early-warning algorithms.
- **Post-Earthquake Rapid Response.** We will improve the rapid scientific response to strong earthquakes in Southern California through the development of new methods for mobilizing and coordinating the core geoscience disciplines in the gathering and preservation of perishable earthquake data.

<u>Reducing seismic risk</u>: Through partnerships coordinated by SCEC's Earthquake Engineering Implementation Interface, we will conduct research useful in motivating societal actions to reduce earthquake risk. Two topics investigated by these engineering partnerships will be:

- **Risk to Distributed Infrastructure.** We will work with engineers and stakeholders to apply measures of distributed infrastructure impacts in assessing correlated damage from physics-based ground-motion simulations. An initial project will develop earthquake scenarios for the Los Angeles water supply.
- Velocity and Rheology of Basin Sediments. In collaboration with geotechnical engineers, we will advance the understanding of site effects and soil-structure interactions by incorporating nonlinear rheological models of near-surface rock and soil layers into full-physics earthquake simulations.

# **Communication, Education and Outreach Plan**

The SCEC CEO program manages and expands a suite of successful activities within four CEO focus areas. *Knowledge Implementation* connects SCEC scientists and research results with practicing engineers, government officials, business risk managers, and other professionals in order to improve application of earthquake science. The *Public Education and Preparedness* focus area educates people of all ages about earthquakes, tsunamis, and other hazards, and motivate them to become prepared. The *K-14 Earthquake Education Initiative* improves earth science education in multiple learning environments, overall science literacy, and earthquake safety in schools and museums. The *Experiential Learning and Career Advancement* program provides research opportunities, networking, and other resources to encourage students and sustain careers in STEM fields. Four long-term intended outcomes of the CEO program are: improved application of earthquake science literacy; and increased diversity, retention, and career success in the scientific workforce. SCEC's vigorous promotion of workforce diversity will be augmented

by a new Transitions Program that will provide students and early-career scientists with resources and mentoring at major steps in their careers.

### **Broader Impacts of Proposed Research**

California comprises about two-thirds of the nation's long-term earthquake risk, and Southern California about 40% of this total. SCEC5 will translate basic research into practical products that will inform efforts to reduce risk and build resilience in California and elsewhere. The Center works with the USGS and California agencies to improve the two basic elements of seismic hazard analysis, earthquake rupture forecasting and ground-motion modeling. It will equip long-term seismic hazard analysis and short-term earthquake forecasting with physics-enabled, system-specific models that can provide authoritative information about the time dependence of seismic hazards to help communities prepare for potentially destructive earthquakes. This research will also lead to improvements in earthquake early warning as well as the delivery of post-event information about strong ground motions and secondary hazards, such as landsliding, liquefaction, and tsunamis.

Los Angeles Mayor Garcetti's plan to strengthen buildings, fortify the water system, and enhance reliable telecommunications has demonstrated how the quantitative characterization of seismic hazards can provide the scientific basis for strong civic actions to mitigate risk and improve resilience. SCEC5 will support the chain of scientific inference that proceeds from hazard characterization to loss estimation and eventually to implementation of effective mitigation options with well-defined costs and benefits.

SCEC, through its CEO program, continues to manage the statewide Earthquake Country Alliance, which now comprises more than 200 partner organizations and sponsors a yearly preparedness campaign—the Great California ShakeOut—that has involved millions of California citizens. SCEC coordinates ShakeOut activities in all U.S. states and territories as well as Canada, Japan, New Zealand, and a growing number of other countries. SCEC also coordinates the EPIcenter Network of more than 60 museums, science centers, and libraries, and it will deliver public in-formation through an extensive array of educational booklets, web-based resources, and social media.

SCEC is a center-without-walls that has developed the virtual organization needed to coordinate and sustain interdisciplinary, multi-institutional earthquake system science. The SCEC5 working groups, workshops, field activities, intern programs, and annual meeting fosters deep collaborations and strong interpersonal networks among earthquake scientists, earthquake engineers, and other professionals. SCEC5 will promote intellectual exchange and amplify the support for students and early-career scientists, giving them the organizational resources and experience to become the field's future leaders.

# 2. Organization and Management

SCEC has developed an effective management structure for coordinating earthquake research and education activities. The Center's ability to facilitate collaborative, investigator-driven research has been repeatedly proven in its diverse accomplishments. Participation in SCEC is rising despite flat funding and its national and international partnerships are flourishing. In its annual reports, the SCEC External Advisory Council has repeatedly documented the enthusiasm among SCEC participants and endorsed their high levels of satisfaction with the Center's leadership and management.

## **Core and Participating Institutions**

SCEC continues as an institution-based center, governed by a Board of Directors, who represent its members. The Center currently involves more than 1000 scientists and other experts in active SCEC projects, making it one of the largest formal collaborations in geoscience. It continues to operate as an open consortium, available to all qualified individuals and institutions seeking to collaborate on earthquake science in Southern California, and its membership continues to evolve. The institutional membership currently stands at 75, comprising 18 core institutions and 57 participating institutions (not

limited to universities, nor to U.S. organizations). The three USGS offices in Menlo Park, Pasadena, and Golden and the California Geological Survey are core institutions. Thirteen foreign institutions are currently recognized as partners with SCEC through a set of international cooperative agreements.

## **Board of Directors**

Each core institution has appointed one member to the SCEC5 Board of Directors, which is chaired by the Center Director. The Board is the primary decision-making body of SCEC; it meets three times per year (typically in February, June, and September) to approve the Annual Collaboration Plan and budget and deal with major business items. The SCEC5 board comprises 18 voting members. Jean-Philippe Avouac (Caltech), Tim Dawson (CGS), John Shaw (Harvard), Patrick Fulton (Texas A&M), Toshiro Tanimoto (UCSB), and Graham Kent (UNR) are new members to the Board. John Shaw serves as Vice-Chair of the Board. The USGS members serve in non-voting liaison capacity. Nico Luco (USGS, Golden) joined the Board as a non-voting liaison member. Ex officio members include the Co-Director; the PC Vice-Chair; the Executive Science Director for Special Projects; and the Associate Directors for CEO, IT, Science Operations, and Administration. The Board is empowered to elect two nominees from the participating institutions to serve two-year terms as At-Large Members. Nominations are still open for the At-Large Members of the SCEC5 Board of Directors.

# **Director Transition**

The SCEC Director acts as Principal Investigator (PI) on most proposals submitted by the Center, retaining final authority to make and implement decisions on Center programs, budgets, and financial obligations. (The modified SCEC5 By-Laws allow the Co-Director to act as PI on special project proposals.) The Director oversees all Center activities and is the Center's official liaison to the rest of the world, and specifically, to the funding agencies. The Director chairs the SCEC Board of Directors, and may appoint committees as needed to carry out Center business.

In 2016, Thomas Jordan (SCEC5 proposal PI) announced plans to retire as SCEC Director as soon as a replacement was found. USC and SCEC began a nationwide search in Fall 2016 for an outstanding scientist to lead SCEC as a Professor in Earth Sciences at USC. The search identified John Vidale from the University of Washington as the top candidate. The USC Department of Earth Sciences, SCEC Board of Directors, and program officers for the SCEC cooperative agreements unanimously supported Vidale's appointment as SCEC Director. John Vidale is a member of the National Academy of Sciences with extensive experience leading a large organization and projects, including serving as Director of the Pacific Northwest Seismic Network and helping lead U.S. efforts in Earthquake Early Warning. He has long been engaged with SCEC, most recently as a member and then Chair of the SCEC Advisory Council. Vidale was appointed Dean's Professor of Earth Sciences at USC in August 2017. The SCEC Director transition took place in September 2017 at the SCEC Annual Meeting. Jordan had served more than 15 years as Center Director.

# **Executive Committee**

The changes in the SCEC leadership structure and formation of an Executive Committee of the Center (ExCom), as written in the modified SCEC5 By-Laws, were intended to redistribute some of the Director's responsibilities and workload. The ExCom handles daily decision-making responsibilities for the Center. It comprises of the Center Director and Board Chair (John Vidale), the Co-Director and PC Chair (Greg Beroza), the Board Vice-Chair (John Shaw), the PC Vice-Chair (Judi Chester), the Executive Director for Special Projects (Christine Goulet), the Associate Directors for Information Technology (Philip Maechling), Science Operations (Tran Huynh), CEO (Mark Benthien), and Administration (John McRaney). The Board Chair and Vice-Chair coordinate program activities with the SCEC Board of Directors. The Co-Director may serve as the Principal Investigator of SCEC special projects. The PC Chair serves as a liaison to

SCEC science partners, chairs of the annual meeting, and oversees the annual science planning process. The PC Vice-Chair and the Executive Director of Special Projects (ED-SP) provide added science leadership when formulating and implementing the annual science program. The ED-SP manages the science activities of projects funded outside the core cooperative agreements and coordinating these activities with the PC and Associate Director for IT. The Associate Director for Science Operations manages all operational and financial aspects of the science planning process. The Associate Director for CEO is responsible for Center communication, education, and outreach activities. The Associate Director for Administration manages the Center budget as approved the Board and liaises with the funding agencies.

# **External Advisory Council**

The external Advisory Council (AC) serves as an experienced advisory body to the Center, charged with developing an overview of SCEC operations, identifying strengths, opportunities, and vulnerabilities, and advising the Director and the Board. Since the inception of SCEC in 1991, the AC has provided perspective to maintain the vitality of the SCEC and help its leadership chart new directions. The Center has always provided its sponsoring agencies and participants, with a complete copy of the yearly AC report.

The AC was reconstituted as part of the SCEC5 transition. Meghan Miller, the president of UNAVCO, accepted the position as AC Chair, effective September 2017. She has served on the AC since 2012 and is well known for her organizational skills and scientific leadership. The new AC members are Rick Aster (Colorado State U.), Susan Beck (U. Arizona), Yann Klinger (IPGP), Tom O'Rourke (Cornell), Susan Owen (JPL), and Heidi Tremayne (EERI). Continuing members are Roger Bilham (U. Colorado), Donna Eberhart-Phillips (UC Davis), Warner Marzocchi (INGV, Rome), and Tim Sellnow (U. Central Florida).

## **Science Planning Committee**

The Planning Committee (PC) is responsible for formulating the Center's science plan, conducting proposal reviews, and recommending projects to the Board for SCEC support. The chair of the PC is the SCEC Co-Director, Greg Beroza of Stanford, and its Vice-Chair is Judi Chester of Texas A&M. The PC comprises the leaders of the SCEC science working groups—disciplinary committees, focus groups, and special project groups—who, together with the working group co-leaders, guide SCEC's research program. Its members play key roles in implementing the SCEC5 science plan.

# SCEC5 Science Planning Organization



SCEC5 science planning organization chart, consisting of Disciplinary Committees (green boxes), Interdisciplinary Focus Groups (yellow boxes), and Technical Activity Groups (ellipses) coordinated by Working Group leaders in Special Projects, San Andreas Fault System, SCEC Community Models, and the Earthquake Engineering Implementation Interface.

## **Science Working Groups**

The SCEC organization comprises a number of disciplinary committees, focus groups, special project teams, and technical activity groups (TAGs). These working groups have been our engines of success, and many of the discussions at this meeting will feed into their plans.

The Center supports disciplinary science through standing **disciplinary committees** in Seismology, Tectonic Geodesy, Earthquake Geology, and Computational Science. These groups are responsible for disciplinary activities relevant to the SCEC Science Plan, and they make recommendations to the

Planning Committee from the perspective of disciplinary research and infrastructure. The leaders of the disciplinary committees are <u>Seismology</u>: Yehuda Ben-Zion and Jamie Steidl; <u>Tectonic Geodesy</u>: David Sandwell and Gareth Funning; <u>Earthquake Geology</u>: Mike Oskin and Whitney Behr; <u>Computational Science</u>: Eric Dunham and Ricardo Taborda.

SCEC coordinates earthquake system science through **interdisciplinary focus groups**. The leadership are <u>FARM</u>: Nadia Lapusta and Nick Beeler; <u>EFP</u>: Max Werner and Ned Field; <u>SDOT</u>: Kaj Johnson and Bridget Smith-Konter; <u>EEII</u>: Jack Baker and Jon Stewart; <u>GM</u>: Domniki Asimaki, Annemarie Baltay-Sundstrom; <u>SAFS</u>: Kate Scharer and Michele Cooke; <u>CXM</u>: Liz Hearn and Scott Marshall.

SCEC **special projects** are research partnerships in targeted earthquake research that heavily leverage the core program. Synergy between the special projects and the core program is ensured by a central SCEC policy, instituted by the Board of Directors in 2005: the science objectives of all SCEC special projects must be aligned with those of the SCEC core program and explicitly included as objectives in the SCEC Annual Science Plan. Current SCEC special projects include UCERF, CSEP, SEISM2, CISM, MSW, and CCSP. Special Projects are currently funded by NSF, USGS, the California Earthquake Authority, the W. M. Keck Foundation, and Pacific Gas & Electric Company. The ED-SP (Christine Goulet) manages the science activities of special projects in coordination with the Associate Director for IT (Phil Maechling), who oversees the SCEC's CME, a high-performance collaboratory for large-scale earthquake simulations. The CME infrastructure and software developers currently support five major SCEC computational platforms: High-F, CyberShake, Broadband, F3DT, and UCVM. The importance and scale of effort involved with CSEP, CXM, and data management led us to request additional funding for software developers focused on these activities in the SCEC5 proposal.

SCEC researchers are encouraged to self-organize into **technical activity groups** (TAGs) to develop and test critical methodologies for solving specific problems. TAGs have formed to verify the complex computer calculations needed for wave propagation and dynamic rupture problems, to assess the accuracy and resolving power of source inversions, and to develop geodetic transient detectors and earthquake simulators. TAGs share a *modus operandi*: the posing of well-defined "standard problems", solution of these problems by different researchers using alternative algorithms or codes, a common cyberspace for comparing solutions, and meetings to discuss discrepancies and potential improvements. TAGs are initiated through successful proposals submitted through the science collaboration process. TAG proposals typically involve a workshop and include a research coordination plan that sets a timetable for successful completion of TAG activities no later than the end of SCEC5.

#### **Science Planning Process**

The annual budget cycle begins with a SCEC Leadership Meeting in early June, when the Board, Planning Committee, Executive Committee of the Center, and agency representatives discuss SCEC research priorities. Based on these discussions, the PC drafts an annual SCEC Science Plan (www.scec.org/scienceplan), which is presented to the SCEC community at the Annual Meeting in early September. The PC uses the feedback received at the meeting to finalize the Annual Science Plan, and a project solicitation released in October. SCEC participants submit proposals in response to this solicitation in November. All proposals are independently reviewed by the Director, the Co-Director, Vice-Chair of the PC, and the leaders of at least three relevant science working groups. Reviews are assigned to avoid conflicts of interest.

The PC meets in January to review all proposals and construct an Annual Collaboration Plan. The plan's objective is a coherent science program, consistent with SCEC's basic mission, institutional composition, and budget that achieves the Center's short-term objectives and long-term goals, as expressed in the Annual Science Plan. The PC Chair submits the recommended Annual Collaboration Plan to the Board of Directors for approval. The annual budget approved by the Board and the Center

Director is submitted to the sponsoring agencies for final approval and funding. Upon approval by the agencies, notifications are sent out to the investigators.

To construct the annual SCEC Collaboration Plan, proposals submitted in response to the annual solicitation are evaluated based on: (a) scientific merit of the proposed research; (b) competence, diversity, career level, and performance of the investigators; (c) priority of the proposed project for short-term SCEC objectives; (d) promise of the proposed project for contributing to long-term SCEC goals; (e) commitment of the principal investigator and institution to the SCEC mission; (f) value of the proposed research relative to its cost; and (g) the need to achieve a balanced budget while maintaining a reasonable level of scientific continuity given funding limitations. With respect to criterion (b), improving the diversity of the SCEC community and supporting early-career scientists is a major goal of the Center. It is important to note that a proposal that receives a low rating or no funding does not necessarily imply it is scientifically inferior. Rather, these proposals may be downgraded because they may not meet other criteria noted above.

SCEC maintains close alignment with the USGS Earthquake Hazards Program during the science planning process through three mechanisms: (1) reporting and accountability required by USGS funding of SCEC, (2) liaison memberships on the Board of Directors by the three USGS offices now enrolled as SCEC core institutions, and (3) a Joint SCEC/USGS Planning Committee (JPC). The JPC augments the SCEC Planning Committee with a group of program leaders designated by the USGS who participate in the construction of the Annual Collaboration Plan. If requested, the PC chair will continue to sit on the Southern California Proposal Review Panel for the USGS External Research Program.

#### **Communication, Education and Outreach**

The Associate Director for CEO (Mark Benthien) manages SCEC's Communication, Education, and Outreach program, with activities focused on four areas: Knowledge Implementation, Public Education and Preparedness, K-14 Earthquake Education, and Experiential Learning and Career Advancement. The Earthquake Engineering Implementation Interface, led by Jack Baker (Stanford) and Jon Stewart (UCLA), provides the organizational structure for connecting SCEC scientists and research results with practicing engineers, government officials, business risk managers, and other professionals in order to improve application of earthquake science. Through coordination with the Earthquake Country Alliance (ECA) and other outreach partners, SCEC educates people of all ages about earthquakes, tsunamis, and other hazards, and motivate them to become prepared. SCEC's education programs are managed by Gabriela Noriega of USC through the Office of Experiential Learning and Career Advancement.

A Communication, Education, and Outreach Planning Committee (CEO PC) provides guidance for CEO programs and activities, reviews reports and evaluations, and identifies synergies with other parts of SCEC and external organizations. Its members include stakeholders representing CEO program focus areas: public education and preparedness (Kate Long); K-14 education initiative (Danielle Sumy); experiential learning and career advancement (Sally McGill); and knowledge implementation (Ricardo Taborda, Tim Dawson). The CEO PC is chaired Tim Sellnow of the University of Central Florida, who also serves as the liaison to the SCEC Advisory Council.

## **SCEC Participants and Demographics**

The SCEC leadership is committed to the growth of a diverse scientific community and actively pursues this goal by (1) encouraging core institutions to consider diversity in their appointments of Board members and electing the Board's members-at-large; (2) making diversity a major criterion in appointments to the Planning Committee, a crucible for developing leadership because it has significant responsibilities in managing SCEC activities; (3) including diversity as a criterion used to evaluate proposals and construct the Annual Collaboration Plan; and (4) promoting diversity among our students and early-career scientists through recruitment for the SCEC internship and diversity programs.

Recognizing that diversity is a long-term issue requiring continuing assessments and constant attention, SCEC continues to track the demographics in order understand the composition and evolution of the SCEC community. For example, people who participate in the SCEC Annual Meeting and/or Annual Collaboration Plan must register in the SCEC Community Information System, which includes providing demographic information. The table below shows a snapshot of the diversity of the SCEC Community as a whole. The SCEC community generally follows historical trends in the geosciences, with much greater diversity among students than senior faculty. Participation of underrepresented minorities is very low, again reflecting the Earth Sciences at large.

We recognize that the current situation is not unique to SCEC and reflects historical trends in the geoscience and physical science communities. We believe SCEC can be most effective in changing these trends by promoting diversity among its students and early-career scientists; i.e., by focusing on the "pipeline problem". The SCEC internship programs have been an effective mechanism for this purpose and we will redouble our efforts to encourage a diverse population of students to pursue careers in earthquake science through the launch of the Transitions Program in SCEC5. This program will provide junior members of the SCEC community with resources and mentoring across key career transitions, directing efforts to encourage and sustain careers in the geosciences and other STEM fields.

			Ra	ice				Ethnicity	
	Native	Asian	Black	Pacific	White	NA	Latino	Not	NA
Faculty (Tenure-Track)	0	22	0	0	127	65	12	142	60
Faculty (Non-Tenure-Track)	0	2	0	0	4	2	0	6	2
Research Faculty (Tenure-Track)	0	4	0	0	9	8	0	11	10
Research Faculty (Non-Tenure-Track)	0	5	0	0	17	6	3	18	7
Postdoctoral Scholar or Fellow	0	17	0	0	28	28	0	40	33
Teacher (K-12)	0	0	0	0	1	0	0	1	0
Student (Graduate)	0	48	2	2	99	65	14	130	72
Student (Undergraduate)	0	5	4	1	15	19	11	20	13
Student (High School)	0	0	0	0	0	0	0	0	0
Staff (Management and Administration)	0	3	0	0	23	5	0	22	9
Staff Scientist (Doctoral Level)	0	17	1	0	58	18	3	68	23
Staff (Research)	0	7	0	0	21	10	1	24	13
Staff (Comm, Outreach, Public Relations)	0	0	1	0	5	1	1	6	0
Technician	0	0	0	0	2	1	0	2	1
Professional Engineer (Civil and Environ)	0	3	0	0	8	2	1	8	4
Professional Engineer (Other)	0	1	0	0	3	1	0	2	3
Professional Geologist	0	1	0	0	15	18	3	12	19
Consultant (Engineering)	0	1	0	0	3	2	0	4	2
Consultant (Information Technology)	0	2	0	0	1	1	0	2	2
Consultant (Other)	0	0	0	0	3	1	0	2	2
Building Official	0	0	1	0	0	0	0	0	1
Emergency Manager	0	0	0	0	3	2	1	2	2
Self-Employed	0	0	0	0	2	0	0	2	0
Unemployed	0	0	0	0	0	0	0	0	0
Retired	0	0	0	0	3	1	0	3	1
Other	0	1	0	0	6	3	1	3	6
Unspecified	0	5	0	0	14	60	1	14	64

Center database of SCEC participants in 2017

		Gender		C	Citizenship			
	Male	Female	NA	US	Other	NA		
Faculty (Tenure-Track)	146	45	23	130	59	25		
Faculty (Non-Tenure-Track)	7	1	0	3	5	0		
Research Faculty (Tenure-Track)	14	5	2	9	10	2		
Research Faculty (Non-Tenure-Track)	19	6	3	16	10	2		
Postdoctoral Scholar or Fellow	37	25	11	21	43	9		
Teacher (K-12)	1	0	0	1	0	0		
Student (Graduate)	112	81	23	116	93	7		
Student (Undergraduate)	15	24	5	28	9	7		
Student (High School)	0	0	0	0	0	0		
Staff (Management and Administration)	15	13	3	25	5	1		
Staff Scientist (Doctoral Level)	69	22	3	65	23	6		
Staff (Research)	23	13	2	23	12	3		
Staff (Comm, Outreach, Public Relations)	3	4	0	7	0	0		
Technician	1	1	1	2	0	1		
Professional Engineer (Civil and Environ)	10	3	0	10	3	0		
Professional Engineer (Other)	4	1	0	3	2	0		
Professional Geologist	23	6	5	25	5	4		
Consultant (Engineering)	6	0	0	3	3	0		
Consultant (Information Technology)	3	1	0	3	1	0		
Consultant (Other)	2	2	0	3	1	0		
Building Official	1	0	0	0	1	0		
Emergency Manager	2	3	0	4	1	0		
Self-Employed	2	0	0	2	0	0		
Unemployed	0	0	0	0	0	0		
Retired	4	0	0	3	1	0		
Other	4	5	1	6	4	0		
Unspecified	22	11	46	11	59	9		

# International Collaborations

- SCEC Advisory Council. We have two international members, Yann Klinger of Institute for Physics of the Globe in Paris and Warner Marzocchi of INGV in Rome.
- CEO/ShakeOut. SCEC collaborates with 60 countries on ShakeOut activities, including
  partnerships with Afghanistan, Canada, Colombia, Greece, Iran, Mexico, New Zealand, India,
  Japan, Italy, Afghanistan, Pakistan, CNMI, and the Philippines on holding ShakeOut drills. SCEC
  hosts the websites for all ShakeOut drills worldwide. In 2017, there were > 58 million participants
  worldwide, with ~20 million participating in the U.S. See www.shakeout.org.
- ERI/Tokyo and DPRI/Kyoto. SCEC has long term MOU's with the Earthquake Research Institute in Tokyo and the Disaster Prevention Research Institute in Kyoto. A partnership between SCEC and these two institutions was initiated in 2012 with funding from NSF under its Science Across Virtual Institutes (SAVI) initiative. This program established a Virtual Institute for the Study of Earthquake Systems (VISES), which will coordinate SCEC/ERI/DPRI collaborations in earthquake system science.

- **CSEP (Collaboratory for the Study of Earthquake Predictability).** SCEC founded CSEP in 2006. CSEP testing centers are now located at USC, ERI/Tokyo, GNS/New Zealand, ETH/Zurich, and CEA/China.
- ACES (APEC Cooperative for Earthquake Simulation). SCEC and JPL are the U.S. organizations participating in ACES. Information on ACES can be found
   http://www.quakes.uq.edu.au/ACES/. Andrea Donnellan of SCEC/JPL is the U.S. delegate the ACES International Science Board and John McRaney of SCEC is the secretary general. Eiichi
   Fukuyama of the National Research Institute for Earth Science and Disaster Prevention (NIED) in
   Japan is the current Executive Director of ACES. The next international workshop is planned for
   September25-28, 2018 on Awaji Island near Osaka, Japan. Awaji Island was the epicenter of the
   1995 Kobe Earthquake.
- **ETH Zurich/Switzerland.** Stefan Wiemar participates in the SCEC/CSEP projects. Luis Dalguer participates in the rupture validation project.
- Korea Institute of Geosciences. Seok Goo Song participates in the rupture validation project.
- KAUST/Saudi Arabia. Martin Mai participates in the Source Inversion Validation TAG.
- **IGNS/New Zealand.** David Rhoades and Matt Gerstenberger of the Institute for Geological and Nuclear Sciences of New Zealand are involved in the CSEP program. Charles Williams, Caroline Holden, and Susan Ellis participate in the ground motion modeling program.
- University of Otago/New Zealand. Mark Stirling of Otago participates in the ground motion modeling program.
- **Canterbury University/New Zealand.** Brendon Bradley of QuakeCore participates in the SCEC ground motion simulation program.
- **GFZ Potsdam/Germany.** Danijel Schorlemmer participates in the CSEP special project. Olaf Zielke participates in the simulators project.
- **University of Bristol/UK.** Max Werner is the co-leader of the Earthquake Forecasting and Prediction Interdisciplinary Focus Group of the SCEC PC.
- UNAM/Mexico. Victor Cruz-Atienza works in the rupture validation project.
- **INGV Rome/Italy.** Warner Marzocchi is a member of the Scientific Review Panel (SRP) for the UCERF3 project.
- **University of Naples/Italy.** Iunio lervolino participates in the Ground Motion Simulation Validation TAG under support from the European REAKT Project.
- **GSJ/Japan.** Yuko Kase works in the rupture validation program.
- **CICESE/Mexico.** John Fletcher and Jose Gonzalez-Garcia are collaborating with SCEC scientists in post earthquake studies of the El Mayor-Cucupah earthquake and its aftershocks and on modeling for the CGM.
- Imperial College London/UK. Dylan Rood collaborates on dating tsunami projects.
- **SCEC Annual Meeting.** The SCEC annual meeting continues to attract international participants each year. There were participants in the 2017 annual meeting from Australia, China, Japan, India, Mexico, Canada, France, Switzerland, Germany, Russia, Italy, Taiwan, Turkey, and New Zealand.
- International Participating Institutions. ETH/Zurich, CICESE/Mexico, Western University/Canada, University of Bristol/UK, University of Canterbury/New Zealand, and Institute for Geological and Nuclear Sciences/New Zealand; and 4 institutions from Taiwan (Academia Sinica; National Central University; National Chung Cheng University; National Taiwan University) are participating institutions in SCEC.
- China Earthquake Administration/Beijing. Director Jordan, Co-Director Beroza, and Associate Director McRaney gave invited presentations on SCEC research and the SCEC organization at several venues in Beijing in December 2016. Talks were given at the CEA Institutes for

Earthquake Science, Institute for Geology, and Institute for Geophysics. Talks were also given at the China Earthquake Networks Center and the Chinese Academy of Sciences. An MOU was signed at the end of the meetings to work for closer collaboration between the China Earthquake Administration and SCEC in the future. The first workshop, International Conference for the Decade Memory of the Wenchuan Earthquake, resulting from this MOU will be held in Chengdu, China in May 2018. John Vidale, Bruce Shaw, and Gareth Funning will represent SCEC at the workshop.

- **10th World Congress on Earthquake Engineering, Santiago, Chile, January 2017.** SCEC participating scientists include Mark Petersen, Nico Luco, Ricardo Taborda, Norm Abrahamson, Andrew Whittaker, David Jackson, Jack Baker, Jonathan Stewart, John Anderson, Greg Deierlein, Jorge Crempien, Ralph Archuleta, Kevin Milner, Jamie Steidl, Matt Gerstenberger, Farzin Zareian. Monica Kohler, Max Werner, David Wald, Luis Dalguer, Mark Stirling, Keith Porter, Hong-Kie Thio, Ting Lin, and Heidi Tremayne.
- StatSeis 10, Wellington, New Zealand, February 2017. SCEC participating scientists include David Jackson, Tom Jordan, David Rhoades, Annemarie Christopherson, Ned Field, Jeanne Hardebeck, Bill Ellsworth, Xiaowei Chen, Bruce Shaw, Morgan Page, Zhigang Peng, Xiaofeng Meng, Martin Mai, Mark Stirling, Warner Marzocchi, Matt Gerstenberger, Yan Kagan, Danijel Schorlemmer, Ruth Harris, and Margaret Boettcher.
- **GADRI Summit, Kyoto, Japan, March 2017.** Mark Benthien and Michelle Wood of CSU-F represented SCEC at the 3rd Global Summit of Research Institutes for Disaster Risk Reduction. PSHA Meeting, Lenzburg, Switzerland, September 2017. Tom Jordan, Norm Abrahamson, Luis Dalguer, Ned Field, Matt Gerstenberger, David Jackson, Martin Mai, Warner Marzocchi, Danijel Schorlemmer, and Stefan Wiemer represented SCEC at this meeting.
- Korea Institute of Geosciences, October 2017. Christine Goulet visited the KIG to discuss SCEC research in ground motions.
- **Probabilities of Earthquake Under Wellington, New Zealand, November 2017.** John Vidale, Heidi Houston, and Bruce Shaw were on the review panel for this meeting.
- Child-Centered Disaster Risk Reduction and Comprehensive School Safety, Chengdu, China, November 2017. Mark Benthien represented SCEC at this meeting at the invitation of Save the Children International. He gave a presentation on the SCEC CEOP program.
- International Travel by PI and SCEC Scientists. The PI and other SCEC scientists participated in many international meetings and workshops during the report year. The former PI presented SCEC research at INGV in Rome in May 2017 and November 2017

# 3. Accomplishments

## **Science Accomplishments**

The SCEC5 Science Plan comprises 14 topical elements, organized into four themes (see Overview). Research priorities within each topical element are guided by a progressive set of science milestones, used by SCEC and its sponsoring agencies as indicators of research progress along conceptual pathways. The milestones are more explicit in the early years than the out-years of SCEC5 owing to the evolving and unpredictable nature of basic research. This section summarizes the science accomplishments under each topical element for the reporting period. Publications from this period are listed in the final section of this report.

#### Theme A: Modeling the Fault System

#### 1. Stress and Deformation Over Time

We are working to construct models of the stress state and its evolution during seismic cycles, compare the models with observations, and assess their uncertainties, particularly in the representation of fault-system rheology and tectonic forcing. The construction of the Community Thermal Model and the Community Rheology Model builds on this effort (see "Community Models" section below).

Mil	estone	Y1	Y2	Y3	Y4	Y5
а	Compare GPS-based stressing rates with focal mechanism-based stressing rates.		х	х	х	
b	Collect and analyze campaign GPS data in areas of sparse GPS coverage and poor InSAR correlation.	х	х	х		
с	Assess level and impact of non-secular deformation in SCEC region from the combined CGM inputs				х	
d	Populate the CSM below the upper crust with depth-dependent modeled stresses. Release updated versions of the CSM based on additional borehole constraints and geodynamic modeling.		x	x		
е	Update high-precision earthquake catalogs, including detection of small events, improved locations, and focal mechanisms, to help inform the CSM.	х	х	х	х	х
f	Map the partitioning between seismic and aseismic components of deformation along the major faults using geodetic and seismic data.		х	х	х	
g	Refine the geologic slip rates on faults in Southern California, including offshore faults, and optimally combine the geologic data with geodetic measurements to constrain fault-based deformation models, accounting for observational and modeling uncertainties.				x	
h	Develop physics-based fault system models that capture possible variations in elastic material properties, and permanent/inelastic deformation processes in the crust.			х	х	х

#### 2. Special Fault Study Areas – Focus on Earthquake Gates

Earthquake gates are regions of fault complexity that may control the propagation of large earthquakes. The SCEC Earthquake Gates Area Incubator Workshop was held in March 2017

(<u>www.scec.org/workshops/2017/ega</u>). Proposals were solicited for earthquake gates areas during SCEC5 (2017-2022). The SCEC Planning Committee evaluated the proposals and chose the junction between the San Andreas and San Jacinto Faults (Cajon Pass region) as the initial area of emphasis for Earthquake Gates Area Initiative. Additional EGAs will be considered through the 2018 SCEC proposal process.

Mil	ilestone				Y4	Y5
а	Hold incubator workshop to develop a research strategy and candidate locations or topics for the Earthquake Gates initiative.	х				
b	Decide on at least one target for the Earthquake Gates initiative and hold an inaugural workshop.		х			
С	Hold joint workshop on multi-disciplinary research on Earthquake Gates focus area(s). Assess scope of Earthquake Gates projects, solicit work as needed.		х	x		
d	Collect and synthesize earthquake recurrence, slip-rate, interseismic deformation and fault geometry information within Earthquake Gate Area(s).	х	х	x	×	
е	Develop multi-cycle rupture and deformation models within the Earthquake Gate focus area(s).	х	х	x	х	
f	Calibrate the model results from the Earthquake Gate area(s) with geologic and geophysical data from within the EGA(s). Incorporate understanding developed under this initiative to improve earthquake rupture forecasts.			x	x	x

g	Develop a paleoseismic event database that includes event ages and quality ranking not limited to Earthquake Gate Area(s).	х	х	x	х	
h	Determine how model-based hypotheses about fault interactions through zones of complexity can be tested by observations of accumulated slip and paleoseismic chronologies.			x	x	x

#### 3. Community Models

The Unified Community Velocity Model (UCVM) is a collection of software tools and application programming interfaces designed for standardized access to the multiple seismic velocity models used in SCEC research. Its development has been driven by physics-based ground-motion simulation and seismic hazard analysis. This year we published a paper describing the UCVM software framework (www.scec.org/publication/2067).

A one-day Community Rheology Model (CRM) workshop was held in September 2017 with the goals of presenting a preliminary Geological Framework (GF) and Community Thermal Model (CTM), developing a draft CRM for the Mojave region based on the CTM and the GF, and fomenting community consideration of flow laws suitable for Mojave lithosphere rock types and conditions. The meeting resulted in a prioritized list of research tasks to move the CRM toward a draft product by 2019 (www.scec.org/proposal/report/17206).

Also in September, we held a successful workshop that developed a plan to create an updatable version of the Community Fault Model (CFM) for use by earthquake simulators.

Mil	estone	Y1	Y2	Y3	Y4	Y5
а	Convene a workshop focused on guiding community model development towards self-consistent and well-integrated community models.		х			
b	Organize TAGs for community models, as appropriate, including a TAG to develop a geologic framework for the Community Rheology Model (CRM).	х				
С	Develop a strategy for a unified approach to data integration, manipulation and querying of community models (CXMs), and identify common or sharable data structures between different CXMs.		x			
d	Develop standards to represent smaller scale features in the CXMs, such as stochastic variations in elastic properties, attenuation, stress, temperature, rheology, fluid transport properties, and fault orientation.		x			
е	Deliver a preliminary Community Thermal Model (CTM) that provides crustal temperatures throughout southern California based on 1D conductive heat flow and a simplified 3D distribution of thermal properties.	х				
f	Update the CTM from 1D to 3D so that it is consistent with CRM lithologies and field data. Improve surface heat flow maps. Search for additional heat flow and thermal property data in areas with poor coverage.		x	x		
g	Add a CTM branch that quantifies advective heat transport, and evaluate the need for anisotropic thermal properties. Provide error ranges for modeled temperatures and alternative models where there are significant disagreements.				х	х
h	Conduct peer review of the Community Fault Model (CFM) 5.1 through a virtual workshop; release a revised version with preferred fault representations.	х				
i	Implement a portable, user-friendly interface to access CFM model versions, components, and metadata, incorporating a new fault naming and number system compatible with the USGS Fault and Fold database.		x	x		
j	Refine CFM representations of the linkages among major fault systems.				х	х
k	Improve the resolution of the Community Velocity Models (CVM-S and CVM-H) in the shallow crust, by adopting products developed or results obtained through the research activities defined for D.14 (physics of the geotechnical layer) and validate against observations.			х		

I	Define and implement a protocol to introduce alternative representations into existing CVMs, leveraging the seismic studies of various geographic regions (e.g., San Jacinto, Salton Sea).			х		
m	Develop a statewide CVM, and validate against independent ambient seismic field measurements.				x	
n	Construct a provisional 3D geologic framework of southern California, as a first step towards developing a CRM. Convene a workshop on how to characterize the brittle, ductile, plastic, and viscoelastic rheologies of the southern California lithosphere, including shear zones.		x			
0	Implement mixing laws for polymineralic rocks of the CRM. Release CRM version 1.0 that includes 3D geologic framework and constitutive models consistent with the CTM.				х	
р	Unify representation of SCEC community models, including refined CFM and CVM structures and prototypes of the CTM and CRM, and enhance their interoperability. Release a CRM that incorporates the rheologies of shear zones.					x
q	Define and implement standards for the periodic evaluation (verification and validation) of different CXMs through direct (e.g., exploration or experimental) and indirect (modeling and simulation) methods, as applicable.	х	x	х		
r	Produce a consensus combined campaign/continuous GPS time series product.	х	х			
s	Develop grids of horizontal velocity and strain rate derived from consensus GPS time series. Upload to CGM v. 1.0 website.	х	х			
t	Develop consensus vertical time series from continuous GPS sites.		х	х		
u	Identify and develop best practices for producing and updating LOS time series from the new data streams provided by Sentinel-1A and 1B, and ALOS-2.		х	х		
v	Produce a consensus secular velocity InSAR product using the full archive of SAR data (ERS, Envisat, ALOS-1, Sentinel) for the SCEC region.	х	х	х	х	
w	Conduct peer review of initial CGM products through a virtual workshop.			х		
x	Develop methods for integrating full vector GPS time series with LOS InSAR time series from multiple platforms to construct 1 km spatial resolution grids of horizontal and vertical time series.				x	x
У	Populate the CSM below the upper crust with depth-dependent modeled stresses. Release updated versions of the CSM based on additional borehole constraints and geodynamic modeling.		x	x		
z	Populate CSM at all depths with stresses (amplitudes) from static deformation models that account for upper crustal rheology as well as ductile rheologies from the CRM			х	x	x
aa	Extend the Community Stress Model (CSM) to incorporate borehole stress data.		х	Х		
bb	Deliver a deformation model based on the Community Geodetic Model (CGM) to the CSM.			х		

#### 4. Data-Intensive Computing

We have developed methods for signal detection and identification that scale efficiently to very large data volume, which we are applying to key problems of Earth structure and seismicity. The "Mining Seismic Wavefields" grant from the NSF/EAR Geoinformatics Program will expire in 2018. NSF's Geoinformatics program is on hiatus, so SCEC has submitted a bridge proposal to NSF to sustain this work until an evolved Geoinformatics program emerges. Participants in this proposal, and others at SCEC, are aggressively adopting machine learning for a variety of purposes that advance earthquake understanding.

Mil	estone	Y1	Y2	Y3	Y4	Y5
а	Develop a distribution pathway (e.g., via GitHub or CIG) for SCEC community software.	х				

b	Distribute efficient earthquake detection software for community use.	х	х	х	х
С	Develop computing tools to handle large datasets from geodesy, lidar and structure-from-motion, 3D tomography, ambient seismic field measurements, and other signal processing techniques used, for example, to search for tectonic tremor and repeating events.	х	x	x	x
d	Develop tools and algorithms for uncertainty quantification in large-scale inversion and forward-modeling studies, for managing I/O, data repositories, workflow, advanced seismic data format, visualization, and end-to-end approaches.	x	x	x	x

## Theme B: Understanding Earthquake Processes

#### 5. Beyond Elasticity

We are engaged in multiple efforts to examine the interplay of fault roughness and plasticity from an observational point of view, as it may explain the apparent deficit of shallow slip in earthquakes, as it affects numerical models of rupture and ground motion, and as it affects long-term fault behavior. Among the ongoing work are sensitivity studies of differing forms of plastic response.

Mil	estone	Y1	Y2	Y3	Y4	Y5
а	Hold an interdisciplinary workshop focused on the topic of Beyond Elasticity.	х				
b	Identify existing modeling capabilities for inelastic rheology, how these are compatible with each other, and establish a framework for verification as presently done for linear anelastic problems.	x	x			
с	Develop inelastic wave propagation codes that can be ported to HPC architectures.	х				
d	Develop strategies to quantify the contribution of inelastic off-fault deformation to geodetic estimates of strain accumulation.		х	х		
е	Apply inelastic crustal deformation models to estimate fault slip rates and assess results through comparison to geologic slip rates.				х	
f	Develop strategies to identify the potential of near-surface plasticity and its effect on ground motion prediction, with emphasis on forward wave propagation simulation, to develop multi-step strategies to account for inelastic behavior.		x	x	x	
h	Develop and quantify the uncertainty of prototype approaches to represent the effects of non-linearity that would allow the continued use of linear wave propagation as an effective approximation.		x	x	x	
i	Identify key material parameters that will be necessary to characterize inelastic behavior of geomaterials in the upper crust and near-surface deposits, and define strategies to add these data to community models (e.g., CVM, CRM) for use in forward and inverse modeling.		x	х	х	
j	Assess the evidence for earthquake supercycles in southern California, and identify future data needs.		х	х		
k	Constrain alternative forms of fault-zone and distributed non-linearity, as well as the factors that influence it, such as cohesion and pore fluid pressure.			х		
Ι	Quantify the differences between full 3D nonlinear and simpler approximations (developed under milestone 5h) and linear anelastic simulations; and their effects on ground motion prediction, intensity measures, and hazard estimation.			x	x	x

#### 6. Modeling Earthquake Source Processes

Among the signal accomplishments this year has been a first-of-its kind experiment to image flash-heated contacts formed during sliding of rock surfaces at seismic slip rates in the laboratory. This has the potential to provide key insights into earthquake source processes, particularly when paired with recent developments in SCEC that document localized heating with fault-zone petrology. Also on this topic, we are developing increasingly realistic multi-cycle earthquake simulations that include coupled

thermal-mechanical effects, and are implementing a new source inversion validation plan that is initially focused on stress-drop validation.

Mil	estone	Y1	Y2	Y3	Y4	Y5
а	Understand and quantify how different levels of complexity and variability in source models influence advances in other areas such as broadband and deterministic ground motion simulation.	x	x	x		
b	Understand how inelastic strain associated with fault roughness and discontinuities influences seismic radiation and scaling of earthquake source parameters, and quantify their effects on ground motion.		x	x	x	
с	Describe how fault complexity, fluid pressure and inelastic deformation interact to determine the probability of rupture propagation through structural complexities.			х		
d	Assess how shear resistance and energy dissipation depend on the maturity and hydrogeological state of the fault system, and how these are expressed geologically.				х	
е	Determine how earthquake source properties such as stress drop estimated from seismic observations based on simplified models correspond to properties of physically realistic sources.		x	x		
f	Study how seismic and aseismic deformation processes interact, and how that interaction affects long-term fault behavior, by exploring how slow slip and microseismicity redistributes stress for the following large events and how large events interact with deeper fault extensions.	x	x	x	х	x
g	Use numerical models to investigate which fault constitutive laws and parameter ranges are compatible with paleoseismic findings, including average recurrence, slip rate, coefficient of variation of earthquake recurrence, and the possibility of earthquake supercycles; determine whether such behavior can be compatible with the currently observed statistics of smaller-magnitude events.					x

#### 7. Ground Motion Simulation

SCEC has built a broad range of ground motion simulation tools that include the effects of topography, fault roughness, and plasticity - both near that fault and remote from it. We are developing improved velocity models, including refined shallow geotechnical layers and with stochastic representation of crustal properties. We continue to expand many of these modeling efforts into Central California with the benefit of additional support from PG&E.

Under the guidance of the Committee for the Utilization of Ground Motion Simulations (UGMS), we finished development of the Beta version of the web-based lookup tool for MCER ground motions and released it in October 2017. The MCER response spectra cover greater Los Angeles, providing a resource for cities and counties in the region. The UGMS also continued to validate CyberShake using data from the 1994 Northridge earthquake, and the committee examined differences between long-period response spectra from the UCERF2 model used in the CyberShake simulations and the UCERF3 model used by the USGS to develop the 2014 national MCER maps. A webinar, organized by the Structural Engineers Association of Southern California (SEAOSC), was given on October 26 by UGMS chair, C.B. Crouse, who reported the availability of the tool and illustrated its use. Crouse then gave a similar presentation at the COSMOS seminar on November 2017.

Milestone			Y2	Y3	Y4	Y5
а	Incorporate and validate multi-segment rupture in the Broadband Platform.	х	х			
b	Derive and implement stochastic models for the representation of the heterogeneous, anisotropic near-surface velocity structure for CVMs.	х	x			
С	Implement standardized approaches and develop software tools to analyze recorded data and synthetic seismograms, and facilitate streamlined verification and validation of broadband and deterministic simulations.	х	x			

d	Gather and develop novel data sets (e.g., small earthquakes, tremor/low-frequency earthquakes, ambient noise) and new instrumentation (e.g., cell-phone accelerometers, strainmeter data, dense arrays) to develop and validate ground motion predictions.	х	х	х		
е	Incorporate nonlinear amplification factors in the Broadband Platform.		х			
f	Develop, validate and incorporate appropriate and realistic constitutive models to represent the inelastic behavior of rock and deposit materials (soils) in 3D deterministic and 2D broadband ground motion simulations.		х	х	х	x
g	Improve computational efficiency of ull 3D ground motion simulations with nonlinear response using approaches such as domain reduction methods. Develop tools to automate the computational domain decomposition and reconstruction for each simulated scenario.			x	x	x
h	Explore and test approximations to represent the effects of non-linearity in computationally efficient reciprocity-based simulations.			х	х	x
i	Quantify the relative roles of fault geometry, heterogeneous frictional resistance, wavefield scattering, intrinsic attenuation, and near-surface heterogeneities and nonlinearities in controlling ground motion and its variability.		х	х	х	
j	Quantify the relative importance of nonlinearities near the fault, along the path, and in near surface soft-material deposits, and their susceptibility to subsurface topography (i.e., 3D basin and site effects).			х	х	x
k	Develop and implement methods for computing, storing, and serving 3D Green's functions.				х	
I	Evaluate the spatio-temporal correlation of ground motions at regional scales from recordings and using CyberShake data. Compare and validate pertinent CyberShake results against empirical correlations.			х	х	x
m	Develop programs and activities to advance the use of 3D deterministic and broadband ground motion simulation products, and results in engineering design, seismic hazard assessment and mitigation.	х	х	х	х	x

#### 8. Induced Seismicity

We developed new methods for detecting small earthquakes, and in the process have segregated non-earthquake sources, including planes and helicopters. SCEC research on induced seismicity is focused on Southern California. The USGS Earthquake Hazards Program already has a well-developed program to investigate induced seismicity nationwide, and so SCEC is coordinating activities in this area with the USGS program through FARM leader Nick Beeler.

Milestone			Y2	Y3	Y4	Y5
а	Assemble appropriate fluid flow data to assess the relationship to earthquakes.		х			
b	Determine the degree to which ground motion from induced seismicity is similar, or different, than that from natural tectonic seismicity.			х		
С	Develop and apply approaches for improved detection and improved characterization, e.g., microseismic detection using fingerprinting and matched-filter approaches to suspected induced seismicity in California.					

Theme C. Characterizing Seismic Hazards

#### 9. Probabilistic Seismic Hazard Analysis

We are continuing to develop physics-based earthquake rupture forecasts and ground-motion models within the CyberShake PSHA framework. We are increasingly focused on fully characterizing faults, velocity models, and recurrence in order to systematically reduce the epistemic uncertainty in shaking intensities for hazard maps. We continue to verify and validate CyberShake to higher frequencies - now up to 1 Hz - and expand the areal coverage - most recently into Central California.

Mil	estone	Y1	Y2	Y3	Y4	Y5
а	Develop methods for evaluating forecasts of finite-size earthquake ruptures against observations. Identify and characterize suitable datasets for retrospective tests of finite-rupture forecasts.		x	x		
b	Identify pathways for using information from physics-based simulators in PSHA and OEF.		х			
С	Carry out targeted experiments to validate ground motion effects identified through simulations of wave propagation in the CVMs.	х	х	х	х	
d	Assess predictive capability of long-term earthquake rupture forecasts by combining patterns of earthquake occurrence and strain accumulation with neotectonic and paleoseismic observations of the last millennium.			x		
е	Place geologic bounds on the character and frequency of multi-segment and multi-fault ruptures of extreme magnitude.				х	
f	Develop a statewide Cybershake-based hazard model.					х
g	Develop earthquake cycle models consistent with paleoseismic chronologies (slip estimates and event dates) that investigate stress accumulation and stress drop sequences over multiple earthquake cycles. Test the hypothesis that seismic supercycles seen in earthquake simulators actually exist in nature and explore the implications for earthquake predictability.					x
h	In coordination with the USGS, communicate improvements in physics-based seismic hazard analysis to the earthquake engineers, emergency responders, and general public.	х	х	х	х	х

#### 10. Operational Earthquake Forecasting

We held the third Workshop on Operational Earthquake Forecasting (OEF) in April, 2017, and published a full OEF model for California (UCERF3-ETAS). Potential early adopters attended this meeting and articulated and compiled potential use cases and their value. One goal of this meeting was to provide guidance to the USGS on what level of effort should be put into developing these capabilities. We continue to make progress towards earthquake-simulator-based forecasting through the CISM project.

Mil	estone	Y1	Y2	Y3	Y4	Y5
а	Develop methods for validating UCERF3-ETAS model forecasts utilizing CSEP or other tools.		х			
b	Formulate approaches for validating physics-based earthquake simulators against observations, and for using them to help constrain existing uncertainties in statistically based OEF models (e.g. UCERF3-ETAS).			x		
С	Assess the predictive power of the Coulomb stress hypothesis by testing physics-based clustering models against multiple earthquake sequences across various tectonic settings.				x	
d	Integrate ensemble modeling techniques within CSEP to enable ensemble forecasting.			х		
е	Assess the importance of visco-elastic post-seismic response for earthquake cycle models.				x	
f	Develop earthquake simulators that can resolve fault processes across the range of scales required to investigate stress-mediated fault interaction, including those caused by dynamic wave propagation or that combine coseismic dynamic rupture and multi-cycle simulators; generate synthetic seismicity catalogs; and assess the viability of earthquake rupture forecasts.				x	
g	Develop approaches for incorporating real-time data products into OEF candidate models.				x	
h	Develop methods for prospectively testing UCERF3-ETAS.				х	
i	Extend CSEP capability to evaluate real-time OEF models.					х

#### 11. Earthquake Early Warning

We set no milestones for this topical element, which the USGS is covering well under research programs outside of SCEC.

#### 12. Post-Earthquake Rapid Response

We continue to improve the rapid scientific response capability for future earthquakes in Southern California through development of new methods and protocols for mobilizing and coordinating the core geoscience disciplines, and gathering and preservation of perishable earthquake data. In 2018, a coordination group that includes the USGS and CGS will be further developing plans.

Mil	Milestone			Y3	Y4	Y5
а	Hold an annual scientific earthquake response exercise.	х	х	х	х	х
b	Update earthquake response plans, including satellite communication and data exchange capabilities.					
с	Coordinate response plans annually with the USGS and the California Earthquake Clearinghouse.	х	х	х	х	х
d	Work with partners (e.g., IRIS, UNAVCO, USGS) to improve instrumental availability for rapid response.		х			
е	Identify and develop opportunities for linking high-resolution postseismic deformation to geological observations (UAVSAR, lidar, SfM).		х			
f	Improve post-event communication between SCEC and other agencies through sharing of information portals, datasets, etc.		х	х	х	х

#### Theme D. Reducing Seismic Risk

#### 13. Risk to Distributed Infrastructure

We are working with engineers and stakeholders to apply measures of distributed infrastructure impacts in assessing correlated damage from physics-based ground-motion simulations. These provide ground motion predictions at densities that existing seismic data cannot. Due to the scale of effort required, we expect that research on this topic will likely be funded under Special Projects rather than the base funding from NSF and USGS. We submitted a proposal to NIST entitled "Development of Science-Based Tools and Framework for Seismic Resilience Assessment of Regional Lifeline Systems," which included several of the California water agencies as partners. Unfortunately, despite very good reviews, this proposal was not funded, but we continue to engage public utilities and the California Department of Water and Power on this topic and pursue funding opportunities.

Milestone					Y4	Y5
а	Identify engineering needs for integrated (multi-step or end-to-end) earthquake simulation. Convene an interdisciplinary workshop bringing together ground motion modelers and earthquake engineers to define a reduced number of scenarios and case-studies that can be used to concentrate subsequent research activities (e.g., LA water supply).	×				
b	Develop computational tools to facilitate integrated earthquake modeling and site-city interaction effects. These tools should allow multi-step or end-to-end simulation and analysis of ground motion and infrastructure (buildings or distributed systems such as clean water and wastewater pipelines) response.		x	x	х	
С	Investigate the implications of ground motion simulations (including amplitude and spatial variability) by integrating observed and simulated ground motions with engineering-based building and distributed infrastructure systems response models. Validate the results by comparison to observed response of instrumented building and distributed infrastructure systems.			x	x	x

d	Develop methods for estimating fault displacements, including distributed deformation and large-scale tilts, for the evaluation of risk to large distributed infrastructures.	х	х	х	
е	Assess the performance of distributed infrastructure systems using simulated ground motions. Evaluate the potential impact of basin effects, rupture directivity, spatial distribution of ground motion, or other phenomena on risk to infrastructure systems.			x	x

#### 14. Velocity and Rheology of Basin Sediments (previously entitled Geotechnical Layer)

We are drawing from the extensive geotechnical engineering literature to advance the implementation of site effects by incorporating nonlinear rheological models of near-surface rock and soil layers into full-physics earthquake simulations. A Workshop on Nonlinear Shallow Crust Effects was held September, 2017. A longer-term goal of effort in this area is to develop accurate, efficient methods to characterize nonlinear effects to implement in SCEC simulation platforms (Broadband, CyberShake, High-F). We continue to use ambient-seismic-field measurements to constrain shallow basin structure. The efforts are important for reducing epistemic uncertainties in ground motion prediction. In the current year we have begun to use the HVSR method to characterize basin structure along the LASSIE profile.

Mil	estone	Y1	Y2	Y3	Y4	Y5
а	Create a Sediment Velocity and Rheology Model (SVRM) TAG to foster collaborations between geotechnical engineers and ground motion modelers to advance modeling and simulation of the physics and effects of the geotechnical layer on ground motion prediction.	x				
b	Develop and validate 3D constitutive models to capture nonlinear phenomena such as near-surface plasticity, permanent ground deformation and earthquake triggered ground failure, for implementation into physics-based simulations.	х	x	x		
с	Develop new velocity parameterizations of the near-surface sediments, based on available site characterization data from past invasive and non-invasive methods, and constrained by the deeper CVM basement structure, and implement these in CVM applications (i.e., UCVM) to facilitate their evaluation through validation exercises.	х	х			
d	Use borehole measurements, near-surface material stiffness proxies (e.g., Vs30, topography), and empirical correlations to estimate input parameters necessary for nonlinear ground motion modeling in both physics-based simulations and empirical models.		x			
e	Develop empirical correlations between measured near-surface sediment properties and the rheology model parameters of these sediments, also drawing information from the velocity and rheology CXMs, to facilitate incorporation of nonlinear response and effects of permanent ground deformation.into regional-scale ground motion simulations.		x	x	x	
f	Populate the CRM with rheology models (velocity, anelastic attenuation, nonlinear properties) of the rock and soil layers of the crust to capture nonlinear phenomena such as off-fault plasticity, permanent ground deformation and earthquake triggered ground failure phenomena in physics-based simulation.			x		
g	Quantify epistemic uncertainties of the velocity variability and nonlinear constitutive laws and parameters derived and implemented for the response of the soft sediments.		х	х	x	х

# Communication, Education, and Outreach

The SCEC CEO program manages a suite of activities in four focus areas: *Knowledge Implementation, Public Education and Preparedness, K-14 Earthquake Education,* and *Experiential Learning and Career Advancement.* The CEO program has leveraged its base funding with additional external support. Since 2010, FEMA has provided SCEC with nearly \$3 million to coordinate the Earthquake Country Alliance in California (at the request of the California Office of Emergency Services, CalOES) and for national ShakeOut coordination. ShakeOut regions in the U.S. and internationally have also provided funding, and the California Earthquake Authority has spent several million dollars each year on advertising that features ShakeOut promotions. Since 2002, SCEC's intern programs have been supported with more than \$2.5 million in additional funding from several NSF programs and a private donor. NOAA, via CalOES, provides funding to SCEC for developing the TsunamiZone.org website.

#### Knowledge Implementation

The Implementation Interface working group provides the organizational structure for connecting SCEC scientists and research results with practicing engineers, government officials, business risk managers, and other professionals to improve application of earthquake science. See above topical elements 7 (Ground Motion Simulations), 10 (Operational Earthquake Forecasting), 13 (Risk to Distributed Infrastructure), and 14 (Velocity and Rhelology of Basin Sediments) for recent activities. SCEC has partnered with EERI as a sponsor for the upcoming 11th National Conference on Earthquake Engineering in Los Angeles on June 25-29, 2018. SCEC also helped develop the conference technical program with the theme of "Integrating Earthquake Science, Engineering, and Policy."

SCEC partners with several organizations to offer programs that train (1) the media on how to report earthquake science and (2) the SCEC community on how to communicate diverse and highly technical research to the public and media. A "Public Communications Theory and Practice for Scientists" workshop was held at the 2017 SCEC Annual Meeting. SCEC has also developed new procedures for post-earthquake media coordination and communication, which will be further refined as earthquake response plans with the USGS and CGS (topic 12 above) evolve.

#### **Public Education and Preparedness**

SCEC's public education and preparedness campaigns are intended to educate people of all ages about earthquakes, tsunamis, and other hazards, and motivate them to become prepared. In 2003, SCEC created the Earthquake Country Alliance (ECA), a statewide public-private-grassroots organization with support from CalOES and FEMA. The ECA leads the Great California ShakeOut earthquake drill (10 million participants each year), promotes Tsunami Preparedness Week, hosts 6-10 regional workshops each year, and manages sector-based committees that develop resources for schools, businesses, people with disabilities, healthcare, community groups, and others. SCEC worked with the USGS to create the first multi-sector "ShakeOut" earthquake safety drill in 2008, which involved 5.4 million Californians. Since then SCEC has coordinated ShakeOut's expansion across the U.S. and around the world (57+ million people participated in 2017). ShakeOut has become a global infrastructure for providing earthquake information to the public and involving them in community resiliency. New countries are being actively recruited to join the ShakeOut movement, which serves to coordinate earthquake messaging internationally. In the near future, ShakeOut will be utilized for educating Californians about Earthquake Early Warning, with yearly tests to be held on ShakeOut day.

*Quake Heroes*, a documentary based on interviews of people who experienced the Northridge earthquake, will be distributed to schools (with science lesson plans) and shown at large events to engage attendees to become prepared via multiple mechanisms, including signing up for trainings, purchasing emergency supplies, and learning about insurance options. Foundation and corporate partners are helping to complete the film and distribute it nationwide.

#### K-14 Earthquake Education

The K-14 earthquake education initiative aims to improve earth science education in multiple learning environments, overall science literacy, and earthquake safety in schools and museums. SCEC coordinates the Earthquake and Tsunami Education and Public Information Center (EPIcenter) Network of more than 60 museums, science centers, and libraries, some of which host SCEC-developed exhibits and programming. SCEC has expanded QuakeCatcher Network (QCN) with installations of low cost seismometers at over 26 EPIcenter museum locations in California and Oregon, and at more than 100

schools in each west coast state including Alaska. The installation of sensor stations around a local museum hub establishes opportunities for building long-term educational partnerships around the ShakeOut, citizen science, and enriching the STEM curriculum. SCEC also is national partner in *EarthConnections*, an NSF INCLUDES project linking three regional projects (one of which is centered in San Bernardino with Dr. Sally McGill) to increase diversity in the geosciences. The program links high school, community college, and university students via geology clubs, field trips, and meetings with geotechnical professionals and research scientists.

#### Experiential Learning and Career Advancement

SCEC's ELCA program works to increase diversity, retention, and career success in the scientific workforce. SCEC provides research opportunities, resources and mentoring to undergraduate through internship programs for Undergraduate Studies in Earthquake Information Technology (UseIT) and Summer Undergraduate Research Experience (SURE). UseIT is a team-based program located at USC that challenges students to develop technical tools to communicate important concepts about earthquakes in Southern California and other earthquake-prone regions. Since 2002, UseIT has built a community of over 250 alumni from more than 40 colleges and universities. UseIT is funded through NSF's REU program, with additional funding from USC and a private donor. The SURE program pairs undergraduates with scientists across the country to perform SCEC research during the summer. The SCEC5 base budget enables 3-4 students to participate in the SURE program each year. In 2017, the delayed start of the SCEC5 NSF award resulted in insufficient time to pair funded SCEC researchers with students for summer projects.

SCEC launched in 2017 a "Transitions Program" to provide junior members of the SCEC community with resources and mentoring across key career transitions, directing efforts to encourage and sustain careers in the geosciences and other STEM fields. At the 2017 SCEC Annual Meeting, ELCA hosted two breakfasts to connect early career attendees with peers and mentors to share experiences and develop strategies for navigating the transition from undergraduate to graduate school and from graduate school to professional career (within and outside of academia). Through the 2018 SCEC Science Plan, the Transitions Program solicits proposals from researchers to expand awareness of professional advancement opportunities and pathways, as well as improve competency in earthquake research tools and techniques for students of the SCEC community.

# 4. Budget and Project Funding

The Southern California Earthquake Center is funded by the NSF and USGS through cooperative agreements with the University of Southern California (USC). Additional funding for the annual SCEC research program may be provided by the Pacific Gas & Electric Company (PG&E), the Keck Foundation, the California Earthquake Authority, geodesy royalty funds, and potentially other external sources. Funding to SCEC supports earthquake research in Southern California that engages an interdisciplinary community of over 1,000 active participants. Funding from external sources have constraints on how they can be spent. For example, SCEC received funding from PG&E for studies in rupture dynamics, development and maintenance of the broadband ground motion simulation platform, and ground motion prediction studies in central California.

The SCEC core program has been level-funded by NSF and USGS since 2002. About 69% of the NSF and USGS core funding is spent on science and infrastructure; other budget lines include management (11%), the education and outreach programs (12%), meetings (6%), and a Director's reserve fund (2%). Augmented USC support of the Center allows SCEC to maintain administrative costs at very low levels while increasing the professional staff at SCEC headquarters.



Total SCEC funding from 2002-2017, including base funding from NSF and USGS, core institution cost sharing, external funding sources for special projects and CEO projects. The connected dots are the totals in 2002 dollars.

The SCEC research program supports over 100 projects each year. Science funding includes (a) smaller grants for individual scientists working in Center focus areas and collaborations, (b) larger grants for scientists and collaborative teams collecting new data on major Center projects or performing data integration and advanced modeling, and (c) workshops that bring all interested scientists together to focus on specific research initiatives.

Funding received from each source is combined (i.e., not treated separately) for the purposes of building the annual SCEC Collaboration Plan. All research awards are funded as subcontracts between USC and the entity to receive funding. Contracts to individual institutions are executed on either the NSF or USGS cooperative agreement and not split, owing to the different legal flow-down provisions of each agency. When SCEC funding becomes available to investigators depends on (1) how soon SCEC/USC receives Center funding from the NSF, USGS and other external sources, and (2) how quickly contracts are negotiated between USC and institution to receive funding. Participant support (workshops, intern project supplement, and travel) award expenditures are managed through the master SCEC account at USC. For investigators at USC, the project expenses are also charged directly to the master SCEC accounts at USC.

### Current Funding (February 1, 2017 to January 31, 2018)

The table below shows the NSF and USGS base funding for SCEC5 Year 1 by budget category, compared to the original SCEC5 proposal request. In 2017, the **USGS fully funded SCEC at the authorized level of \$1,595,882 in Year 1.** The NSF cut funding to SCEC by about \$76K (from the \$3,000,000 per year SCEC5 authorized level) to \$2,923,365.

P						
SCEC5 Funding (Year 1)	NS	F	US	GS	Comb	oined
Budget Category	Request	Funded	Request	Funded	Request	Funded
Science and IT Infrastructure	\$2,374K	\$1,679K	\$1,366K	\$1,396K	\$3,740K	\$3,075K
Center Management	\$500K	\$211K	\$115K	\$200K	\$615K	\$411K
Communication, Education, and Outreach	\$500K	\$535K	\$115K	\$0K	\$615K	\$535K
Undergraduate Intern Program (SURE)	\$50K	\$20K	\$0K	\$0K	\$50K	\$20K
Diversity Transitions Program	\$150K	\$0K	\$0K	\$0K	\$150K	\$0K
Annual and Leadership Meetings	\$350K	\$370K	\$0K	\$0K	\$350K	\$370K
Director's Reserve	\$140K	\$108K	\$0K	\$0K	\$140K	\$108K
Total Request	\$4.064M	\$2.923M	\$1.596M	\$1.596M	\$5.660M	\$4.519M

SCEC5 Base Funding by Budget Category (Year 1)

**Building the 2017 SCEC budget was especially difficult.** The fifth phase of the Southern California Earthquake Center (SCEC5) is funded under cooperative agreements NSF-EAR 1650087 and USGS G17AC00047. The cooperative agreement (CA) with the USGS is effective Feb 1, 2017 through Jan 31, 2022. Due to the new mandatory risk assessment required for federal awards over \$10M, the CA with NSF was delayed and finally executed with effective dates of May 1, 2017 to Apr 30, 2022. This resulted in a three-month funding gap at the start of 2017, as well as different annual budget period dates for the USGS CA and NSF CA. The NSF SCEC5 risk assessment determined that (1) "USC should not waive indirect cost recovery on its subaward agreements," (2) all subaward requests must be submitted through the NSF FastLane system for prior approval, and (3) SCEC has increased responsibility to establish subaward monitoring and compliance processes. Therefore, budget plans were significantly reconfigured for Year 1 to comply with the new NSF requirements, and careful plans and processes were put in place to minimize the overall impact on the research collaborations and SCEC5 Year 1 budget was not finalized until September 2017.

The different start/end dates on the USGS and NSF cooperative agreements have caused challenges for the establishment of subawards for Budget Year 1. Since 2002 (when SCEC graduated from an STC to a standalone center) the annual science planning process as described in Section 2 has been in place. The roster of participating investigators changes each year as new people and institutions join the SCEC research collaboration. The annual review of the SCEC program (and associated subawards) allows SCEC to drive and change the direction of research as needed to meet the Center's goals, milestones, and metrics. The fact that this is done on an annual basis, involving so many people and institutions, is a unique and necessary characteristic of SCEC and very different from how other research centers typically operate.

The research done by the community, and the progress reports submitted each year to SCEC, provide critical information for the Center's science and budget planning for following budget years. Therefore, all subawards are established with the same set of start/end dates and reporting requirements — irregardless of the funding source. The delayed NSF CA necessitated setting up the 2017 subawards with a start date of May 1, 2017 and ending on April 30, 2018. However, the end date is beyond the budget year end date of the USGS CA, which has restrictions for carrying forward funds. This causes additional administrative burden in negotiating agreements, justifying the necessity of a subset of projects

to carry forward funds, and monitoring the subawards. In addition, the much delayed timing of subaward notifications sent to SCEC investigators made it virtually impossible for them to plan summer salary support and field studies for 2017.

These difficulties will be faced every year if the current start/end dates for the budget year remain. In October, we requested that the NSF CA be amended to allow for Budget Years 2-5 to start February 1 and end January 31 the following year to allow annual dates to sync between the NSF CA and USGS CA. NSF has approved this amendment request, which effectively resets the SCEC calendar back to the planning and budget cycle we have been operating on since 2002, and hopefully reducing the administrative burden on SCEC5 subawards management.

Despite the challenges of initiating SCEC5 in 2017, we can report that all 2017 (Budget Year 1) funds received from USGS have been obligated at this time. Subcontracts totaling \$916,814 (USGS) and \$1,442144 (NSF) will have been executed by January 31, 2018. We consider these executed subcontracts as fully expended.

### Upcoming Year (February 1, 2018 to January 31, 2019)

As of submission of this report, the USGS has funded the SCEC5 Year 2 request in full at \$1,602,966. NSF still does not have an agency budget, but SCEC has received guidance to assume level funding as in 2017 from NSF (\$2,923,365). A combined Year 2 budget plan has been submitted to NSF and USGS for approval. Early in 2018, SCEC received \$150K from PG&E (derived from their 2017 end of year funds) to be directed towards tomography projects in the current PC approved plan (\$100K) and a specific project not reviewed by the PC (\$50K). However, we do not know the final funding for 2018 from PG&E and other external sources.

For the 2018 cycle, SCEC received 152 proposals requesting a total of \$4,895,422 (from 188 distinct investigators). With the NSF approval of a revised start/end date for Budget Years 2-5, the time-period for SCEC subcontracts in these years will reset to the dates SCEC has traditionally used: February 1 as the start date, and January 31 as the end date. If an investigator submits a successful proposal to SCEC the following year, his/her current subcontract is usually amended to add on the new year of funding.

# 5. Report of the Advisory Council

## Introduction

The SCEC Advisory Committee (AC) convened at the SCEC Annual meeting in Palm Springs from September 10 to 13, 2017, reviewing SCEC activities in order to offer advice to the SCEC leadership. The SCEC AC comprises the following members, all of whom were present at the meeting, except where noted:

- M. Meghan Miller, Chair, UNAVCO
- Rick Aster, Colorado State U.
- Susan Beck, U. Arizona
- Roger Bilham, U. Colorado
- Donna Eberhart-Phillips, U. California, Davis
- Yann Klinger, IPGP/Paris
- Warner Marzocchi, INGV, Rome
- Tom O'Rourke, Cornell U. (not present)
- Susan Owen, JPL
- Tim Sellnow, U. Central Florida (not present)
- Heidi Tremayne, EERI

Advisory Committee members were given a 140-page briefing book on September 6. The AC met initially on September 9 and was briefed by SCEC leadership and by USGS and NSF representatives. Director Tom Jordan and incoming Director John Vidale provided the AC with a summary of the state of SCEC and provided a list of issues on which they sought AC feedback. Following the leadership briefing, the AC attended scientific sessions and solicited feedback from attendees. The AC also met three additional times during the meeting to discuss observations and findings. AC Chair Miller presented a summary of AC observations on Wednesday morning of the meeting, and this written report is intended to provide more detail. All committee members reviewed this report.

This report addresses the various questions and topics posed by the SCEC leadership, and offers additional observations.

#### Overview

At this critical transition to SCEC5 and a new SCEC Director, the Advisory Committee commends the exceptional achievements of SCEC and its globally significant contributions to earthquake and Earth system science. In spite of funding limitations and other external challenges, the AC sees a healthy organization with excellent future prospects and a coherent and ambitious 5-year plan.

## AC Membership

#### 0. Are new AC members needed?

An Engineering Seismologist or Geotechnical Engineer would be an appropriate addition to the AC to expand the committee expertise at the interface between engineering and seismology. Heidi Tremayne can help to identify possible candidates, if desired.

## **SCEC5 Science and Applications**

#### 1. Are the SCEC5 milestones appropriate?

The milestones are appropriate with enough detail to assure a structure to evaluate progress. The workshop provides useful points to engage current and new researchers in SCEC5 components and

milestones that include a useful mixture of developmental research, quantitative products and consensus building aspects.

# 2. The Earthquake Gates Area Initiative represents a sustained commitment. How should they evolve, and should more be seeded?

The Earthquake Gates initiative looks very promising with some exciting early results. Understanding the controls on the probability of an earthquake rupturing multiple segments is key because it may control the ultimate size of the earthquake rupture. Hence, we view the Earthquake Gates initiative as an important activity for SCEC. We agree with the SCEC plan to use community input to identify one or more focus sites. Some issues, however, might not be possible to tackle at the chosen EG site and SCEC should stay open to investigation outside EG site proper, elsewhere in the US or abroad, as long as the study area remains clearly relevant to SCEC EG activities. Starting with a small number of focus sites and then expanding as resources allow may be the best approach. It will be important to identify criteria to define the success of the Earthquake Gates initiative.

# <u>3. SCEC Community Models are in various stages of completion and improving at various rates. Are the levels of effort and accomplishment appropriate?</u>

The SCEC community models, with their wide and integrated application, are a highlight achievement. The articulated goals going forward are appropriate (and appropriately ambitious). The goal of going to higher frequency and more accurately reflecting near-surface structure and effects, as well as fault geometries, will require even more massive data collection, assimilation, and validation.

The levels of effort and accomplishment are appropriate. The development of unified ways to represent detail will make the results more useful and facilitate addressing research questions that flow from integrating the various CXM. The systematic study of velocity and rheology of basin sediment will provide necessary parameters for inferring near-surface effects on ground motion. At the meeting, it has been good to see the work done so far on the rheology component, including even some implementation. It appears that the CRM will also eventually improve the CVM, and the groups will develop new understanding, as the rheology users may define deeper crustal features for determining viscoelastic response.

# <u>4. How can we make better progress on the reduction of risk to distributed infrastructure? What would be good ways to interact with the relevant engineering community?</u>

Regional oil and gas pipeline operators have not planned for the possibility of multiple simultaneous lesions during a major earthquake, nor the consequences of unstemmed leaks into State Parks, highways and wildlife preserves. A cost-benefit analysis of cleanup costs following an earthquake that causes multiple or major pipe ruptures (as a counterexample, the averted Alaska Oil Spill after Denali Earthquake) might provide an incentive for future interactions between pipeline operators and SCEC. Although state legislation may ultimately be necessary to ensure implementation, a cost-benefit analysis of a catastrophic multiple failure event may persuade operators of the urgency of pipeline resilience or inform state action.

A useful direction might be to contact and connect with the existing LA lifelines council, National and State Parks, Wildlife organisations, to encourage California legislation to mitigate fault-crossing pipe damage.

In his presentation Jack Baker showed clearly the importance of the spatial correlation of ground shaking in its effects on loss estimation, in particular when the target is a spatially distributed system (e.g. highways). This effect cannot be accounted for through the usual PSHA and GMPEs models, because the models are targeted only on single sites. The procedure described by Jack, although at a preliminary

stage, appears very promising and immediately applicable. This motivates higher frequency (temporal and spatial) CyberShake-type ground motion modeling and its use in this type of analysis.

Regarding enhanced partnerships with the engineering community, promoting collaboration on PSHA is an excellent opportunity to shape a common language and to understand what engineers need and what seismologists can provide.

SCEC should also continue knowledge transfer activities to the engineering community that reach engineers in locations where they normally gather. Expanding collaboration with engineering research centers and organizations would facilitate this task. One suggestion is to design more sessions, presentations and workshops at related engineering conferences/events that seek feedback on SCEC products, similar to SCEC's work for the 11th National Conference on Earthquake Engineering in Los Angeles in June 2018 including a partnership with the Earthquake Engineering Research Institute (EERI). Other engineering groups of interest for technical collaboration and feedback include Natural Hazards Engineering Research Infrastructure (NHERI) SimCenter and DesignSafe, Pacific Earthquake Engineering Research (PEER), American Society of Civil Engineers (ASCE) Geo-Institute, and Structural Engineers Association of California (SEAOC).

#### Communication, Education, and Outreach

# 5. Does the draft SCEC5 CEO Evaluation Framework and its related logic model, metrics, and milestones provide an appropriate level of assessment?

The scope and scale of CEO activities continues to impress the Advisory Committee. The CEO is successful as a means of educating the public about earthquakes, and as an inspiration for what the public might do to mitigate their effects. Efforts to train and transition students (especially from underrepresented groups) to early career researchers and practitioners is also admirable.

The CEO group has actively responded to the 2015 evaluation recommendations by strategically selecting key indicators and metrics. This work is applauded and should be extended by identifying effective assessment tools or procedures to gather data for metrics that don't have simple quantitative metrics. Because long-term outcomes can be difficult to quantify and the number of outcomes in the logic model are numerous, the CEO group (with limited staff time and funding for assessment) may want to consider focusing more targeted, detailed, or nuanced assessments for some activities or specific outcomes, while more straightforward statistics collection/numerical metrics/reporting for other outcomes may be sufficient to track their progress. Such assessment should be incorporated as the logic model evolves in the first year of application, taking into account how the logic model should influence and inform an evaluation plan.

Some discussion centered on metrics to track ShakeOut success that had been generated in the CEO Planning Meeting, and to work with USGS and social scientists to identify how to add or modify 1-2 questions on the "Did You Feel It" survey to reflect (1) if the citizen reporting providing feedback actually dropped, covered, and held on, or took other protective actions, and (2) if they have participated in ShakeOut drills that influenced this action. This discussion included the caveat that any modification of questions should be carefully reviewed and validated by social scientists.

6. The proposed Transitions Program was favorably reviewed and is a priority for NSF, yet with reduced funding its activities will be limited.... What other cost efficient concepts should we consider to increase retention and diversity into geoscience careers?

We applaud SCEC for the focused breakfast meetings with students and early career scientists at the SCEC meeting. Similar events could be undertaken jointly with UNAVCO and IRIS (or other organizations) at the AGU meeting. A website for early career scientists where they can share information and resources would also be of value. The summer internship programs have been very successful and

should be continued. We agree that partnering with SCEC institutions to identify external intern opportunities is important.

One cost efficient concept for increasing diversity and retention in geoscience careers would be to plan for a presentation, workshop, or session at future SCEC annual meetings, one that explores implicit bias and strategies for reducing its influence. AGU (with others) is leading a national and international conversation on implicit bias and its role in limiting diversity. SCEC could consider reaching out to AGU or AWG for speaker suggestions on implicit bias and strategies to avoid it. University programs that succeed in broadening participation in geosciences or other STEM fields (e.g., the Harvey Mudd program to increase female students participation in computer science) could also be a source for inspirational speakers or workshop leaders.

7. The AC has strongly encouraged SCEC to provide risk communication training/discussion at the SCEC Annual Meeting. For the second year CEO has organized a communications workshop on Sunday for interested attendees. Is this sufficient or should there be a plenary session presentation as well? The Public Communications workshop included an informative talk on how to interact with the public with a hands-on practice; it was commended for engaging participants. The SCEC Distinguished Speaker also did a nice job of elevating the topic of risk communication to all participants in a plenary setting Sunday evening. And the Temblor demonstration provided a useful tool to enable individual conversations between SCEC participants and non-specialists.

The committee further noted the usefulness of skills development for communicating science results to lay-people (as well as communicating risk). Few researchers are likely to participate in a press conference, but many of us have wished we knew how to prepare and perform better in common media situations. SCEC should consider expanding specific training to include the more basic topic of a media interview (live tv, radio, other interviews or written contributions).

# <u>8. SCEC annual meeting size challenges SCEC resources and may hinder function — should we strive to limit attendance to ~500, and if so, how?</u>

Optimized meeting size is one broad measure of SCEC's success. The large number of early career attendees, for example, is a positive factor for the community at large and for long-term advancement of SCEC goals; thus their integration is highly desirable. The 2017 meeting hit this right, and corrected for the open floodgates of 2016.

More broadly, limiting strategies should be motivated by clear and prioritized overall meeting goals and letting these goals drive decisions regarding recruitment, with appropriate incentives and disincentives to optimize attendance. The 2017 emphasis on communication, reflected in the Sunday workshop and Distinguished Speaker topic, well served the advancement of SCEC's broader influence and ultimate value to society, while engaging scientists in critical communications, an area where many aspire to do better.

Large plenary sessions can make discussion difficult, and can be intimidating for early career participants. Some organizations are experimenting with ways for attendees to provide questions/comments via tools like Google Docs that moderators and session chairs can use to seed questions and stimulate discussions. Texting could also provide a mechanism that doesn't encourage broad use of laptops in plenaries. That said, the discussions following plenary sessions were much improved over previous years on two counts: colleagues kept each other in check and younger participants were more forthcoming. While they may have been postdocs rather than grad students, this is still good progress. The online strategies could further this progress for 2018, and potentially expand participation.

# **Recommendations for action - opportunities and threats**

# <u>9. How can we better recruit excellent high performance computing (HPC) talent and maintain connections to the HPC world?</u>

One strategy to consider for recruiting HPC talent is to reach out to those who have interests in the broader scientific and societal problems to be addressed with the application of their HPC expertise and talent. These individuals can be recruited and retained through broader engagement in the mission, publications, and exposure to Earth science, combined with a concerted focus on mentorship. Emphasizing the scientific mission of SCEC, plus the altruistic appeal and societal impact of careers in earthquake science, could make SCEC positions more desirable to millennials and other early career prospects. SCEC should also expect and plan for the inevitable turnover in its own staff (given national trends for younger professionals) by ensuring overlap in knowledge, tasks, and skills.

#### 10. What additional strategies should we pursue for funding CEO activities?

NSF's Division of Education and Human Resources offers a changing landscape of award opportunities, a landscape that SCEC leadership is aware of. Visit program officers in their new digs in Alexandria, monitor EHR program solicitations for focus areas that align with SCEC goals, and cultivate a spectrum of community-embedded capabilities and expertise (pedagogy, assessment) to draw on for new initiatives. Some of these might be accessed (and are being accessed) in the community geophysics facilities as well; partnerships could provide further synergies.

Mitigation strategies might include: Diversification of the SCEC portfolio and sponsorship, but this can be very time consuming to cultivate and unreliable over time. Choosing what not to do is another mitigation. There is no substitute for sponsorship that has wholesale ownership of the mission and structure of the organization. That said, in the current mix, SCEC should continue to develop projects that cultivate new capabilities and sponsorship including the broader public sector or private interests - power, water, transportation, municipalities.

#### <u>11. Changes in leadership at PG&E: Norm Abrahamson is leaving, PG&E budget was cut from</u> <u>\$1.6M to ~\$1M late in the year, and planning the future of PG&E funding is in flux. We proactively</u> <u>discussing with PG&E management on future research priorities.</u>

The committee recognizes the potential impact of losing this key relationship, and encourages the new leadership to commit time to developing new relationships (or strengthening other existing relationships) at PG&E. PG&E's interest is well aligned with SCEC. Find the PG&E new kid in town and cultivate common interests.

#### <u>12. NSF has postponed announcement of the next solicitation of Geoinformatics and SI2 proposals, two</u> <u>mainstays of SCEC Special Project efforts. How do we plan for continuation of efforts supported by these</u> <u>programs?</u>

Continued engagement with NSF leadership on the importance of specific solicitations to the community, or partnering with other groups affected by the delay in solicitations to communicate en masse, might help shine light on the costs to NSF in lost productivity. NSF programs are expected to evolve, and recipients are expected to evolve as well - so engagement with NSF program managers on future directions could help ensure that NSF is evolving in alignment with SCEC community needs. NSF uses unmet priorities in the investigator community to shape solicitations. The new director would be well served to interact with program officers in a variety of roles and directorates.

Other wisdom from the committee includes guidance (1) to develop a plan that consistently pursues a diverse set of funding sources, to increase stability when programs change and (2) develop a funding

'succession plan' by reviewing other information technology programs within NSF (e.g., EarthCube or whatever succeeds it) and outside of NSF (e.g., NASA).

13. A byproduct of the extensive SCEC5 NSF risk assessment has been outlawing the overhead waiver on subcontracts (e.g., subawards). Heroic efforts by John McRaney, Tran Huynh, and Deborah Gormley have adjusted SCEC arrangements so this change does not affect finances, at a cost of increased complication in administration of budgets. Does this somewhat convoluted arrangement require further corrective adjustments?

Heroic efforts are duly noted and highly commended! The subaward rule is long-standing, while NSF's attention to and application of award rules is increasingly comprehensive and rigid, creating significant new administrative burden. It is not clear if or when the pendulum will swing back. Until a sea change comes, recipient award administrators might benefit from taking a more proactive stance. Participation by the USC award administrator in structured NSF events like the Large Facilities Workshop (or similar professional development) can build understanding on both sides, expose model practices for coming constraints, and help anticipate or even shape change. Such participation develops communication pathways to directly convey the impact of the administrative burden on awardees. This is important to make visible at NSF.

14. The SCEC5 NSF risk assessment and subsequent overhead negotiations have resulted in separate start dates for NSF (May) and USGS (February) cooperative agreements. How do we bring the NSF date back to February, in sync with USGS and internal planning and funding cycles, and obviating the problematic budgetary gyrations necessitated by multiple start and end dates?

Alignment of the dates may simply not be achievable, even at the cost of one quarter of funding. Greg Anderson has demonstrated creativity and effectiveness in finding solutions to odd administrative problems at NSF in cases where a solution could be found. If Maggie and Greg cannot explore and devise a technical fix for this problem, NSF options will likely have been exhausted. At that point, it might be time to seek the serenity to accept the things that cannot change and work to minimize impact on staff and workload, which the committee recognizes will be significant. This might include a reporting schedule based on a defined project year that makes sense for SCEC, but cannot match the various fiscal years of different sponsors, if sponsor agreement can be secured.

# <u>15. Future steps for UCERF? We just submitted a 1-year, \$370K proposal to CEA for understanding uncertainties in UCERF3 and simplifying calculations (logic tree trimming).</u>

Quantifying uncertainties and simplifying calculations are positive new directions. Ongoing refinement of UCERF is foundational to SCEC's mission, and for planning and prioritization. The risk information coming out from UCERF3-ETAS may be of interest to reinsurance and insurance companies.

16. There are potential opportunities for SCEC funding through DOE and NASA. Ben Phillips, the lead for NASA's Earth Surface and Interior Focus Area, has been invited to the past two SCEC meetings, and he has indicated that a SCEC proposal to the NASA Research Opportunities in Space and Earth Sciences (ROSES) program would be appropriate. Funding from DOE is more problematic, because earthquake science is not well represented in the RFP for their Scientific Discovery through Advanced Computing (SciDAC) program. AC advice on how to approach these agencies is welcome.

The AC encourages SCEC leadership to first consider goal alignment between NASA and DOE goals - e.g., does integrating SCEC better with the NASA ESI community make sense and provide benefit to both SCEC and NASA? With NASA launching a SAR mission in 2021, there is potential for significant overlap in research goals related to earthquake science.

As for any sponsor, spend the time to develop new relationships to explore common interests and goals and to explore and understand the agency award mechanisms. Proactive development of the relationship could lead to inclusion of SCEC-aligned NASA priorities in a specific announcement of opportunity, if the groundwork has been done in advance.

There are also institutional structural limitations for researchers at NASA centers to receive funding to participate in research projects and community working groups. SCEC could discuss with Ben Phillips potential avenues for better integration of NASA scientists into the SCEC community through NASA funding of NASA participants in SCEC research projects - effectively enlarging the funding pool for small research awards.

## Earthquake Response Planning

17. Post-earthquake response planning is timely and there is growing consensus that we should get more organized: how do we form a southern California response plan and how do we sustain SCEC effort at an operational level?

Revisiting the scope and objectives of SCEC's earthquake response plan and its engagement platform response.scec.org is timely.

Post-Earthquake Response is a cross-cutting topic amongst many areas and many SCEC partnerships. SCEC leadership should define the SCEC vision and strategy in this landscape before working with external partners and finalizing a plan.

After internal alignment of goals and priorities, SCEC should ensure that the leadership successfully engages and strategizes with other partners and agencies who are working in the area of post-earthquake response (e.g., California Earthquake Clearinghouse, GEER, EERI, USGS, CGS, CalOES, IRIS, UNAVCO, universities), and align their plans accordingly. Goals might include filling gaps, avoiding duplication, and capitalizing on SCEC strengths and mission. Several specific recommendations came out of discussions during the meeting that should be explored for feasibility and alignment with other SCEC efforts:

(A) Provide training or resources to support scientists' awareness about mental health impacts when responding to earthquakes, including how to be sensitive to people who have experienced losses. These resources may also be helpful in times of stress unrelated to earthquakes.

(B) Continue to strategize SCEC's involvement and role in the California Earthquake Clearinghouse. One way would be to raise awareness of data sharing and available tools, as an option in addition to SCEC's response.scec.org website.

(C) Conduct an Earthquake Response Workshop at every SCEC Annual Meeting using the California Earthquake Clearinghouse Training module that could be customized for SCEC. This workshop would include a Disaster Service Worker certification.

(D) Explore provision of GIS support (possibly via an ArcGIS Online interface) during the earthquake response phase to collate and visualize data gathered by SCEC researchers, establishing base layers of background data helpful for field studies, or analysis of existing data.

#### **Other comments**

#### 18. Notes on the Leadership Transition

The SCEC leadership transition was very well executed. Tom Jordan is commended for his dedication to ensuring the success of the transition, both by continuing his service until a successor was identified and recruited, enabling Greg Beroza's elevated role, and by graciously handing over the reins while remaining available and engaged with SCEC's success.

John Vidale is poised to succeed in this new role and brings breadth, leadership, and a history of work with broader constituencies at PNSN to the leadership position at SCEC. The Committee looks forward to a productive future in working with SCEC Leadership.

The dedication and professionalism of SCEC staff across the organization is also highly commended. Leadership transitions are difficult times, and staff members have clearly engaged in ensuring SCEC's future through staying the course, supporting the transition, and continuing to provide a signature level of extraordinary support for the organization and the SCEC Community. Well done!

#### 19. SCEC5 as a Framework for Augmentation

The committee noted that the scientific, cyber, and observational infrastructure of SCEC could provide leverage and synergies to broader efforts or emerging opportunities:

- Improved understanding of intermediate period fault behavior likely requires greater knowledge of hydrogeology, aqueous geochemistry, fluid pressure effects, and fluid sources. Work in this area may benefit from new and/or smaller-scale simulations of fault-fluid interactions and studies of induced seismicity outside of southern California.
- There may be valuable unrealized opportunities for SCEC programmatic involvement in induced seismicity research and/or possible upcoming in-situ earthquake experiments being considered elsewhere in the seismological community.
- Dense portable seismic arrays have clear benefits for high-resolution modeling of near-surface structures, fault structures, and response, as well as for post-earthquake studies. Such studies could benefit site characterization.
- Coordinate with existing facilities and institutions that support instrumentation and data acquisition to ensure SCEC's unique strengths benefit broader data collection efforts.

#### 20. Annual Meeting Logistics

Additional coffee stations are needed for a meeting of this size. The 15-minute break is simply too short to move 500 people in and out of the large plenary room. The unstructured time to interact with colleagues is very useful in stimulating interaction.

The meeting increasingly relies on posters for expanded participation, and some adjustments are needed to ensure effectiveness. (1) If there is to continue to be no dinner on Tuesday, provide snacks to support poster attendance; this is a key time for interaction between student/early career investigators and senior scientists. (2) There are a number of technical problems with the poster room. A larger room or acoustic absorption props could reduce the decibel level and permit conversations to be undertaken without participants shouting at each other. The illumination cross lighting of the past several years hinders viewing of posters beneath the spotlights. Consider more elevated lighting.

It was further noted that the restrooms really need to be moved to the plenary meeting floor, with little hope that this is within SCEC's span of influence.

#### 21. Improving Clarity and Ease of SCEC and SCEC AC interactions

It would be useful to the AC if SCEC provided a secure discussion list-serve or email list that does not include SCEC staff to freely air, peer-educate, reconcile and integrate disparate perspectives and misconceptions while including off-site committee members, before finalizing the report. We believe that this will provide a more informed report.

Establishing a set of staggered terms for Committee Members is an important step forward. It would be useful for SCEC leadership to communicate the term for each committee member in an appointment letter or email at the time of appointment.

# 6. 2018 Science Plan

The Southern California Earthquake Center (SCEC) was founded as a Science & Technology Center on February 1, 1991, with joint funding by the National Science Foundation (NSF) and the U. S. Geological Survey (USGS). Since 2002, SCEC has been sustained as a stand-alone center under cooperative agreements with both agencies in three consecutive, five-year phases (SCEC2–SCEC4). The Center was extended for another 5-year period, effective 1 February 2017 to 31 January 2022 (USGS SCEC5) and 1 May 2017 to 30 April 2022 (NSF SCEC5). SCEC coordinates fundamental research on earthquake processes using Southern California as its main natural laboratory. Currently, over 1000 earthquake professionals participate in SCEC projects. This research program is investigator-driven and supports core research and education in seismology, tectonic geodesy, earthquake geology, and computational science. The SCEC community advances earthquake system science by gathering information from seismic and geodetic sensors, geologic field observations, and laboratory experiments; synthesizing knowledge of earthquake phenomena through system-level, physics-based modeling; and communicating understanding of seismic hazards to reduce earthquake risk and promote community resilience.

The SCEC Science Plan solicits proposals from individuals and groups to participate in the SCEC research program on an annual basis. Typical grants awarded under the SCEC Science Plan fall in the range of \$10,000 to \$35,000. This is not intended to limit SCEC to a fixed award amount, nor to a specified number of awards, but rather to calibrate expectations for proposals submitted to SCEC. Field investigations outside southern California may be considered, provided the proposed research demonstrates direct relevance to SCEC5 goals that are not achievable within the southern California natural laboratory.

The 2018 Science Plan was announced to the SCEC community in October 2017 and posted on the SCEC website. The complete 2018 Science Plan (47 pages total) can be downloaded at: <a href="https://files.scec.org/s3fs-public/SCEC2018RFP.pdf">https://files.scec.org/s3fs-public/SCEC2018RFP.pdf</a>. In this report, we include only the "New This Year" section of the 2018 Science Plan. The science milestones for all years are included in the Accomplishments section of this report.

#### **New This Year**

The SCEC Science Plan (aka RFP) reflects the research priorities articulated in the SCEC5 proposal, and the project plan approved by the National Science Foundation and the U.S. Geological Survey. The SCEC Science Plan detailed in this document is provisional pending final SCEC5 Year 2 budget authorization. Substantial changes have been made to the RFP since last year, so we strongly encourage researchers to read carefully the RFP in its entirety.

- The time-period for SCEC funded projects will reset to the dates SCEC has traditionally used: **February 1** as the start date, and **January 31** as the end date.
- As a reminder, the Science Planning Committee (PC) was reconfigured for SCEC5. The current composition includes four disciplinary committees (Seismology, Tectonic Geodesy, Earthquake Geology, and Computational Science), and five interdisciplinary focus groups (FARM, SDOT, EFP, GM, SAFS, CXM and EEII), each with individual representation in the PC. The PC also includes two members representing the Special Projects.
- A new focus area, called "Earthquake Gates" was started in the first year of SCEC5. This initiative is designed to foster multidisciplinary studies of the factors that permit earthquakes to start or stop (as at a gate). To organize this initiative the SCEC community held an incubator workshop in March 2017 and solicited proposals to establish Earthquake Gate Areas. The Cajon Pass Region

has been selected as the first Earthquake Gate of SCEC5. Refer to section 5.5 SAFS for more information on the Earthquake Gates Initiative and the Cajon Pass Earthquake Gate Integrated Science Plan.

- As a reminder, investigators that anticipate use of SCEC computational resources and/or help from SCEC software developers for proposed research must consult with SCEC Special Projects leadership to estimate support time and coordinate activities.
- As a reminder, investigators interested in undergraduate summer interns should include an
  "intern project" description in their proposal. The undergraduate intern will be recruited by the
  SCEC CEO Program staff. Selected intern projects will be awarded as supplemental funds on the
  proposal award. Funds used for summer stipends and travel support to the SCEC annual meeting
  for the selected undergraduate students will be managed at and dispersed from USC. The
  number of intern projects awarded each year will depend on available funding in the SCEC
  annual budget and the pool of interested applicants.
- A new SCEC Transitions Program has been launched for SCEC5. This program will provide students and early-career scientists with resources and mentoring, particularly at major transitions in their educational and professional careers. In doing so, the *Transitions Program* aims to encourage and sustain careers in the geosciences and other STEM fields. The SCEC Transitions Program welcomes proposals that expand awareness of professional advancement opportunities and pathways, as well as improve competency in earthquake research tools and techniques of the junior members of the SCEC community.
- As a reminder, geochronology infrastructure supports Accelerator Mass Spectrometer analysis of <sup>14</sup>C, <sup>10</sup>Be, <sup>26</sup>Al, and 36Cl through collaboration with Lawrence Livermore National Laboratory and the University of California, Irvine (<sup>14</sup>C only). Luminescence dating (OSL, pIR-IRSL) will be supported through regular proposal budgets, through arrangement with a luminescence laboratory (see Earthquake Geology section for suggestions).
- As a reminder, SCEC no longer supports proposals solely for annual meeting participation. Funding for travel to participate in the SCEC Annual Meeting will be considered only in the context of a research proposal in response to the current Science Plan. International travel funding for a co-investigator to participate in the SCEC Annual Meeting will be considered, provided the proposal clearly states (a) how the investigators are critical to the project and (b) a plan for how the international participant's institution will cost-share the anticipated travel expenses.

# 7. SCEC Publications

This section lists the publications recorded as submitted and/or published in the SCEC community database (<u>www.scec.org/publications</u>) between February 1, 2017 to December 1, 2017. Each publication is preceded by its SCEC publication number.

## Journal Articles (86 total)

- 2067 Small, P., Gill, D., Maechling, P. J., Taborda, R., Callaghan, S., Jordan, T. H., Ely, G. P., Olsen, K. B., & Goulet, C. A. (2017). The SCEC Unified Community Velocity Model Software Framework. Seismological Research Letters, 88(5).
- 6019 Shi, J., & Asimaki, D. (2017). From stiffness to strength: Formulation and validation of a hybrid hyperbolic nonlinear soil model for site response analyses. Bulletin of the Seismological Society of America, 107(3), 1336-1355.
- 6064 Luttrell, K., & Smith-Konter, B. (2017). Limits on crustal differential stress in southern California from topography and earthquake focal mechanisms. Geophysical Journal International, 211(1), 472-482.
- 6238 Onderdonk, N. W., McGill, S. F., & Rockwell, T. K. (2017). The distribution and frequency of prehistoric surface ruptures on the San Jacinto and San Andreas faults near their junction. Geology, (under review).
- 6260 Kagan, Y. Y. (2017). Worldwide earthquake forecasts. Stochastic Environmental Research and Risk Assessment (SERRA), 31(6), 1273-1290.
- 6265 Zaliapin, I., & Kreemer, C. W. (2017). Systematic fluctuations in the global seismic moment release. Geophysical Research Letters, 44(10), 4820-4828.
- 6272 Rubino, V., Rosakis, A. J., & Lapusta, N. (2017). Understanding dynamic friction through spontaneously evolving laboratory earthquakes. Nature Communication, (accepted).
- 7068 Salisbury, J. B., Rockwell, T. K., & Buga, M. T. (2017). Paleoseismic Evidence for the 21 April 1918 Mw 6.9 Surface Rupture of the Northern Clark Strand of the Central San Jacinto Fault, California. Bulletin of the Seismological Society of America,.
- 7093 Forand, D. H., Evans, J. P., Janecke, S. U., & Jacobs, J. (2017). Insights into fault processes and the geometry of the San Andreas fault system: Analysis of core from the deep drill hole at Cajon Pass, California. Geological Society of America Bulletin, 117.
- 7118 McClure, M., Riley, G., Kitkwan, C., & Ranganath, R. (2017). Identifying potentially induced seismicity and assessing statistical significance in Oklahoma and California. Journal of Geophysical Research, 122(3), 2153-2172.
- 7139 Liel, A. B., DeBock, D. J., Harris, J. R., Ellingwood, B. R., & Torrents, J. M. (2017). Reliability-based design snow loads: II. Reliability assessment and mapping procedures. Journal of Structural Engineering, 143(7).
- 7163 Field, E. H., Milner, K. R., Hardebeck, J. L., Page, M. T., van der Elst, N. J., Jordan, T. H., Michael, A. J., Shaw, B. E., & Werner, M. J. (2017). A Spatiotemporal Clustering Model for the Third Uniform California Earthquake Rupture Forecast (UCERF3-ETAS): Toward an Operational Earthquake Forecast. Bulletin of the Seismological Society of America, 107(3), 1049-1081.
- Field, E. H., Jordan, T. H., Page, M. T., Milner, K. R., Shaw, B. E., Dawson, T., Biasi, G. P.,
  Parsons, T., Hardebeck, J. L., Michael, A. J., Weldon, R. J., Powers, P. M., Johnson, K. M., Zeng,
  Y., Bird, P., Felzer, K. R., van der Elst, N. J., Madden, C., Arrowsmith, R., Werner, M. J.,
  Thatcher, W. R., & Jackson, D. D. (2017). A Synoptic View of the Third Uniform California
  Earthquake Rupture Forecast (UCERF3). Seismological Research Letters,.
- 7167 Song, X., & Jordan, T. H. (2017). Stochastic Representations of Seismic Anisotropy: Transversely Isotropic Effective Media Models. Geophysical Journal International, 209(3), 1831-1850.

- 7171 Jiang, J., & Lapusta, N. (2017). Connecting depth limits of interseismic locking, microseismicity, and large earthquakes in models of long-term fault slip. Journal of Geophysical Research: Solid Earth, 122.
- 7187 Scharer, K. M., Weldon, R. J., Biasi, G. P., Streig, A. R., & Fumal, T. E. (2017). Ground-rupturing earthquakes on the northern Big Bend of the San Andreas Fault, California, 800 A.D. to present. Journal of Geophysical Research, (under review).
- 7189 Harris, R. A. (2017). Large Earthquakes and Creeping Faults. Reviews of Geophysics, 55(1), 169–198.
- 7190 Davis, P. M. (2017). Dependence of the Brittle Ductile Transition on Strain-Rate-Dependent Critical Homologous Temperature. Geophysical Journal International, 209(2), 1180-1194.
- 7201 Archuleta, R. J., & Ji, C. (2016). Moment rate scaling for earthquakes 3.3≤M≤5.3 with implications for stress drop. Geophysical Research Letters, 43(23), 12,004-12,011.
- 7204 Sleep, N. H., & Nakata, N. (2017). Nonlinear Attenuation of S Waves by Frictional Failure at Shallow Depths. Bulletin of the Seismological Society of America, 1828–1848.
- 7207 McClure, M., Gibson, R., Chiu, K., & Ranganath, R. (2017). Identifying potentially induced seismicity and assessing statistical significance in Oklahoma and California. Journal of Geophysical Research: Solid Earth, 122.
- 7218 Zhang, Q., Lin, G., Zhan, Z., Chen, X., Qin, Y., & Wdowinski, S. (2017). Absence of remote earthquake triggering within the Coso and Salton Sea geothermal production fields. Geophysical Research Letters,.
- 7222 Scott, C. P., & Lohman, R. B. (2016). Sensitivity of earthquake source inversions to atmospheric noise and corrections of InSAR data. Journal of Geophysical Research, Solid Earth,.
- 7223 Moser, A. C., Evans, J. P., Ault, A. K., Janecke, S. U., Bradbury, K. K., & Reiners, P. (2017). (U-Th)/He thermochronometry reveals Pleistocene punctuated deformation and synkinematic hematite mineralization in the Mecca Hills, southernmost San Andreas Fault zone. Earth and Planetary Science Letters, 476, 87-99.
- 7235 Trugman, D. T., & Shearer, P. M. (2017). Application of an improved spectral decomposition method to examine earthquake source scaling in southern California. J. Geophys. Res.,.
- 7237 Kilgore, B. D., Lozos, J. C., Beeler, N. M., & Oglesby, D. D. (2017). Rock friction under variable normal stress. JGR SE, (accepted).
- 7239 Shinevar, W., Behn, M., & Hirth, G. (2015). Compositional dependence of lower crustal viscosity. Geophysical Research Letters, 42(20), 8333-8340.
- 7250 Hollingsworth, J., Ye, L., & Avouac, J. (2017). Dynamically triggered slip on a splay fault in the Mw 7.8, 2016 Kaikoura (New Zealand) earthquake. Geophysical Research Letters, 44.
- 7251 Bird, P. (2017). Stress field models from Maxwell stress functions: Southern California. Geophysical Journal International, 210, 951-963.
- 7261 Rubino, V., Lapusta, N., & Rosakis, A. J. (2017). Designing laboratory experiments of dynamic rupture triggering and low-prestress supershear transition. Journal of Geophysical Research, (in preparation).
- 7262 Rubino, V., Lapusta, N., & Rosakis, A. J. (2017). Experimental evidence of dynamic rupture triggering and low-prestress supershear transition. Journal of Geophysical research, (in preparation).
- 7263 Rubino, V., Rosakis, A. J., & Lapusta, N. (2017). Visualization of laboratory earthquakes using the digital image correlation technique. Experimental Mechanics, (in preparation).
- 7264 Rubino, V., Rosakis, A. J., & Lapusta, N. (2017). Investigation of ground motion attenuation of crack-like and pulse-like ruptures. Tectonophysics, (in preparation).
- 7265 Perry, S. M., & Lapusta, N. (2017). Reproducing magnitude-invariant stress drops in fault models with dynamic weakening. Journal of Geophysical Research, (in preparation).

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- 7269 Marzocchi, W., & Jordan, T. H. (2017). A unified probabilistic framework for seismic hazard analysis. Bulletin of the Seismological Society of America, (accepted).
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- 7272 Allison, K. L., & Dunham, E. M. (2017). Earthquake cycle simulations with rate-and-state friction and nonlinear Maxwell rheology. Tectonophysics, (submitted).
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- 7283 Giraldo, D., & Restrepo, D. (2017). The Spectral Cell Method in Nonlinear Earthquake Modeling. Computational Mechanics, (accepted).
- 7285 Xu, X., Sandwell, D. T., Tymofyeyeva, E., Gonzalez-Ortega, A., & Tong, X. (2017). IEEE Transactions on Geoscience and Remote Sensing. Tectonic and Anthropogenic Deformation at the Cerro Prieto Geothermal Step-Over Revealed by Sentinel-1A InSAR, 1-9.
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- 7292 Field, E. H., Jordan, T. H., Jones, L. M., Michael, A. J., & Blanpied, M. L. (2017). The potential uses of operational earthquake forecasting. Seismological Research Letters, 87(2a), 313-322.
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- 7294 Goebel, T. H., Walter, J. I., Murray, K. D., & Brodsky, E. E. (2017). Comment on: How will induced seismicity in Oklahoma respond to decreased saltwater injection rates. Science Advances, (accepted).
- 7299 Moyer, P. A., Boettcher, M. S., Ellsworth, W. L., Ogasawara, H., Cichowicz, A., Birch, D., & van Aswegen, G. (2017). Call for Models—A Test Case for the Source Inversion Validation: The 2014 ML 5.5 Orkney, South Africa, Earthquake. Seismological Research Letters,.
- 7300 Roten, D., Olsen, K. B., & Day, S. M. (2017). Off-fault deformations and shallow slip deficit from dynamic rupture simulations with fault zone plasticity. Geophysical Research Letters, 40, 1-10.
- 7303 Yu, E., Acharya, P., Jaramillo, J., Kientz, S., Thomas, V., & Hauksson, E. (2017). The Station Information System (SIS): A Centralized Seismic Station Repository for Populating, Managing, and Distributing Metadata. Seismological Research Letters, (in preparation).

- 7349 Yule, D., & Heermance, R. V. (2017). Holocene slip rates along the San Andreas Fault System in the San Gorgonio Pass and implications for large earthquakes in southern California. Geophysical Research Letters, 44(11), 5391-5400.
- 7365 Sheng, Y., Denolle, M. A., & Beroza, G. C. (2017). Multi-Component C3 Green's Functions for Improved Long-Period Ground Motion Prediction. BSSA, (awaiting publication).
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- 7485 Anderson, J. G., Biasi, G. P., & Wesnousky, S. G. (2017). Fault scaling relationships depend on the average fault slip rate. Bulletin of the Seismological Society of America, (awaiting publication).
- 7524 Tymofyeyeva, E., & Fialko, Y. (2017). Geodetic evidence for a blind fault segment at the Southern end of the San Jacinto Fault Zone. Journal of Geophysical Research, (under review).
- 7640 Persaud, P., Tan, E., Contreras, J., & Lavier, L. L. (2016). A bottom-driven mechanism for distributed faulting in the Gulf of California rift. Tectonophysics,.
- 7884 Carlson, J. M., Elbanna, A. E., & Lieou, C. K. (2016). Dynamic friction in sheared fault gouge: Implications of acoustic vibration on triggering and slow slip. Journal of Geophysical Research: Solid Earth, 121(3), 1483-1496.
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- 7914 Denolle, M. A., Boué, P., Hirata, N., & Beroza, G. C. (2017). Strong Shaking Predicted in Tokyo from an Expected M7+ Itoigawa-Shizuoka Earthquake. Journal of Geophysical Research, (submitted).
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- 7917 Li, Z., & Peng, Z. (2017). Geophysical Research Letters. Stress- and structure-induced anisotropy in Southern California from two-decades of shear-wave splitting measurements, (accepted).
- 7921 Resor, P. G., Cooke, M. L., Marshall, S. T., & Madden, E. H. (2017). Influence of fault geometry on the spatial distribution of long-term slip with implications for determining representative fault slip rates. Bulletin of the Seismological Society of America, (submitted).
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### Books or Other Non-periodical, One-Time Publications (1 total)

7919 Branum, D., Harmsen, S., Kalkan, E., Petersen, M. D., & Wills, C. J. (2008). Earthquake Shaking Potential for California. Mapsheet 48 (Revised 2008): California Geological Survey.

#### **Conference Papers and Presentations (326 total)**

- 6252 Taborda, R., Khoshnevis, N., Azizzadeh-Roodpish, S., & Huda, M. (2017). Influence Of The Source, Seismic Velocity, And Attenuation Models On The Validation Of Ground Motion Simulations. Poster Presentation at 16 World Conference on Earthquake Engineering.
- 6571 Farris, A. C., & Onderdonk, N. W. (2017, 03). Quantifying Late Quaternary deformation in the Santa Maria Basin: A OSL, GPS and soil chronosequence based model for determining strath terrace deformation in the Zaca Creek drainage, Santa Barbara County. Poster Presentation at 2016 SCEC Annual Meeting.
- 6899 Ye, L., Kanamori, H., Lay, T., & Avouac, J. (2017, 05). Strike-slip Faulting Energy Release. Poster Presentation at 2016 SCEC Annual Meeting.
- 7219 Cheng, Y., & Chen, X. (2016, 12). Seismicity and source spectra analysis in Salton Sea Geothermal Field. Poster Presentation at AGU 2016.
- 7245 Jacobs, J., Howard, S., Forand, D. H., Dor, O., & Evans, J. P. (2006, 09). Field Guide to Exhumed Major Faults in Southern California. Oral Presentation at SCEC 2005 Meeting Field trip.
- 7256 Ye, L., Avouac, J., & Lapusta, N. (2016, 12). Dynamic Stress Changes during the 2015 Gorkha, Nepal Earthquake. Oral Presentation at AGU Annual Meeting.
- 7257 Lay, T., Ye, L., Kanamori, H., & Avouac, J. (2016, 12). The 16 April 2016, Mw 7.8 Ecuador earthquake: a quasi-repeater of the 1942 Ms 7.5 earthquake and partial re-rupture of the 1906 Ms 8.6 Colombia-Ecuador earthquake. Oral Presentation at AGU Annual Meeting.
- 7268 Abercrombie, R. E., Shearer, P. M., & Trugman, D. T. (2017, 04). A comparison of different methods of calculating source spectra and stress drop in Southern California. Poster Presentation at Annual Meeting of the Seismological Society of America.
- 7278 Savran, W. H., Olsen, K. B., & Day, S. M. (2017, 04). Kinematic Rupture Generator Based on 3D Rough Fault Dynamic Rupture Simulations. Poster Presentation at Seismological Society of America.
- 7290 Johnson, C. W., Fu, Y., & Bürgmann, R. (2016, 10). Seasonal stress modulation on active California fault structures. Oral Presentation at State of stress in the Earth.
- 7298 Crouse, C., & Jordan, T. H. (2016, 10). Development of new ground-motion maps for Los Angeles based on 3-D numerical simulations and NGA West2 equations. Oral Presentation at 2016 California Strong Motion Instrumentation Program Annual Seminar.
- 7309 Sleep, N. H. (2017, 07). Earthquake cycles with dynamic weakening from flash melting with heterogeneous stress and near-fault anelastic strain. Poster Presentation at 2017 SCEC Annual Meeting.
- 7311 Hudnut, K. W., Wein, A. M., Cox, D. A., Perry, S. C., Porter, K. A., Johnson, L. A., & Strauss, J. A. (2017, 07). The HayWired Scenario — How can the San Francisco bay region bounce back better? Oral Presentation at 2017 SCEC Annual Meeting.
- 7330 Spica, Z., Perton, M., Clayton, R. W., & Beroza, G. C. (2017, 07). Geometry of the Los Angeles Basin Using Full H/V Spectral Ratio Inversion. Poster Presentation at 2017 SCEC Annual Meeting.

- 7334 Hough, S. E., & Bilham, R. (2017, 07). Rocking the Boat: Poro-elastic Stress Change at Seismogenic Depth Associated with Oil Production in the Los Angeles Basin in the Early 20th Century. Poster Presentation at 2017 SCEC Annual Meeting.
- 7337 Xu, X., & Sandwell, D. T. (2017, 07). Line-of-Sight Velocity Map along the San Andreas Fault System from GPS and Sentinel-1 InSAR: Contribution to the SCEC Community Geodetic Model. Poster Presentation at 2017 SCEC Annual Meeting.
- 7345 Hardebeck, J. L. (2017, 07). Are the Stress Drops of Small Earthquakes Good Predictors of the Stress Drops of Larger Earthquakes? Poster Presentation at 2017 SCEC Annual Meeting.
- 7346 Foster, K., Bradley, B. A., Wotherspoon, L., & McGann, C. R. (2017, 07). A data-driven V\_s,30 model for New Zealand engineering research & practice. Poster Presentation at 2017 SCEC Annual Meeting.
- 7347 Bowden, D. C., & Tsai, V. C. (2017, 07). The Site Response of Surface Waves. Poster Presentation at 2017 SCEC Annual Meeting.
- 7350 Marzocchi, W. (2017, 07). Progresses and challenges for Operational Earthquake Forecasting in Italy. Oral Presentation at 2017 SCEC Annual Meeting.
- 7351 Cochran, E. S., Kroll, K. A., Richards-Dinger, K. B., & Murray, K. D. (2017, 07). Permeability Changes Observed in the Arbuckle Group Coincident with Nearby Earthquake Occurrence. Poster Presentation at 2017 SCEC Annual Meeting.
- 7355 Evans, E. L. (2017, 07). Strategies for building community-based geodetic models of fault slip rates. Oral Presentation at 2017 SCEC Annual Meeting.
- 7357 Llenos, A. L., & Michael, A. J. (2017, 07). Space-time earthquake rate models for one-year hazard forecasts in Oklahoma. Poster Presentation at 2017 SCEC Annual Meeting.
- 7360 Gold, P. O., Behr, W. M., Rockwell, T. K., & Fletcher, J. M. (2017, 07). Quaternary Slip History for the Agua Blanca Fault, northern Baja California, Mexico. Poster Presentation at 2017 SCEC Annual Meeting.
- 7363 Chen, K., Liu, Z., & Song, T. (2017, 07). Toward a more robust tsunami early warning system: integration of real-time GPS, strong motion and teleseismic data for fast seismic source inversion. Poster Presentation at 2017 SCEC Annual Meeting.
- 7364 Gerstenberger, M. C., Rhoades, D. A., Christophersen, A., Fry, B., Wallace, L. M., McVerry, G., & Horspool, N. (2017, 07). Earthquake Forecasting in recent large events in New Zealand and the role of CSEP. Oral Presentation at 2017 SCEC Annual Meeting.
- 7367 Sahakian, V. J., Baltay, A. S., Hanks, T. C., Buehler, J., & Vernon, F. L. (2017, 07). Path and site effects in GMPEs: Incorporating crustal physical properties for region-specific ground motion estimation using small magnitude data from Southern California. Poster Presentation at 2017 SCEC Annual Meeting.
- 7370 Langridge, R. M., Villamor, P., Litchfield, N., Van Dissen, R. J., Clark, K., Ries, W., Kearse, J., Little, T., Gerstenberger, M. C., Goded, T., & Response Team, t. (2017, 07). The 2016 Mw 7.8 Kaikoura Earthquake: Perspectives from Earthquake Geology into Seismic Hazard. Oral Presentation at 2017 SCEC Annual Meeting.
- 7374 Murray, J. R. (2017, 08). The impact of model prediction error in designing geodetic networks for crustal deformation applications. Poster Presentation at 2017 SCEC Annual Meeting.
- 7376 Xue, L., Bürgmann, R., & Shelly, D. R. (2017, 08). Frequency-Dependent Tidal Triggering of Low Frequency Earthquakes Near Parkfield, California. Poster Presentation at 2017 SCEC Annual Meeting.
- 7378 Kroll, K. A., Richards-Dinger, K. B., Dieterich, J. H., & Oglesby, D. D. (2017, 08). 3D Simulations of Earthquakes on Parallel Offset Faults with Homogeneous Stress Conditions. Poster Presentation at 2017 SCEC Annual Meeting.

- 7379 Douilly, R., Oglesby, D. D., Cooke, M. L., & Beyer, J. L. (2017, 08). Dynamic Models of Earthquake Rupture along branch faults of the Eastern San Gorgonio Pass Region in CA using Complex Fault Structure. Poster Presentation at 2017 SCEC Annual Meeting.
- 7380 Jones, L. M. (2017, 08). Science in Society: Bridging the Gap. Oral Presentation at 2017 SCEC Annual Meeting.
- 7383 Wu, B., Oglesby, D. D., Ghosh, A., & LI, B. (2017, 08). Investigating the physics behind VLFEs and LFEs: analysis based on dynamic rupture models with ductile-like friction. Poster Presentation at 2017 SCEC Annual Meeting.
- 7386 Huang, Y. (2017, 08). The effects of segmented fault zones on earthquake rupture propagation and termination. Poster Presentation at 2017 SCEC Annual Meeting.
- 7388 Li, Z., & Peng, Z. (2017, 08). Stress- and structure-induced anisotropy in Southern California from two-decades of shear-wave splitting measurements. Poster Presentation at 2017 SCEC Annual Meeting.
- 7389 Kuo, S., Kitamura, M., & Kitajima, H. (2017, 08). Experimental Investigation on Poro-Elasto-Visco-Plastic Behavior of the Inner Accretionary Wedge Sediments at the Nankai Subduction Zone. Poster Presentation at 2017 SCEC Annual Meeting.
- 7391 Ma, K., & (TEM) team, T. (2017, 08). Taiwan Earthquake Model: PSHA and Scenario Hazard Map. Poster Presentation at 2017 SCEC Annual Meeting.
- 7392 Milliner, C. W., Bürgmann, R., Wang, T., Inbal, A., Bekaert, D., Liang, C., & Fielding, E. J. (2017, 08). Capturing Postseismic Processes of the 2016 Mw 7.1 Kumamoto Earthquake, Japan, Using Dense, Continuous GPS and Short-repeat Time ALOS-2 InSAR Data: Implications for the Shallow Slip Deficit Problem. Poster Presentation at 2017 SCEC Annual Meeting.
- 7393 Skoumal, R., Patlan, E., Dawson, P. B., Kaven, J., & Hickman, S. H. (2017, 08). Microseismic events associated with the Oroville Dam spillway. Poster Presentation at 2017 SCEC Annual Meeting.
- Callaghan, S., Graves, R. W., Olsen, K. B., Cui, Y., Milner, K. R., Goulet, C. A., Maechling, P. J.,
  & Jordan, T. H. (2017, 08). 10 years of CyberShake: Where are we now and where are we going with physics-based PSHA? Oral Presentation at 2017 SCEC Annual Meeting.
- 7395 Johnson, C. W., Fu, Y., & Bürgmann, R. (2017, 08). Stress models of the annual hydrospheric, atmospheric, thermal, and tidal loading cycles on California faults: Perturbation of background stress and changes in seismicity. Poster Presentation at 2017 SCEC Annual Meeting.
- 7398 Lohman, R. B., Scott, C. P., & Jordan, T. E. (2017, 08). InSAR coherence time series soil moisture as a proxy for alluvial fan age? Poster Presentation at 2017 SCEC Annual Meeting.
- 7402 Rinkema, S., Oda, A. R., Narvaez-Colon, A. G., Rolón-Domena, K., Tantiwuttipong, P., Kala, E., Yu, J., Milner, K. R., Noriega, G. R., Pearson, J. K., & Jordan, T. H. (2017, 08). 2017 USEIT: SCEC-VDO Enhancement and Release. Poster Presentation at 2017 SCEC Annual Meeting.
- 7403 Troise, S. A., Bent, M. T., Hernandez, R. A., Cervantes, R. G., Hermosura, J., Martinez, M. D., Callaghan, S., Gilchrist, J. J., Pearson, J. K., Noriega, G. R., & Jordan, T. H. (2017, 08). 2017 UseIT: High Performance Computing Team. Poster Presentation at 2017 SCEC Annual Meeting.
- Loh, C. Y., Dorencz, O. J., Escanuela, A., Qualls, K. F., Milner, K. R., Jordan, T. H., Pearson, J. K., & Noriega, G. R. (2017, 08). 2017 UseIT: Probability Team. Poster Presentation at 2017 SCEC Annual Meeting.
- 7405 Li, Y., Belvoir, S., Edwards, A., Midgley, A., Uribe, R., Verna, R., Pearson, J. K., Jordan, T. H., Noriega, G. R., Milner, K. R., & Seligson, H. A. (2017, 08). 2017 USEIT: Hazard and Risk Visualization of Earthquake Scenarios. Poster Presentation at 2017 SCEC Annual Meeting.
- 7407 Dorencz, O. J., Hernandez, R., Midgley, A., Verna, R., Qualls, K. F., Rolón-Domena, K., Cervantes, R. G., Oda, A. R., Ballmann, J., Jordan, T. H., Pearson, J. K., & Noriega, G. R. (2017,

08). 2017 UseIT: Communications Work Group. Poster Presentation at 2017 SCEC Annual Meeting.

- 7409 Wirth, E., Frankel, A., Vidale, J. E., Marafi, N., & Stephenson, W. J. (2017, 08). 3-D Simulations of M9 Earthquakes on the Cascadia Megathrust. Poster Presentation at 2017 SCEC Annual Meeting.
- 7415 Share, P., Ben-Zion, Y., Thurber, C. H., Zhang, H., & Guo, H. (2017, 08). Seismic imaging of the southern California plate-boundary around the South-Central Transverse Ranges using double-difference tomography. Poster Presentation at 2017 SCEC Annual Meeting.
- 7416 Wang, K., & Fialko, Y. (2017, 08). Postseismic deformation following the 2013 Mw 7.7 Balochistan (Pakistan) earthquake observed with Sentinel-1 Interferometry. Poster Presentation at 2017 SCEC Annual Meeting.
- 7420 Lin, J. C., Moon, S., Yong, A., Meng, L., Martin, A., & Davis, P. M. (2017, 08). Linking Subsurface and Surface Processes: Insights on Vs30 Distribution in Southern California. Poster Presentation at 2017 SCEC Annual Meeting.
- 7425 Baker, J. W., & Chen, Y. (2017, 08). Characterization of spatial correlations in ground motions—insights from physics-based simulations. Oral Presentation at 2017 SCEC Annual Meeting.
- 7427 Taciroglu, E. (2017, 08). A Vision for Regional Performance-Based Seismic Assessment. Oral Presentation at 2017 SCEC Annual Meeting.
- 7430 Halkia, G., & Grant Ludwig, L. (2017, 08). Newspaper Media Content Analysis: Community Effects of Induced Seismicity in Oklahoma. Poster Presentation at 2017 SCEC Annual Meeting.
- 7434 Roh, B., Buyco, K., & Heaton, T. H. (2017, 08). NGA high-pass filters remove important real signals; simple tilt correction is preferable when predicting collapse. Poster Presentation at 2017 SCEC Annual Meeting.
- 7436 Retailleau, L., & Beroza, G. C. (2017, 08). Towards Structural Imaging Using Scattering Artifacts Detected in Ambient Field Correlations. Poster Presentation at 2017 SCEC Annual Meeting.
- 7438 McDermott, R., Ault, A. K., & Evans, J. P. (2017, 08). Examining earthquake processes with microtextural analysis and (U-Th)/He thermochronometry: a case study from hematite fault mirrors in the Wasatch fault zone. Poster Presentation at 2017 SCEC Annual Meeting.
- 7440 Swiatlowski, J. L., Moore, D., & Lockner, D. A. (2017, 08). Frictional strengths of fault gouge from a creeping segment of the Bartlett Springs Fault, northern California. Poster Presentation at 2017 SCEC Annual Meeting.
- 7441 Clayton, R. W., Lin, F., Denolle, M. A., Persaud, P., & Polet, J. (2017, 08). Imaging the San Gabriel and San Bernardino Basins with short-term Nodal deployments. Poster Presentation at 2017 SCEC Annual Meeting.
- 7442 Khoshnevis, N., & Taborda, R. (2017, 09). Towards an Informed Decision Making in Validation Metrics. Oral Presentation at QuakeCoRE Annual Meeting.
- 7443 Jackson, D. D. (2017, 08). Prospective test of the 1995 WGCEP SoCal earthquake forecast . Poster Presentation at 2017 SCEC Annual Meeting.
- 7444 Ellsworth, W. L., Boettcher, M. S., & Ogasawara, H. (2017, 08). A Test Case for the Source Inversion Validation: The 2014 ML 5.5 Orkney, South Africa Earthquake. Poster Presentation at 2017 SCEC Annual Meeting.
- 7445 Xie, Y., & Meng, L. (2017, 08). Application of array-based early warning system to tsunami offshore Ventura, California. Poster Presentation at 2017 SCEC Annual Meeting.
- 7446 Lee, R. L., Bradley, B. A., Graves, R. W., Rodriguez-Marek, A., & Stafford, P. J. (2017, 08). Investigation of Systematic Ground Motion Effects Through Ground Motion Simulation of Small-to-Moderate Magnitude Earthquakes in the Canterbury, New Zealand Region. Poster Presentation at 2017 SCEC Annual Meeting.

- 7449 Bao, X., & Song, X. (2017, 08). Crust azimuthal anisotropy beneath the eastern Tibetan Plateau revealed by ambient noise tomography. Poster Presentation at 2017 SCEC Annual Meeting.
- 7455 Brune, J. N., Anderson, J. G., & Brune, R. J. (2017, 08). Additional Interpretation of the Orientations of Precariously Balanced Rocks in the Band Between the San Jacinto and Elsinore Faults. Poster Presentation at 2017 SCEC Annual Meeting.
- 7456 Bruhat, L., & Segall, P. (2017, 08). Can deformation rates across the Carrizo Plain segment of the San Andreas Fault be explained by vertical migration of the locked to-creeping transition? Poster Presentation at 2017 SCEC Annual Meeting.
- 7457 Abolfathian, N., Martínez-Garzón, P., & Ben-Zion, Y. (2017, 08). Spatio-temporal variations of stress parameters in the San Jacinto Fault Zone. Poster Presentation at 2017 SCEC Annual Meeting.
- 7458 Shaw, B. E., Milner, K. R., Field, E. H., Richards-Dinger, K. B., Gilchrist, J. J., Dieterich, J. H., & Jordan, T. H. (2017, 08). Striking agreement of physics-based earthquake simulator and UCERF3 California seismic hazard model. Poster Presentation at 2017 SCEC Annual Meeting.
- 7460 Wang, K., Ellsworth, W. L., & Beroza, G. C. (2017, 08). Reanalyzing the Rangely earthquake control experiment using machine learning. Poster Presentation at 2017 SCEC Annual Meeting.
- 7461 Lifton, N. (2017, 08). A new, 170 ka slip rate estimate on the Sierra Madre Fault. Poster Presentation at 2017 SCEC Annual Meeting.
- 7462 Cheng, Y., Ross, Z. E., & Ben-Zion, Y. (2017, 08). Diverse volumetric seismicity in the Trifurcation area of the San Jacinto fault zone. Poster Presentation at 2017 SCEC Annual Meeting.
- 7463 Goebel, T. H., Kwiatek, G., Becker, T. W., Brodsky, E. E., & Dresen, G. (2017, 08). What allows seismic events to grow big?: Insights from b-value and fault roughness analysis in laboratory stick-slip experiments. Poster Presentation at 2017 SCEC Annual Meeting.
- 7465 Kalkan, E., Jones, J., Stephens, C., & Ng, P. (2017, 08). PRISM, Processing and Review Interface for Strong Motion Data Software. Poster Presentation at 2017 SCEC Annual Meeting.
- 7468 Eymold, W. K., & Jordan, T. H. (2017, 08). Objective Tectonic Regionalization of CVM-S4.26 Using the k-means Clustering Algorithm. Poster Presentation at 2017 SCEC Annual Meeting.
- 7469 Ogata, Y. (2017, 08). On secular spatial seismicity. Poster Presentation at 2017 SCEC Annual Meeting.
- 7471 Gong, J., & McGuire, J. J. (2017, 08). Interactions Between Strike-slip Earthquakes and the Subduction Interface near the Mendocino Triple Junction. Poster Presentation at 2017 SCEC Annual Meeting.
- 7473 Schoenball, M., & Ellsworth, W. L. (2017, 08). A systematic assessment of the spatio-temporal evolution of fault activation through induced seismicity in Oklahoma and southern Kansas. Poster Presentation at 2017 SCEC Annual Meeting.
- 7477 Page, M. T., van der Elst, N. J., & Shaw, B. E. (2017, 08). Characterizing the Triggering Susceptibility of Characteristic Faults. Poster Presentation at 2017 SCEC Annual Meeting.
- 7478 Taylor, S. E., & Brodsky, E. E. (2017, 08). Granular Temperature Measured Experimentally in a Shear Flow by Acoustic Energy. Poster Presentation at 2017 SCEC Annual Meeting.
- 7488 Zhang, Y., Yang, J., & Xie, F. (2017, 08). Stress patterns analysis about the seismic focal zone of the great Tohoku-Oki earthquake (M=9.0) in the Japan Trench subduction zone. Poster Presentation at 2017 SCEC Annual Meeting.
- 7490 Reynolds, L. C., Simms, A. R., Rockwell, T. K., Yokoyama, Y., Miyairi, Y., & Hangsterfer, A. (2017, 08). Evidence for Holocene coseismic subsidence during a non- plate boundary earthquake. Poster Presentation at 2017 SCEC Annual Meeting.

- Wilson, J. M., Rundle, J. B., Ward, S., Donnellan, A., Song, T., Komjathy, A., & Savastano, G. (2017, 08). Tsunami Squares: fast tsunami computation for use in coupled earthquake, tsunami, and ionosphere simulations. Poster Presentation at 2017 SCEC Annual Meeting.
- 7494 Luginbuhl, M., Turcotte, D. L., & Rundle, J. B. (2017, 08). Natural Time and Nowcasting Induced Seismicity at the Groningen Gas Field in the Netherlands. Poster Presentation at 2017 SCEC Annual Meeting.
- 7495 Motamed, R., Saxena, S., & Anderson, J. G. (2017, 08). Using Spatial Variation of kappa to Develop Site-Specific Attenuation Model for Improved Broadband Simulations. Poster Presentation at 2017 SCEC Annual Meeting.
- 7496 Chourasia, A., Nadeau, D. R., & Norman, M. L. (2017, 08). SeedMe: Data Sharing Building Blocks. Poster Presentation at 2017 SCEC Annual Meeting.
- 7497 Kedar, S., Bock, Y., Moore, A. W., Fang, P., sullivan, A., Argus, D. F., Jiang, S., & Marshall, S. T. (2017, 08). Production and Uses of Multi-Decade Geodetic Earth Science Data Records. Poster Presentation at 2017 SCEC Annual Meeting.
- 7500 Rubinstein, J. L., & Ellsworth, W. L. (2017, 08). Repeating Earthquakes Trigger Themselves in Parkfield. Poster Presentation at 2017 SCEC Annual Meeting.
- 7501 Patyniak, M., Landgraf, A., Dzhumabaeva, A., Abdrakhmatov, K., Rosenwinkel, S., Korup, O., Preusser, F., Fohlmeister, J., Arrowsmith, R., & Strecker, M. (2017, 08). Paleoseismic Record of Three Holocene Earthquakes Rupturing the Issyk-Ata Fault near Bishkek, North Kyrgyzstan. Poster Presentation at 2017 SCEC Annual Meeting.
- Fuis, G. S., Zhang, E., Catchings, R. D., Scheirer, D. S., Goldman, M. R., & Bauer, K. (2017, 08). A re-examination of the subsurface fault structure in the vicinity of the 1989 Loma Prieta Mw 6.9 earthquake, central California, from analysis of steep reflections, earthquakes, and potential-field data. Poster Presentation at 2017 SCEC Annual Meeting.
- 7504 Juarez, A., & Jordan, T. (2017, 08). Automated Waveform Assembling for Full-3D Tomography. Poster Presentation at 2017 SCEC Annual Meeting.
- 7506 Ross, Z. E., Kanamori, H., & Hauksson, E. (2017, 08). Anomalously large complete stress drop during the 2016 Mw 5.2 Borrego Springs earthquake inferred by waveform modeling and near-source aftershock deficit. Poster Presentation at 2017 SCEC Annual Meeting.
- 7507 Sandwell, D. T., & Smith-Konter, B. R. (2017, 08). A 4-D Earthquake Cycle Model with Lateral Variations in Shear Modulus. Poster Presentation at 2017 SCEC Annual Meeting.
- 7510 Morell, K. D., Regalla, C. A., Amos, C. B., Bennett, S. E., Graham, A., Leonard, L., Lynch, E., & Harrichhausen, N. (2017, 08). Lidar data, geologic mapping, and paleoseismic trenching reveal late Quaternary surface ruptures and increased seismic hazard in southwestern British Columbia, Canada. Poster Presentation at 2017 SCEC Annual Meeting.
- 7513 Gheibi, A., & Hedayat, A. (2017, 08). Laboratory geophysical observation of grain compression and crushing in synthetic fault gouges. Poster Presentation at 2017 SCEC Annual Meeting.
- 7517 Shinevar, W., Behn, M., Hirth, G., & Jagoutz, O. (2017, 08). Inferring Crustal Viscosity from Seismic Wavespeeds: Applications to the Rheologic Structure of Southern California. Poster Presentation at 2017 SCEC Annual Meeting.
- 7520 Oskin, M. E., Behr, W. M., Morelan, A. E., Plesch, A., & Shaw, J. H. (2017, 08). Toward a Geologic Framework for the Community Rheology Model, with focus on the Mojave region. Poster Presentation at 2017 SCEC Annual Meeting.
- 7522 Sheng, Y., Nakata, N., & Beroza, G. C. (2017, 08). On the Properties of Higher-Order Ambient Field Correlation. Poster Presentation at 2017 SCEC Annual Meeting.
- 7527 Huang, H., & Meng, L. (2017, 08). Large-scale Acceleration of Slow Slip Before the 2015 Mw 8.4 Illapel, Chile Earthquake. Poster Presentation at 2017 SCEC Annual Meeting.

- 7528 Mousavi, M., & Beroza, G. C. (2017, 08). Towards Testing Probabilistic Seismic Hazard Estimates. Poster Presentation at 2017 SCEC Annual Meeting.
- 7529 White, M. C., Ross, Z. E., Ben-Zion, Y., & Vernon, F. L. (2017, 08). A detailed, automatically-derived, seismicity catalog for the San Jacinto fault zone (1998-2016). Poster Presentation at 2017 SCEC Annual Meeting.
- 7533 Guns, K. A., Bennett, R. A., & Blisniuk, K. D. (2017, 08). Investigating strain transfer along the Southern San Andreas Fault: A geomorphic and geodetic study of block rotation in the Eastern Transverse Ranges, Joshua Tree National Park, CA. Poster Presentation at 2017 SCEC Annual Meeting.
- 7534 Beyer, J. L., Cooke, M. L., & Marshall, S. T. (2017, 08). Getting pushy with the San Gorgonio Pass: Investigating active fault geometries with crustal deformation models. Poster Presentation at 2017 SCEC Annual Meeting.
- 7537 Louie, J. N., Boudjema, M., Dunn, M., & Kent, G. M. (2017, 08). Ground-Motion Variance from Modeling of Multiple Rupture-Directivity Scenarios on the Newport-Inglewood/Rose Canyon Fault System. Poster Presentation at 2017 SCEC Annual Meeting.
- 7538 Trugman, D. T., & Shearer, P. M. (2017, 08). Examining the relationship between stress drop and peak ground acceleration for small-to-moderate earthquakes in the San Francisco Bay Area. Poster Presentation at 2017 SCEC Annual Meeting.
- 7539 Yano, T. E., & Matsubara, M. (2017, 08). Seismogenic depth of the crust beneath the Japanese Island using Japan unified hlgh-resolution relocated catalog for earthquakes (JUICE). Poster Presentation at 2017 SCEC Annual Meeting.
- 7540 Callaghan, S., Juve, G., Vahi, K., Maechling, P. J., Jordan, T. H., & Deelman, E. (2017, 08). rvGAHP - Push-based job submission using reverse SSH connections. Oral Presentation at International Conference for High Performance Computing, Networking, Storage and Analysis (SC 2017).
- 7543 Wang, W., & Shearer, P. M. (2017, 08). An Improved Method to Determine Coda-Q, Earthquake Magnitude, and Site Amplification: Theory and Application to Southern California. Poster Presentation at 2017 SCEC Annual Meeting.
- Kilb, D., Borsa, A. A., & Agnew, D. C. (2017, 08). On the Geodetic Signature from Lake Mead Water Levels Fluctuations (1940-2016). Poster Presentation at 2017 SCEC Annual Meeting.
- 7545 Zhang, D., & Clayton, R. W. (2017, 08). Near-Surface Shear-Wave Velocities determined using the Community Seismic Network (CSN). Poster Presentation at 2017 SCEC Annual Meeting.
- 7546 Elizondo, K. Q., & Polet, J. (2017, 08). Measurements of Tilt from Triangular Bench Mark Arrays Installed Within Long Valley Caldera in the 1980s. Poster Presentation at 2017 SCEC Annual Meeting.
- 7547 Wesnousky, S. G., & Biasi, G. P. (2017, 08). A predictive model for earthquake rupture extents given an early warning epicenter. Poster Presentation at 2017 SCEC Annual Meeting.
- 7548 Evans, J. P., Borhara, K., & Webb, S. (2017, 08). Earthquake Petrology: Insights into Fault Slip Localization and Fault Heating via Micro X-Ray Fluorescence Mapping and X-Ray Absorption Near Edge Spectroscopy. Poster Presentation at 2017 SCEC Annual Meeting.
- 7550 Wang, J., & Tanimoto, T. (2017, 08). Shallow Earth Structure from Wind-Induced Ground Motion. Poster Presentation at 2017 SCEC Annual Meeting.
- 7551 Todd, E. (2017, 08). Seismicity and tectonic tremor associated with shallow offshore slow slip along the northern Hikurangi Margin, New Zealand. Poster Presentation at 2017 SCEC Annual Meeting.
- 7553 Teng, G., & Baker, J. W. (2017, 08). Evaluations of CyberShake simulated motions for use in engineering analysis. Poster Presentation at 2017 SCEC Annual Meeting.

- 7554 Anderson-Merritt, E., Cowgill, E. S., Scharer, K. M., & Keen-Zebert, A. (2017, 08). Preliminary paleoslip results from the Pearblossom site on the Mojave section of the San Andreas Fault. Poster Presentation at 2017 SCEC Annual Meeting.
- 7555 Liu, Q., Wen, X., & Shao, Z. (2017, 08). Seismogenic structure and coseismic slip distribution of the 2013 Ms7.0 Lushan earthquake in southwestern China. Poster Presentation at 2017 SCEC Annual Meeting.
- Böse, M., Smith, D. E., Felizardo, C., Meier, M., Heaton, T. H., & Clinton, J. (2017, 08). Rapid Line-Source and Ground-Motion Estimates for Earthquake Early Warning Using FinDer Version
   Poster Presentation at 2017 SCEC Annual Meeting.
- Bradley, B. A., Savarimuthu, S., Lagrava, D., Huang, J., Motha, J., Polak, V., & Bae, S. (2017, 08). SeisFinder: A web application for extraction of data from computationally-intensive earthquake resilience calculations. Poster Presentation at 2017 SCEC Annual Meeting.
- 7562 Jeong, S., Mohammadi, K., Asimaki, D., & Bradley, B. A. (2017, 08). Simulation and Validation of Topographic Effects on Mt Pleasant, Christchurch, New Zealand. Poster Presentation at 2017 SCEC Annual Meeting.
- 7564 McGuire, J. J., & Kaneko, Y. (2017, 08). Directly Estimating Rupture Area to Remove the Uncertainty in Stress Drop. Poster Presentation at 2017 SCEC Annual Meeting.
- 7565 Nakata, N., & Beroza, G. C. (2017, 08). Towards a High-Resolution Velocity Model with a Very Dense Array at Diablo Canyon, California. Poster Presentation at 2017 SCEC Annual Meeting.
- 7566 Shearer, P. M., Abercrombie, R. E., & Trugman, D. T. (2017, 08). Testing and Reconciling Stress Drop and Attenuation Models for Southern California. Poster Presentation at 2017 SCEC Annual Meeting.
- 7569 Glasscoe, M. T., Parker, J. W., & Donnellan, A. (2017, 08). Characterizing fault motion using edge detection in radar images. Poster Presentation at 2017 SCEC Annual Meeting.
- 7570 Inbal, A., Kong, Q., Allen, R. M., & Savran, W. H. (2017, 08). Earthquake Monitoring with the MyShake Global Smartphone Seismic Network. Poster Presentation at 2017 SCEC Annual Meeting.
- 7576 Ault, A. K., McDermott, R. G., Moser, A. C., & Evans, J. P. (2017, 08). Hematite nano- to micro-textures and (U-Th)/He thermochronometry inform seismic and aseismic fault damage zone processes. Poster Presentation at 2017 SCEC Annual Meeting.
- 7578 Field, E. H., & WGCEP Participants,. (2017, 08). An Overview of the 3rd Uniform California Earthquake Rupture Forecast (UCERF3). Poster Presentation at 2017 SCEC Annual Meeting.
- 7579 Khoshnevis, N., & Taborda, R. (2017, 08). An application of machine learning techniques to the evaluation of goodness-of-fit scores used in earthquake ground motion validation. Poster Presentation at 2017 SCEC Annual Meeting.
- 7580 Withers, K. B., & Moschetti, M. P. (2017, 08). 3D Dynamic Rupture Simulations along Dipping Faults, with a focus on the Wasatch Fault Zone, Utah. Poster Presentation at 2017 SCEC Annual Meeting.
- 7581 Qin, L., Ben-Zion, Y., & Vernon, F. L. (2017, 08). Ground motion coherence study in multiple distance ranges and frequency bands. Poster Presentation at 2017 SCEC Annual Meeting.
- 7582 Aslam, K., & Daub, E. G. (2017, 08). Modelling the spatio-temporal pattern of heterogeneous stresses and strain accumulation due to earthquake rupture on a geometrically complex fault. Poster Presentation at 2017 SCEC Annual Meeting.
- 7583 Hirakawa, E. T., & Ma, S. (2017, 08). Effect of Undrained Gouge Plasticity on Rupture Dynamics of Rough Faults. Poster Presentation at 2017 SCEC Annual Meeting.
- 7590 Buyco, K., & Heaton, T. (2017, 08). 70%-damped spectral acceleration as a ground motion intensity measure for predicting highly nonlinear response of structures. Poster Presentation at 2017 SCEC Annual Meeting.

- 7595 Hatem, A. E., & Dolan, J. F. (2017, 08). A model for the initiation, evolution and continued activity of the Garlock fault, California. Poster Presentation at 2017 SCEC Annual Meeting.
- 7596 Pekurovsky, D., Chourasia, A., Richards-Dinger, K. B., Shaw, B. E., Dieterich, J. H., & Cui, Y. (2017, 08). Performance enhancements and visualization for RSQSim earthquake simulator. Poster Presentation at 2017 SCEC Annual Meeting.
- 7597 Evans, W. S., Plesch, A., Lee, W., Pillai, N., Shaw, J. H., Meier, M., & Hauksson, E. (2017, 08). Implementing rapid, probabilistic association of earthquakes with source faults in the CFM for southern California. Poster Presentation at 2017 SCEC Annual Meeting.
- Yu, E., Acharya, P., Bhaskaran, A., Chen, S., Andrews, J., Thomas, V., Hauksson, E., & Clayton, R. W. (2017, 08). Obspy, Web Services and Big Data – Using the Southern California Earthquake Data Center (SCEDC) and the Southern California Seismic Network (SCSN) Products and Services for Earthquake Research. Poster Presentation at 2017 SCEC Annual Meeting.
- 7601 Denolle, M. A., Boué, P., Beroza, G. C., & Hirata, N. (2017, 08). Seismic noise based ground motion: strong shaking predicted in Tokyo for the next M7+ earthquake on the Itoigawa-Shizuoka tectonic line. Poster Presentation at 2017 SCEC Annual Meeting.
- 7604 Meng, H., Ben-Zion, Y., & McGuire, J. J. (2017, 08). Towards quasi-automated estimates of directivity and related source properties of small to moderate earthquakes with second seismic moments. Poster Presentation at 2017 SCEC Annual Meeting.
- 7607 Minson, S. E., Baltay, A. S., Cochran, E. S., Hanks, T. C., & Meier, M. (2017, 08). The Limits of Earthquake Early Warning. Oral Presentation at 2017 SCEC Annual Meeting.
- 7609 Dorsett, J. H., Marshall, S. T., Madden, E. H., & Cooke, M. L. (2017, 08). Mechanical Models of Fault Slip Rates in the Imperial Valley, CA. Poster Presentation at 2017 SCEC Annual Meeting.
- 7610 da Silva, R. F., Callaghan, S., & Deelman, E. (2017, 08). On the use of burst buffers for accelerating data-intensive scientific workflows. Oral Presentation at International Conference for High Performance Computing, Networking, Storage and Analysis (SC 2017).
- 7611 Silva, F., Maechling, P. J., Goulet, C. A., & Jordan, T. (2017, 08). The SCEC Broadband Platform: Open-Source Software for Strong Ground Motion Simulation and Validation. Poster Presentation at 2017 SCEC Annual Meeting.
- 7614 Yu, C., Hauksson, E., Zhan, Z., & Cochran, E. S. (2017, 08). Depth Distribution of the 2010 El Mayor-Cucapah Earthquake Sequence (M>=4) Determined from Regional Waveform Modeling. Poster Presentation at 2017 SCEC Annual Meeting.
- 7615 Quackenbush, P., West, J., Clark, M., Zekkos, D., & Deepak, C. (2017, 08). Tectonic control on landsliding in the nepal himalaya revealed by the 2015 gorkha earthquake. Poster Presentation at 2017 SCEC Annual Meeting.
- 7617 Hauksson, E., & Meier, M. (2017, 08). Applying Paleo-earthquake Data to Query for Earthquake Gate Areas. Oral Presentation at 2017 SCEC Annual Meeting.
- 7620 Hauksson, E., Meier, M., & Ross, Z. E. (2017, 08). Can the Depth Distribution of Seismicity be Applied to Probe the Rheology of the Seismogenic Crust in Southern California? Poster Presentation at 2017 SCEC Annual Meeting.
- Scharer, K. M., Burgette, R. J., Hanson, A., Lifton, N., Rittenour, T. M., & McPhillips, D. (2017, 08). Slip rate variation of the Central Sierra Madre fault, southern California over the past 200 ka. Poster Presentation at 2017 SCEC Annual Meeting.
- 7624 Giguere, A. (2017, 08). Natural Time and Earthquake Aftershock Entropy. Poster Presentation at 2017 SCEC Annual Meeting.
- 7625 Rezaeian, S., Sun, X., Clayton, B., & Hartzell, S. (2017, 08). Estimation of Ground Motion Variability in the CEUS. Poster Presentation at 2017 SCEC Annual Meeting.

- Gilchrist, J. J., Jordan, T. H., Shaw, B. E., Milner, K. R., Richards-Dinger, K. B., & Dieterich, J. H. (2017, 08). Conditional Probabilities of Large Earthquake Sequences in California from the Physics-based Rupture Simulator RSQSim. Poster Presentation at 2017 SCEC Annual Meeting.
- 7629 Miranda, E., Stewart, C., & Lourcey, K. (2017, 08). Grain boundary sliding triggers coeval pseudotachylyte development in brittle-ductile transition mylonites: an Electron Backscatter Diffraction (EBSD) case study of mid-crustal interseismic and coseismic deformation. Poster Presentation at 2017 SCEC Annual Meeting.
- 7631 Levy, Y., Rockwell, T. K., Shaw, J. H., Plesch, A., Driscoll, N. W., & Perea, H. (2017, 08). Structural Architecture of the Western Transverse Ranges and Potential for Large Earthquakes – Trishear Forward Models. Poster Presentation at 2017 SCEC Annual Meeting.
- 7633 Borhara, K., Bradbury, K. K., & Evans, J. P. (2017, 08). Carbonaceous fault-related rocks in SAFOD Phase III core: Indicators of fluid-rock interaction and structural diagenesis during slip. Poster Presentation at 2017 SCEC Annual Meeting.
- 7636 Hernandez, A., Persaud, P., Bauer, K., Stock, J. M., Fuis, G. S., Hole, J. A., & Goldman, M. R. (2015, 09). Profile of Shallow Crustal Structure across the San Andreas Fault Zone, Coachella Valley based on Controlled-Source Data from the Salton Seismic Imaging Project (SSIP). Poster Presentation at SCEC Annual Meeting.
- 7637 Larochelle, S., Lapusta, N., & Ampuero, J. (2017, 08). The Role of Dilatancy in Fluid-Induced Fault Slip. Poster Presentation at 2017 SCEC Annual Meeting.
- 7638 Onderdonk, N. W., Farris, A., Tyler, E., Pytlewski, A. M., Garcia, A., & Mahan, S. A. (2017, 08). Strath terraces in the Santa Ynez Valley suggest late Quaternary activity on a detachment fault beneath the Western Transverse Ranges, California. Poster Presentation at 2017 SCEC Annual Meeting.
- 7639 Han, J., & Meng, L. (2017, 08). Time Reversal Imaging of the 2014 Iquique Tsunami Source. Poster Presentation at 2017 SCEC Annual Meeting.
- 7641 Perea, H., Ucarkus, G., Driscoll, N. W., Kent, G. M., Levy, Y., & Rockwell, T. K. (2017, 08). New high-resolution seismic data reveals the Holocene active structures and deformation events in offshore Ventura basin, CA. Poster Presentation at 2017 SCEC Annual Meeting.
- 7642 Luttrell, K. M., & Hardebeck, J. L. (2017, 08). Borehole Breakouts Versus Earthquake Focal Mechanisms as Stress Field Orientation Indicators in Southern California: Should We Agree to Disagree? Poster Presentation at 2017 SCEC Annual Meeting.
- 7644 Breuer, A. N., Heinecke, A., & Cui, Y. (2017, 08). Fused Seismic Simulations with the Discontinuous Galerkin Method at Extreme-Scale. Poster Presentation at 2017 SCEC Annual Meeting.
- 7646 Ajala, R., Persaud, P., Stock, J. M., Fuis, G. S., Hole, J. A., Goldman, M. R., & Scheirer, D. S. (2017, 08). 3-D Velocity Model of the Coachella Valley Determined Using P-Wave First Arrival Times from the Salton Seismic Imaging Project and Local Earthquakes. Poster Presentation at 2017 SCEC Annual Meeting.
- 7649 Fletcher, J. M., Cambron, J. F., Rockwell, T. K., Karlsson, K. W., Figueiredo, P. M., Spelz, R. M., Lachan, P. G., Peña Villa, I., Leon Loya, A., Hinojosa, A., Prasanajit Naik, S., & Owen, L. A. (2017, 08). Do low-angle normal faults produce large earthquakes? A case study of the Cañada David Detachment of northern Baja California, Mexico. Poster Presentation at 2017 SCEC Annual Meeting.
- 7652 Schulte-Pelkum, V., Mueller, K., Brownlee, S. J., Becker, T. W., & Mahan, K. H. (2017, 08). Constraints on seismic anisotropy in ductile rock fabric and application to imaging fault roots in southern California. Poster Presentation at 2017 SCEC Annual Meeting.

- 7653 Shelly, D. R. (2017, 08). A 15-year catalog of more than 1 million low-frequency earthquakes: tracking tremor and slip along the deep San Andreas Fault. Poster Presentation at 2017 SCEC Annual Meeting.
- 7654 Dougherty, S. L., Cochran, E. S., & Harrington, R. M. (2017, 08). Large-N array observations of injection-induced seismicity in northern Oklahoma: the LASSO experiment. Poster Presentation at 2017 SCEC Annual Meeting.
- 7655 Kraner, M. L., Hammond, W. C., Kreemer, C., & Zaliapin, I. (2017, 08). Seasonal Variation of Strain in Central California and its Correlation with Seismicity. Poster Presentation at 2017 SCEC Annual Meeting.
- 7656 Gonzalez-Ortega, A., Vidal-Villegas, A., Ramon Morales, E., Valdez, A., & Arregui Ojeda, S. M. (2017, 08). Red Geodesica del Noroeste de Mexico (REGNOM) in northern Baja California. Poster Presentation at 2017 SCEC Annual Meeting.
- 7657 Bydlon, S. A., Withers, K. B., & Dunham, E. M. (2017, 08). A Ground Motion Prediction Equation for Earthquakes Mw 4-6 in Oklahoma and Kansas Derived from a Composite Recorded/Simulated Ground Motion Catalog. Poster Presentation at 2017 SCEC Annual Meeting.
- 7661 Roten, D., Olsen, K. B., & Day, S. M. (2017, 08). Off-fault deformations and shallow slip deficit from dynamic rupture simulations with fault zone plasticity. Poster Presentation at 2017 SCEC Annual Meeting.
- 7667 Zhuang, J., Guo, Y., Murru, M., Falcone, G., & Tinti, E. (2017, 08). Clustering features of seismicity in Italy during 2005 to 2016. Poster Presentation at 2017 SCEC Annual Meeting.
- Lindvall, S. C., Kerwin, S., Evans, J. P., Tyson, J., Chestnut, J., Heron, C., Mass, K., Scharer, K. M., McPhillips, D., Moore, D., Farr, M., Ballard, C., Williams, R. T., Bradbury, K. K., Rowe, C. D., & Savage, H. M. (2017, 08). San Andreas Fault Characterization at the LADWP Elizabeth Tunnel. Poster Presentation at 2017 SCEC Annual Meeting.
- 7669 Lippoldt, R. C., & Sammis, C. G. (2017, 08). A Simple Spring-Mass-Dashpot Model for Slow Earthquakes on a Viscous Fault. Poster Presentation at 2017 SCEC Annual Meeting.
- 7671 Khoshmanesh, M., & Shirzaei, M. (2017, 08). Creep avalanches on San Andreas Fault and their underlying mechanism from 19 years of InSAR and seismicity. Poster Presentation at 2017 SCEC Annual Meeting.
- 7674 Feng, T., & Meng, L. (2017, 08). Detecting small offshore earthquakes with Back-Projection Imaging and Match-filter Method. Poster Presentation at 2017 SCEC Annual Meeting.
- 7675 Wang, Y., Day, S. M., & Denolle, M. A. (2017, 08). Dynamic Rupture Models of the 2015 Mw7.8 Nepal Earthquake. Poster Presentation at 2017 SCEC Annual Meeting.
- 7679 Li, G., & West, J. (2017, 08). Distribution of Earthquake-Triggered Landslides across Landscapes: Towards Understanding Erosional Agency and Cascading Hazards. Poster Presentation at 2017 SCEC Annual Meeting.
- 7681 Tymofyeyeva, E., & Fialko, Y. (2017, 08). Toward the 3-component time-dependent Crustal Motion Model: Integration of Sentinel-1 SAR interferometry and continuous GPS. Poster Presentation at 2017 SCEC Annual Meeting.
- <sup>7683</sup> Li, Y., Bürgmann, R., Yang, H., & Zhou, S. (2017, 08). Dynamic triggering of earthquakes north of Xiaojiang Fault, Yunnan. Poster Presentation at 2017 SCEC Annual Meeting.
- 7684 De Cristofaro, J., & Polet, J. (2017, 08). Towards an Understanding of the Geometry of the Hilton Creek Fault System Within the Long Valley Caldera, Using Ground-Based Magnetics and High-Resolution Topographic Profiles. Poster Presentation at 2017 SCEC Annual Meeting.
- 7686 Ortega-Arroyo, D., Behr, W. M., & Gentry, E. (2017, 08). The rock record of seismic nucleation: a case study from the Whipple Mountains Detachment Fault, eastern California. Poster Presentation at 2017 SCEC Annual Meeting.

- 7689 Rhoades, D. A., Gerstenberger, M. C., Christophersen, A., & Harte, D. S. (2017, 08). Earthquake forecasts and their applications following the M7.8 2016 Kaikoura earthquake. Poster Presentation at 2017 SCEC Annual Meeting.
- 7690 Hu, Z., & Olsen, K. B. (2017, 08). Testing the Density of Seismic Networks with ShakeMap. Poster Presentation at 2017 SCEC Annual Meeting.
- 7692 Wang, N., Roten, D., Olsen, K. B., & Pechmann, J. (2017, 08). Rupture Direction, Basin, Distance and Hanging-wall Effects on Ground Motions from M7 Earthquakes on the Salt Lake City Segment of the Wasatch Fault, Utah. Poster Presentation at 2017 SCEC Annual Meeting.
- 7693 Liu, X., Beroza, G. C., & Nakata, N. (2017, 08). Separating non-diffuse component from ambient seismic noise cross-correlation in southern California¬¬. Poster Presentation at 2017 SCEC Annual Meeting.
- 7696 Murray, K. D., & Lohman, R. B. (2017, 08). InSAR and GPS time series analysis in areas with large scale hydrological deformation: separating signal from noise at varying length scales in the San Joaquin Valley. Poster Presentation at 2017 SCEC Annual Meeting.
- 7697 Maeda, T., Fujiwara, H., Hayakawa, T., Shimono, S., & Akagi, S. (2017, 08). Cluster analysis of the long-period ground-motion simulation data application of the Nankai Trough megathrust earthquakes scenarios. Poster Presentation at 2017 SCEC Annual Meeting.
- 7698 Ferrarini, F., Lavecchia, G., de Nardis, R., Arrowsmith, R., Brozzetti, F., & Cirillo, D. (2017, 08). Exploring new seismic hazard scenarios in central Italy: hints about a previously unknown active normal fault highlighted by the Norcia 2016 (Mw 6.5) seismic sequence. Poster Presentation at 2017 SCEC Annual Meeting.
- 7699 Castillo Castellanos, J. A., Kohler, M. D., Massari, A. T., & Clayton, R. W. (2017, 08). Complex Rayleigh Wave Effects on the Seismic Demands of Mid-Rise Buildings. Poster Presentation at 2017 SCEC Annual Meeting.
- 7701 Burgi, P., & Lohman, R. B. (2017, 08). The effect of InSAR time series generation techniques on signals with small spatial scales. Poster Presentation at 2017 SCEC Annual Meeting.
- 7702 Chapman, A. D. (2017, 08). The Pelona–Orocopia–Rand and related schists of southern California: a review of the best-known archive of shallow subduction on the planet. Poster Presentation at 2017 SCEC Annual Meeting.
- 7703 Materna, K., Taira, T., & Bürgmann, R. (2017, 08). Measuring Aseismic Slip through Characteristically Repeating Earthquakes at the Mendocino Triple Junction. Poster Presentation at 2017 SCEC Annual Meeting.
- 7704 Hutchison, A. A., & Ghosh, A. (2017, 08). Ambient tectonic tremor in the San Jacinto Fault. Poster Presentation at 2017 SCEC Annual Meeting.
- 7705 Meier, M., Ampuero, J., & Heaton, T. H. (2017, 08). What does an 'average' large subduction earthquake look like? Poster Presentation at 2017 SCEC Annual Meeting.
- Boyd, O. S., Thompson, E. M., Shumway, A., Moschetti, M. P., Stephenson, W. J., & Rezaeian, S. (2017, 08). Basin ZX Maps for use in the USGS National Seismic Hazard Model for the Western United States. Poster Presentation at 2017 SCEC Annual Meeting.
- 7707 Dahlquist, M. P., West, J., & Martinez, J. (2017, 08). Co- and post-seismic debris flows triggered by the 2015 Gorkha Earthquake. Poster Presentation at 2017 SCEC Annual Meeting.
- 7709 Vierra, E. J., Webb, H. N., Dennis, K., Peppard, D. W., Girty, G. H., & Rockwell, T. K. (2017, 08). Recognition of a dismembered positive flower structure along the San Jacinto fault: Stratigraphic and structural implications. Poster Presentation at 2017 SCEC Annual Meeting.
- 7710 Luo, B., & Duan, B. (2017, 08). Dynamics of Non-planar Thrust Faults Governed by Various Friction Laws. Poster Presentation at 2017 SCEC Annual Meeting.

- 7711 Mu, D., Cicotti, P., & Cui, Y. (2017, 08). Manage I/O Task in a Normalized Cross-Correlation Earthquake Detection Code for Large Seismic Datasets. Poster Presentation at 2017 SCEC Annual Meeting.
- 7712 Badt, N. Z., Tullis, T. E., & Hirth, G. (2017, 08). Experimental Study of Thermal Pressurization Weakening and the Role of Fault Roughness. Poster Presentation at 2017 SCEC Annual Meeting.
- 7713 Alvarez, K., & Polet, J. (2017, 08). Measurements of Ground-Based Magnetics and Vertical Deformation From a Leveling Line Across the San Andreas Fault at Durmid Hill. Poster Presentation at 2017 SCEC Annual Meeting.
- 7714 Zhan, Z., Yu, C., Hauksson, E., & Cochran, E. S. (2017, 08). Strong SH-to-Love Wave Scattering off the Southern California Continental Borderland. Poster Presentation at 2017 SCEC Annual Meeting.
- 7716 Stein, R. S., Sevilgen, V., Jacobson, D., Kim, A., & Lotto, G. C. (2017, 08). Temblor, an app to transform seismic science into personal risk reduction. Poster Presentation at 2017 SCEC Annual Meeting.
- 7718 Davis, P. M. (2017, 08). How Much Concentrated Earthquake Damage is due to Site Effects Versus Basin Edge Focusing? Poster Presentation at 2017 SCEC Annual Meeting.
- Singleton, D. M., Rockwell, T. K., Murbach, M., Murbach, D., Maloney, J. M., Levy, Y., Marquez, E., & Weidman, L. (2017, 08). Late-Holocene Earthquakes on the Rose Canyon Fault at Old Town, San Diego CA. Poster Presentation at 2017 SCEC Annual Meeting.
- 7720 Qiu, H., Ben-Zion, Y., & Lin, F. (2017, 08). Eikonal Tomography of the Southern California Plate Boundary Region. Poster Presentation at 2017 SCEC Annual Meeting.
- 7722 Kiuchi, R., Mooney, W. D., Mori, J., Zahran, H. M., AlRaddadi, W., & Youssef, S. (2017, 08). Developing ground motion prediction equations for western Saudi Arabia using an adjustment of a reference model. Poster Presentation at 2017 SCEC Annual Meeting.
- Axen, G., Soundy, K., & Leuth, V. (2017, 08). Comparison of fault rocks formed paleoseismically and by paleocreep(?): Initial results from the West Salton detachment fault, southern California. Poster Presentation at 2017 SCEC Annual Meeting.
- 7725 Callaghan, S., Maechling, P. J., Goulet, C. A., Milner, K. R., Graves, R. W., Olsen, K. B., & Jordan, T. H. (2017, 08). CyberShake: bringing physics-based PSHA to central California. Poster Presentation at 2017 SCEC Annual Meeting.
- 7728 Determan, D. N., Aspiotes, A. G., Guillemot, C., Langbein, J. O., Murray, M., Alvarez, M., & Stark, K. F. (2017, 08). USGS Global Positioning System (GPS) Network in Southern California. Poster Presentation at 2017 SCEC Annual Meeting.
- 7729 Yoshimitsu, N., Ellsworth, W. L., Beroza, G. C., & Schoenball, M. (2017, 08). Two years stress drop estimates for induced earthquakes in Oklahoma. Poster Presentation at 2017 SCEC Annual Meeting.
- 7730 Wooddell, K. E., & Abrahamson, N. A. (2017, 08). Methodology for Incorporation of 3-D Simulation Results into Non-Ergodic Ground-Motion Models for Central California. Poster Presentation at 2017 SCEC Annual Meeting.
- 7732 Savran, W. H., Olsen, K. B., & Day, S. M. (2017, 08). Generating 10 Hz deterministic broadband ground motions using kinematic source descriptions. Poster Presentation at 2017 SCEC Annual Meeting.
- 7734 Lin, T., Bijelic, N., & Deierlein, G. (2017, 08). Characterization of basin effects for seismic performance assessments of tall buildings using CyberShake simulations. Poster Presentation at 2017 SCEC Annual Meeting.

- 7735 Nicholson, C., Plesch, A., & Shaw, J. H. (2017, 08). Community Fault Model Version 5.2: Updating & expanding the CFM 3D fault set and its associated fault database. Poster Presentation at 2017 SCEC Annual Meeting.
- 7738 Wade, A., Arrowsmith, R., Donnellan, A., Vernon, F. L., & Ben-Zion, Y. (2017, 08). Dekameter-scale geologic structure validation of shallow seismic properties along the San Jacinto fault at Sage Brush Flat, Anza, California. Poster Presentation at 2017 SCEC Annual Meeting.
- 2739 Lin, Y., & Jordan, T. H. (2017, 08). Attenuation Tomography at High Frequencies in Southern California. Poster Presentation at 2017 SCEC Annual Meeting.
- 7740 Chen, Q., & Elbanna, A. E. (2017, 08). The material-geometry nexus: Understanding topographic effects on wave propagation. Poster Presentation at 2017 SCEC Annual Meeting.
- 7741 Saunders, J. K., & Haase, J. S. (2017, 08). Improving static slip characterization of near-shore earthquakes with amphibious datasets: A Cascadia example. Poster Presentation at 2017 SCEC Annual Meeting.
- 7742 Walker, R. L., Kumar, A., Hammack, R., Dressel, B., Harbert, W., & Aminzadeh, F. (2017, 08). Identifying Long Period Long Duration Events Spatially Associated With Hydraulic Stimulation Operations. Poster Presentation at 2017 SCEC Annual Meeting.
- 7745 Pierce, I., Wesnousky, S. G., & Owen, L. A. (2017, 08). Terrestrial cosmogenic surface exposure dating of moraines at Lake Tahoe in the Sierra Nevada, California, and slip rate estimate for the West Tahoe fault. Poster Presentation at 2017 SCEC Annual Meeting.
- 7746 Taborda, R., & Isbiliroglu, Y. D. (2017, 08). Influence of Buildings Spacing in Site-City Interaction Effects. Poster Presentation at 2017 SCEC Annual Meeting.
- 7747 Harris, R. A. (2017, 08). Large Earthquakes and Creeping Faults. Poster Presentation at 2017 SCEC Annual Meeting.
- 7748 Grant Ludwig, L., Donnellan, A., & Parker, J. W. (2017, 08). Using GeoGateway Line-of-Sight (LOS) Tool to Explore Deformation along the San Andreas Fault in the Carrizo Plain, CA. Poster Presentation at 2017 SCEC Annual Meeting.
- Yoon, C., Bergen, K., Rong, K., Elezabi, H., Bailis, P., Levis, P., & Beroza, G. C. (2017, 08). Efficient blind search for small similar-waveform earthquakes in a decade of continuous seismic data (2007-2017) in coastal central California. Poster Presentation at 2017 SCEC Annual Meeting.
- 7752 Pritchard, E. H., Persaud, P., & Stock, J. M. (2017, 08). Using Borehole Breakouts in Deviated Offshore Wells to Constrain Stress Regimes Beneath The Santa Barbara Channel, Offshore Southern California. Poster Presentation at 2017 SCEC Annual Meeting.
- 7753 Schoenberg, F. P., & Molyneux, J. (2017, 08). Nonparametric Hawkes models with strike angle covariates. Poster Presentation at 2017 SCEC Annual Meeting.
- 7757 Chaudhuri, K., & Ghosh, A. (2017, 08). Tectonic tremor in San Andreas Fault near Cholame captured by a mini seismic array. Poster Presentation at 2017 SCEC Annual Meeting.
- 7758 Li, B., Ghosh, A., Thurber, C. H., & Lanza, F. (2017, 08). Continuous Tremor in the Alaska-Aleutian Subduction Zone Detected by Aleutian Array of Arrays. Poster Presentation at 2017 SCEC Annual Meeting.
- 7759 Ahamed, S., & Daub, E. G. (2017, 08). A Machine Learning Approach to Earthquake Rupture Dynamics. Poster Presentation at 2017 SCEC Annual Meeting.
- 7760 Graves, R. W. (2017, 08). Ground-Motion Simulations on Rough Faults in Complex 3D Media. Poster Presentation at 2017 SCEC Annual Meeting.
- 7761 McNeil, J. C., Yule, D., Scharer, K. M., McGill, S. F., McPhillips, D., Castillo, B. A., & Pace, A. (2017, 08). Assessing stratigraphic correlations and fault zone extent at the 18th Ave trench site, Banning strand of the San Andreas Fault, North Palm Springs, California. Poster Presentation at 2017 SCEC Annual Meeting.

- 7764 Lin, F., Berg, E., Allam, A. A., Qiu, H., Wang, Y., & Ben-Zion, Y. (2017, 08). Shallow crustal imaging in Southern California using ambient noise and fault zone trapped waves. Poster Presentation at 2017 SCEC Annual Meeting.
- Liu, Z., Shen, Z., Liang, C., & Lundgren, P. (2017, 08). Integration of InSAR and GPS data for 3-dimensional crustal deformation mapping. Poster Presentation at 2017 SCEC Annual Meeting.
- Chamlagain, D., Wesnousky, S. G., Kumahara, Y., Pierce, I., Reedy, T. J., Angster, S. J., & Giri, B. (2017, 08). Large paleoearthquake timing and displacement near Damak in eastern Nepal on the Himalayan Frontal Thrust. Poster Presentation at 2017 SCEC Annual Meeting.
- 7770 Smith-Konter, B. R., Sandwell, D. T., Tong, X., Xu, X., Ward, L., & Higa, J. (2017, 08). Deformation of the southern San Andreas Fault System induced by lateral variations in crustal rigidity. Poster Presentation at 2017 SCEC Annual Meeting.
- 7771 Angster, S. J., Wesnousky, S. G., Owen, L. A., Figueiredo, P. M., & Hammer, S. (2017, 08). Quaternary Rates of Slip for faults of the Central Walker Lane. Poster Presentation at 2017 SCEC Annual Meeting.
- 7772 Wolfe, F. D., Dolan, J. F., Plesch, A., & Shaw, J. H. (2017, 08). Activity and earthquake potential of the Wilmington blind thrust, Los Angeles, CA: The largest earthquake source not on current southern California hazard maps? Poster Presentation at 2017 SCEC Annual Meeting.
- 7774 Crempien, J. G., & Archuleta, R. J. (2017, 08). Seismic source and path parameters in Central California estimated with recorded ground motion. Poster Presentation at 2017 SCEC Annual Meeting.
- 7775 Kendrick, K. J., & Matti, J. C. (2017, 08). Geomorphic and geologic evidence for slip along the San Bernardino strand of the San Andreas Fault System through the San Gorgonio Pass structural knot, southern California. Poster Presentation at 2017 SCEC Annual Meeting.
- Donnellan, A., Parker, J. W., Granat, R. A., Heflin, M. B., Rundle, J. B., Grant Ludwig, L., Pierce, M. E., & Wang, J. (2017, 08). Northwest Propagation of Postseismic Deformation in the Yuha Desert from the 2010 M7.2 El Mayor Cucapah Earthquake. Poster Presentation at 2017 SCEC Annual Meeting.
- 7778 Ye, L., Lapusta, N., & Avouac, J. (2017, 08). Dynamic Stress Changes during the 2015 Gorkha, Nepal Earthquake. Poster Presentation at 2017 SCEC Annual Meeting.
- 7780 Ma, X., & Elbanna, A. E. (2017, 08). Stick Slip Instabilities and Strain Localization Dynamics in a fluid-infiltrated fault gouge zone model. Poster Presentation at 2017 SCEC Annual Meeting.
- 7781 Scott, C. P., Arrowsmith, R., Lajoie, L. J., Nissen, E., Maruyama, T., & Tatsuro, C. (2017, 08). The M7 2016 Kumamoto, Japan, Earthquake: 3D coseismic deformation from differential topography. Poster Presentation at 2017 SCEC Annual Meeting.
- 7782 Best Mckay, M., & Erickson, B. A. (2017, 08). Incorporating anisotropic material properties into simulations of the earthquake cycle. Poster Presentation at 2017 SCEC Annual Meeting.
- 7783 Peshette, P. L., Lozos, J. C., & Yule, D. (2017, 08). Dynamic rupture modeling of thrust faults with parallel surface traces. Poster Presentation at 2017 SCEC Annual Meeting.
- 7784 Young, Z. M., & Kreemer, C. W. (2017, 08). The Far-Field Effect of Large Earthquakes in GPS Time-Series. Poster Presentation at 2017 SCEC Annual Meeting.
- 7786 Lin, Y., & Lapusta, N. (2017, 08). Comparison of actual and seismologically inferred stress drops in asperity-type dynamic source models of microseismicity. Poster Presentation at 2017 SCEC Annual Meeting.
- 7789 Sudhir, K., & Lapusta, N. (2017, 08). Slip Patterns on Rate-and-State Faults with Heterogeneous Velocity-Weakening and Velocity-Strengthening Friction. Poster Presentation at 2017 SCEC Annual Meeting.

- 7790 Lambert, V. R., & Lapusta, N. (2017, 08). Implications of depth-dependent variations in fault zone properties for the frequency content of seismic radiation. Poster Presentation at 2017 SCEC Annual Meeting.
- 7791 Erickson, B. A., & Kozdon, J. E. (2017, 08). Earthquake Cycles With Complex Fault Geometries. Poster Presentation at 2017 SCEC Annual Meeting.
- 7792 Hernandez, S. (2017, 08). The seismological aftermath of the 2016 Mw7.8 Pedernales, Ecuador earthquake. Poster Presentation at 2017 SCEC Annual Meeting.
- 7794 Nie, S., Roten, D., Olsen, K. B., & Day, S. M. (2017, 08). Fourth-Order Staggered-Grid Finite-Difference Seismic Wavefield Estimation Using a Discontinuous Mesh Interface (WEDMI). Poster Presentation at 2017 SCEC Annual Meeting.
- 7795 Kyriakopoulos, C., Oglesby, D. D., Meltzner, A. J., Rockwell, T. K., & Barall, M. (2017, 08). Can the Southern San Andreas Fault be Triggered by Cross-Fault Earthquakes? Poster Presentation at 2017 SCEC Annual Meeting.
- 7796 Buehler, J., Kilb, D., Vernon, F. L., Wang, W., & Shearer, P. M. (2017, 08). Focal mechanism effects on S/P amplitude ratios in southern California. Poster Presentation at 2017 SCEC Annual Meeting.
- 7797 Baltay, A. S., Ellsworth, W. L., Schoenball, M., & Beroza, G. C. (2017, 08). Proposed Community Stress Drop Validation Experiment. Poster Presentation at 2017 SCEC Annual Meeting.
- 7798 Jiang, J., & Fialko, Y. (2017, 08). Earthquake variability, geodetic coupling, and microseismicity on heterogeneous faults: A case study of the Anza seismic gap. Poster Presentation at 2017 SCEC Annual Meeting.
- 7800 Meng, L., & Feng, T. (2017, 08). Improving Distance Metrics in Ground Motion Prediction Equations Based with Seismic Array Back-Projections. Poster Presentation at 2017 SCEC Annual Meeting.
- 7801 Weiser, D., Porto, N. B., & Jackson, D. D. (2017, 08). Can maximum magnitude be derived from fault dimensions? Poster Presentation at 2017 SCEC Annual Meeting.
- 7803 Reedy, T. J., & Wesnousky, S. G. (2017, 08). Toward characterizing extension and Quaternary faulting on the Pleasant Valley fault, Central Nevada. Poster Presentation at 2017 SCEC Annual Meeting.
- 7804 Gontz, A. M., Rockwell, T. K., Karlsson, K. W., Fletcher, J. M., & Cambron, J. F. (2017, 08). GPR imagery and identification of neotectonic features of the Chupamiertos Fault System, Baja California, Mexico. Poster Presentation at 2017 SCEC Annual Meeting.
- 7806 Lai, V., Graves, R. W., & Helmberger, D. V. (2017, 08). Impact of Earthquake Depth on Basin Response. Poster Presentation at 2017 SCEC Annual Meeting.
- 7808 Abercrombie, R. E., Ruhl, C. J., & Smith, K. D. (2017, 08). Detailed observations of seismicity, stress drop and directivity on a complex fault structure in Mogul Nevada. Poster Presentation at 2017 SCEC Annual Meeting.
- 7809 Cui, Y., Mu, D., & Roten, D. (2017, 08). SEISM-IO: A High Level Parallel I/O Library for High-Performance Seismic Applications. Poster Presentation at 2017 SCEC Annual Meeting.
- 7811 Keen-Zebert, A. (2017, 08). Luminescence dating for paleoseismic research: What users need to know. Poster Presentation at 2017 SCEC Annual Meeting.
- 7813 Lenz, D., Tobin, J., Breuer, A. N., Heinecke, A., Yount, C., & Cui, Y. (2017, 08). Tuning AWP-ODC-OS for efficient, scalable performance on manycore architectures. Poster Presentation at 2017 SCEC Annual Meeting.
- 7816 Lozos, J. C. (2017, 08). Rupture propagation through the Big Bend of the San Andreas Fault: a dynamic modeling case study of the Great Earthquake of 1857. Poster Presentation at 2017 SCEC Annual Meeting.

- 7817 Elbanna, A. E., Ma, X., & Hajaroalsvadi, S. (2017, 08). Towards dynamic rupture models with high resolution fault zone physics. Poster Presentation at 2017 SCEC Annual Meeting.
- 7818 Cattania, C., Segall, P., & Hainzl, S. (2017, 08). Slip partitioning and scaling relations of repeating earthquakes on rate-state faults. Poster Presentation at 2017 SCEC Annual Meeting.
- 7819 Barbery, M. R., Saber, O., Chester, F. M., & Chester, J. S. (2017, 08). Examination of multi-scale flash-heating at seismic slip rates in granite. Poster Presentation at 2017 SCEC Annual Meeting.
- 7820 Ramirez-Guzman, L., Jaimes, M. A., & Mendoza, C. (2017, 08). Sensitivity and Comparison of Two Broad-band Synthetic Generation Methods. Poster Presentation at 2017 SCEC Annual Meeting.
- 7823 Bahadori, A., Kim, J., Kraner, M. L., & Holt, W. E. (2017, 08). Ten Years of Seasonally Modulated Strain History in Southern California Inferred from cGPS Data. Poster Presentation at 2017 SCEC Annual Meeting.
- 7824 Adusumilli, S., Borsa, A. A., Silverii, F., & Agnew, D. C. (2017, 08). Learn to be still: Accounting for the hydrologic contributions to GPS displacements in the continental United States. Poster Presentation at 2017 SCEC Annual Meeting.
- Walton, M. L., Brothers, D. S., Conrad, J. E., Maier, K. L., Roland, E. C., & Kluesner, J. W. (2017, 08). Fault and depositional architecture of the Catalina Basin, southern California Inner Continental Borderland: implications for hazards and basin evolution. Poster Presentation at 2017 SCEC Annual Meeting.
- 7828 Castillo, B. A., McGill, S. F., Scharer, K. M., Yule, D., McPhillips, D., McNeil, J. C., & Pace, A. (2017, 08). Preliminary ages of prehistoric earthquakes on the Banning Strand of the San Andreas Fault, near North Palm Springs, California. Poster Presentation at 2017 SCEC Annual Meeting.
- 7830 Zaliapin, I., & Ben-Zion, Y. (2017, 08). Quantifying the coalescence process of microcracks leading to a system-size failure. Poster Presentation at 2017 SCEC Annual Meeting.
- 7832 Zhong, K., Yan, W., Lin, T., & Deierlein, G. (2017, 08). Demonstration of the efficacy of the BBP ground motions for nonlinear structural analysis and collapse assessment. Poster Presentation at 2017 SCEC Annual Meeting.
- 7834 Janecke, S. U., Belgarde, B. E., Bykerk-Kauffman, A., Evans, J. P., Kirby, S., Markowski, D., Steely, A., & Thornock, S. J. (2017, 08). Ladders, stair-steps, and crossing faults: Insights from southern California's active strike-slip faults. Poster Presentation at 2017 SCEC Annual Meeting.
- 7835 Milner, K. R., Shaw, B. E., Gilchrist, J. J., & Jordan, T. H. (2017, 08). Are Physics-Based Simulators Ready for Prime Time? Comparisons of RSQSim with UCERF3 and Observations. Poster Presentation at 2017 SCEC Annual Meeting.
- 7836 van der Elst, N. J., & Page, M. T. (2017, 08). Model-free aftershock forecasts constructed from similar sequences in the past. Poster Presentation at 2017 SCEC Annual Meeting.
- 7837 Shakibay Senobari, N., & Funning, G. J. (2017, 08). Repeating earthquakes detected by a new fast method reveal complex creep behavior in the northern San Francisco Bay Area. Poster Presentation at 2017 SCEC Annual Meeting.
- 7839 Dorsey, M. T., Rockwell, T. K., Girty, G. H., Ostermeijer, G., Mitchell, T. M., & Fletcher, J. M. (2017, 08). Evidence of Na- and Mg-rich Hydrothermal Brines Driving Chloritization and Albitization in an Active Fault Zone: Case Study of the Borrego Fault, Baja CA, Mexico. Poster Presentation at 2017 SCEC Annual Meeting.
- 7842 Song, X., Jordan, T. H., & Okaya, D. A. (2017, 08). Stochastic Representations of Seismic Anisotropy: Verification of Effective Media Models for Locally Isotropic 3D Heterogeneity. Poster Presentation at 2017 SCEC Annual Meeting.

- 7843 McPhillips, D., & Scharer, K. M. (2017, 08). Sources and Magnitudes of Uncertainty in Fault Slip Rate, Cucamonga Thrust Fault, Southern California. Poster Presentation at 2017 SCEC Annual Meeting.
- 7844 Nyst, M., Fitzenz, D. D., & Shome, N. (2017, 08). How NSHMP 2014 and UCERF3 have changed the earthquake risk landscape in the US. Poster Presentation at 2017 SCEC Annual Meeting.
- 7845 Shaw, K. A., & Kent, G. M. (2017, 08). Garlock Fault: Re-assessing past stream offsets at Oak Creek Canyon and predicting future fault displacements. Poster Presentation at 2017 SCEC Annual Meeting.
- Maechling, P. J., Taborda, R., Olsen, K. B., Callaghan, S., Jordan, T. H., & Goulet, C. A. (2017, 08). Current Capabilities of the SCEC Unified Community Velocity Model (UCVM) Software Framework. Poster Presentation at 2017 SCEC Annual Meeting.
- 7848 Mueller, K. J., & Anthony, R. (2017, 08). Revised (lower) slip rate for the Northern Death Valley Fault based on a new method for restoring alluvial fan cutoff lines. Poster Presentation at 2017 SCEC Annual Meeting.
- 7849 Waco, J., Blisniuk, K. D., & Fosdick, J. C. (2017, 08). Evidence for an active and evolving left-stepping San Andreas fault (Mission Creek fault strand) from the Little San Bernardino Mountains to Yucaipa Ridge. Poster Presentation at 2017 SCEC Annual Meeting.
- 7850 Sana, H. (2017, 08). Synthetic ground motions of the 8 October 2005 Kashmir earthquake (Mw 7.6): a stochastic finite fault element approach. Poster Presentation at 2017 SCEC Annual Meeting.
- 7852 Hatch, R. L., Smith, K. D., & Abercrombie, R. E. (2017, 08). Analysis of Two Magnitude ~4 Earthquakes and Aftershocks Near Truckee, California, 2017. Poster Presentation at 2017 SCEC Annual Meeting.
- 7853 Adams, M. N., & Ji, C. (2017, 08). Preliminary insights into the fault geometry and rupture history of the 2016 Mw 7.8 Kaikoura, New Zealand, earthquake. Poster Presentation at 2017 SCEC Annual Meeting.
- 7854 Funning, G. J., & Garcia, A. (2017, 08). A Systematic Study of Earthquake Detectability Using Sentinel-1 TOPS InSAR. Poster Presentation at 2017 SCEC Annual Meeting.
- 7855 Schaal, N., Lapusta, N., & Lin, Y. (2017, 08). Exploring seismological properties of asperity-type events in a rate-and-state fault model. Poster Presentation at 2017 SCEC Annual Meeting.
- 7856 Yao, D., Peng, Z., Daniels, C., & Meng, X. (2017, 08). Systematic Search for Repeating Earthquakes along the Central San Jacinto Fault. Poster Presentation at 2017 SCEC Annual Meeting.
- 7857 Thatcher, W. R., Chapman, D. S., Allam, A. A., & Williams, C. (2017, 08). Refining Southern California Geotherms Using Seismologic, Geologic, and Petrologic Constraints. Poster Presentation at 2017 SCEC Annual Meeting.
- 7858 Prush, V. B., & Oskin, M. E. (2017, 08). Effects of Improved Production Rates and Statistical Treatment of Cosmogenic Dates on California fault slip rates. Poster Presentation at 2017 SCEC Annual Meeting.
- 7859 Inserra, N. J., Nelems, C., Muthala, R., Torres, J., & Akciz, S. O. (2017, 08). Paleoseismic Investigation of Van Matre Ranch Site Along the Carrizo Plain Section of the San Andreas Fault. Poster Presentation at 2017 SCEC Annual Meeting.
- 7860 Williams, A. M., Arrowsmith, R., Rockwell, T. K., Grant Ludwig, L., Akciz, S. O., & Gontz, A. M. (2017, 08). Testing the shorter and variable recurrence interval hypothesis along the Cholame segment of the San Andreas Fault. Poster Presentation at 2017 SCEC Annual Meeting.
- 7861 Seitz, G. G., Mareschal, M., Barrett, N., & Olsen, D. (2017, 08). Timing of Earthquakes during the past 800 years along the Peninsula Section of the San Andreas Fault Suggests Persistent 1906-like Behavior. Poster Presentation at 2017 SCEC Annual Meeting.

- 7862 Mendoza, M. M., Ghosh, A., Karplus, M. S., Nabelek, J., Sapkota, S. S., Adhikari, L. B., Klemperer, S. L., & Velasco, A. A. (2017, 08). Reconciling Fault Geometry in Nepal Himalaya using the "NAMASTE" Seismic Network. Poster Presentation at 2017 SCEC Annual Meeting.
- 7863 Michel, S. G., Avouac, J., Lapusta, N., & Jiang, J. (2017, 08). Pulse-Like Partial Ruptures and High-Frequency Radiation at Creeping-Locked Transition during Megathrust Earthquakes. Poster Presentation at 2017 SCEC Annual Meeting.
- 7865 Lozos, J. C., Nicholson, C., & Onderdonk, N. W. (2017, 08). Introducing the Cajon Pass Earthquake Gate Area. Oral Presentation at 2017 SCEC Annual Meeting.
- 7866 Allison, K. L., & Dunham, E. M. (2017, 08). Thermomechanical earthquake cycle simulations with rate-and-state friction and nonlinear viscoelasticity. Poster Presentation at 2017 SCEC Annual Meeting.
- 7867 Holmes, J. J., Driscoll, N. W., & Kent, G. M. (2017, 08). 3D Constraints On Fault Architecture and Strain Distribution of the Newport-Inglewood Rose Canyon and San Onofre Trend Fault Systems. Poster Presentation at 2017 SCEC Annual Meeting.
- 7868 Terry, R. L., Funning, G. J., & Floyd, M. (2017, 08). A study of the December 2016, The Geysers, CA earthquake using InSAR and GPS. Poster Presentation at 2017 SCEC Annual Meeting.
- 7871 Peng, Z., Li, C., Li, Z., Zhang, C., & Nakata, N. (2017, 08). Detecting Micro-seismicity and Long-duration Tremor-like Events from the Oklahoma Wavefield Experiment. Poster Presentation at 2017 SCEC Annual Meeting.
- 7874 Zeng, Y., Petersen, M. D., & Shen, Z. (2017, 08). Earthquake Potential in California-Nevada Implied by Correlation of Strain Rate and Seismicity. Poster Presentation at 2017 SCEC Annual Meeting.
- 7878 McGill, S. F., Figueiredo, P. M., & Owen, L. A. (2017, 08). Puzzling results in a slip rate study for the Banning Strand of the San Andreas Fault near North Palm Springs. Poster Presentation at 2017 SCEC Annual Meeting.
- 7880 Pearson, J. K., & Barth, N. C. (2017, 08). Using lidar to elucidate the slip behavior of the southern Alpine Fault, New Zealand. Poster Presentation at 2017 SCEC Annual Meeting.
- 7883 Asimaki, D., Shi, J., & Taborda, R. (2017, 08). A velocity model for basin sediments in Southern California based on field measurements. Poster Presentation at 2017 SCEC Annual Meeting.
- 7887 Zhang, Y., Wu, Z., Zhang, X., & Li, G. (2017, 08). Annual Earthquake Potential Consultation: A Real Forward Prediction Test in China. Poster Presentation at 2017 SCEC Annual Meeting.
- 7888 Mazzoni, S. (2017, 08). Post-Earthquake Reconnaissance: a Structural Engineer's Perspective. Oral Presentation at 2017 SCEC Annual Meeting.
- 7889 Zinke, R., Hollingsworth, J., Dolan, J. F., & Van Dissen, R. J. (2017, 08). Quantifying 3D deformation in the 14 November MW 7.8 Kaikoura, New Zealand earthquake using a novel technique for correlation of optical satellite imagery. Poster Presentation at 2017 SCEC Annual Meeting.
- 7890 Gu, C., Prieto, G. A., Mok, U., Marzouk, Y. M., Evans, B., & Toksöz, N. (2017, 08). Bayesian source mechanism inversion of induced seismicity in oil/gas fields and pico-seismicity (acoustic emission) in the laboratory. Poster Presentation at 2017 SCEC Annual Meeting.
- 7891 Keranen, K. M., Savage, H. M., Coffey, G. L., Lohman, R. B., Lambert, C., Stevens, N., & Rabinowitz, H. S. (2017, 08). Rupture of an Immature Fault in the Pawnee Mw5.8 earthquake. Poster Presentation at 2017 SCEC Annual Meeting.
- 7892 Williams, E. F., Castillo, C. M., Klemperer, S. L., Raineault, N., & Gee, L. S. (2017, 08). A new estimate of latest Quaternary slip on the offshore Anacapa-Dume Fault at Sycamore Knoll, Southern California Continental Borderland. Poster Presentation at 2017 SCEC Annual Meeting.
- 7893 Barba, M., Tiampo, K. F., & Glasscoe, M. T. (2017, 08). Linking seismicity and fault surface properties. Poster Presentation at 2017 SCEC Annual Meeting.

- 7902 Isbiliroglu, Y. D., & Taborda, R. (2017). A preliminary study about the influence of building clusters on the variability of the ground motion during earthquakes. Poster Presentation at QuakeCoRE Annual Meeting.
- 7981 Bormann, J. M., Kent, G. M., Driscoll, N. W., & Harding, A. J. (2015, 08). Strike slip tectonics in the Inner California Borderlands, Lasuen Knoll, and the southern termination of the Palos Verdes fault. Poster Presentation at 2015 SCEC Annual Meeting.
- 7984 Bormann, J. M., Kent, G. M., Driscoll, N. W., Harding, A. J., Holmes, J. J., Sahakian, V. J., & Wesnousky, S. G. (2014, 08). Neotectonics of the San Diego Trough and Coronado Bank fault systems, Inner California Borderlands. Poster Presentation at 2014 SCEC Annual Meeting.
- 7989 Maechling, P. J., Gill, D., Taborda, R., Shaw, J. H., Plesch, A., Olsen, K. B., Callaghan, S., Jordan, T. H., & Goulet, C. A. (2018, 06). The SCEC UCVM Software Framework for Distributing and Querying Seismic Velocity Models. Poster Presentation at 11th National Conference in Earthquake Engineering.
- 7990 Taborda, R., Olsen, K. B., Graves, R. W., Silva, F., Khoshnevis, N., Savran, W. H., Roten, D., Shi, Z., Goulet, C. A., Bielak, J., Maechling, P. J., Cui, Y., & Jordan, T. H. (2018, 06). High-frequency simulations: Verification and validation of the M5.1 La Habra, CA, earthquake. Oral Presentation at 11th National Conference in Earthquake Engineering.
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