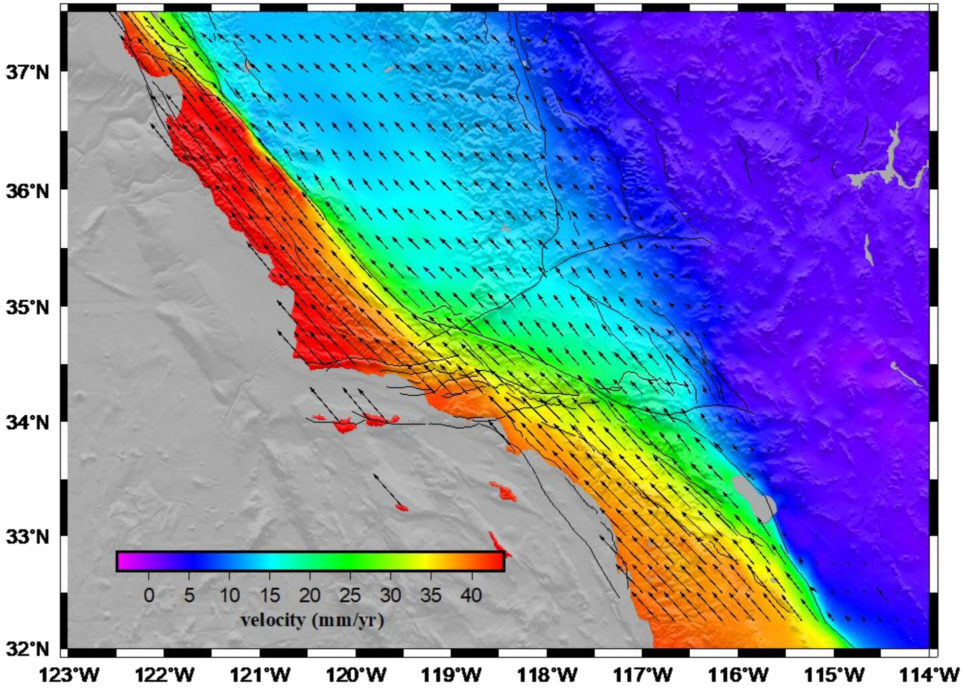
SCEC Research Highlights

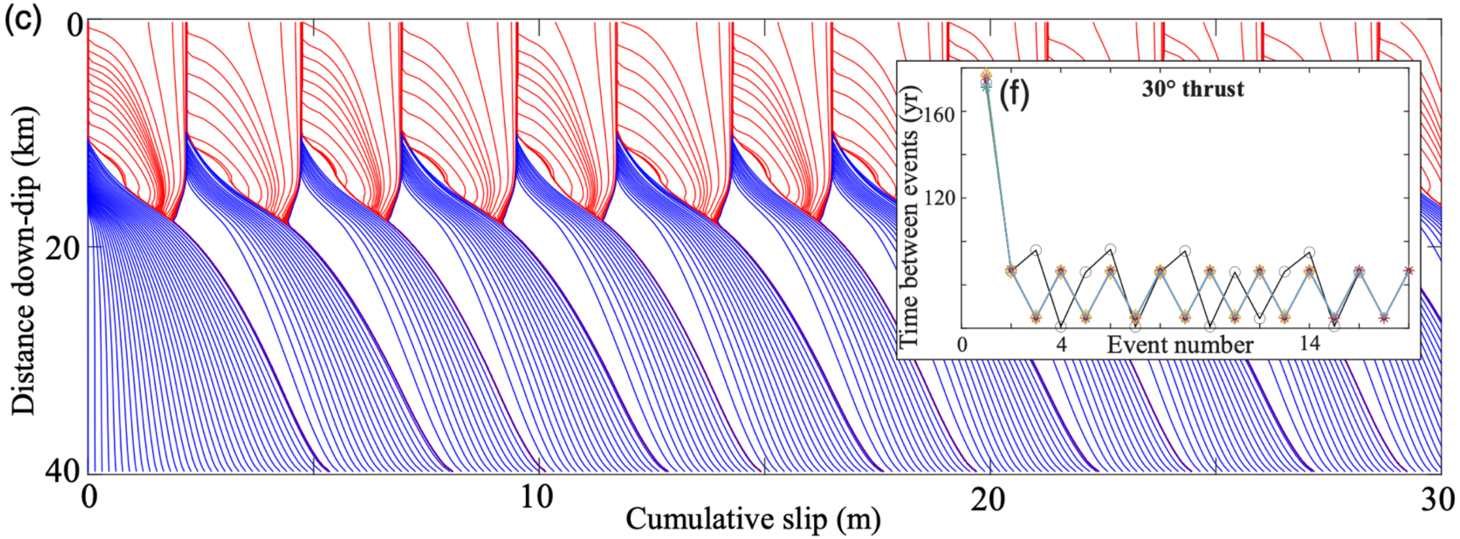
Greg Beroza (Stanford) and Alice-Agnes Gabriel (UCSD)

SCEC Spans Model- and Data-Driven Approaches

Data-Driven



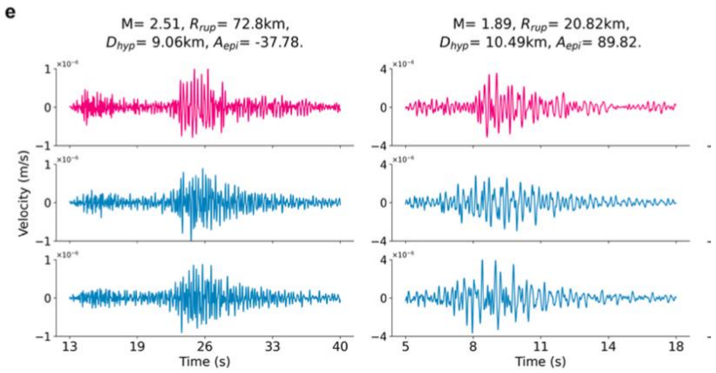
Model-Driven



The SCEC annual meeting is formatted to promote interaction across these approaches

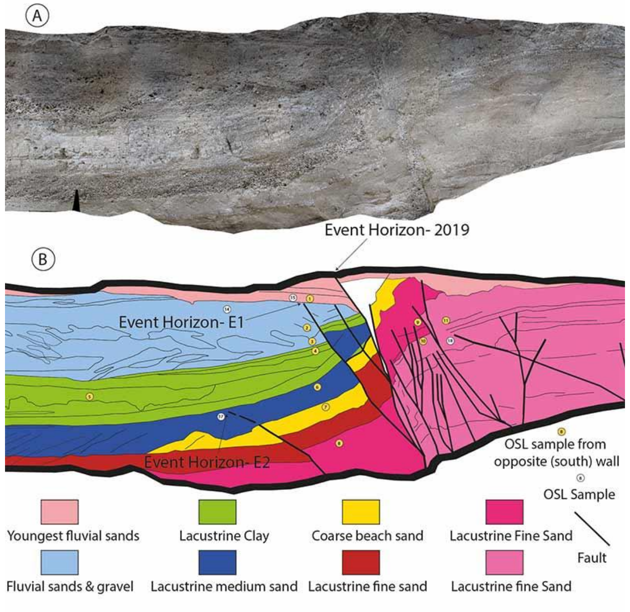
SCEC Spans Earthquake Science Disciplines

Seismology

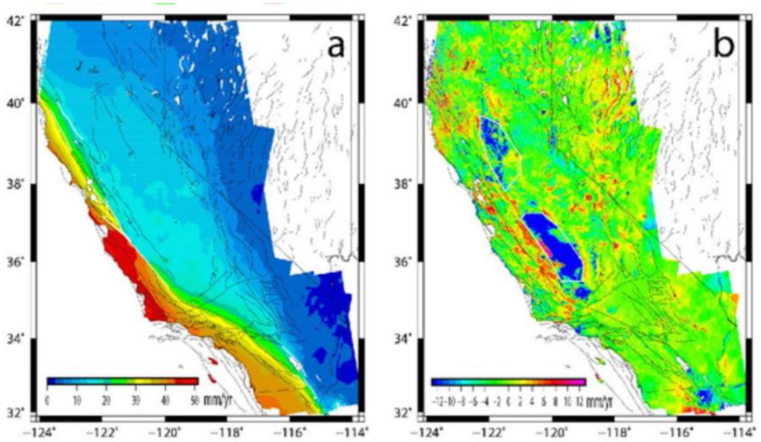


Computational Science

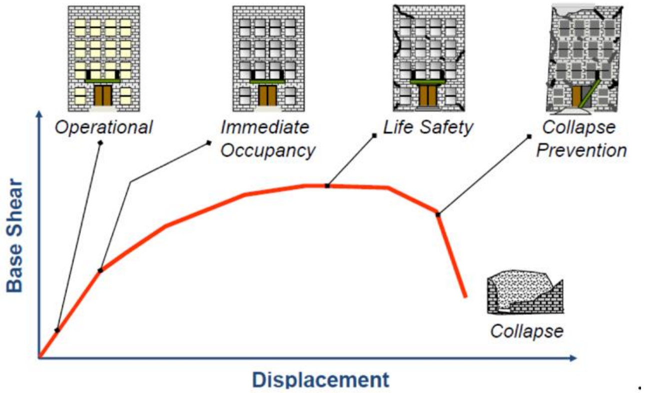
Geology



Geodesy



Earthquake Engineering

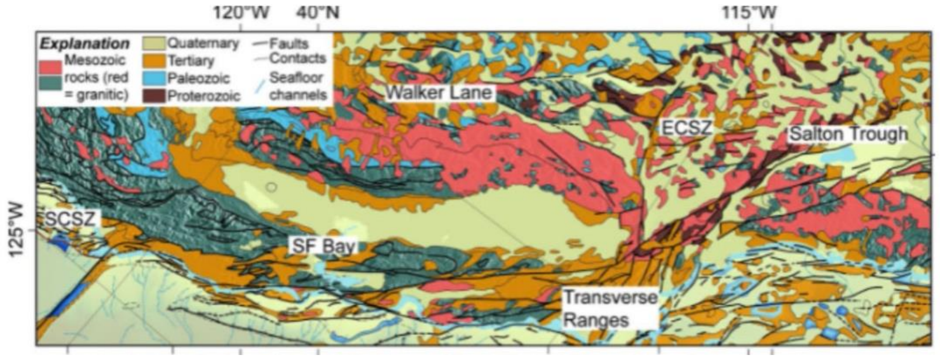


The SCEC annual meeting is formatted to promote interaction across disciplines.

SCEC Science Plan: Organized Around Themes

A: Improving observations and closing critical data gaps

1. Near-Fault Studies
2. The Dynamic and Nonlinear Shallow Crust
3. Geodata for Earthquake Science
4. Integrated Multi-Scale Community Models



Earthquake Chronology of Northern SAF from Tomales Bay

Poster #101

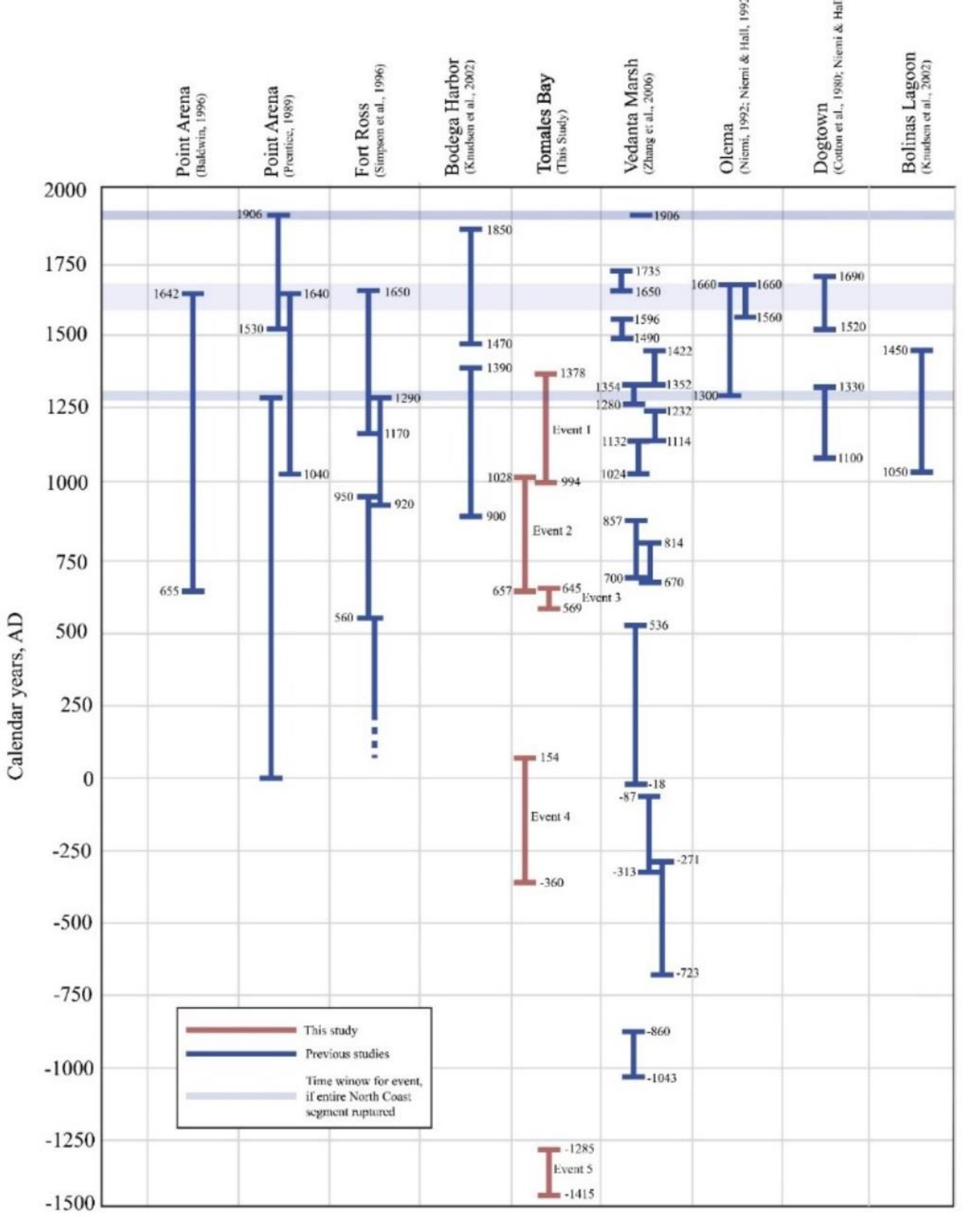
Divola, Simms, and Garrett

~ Co-seismic subsidence in upper Tomales Bay, California in the 1906 earthquake.

Developed foram-based Bayesian transfer functio for identifying past subsidence in sediment cores

25 cores in Tomales Bay found candidate events A.D. 1600, 1300, 1000, and 650, as well as 100 and 1350 B.C

Better constraints on the long-term behavior of th North Coast Segment of the San Andreas Fault.



Statewide Paleoseismic Inter-Event Time Statistics

24120; Oskin

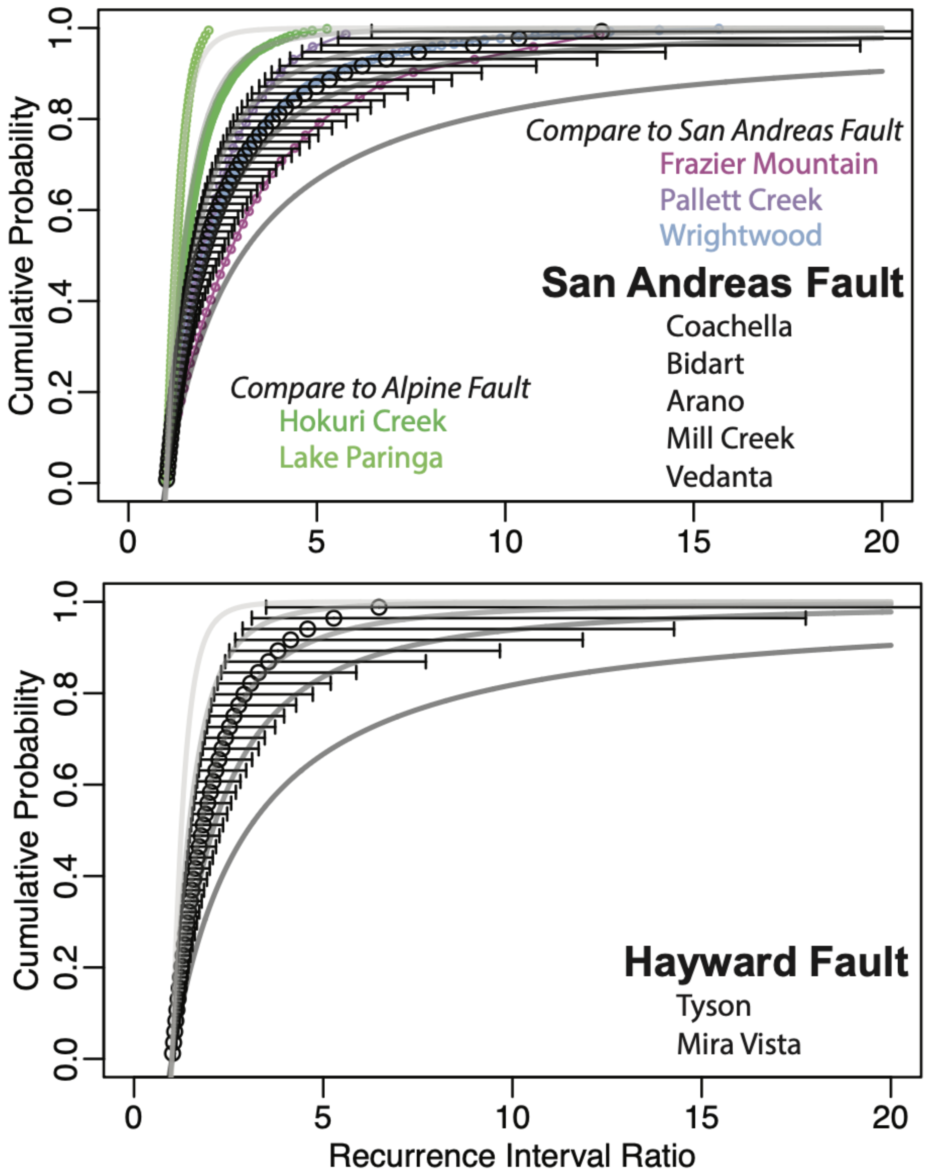
What is appropriate probability model to describe recurrence?

Do existing models underpredict short-recurrence hazard and overpredict long-recurrence hazard?

Constraints on the hazard exponent, k (describes event regularity).

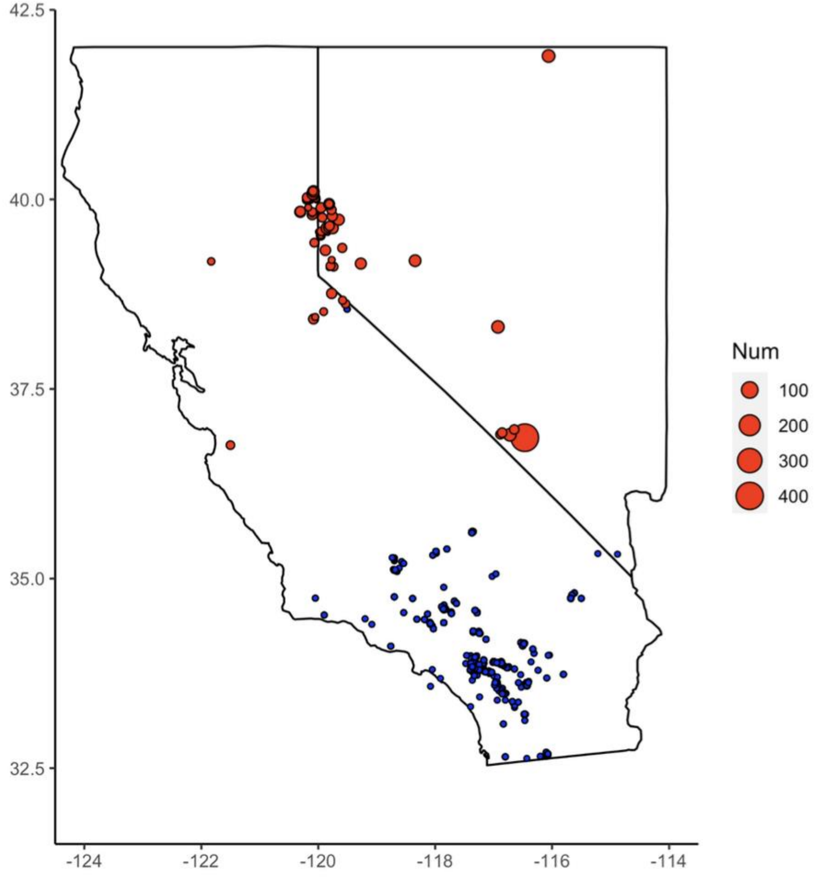
Ratio distribution analysis indicates SAF (and secondary faults) more irregular (k~0.5) than Hayward Fault (k~1)

See also Poster #201 Dascher-Cousineau and Oskin on open intervals and the "waiting-time paradox," *"We test a third option: we should expect it to be a boring time to study earthquakes."*



Fragile Geologic Features Database

24091
Meng, Maechling, Ben-Zion, Trugman, Kapri, and Paton

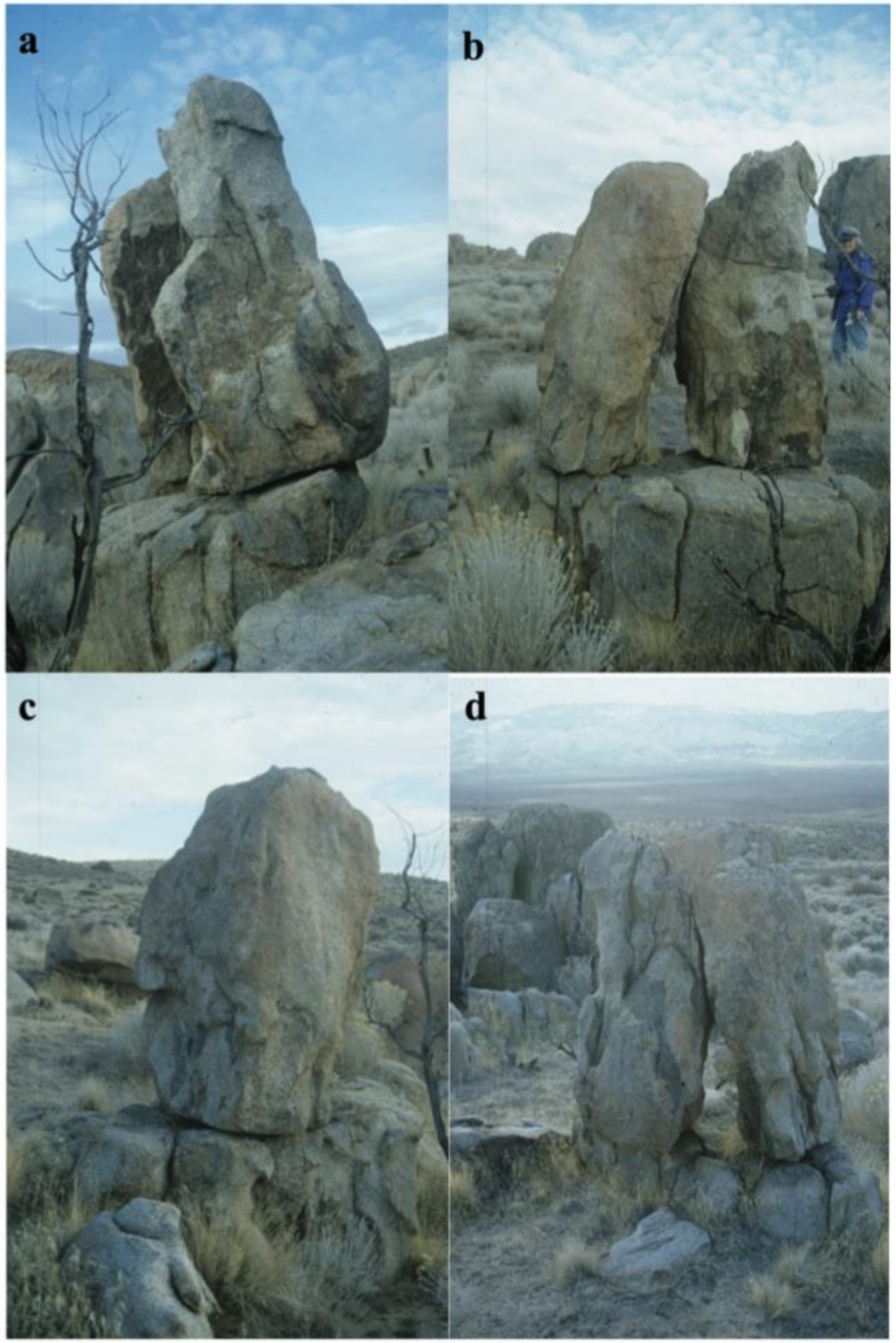


Longstanding effort

Important constraint on long-term ground motion exceedance as points in hazard space.

Uneven geographical distribution

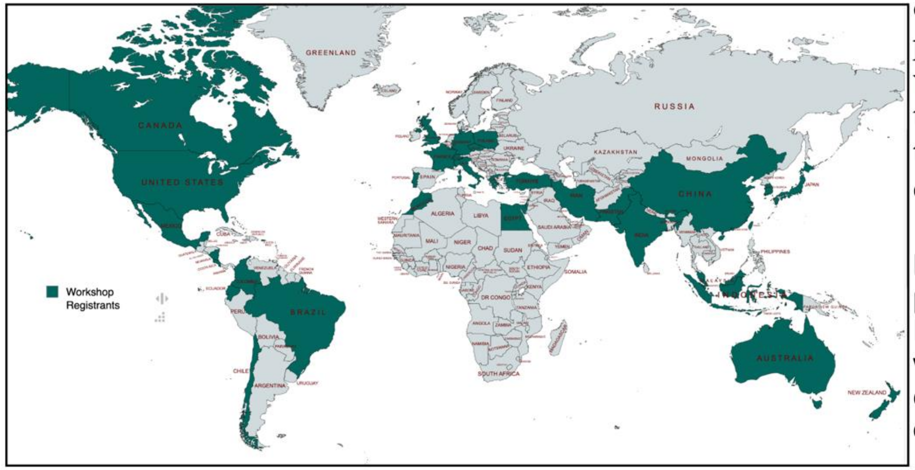
Red indicates new additions.



Community Stress Drop Validation Project

Poster #021

Baltay and Abercrombie



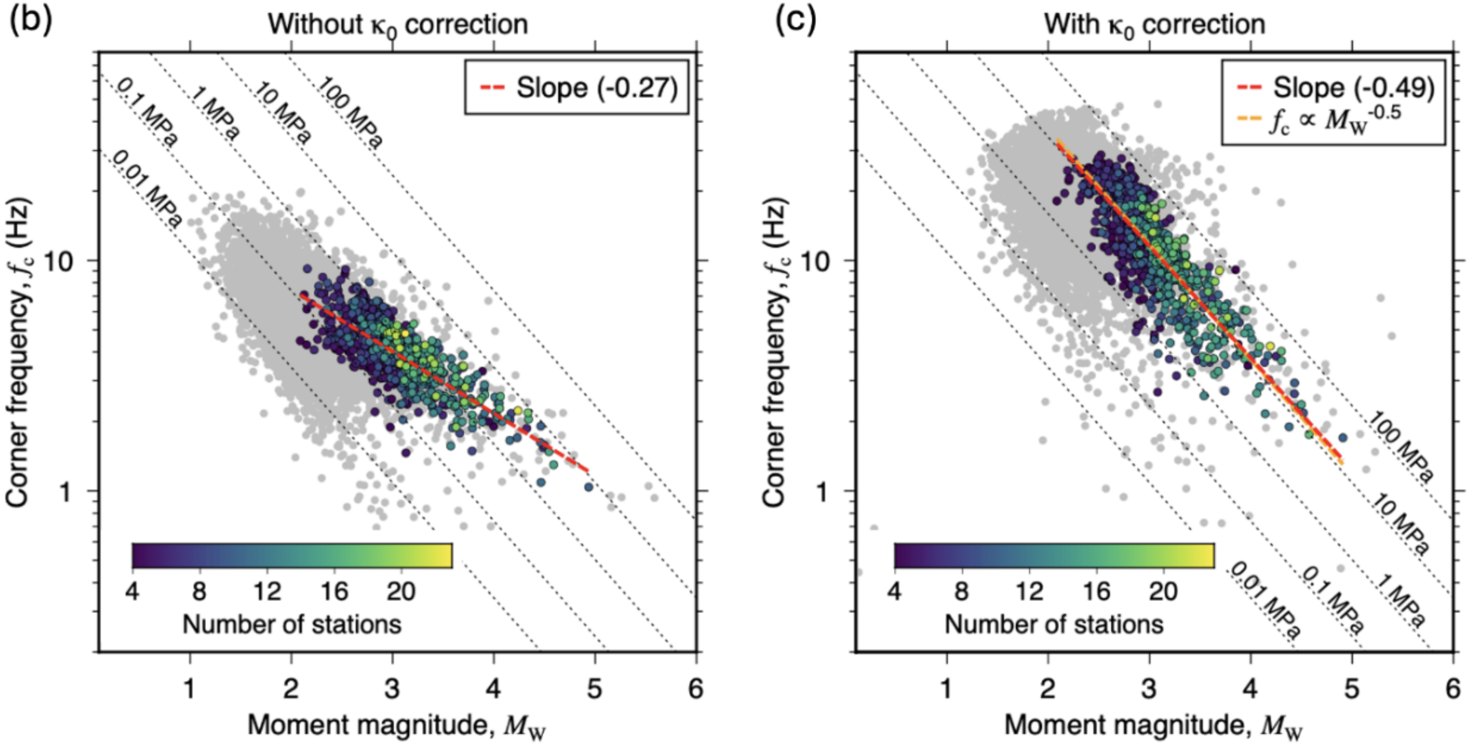
International Participation

Ahn et al. (2025) showing scaling with and without kappa correction.

RESEARCH ARTICLE | MAY 02, 2025

Overview of the SCEC/USGS Community Stress Drop Validation Study Using the 2019 Ridgecrest Earthquake Sequence

Rachel E. Abercrombie; Annemarie Baltay; Shanna Chu; Taka'aki Taira; Dino Bindi; Oliver S. Boyd; Xiaowei Chen; Elizabeth S. Cochran; Emma Devin; Douglas Dreger; William Ellsworth; Wenyuan Fan; Rebecca M. Harrington; Yihe Huang; Kilian B. Kemna; Meichen Liu; Adrien Oth; Grace A. Parker; Colin Pennington; Matteo Picozzi; Christine J. Ruhl; Peter Shearer; Daniele Spallarossa; Daniel Trugman; Ian Vandevert; Qimin Wu; Clara Yoon; Ellen Yu; Gregory C. Beroza; Tom Eulenfeld; Trey Knudson; Kevin Mayeda; Paola Morasca; James S. Neely; Jorge Roman-Nieves; Claudio Satriano; Mariano Supino; William R. Walter; Ralph Archuleta; Gail Marie Atkinson; Giovanna Calderoni; Chen Ji; Hongfeng Yang; Jiewen Zhang



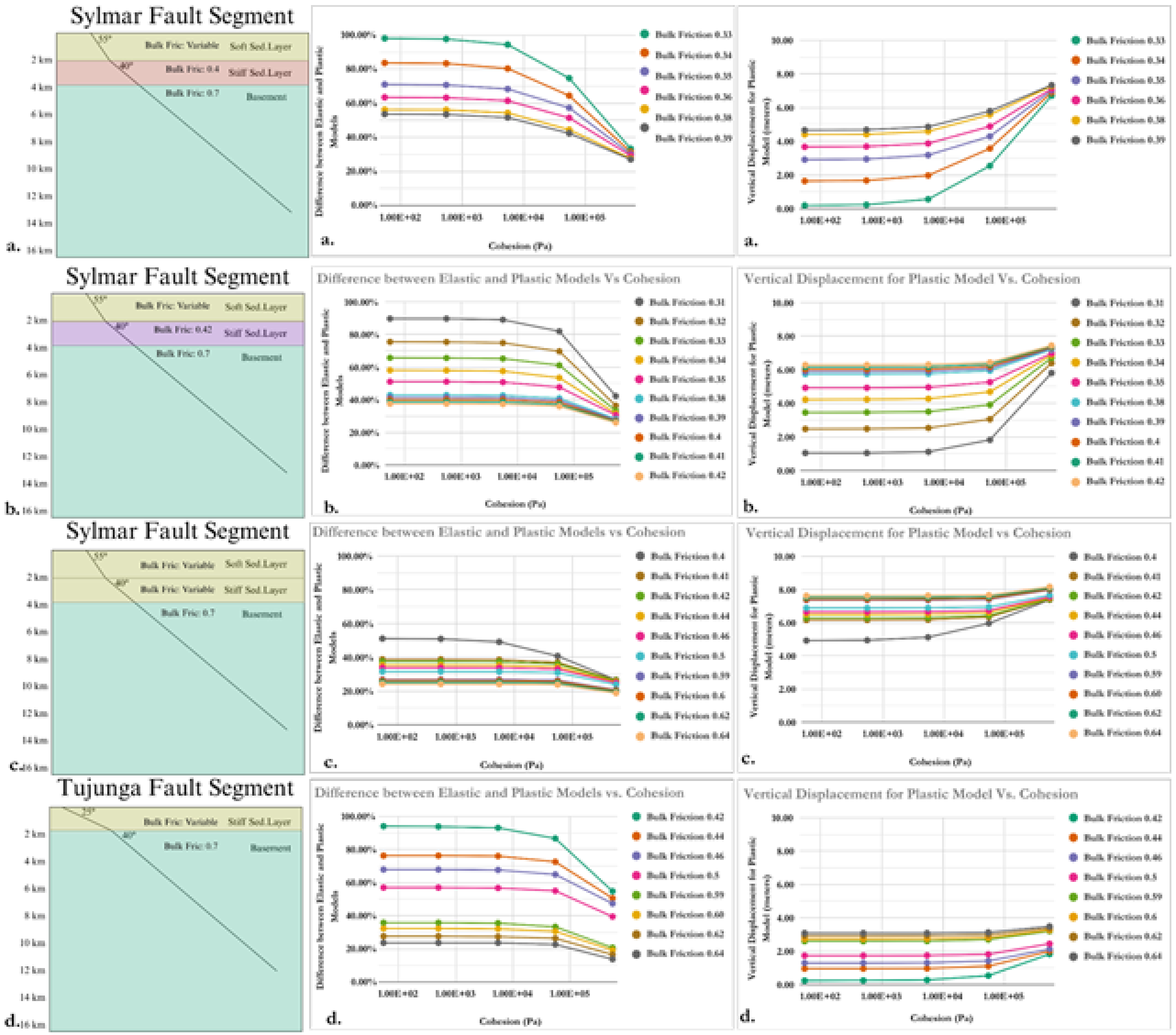
SCEC

Shallow Faulting Response of the San Fernando EQ

Poster #137

Bravo, Oglesby, Gaudreau, Funning,
Nissen, and Hollingsworth

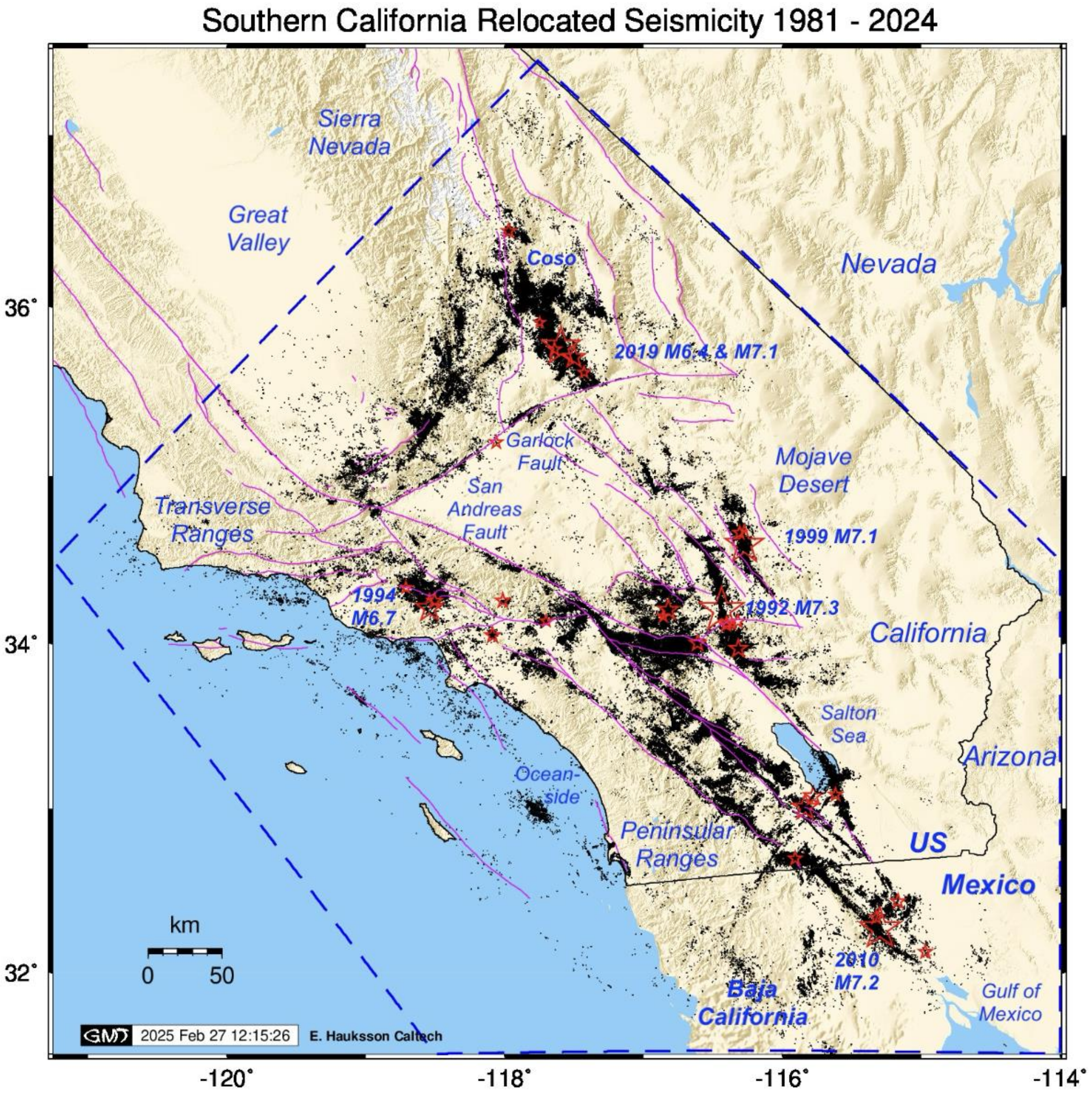
- **Study of effects of bulk friction, cohesion, and fault geometry on shallow off-fault deformation.**
- **Models with lower bulk friction and cohesion have less slip surface slip than those with values.**
- **For low values of bulk friction and cohesion, the surface slip and deformation are extremely sensitive to the change in bulk friction, making the fitting of observations challenging.**

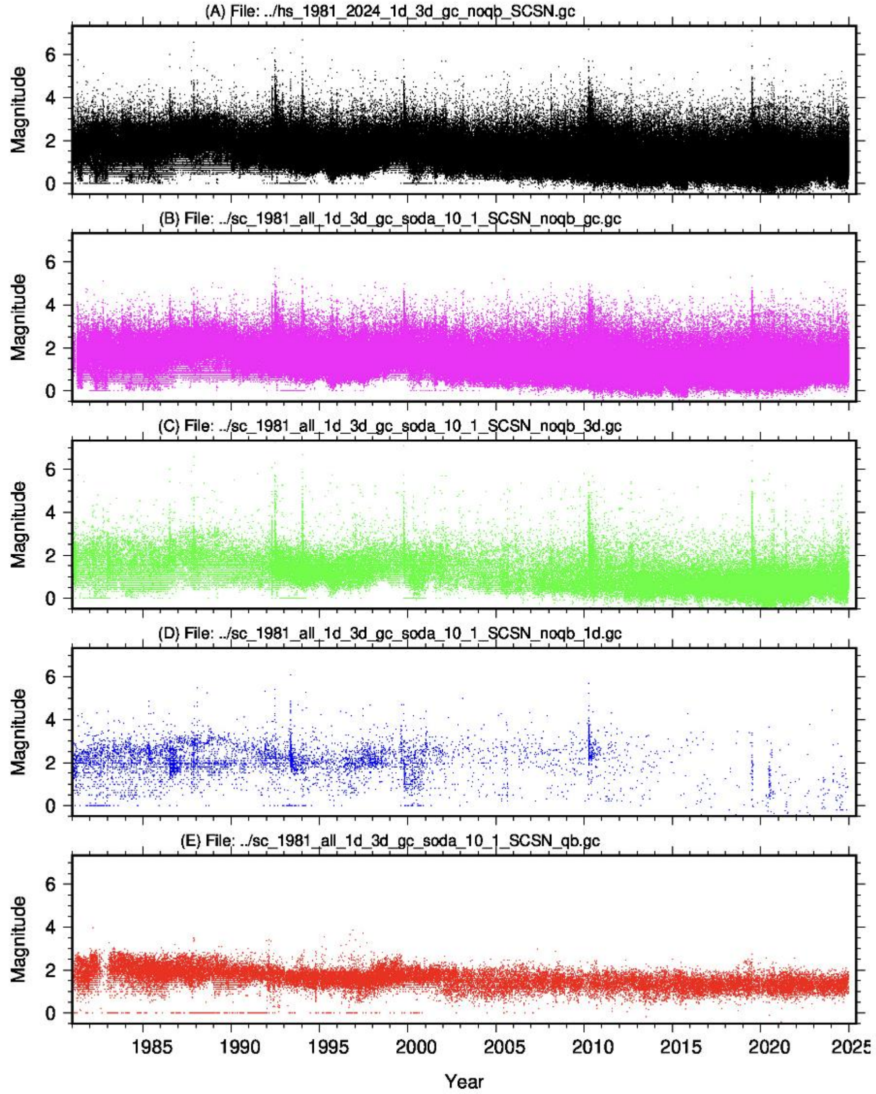


Earthquake Catalog Development

24003
Hauksson

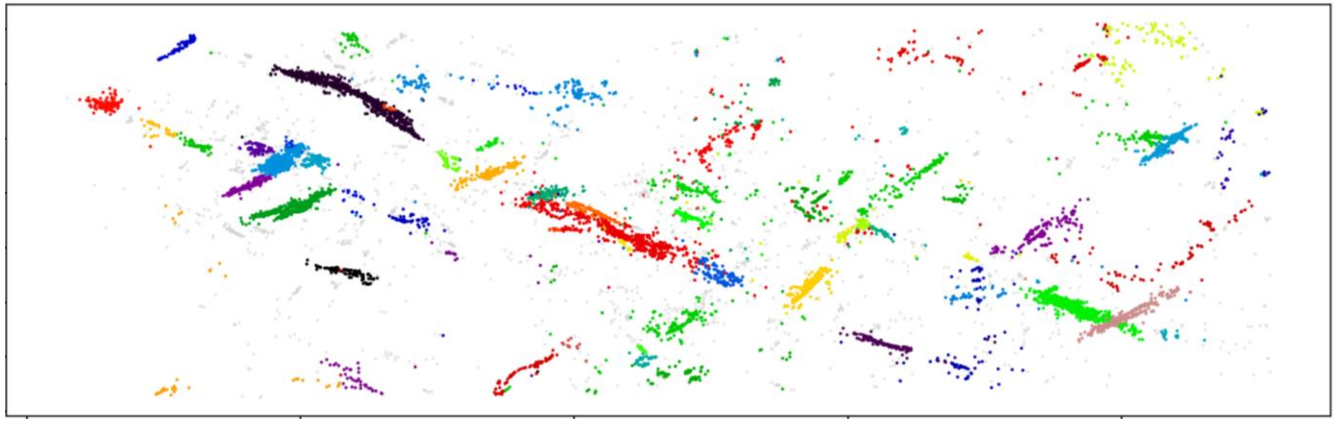
- **Update H-S Catalog to 2024.**
- **GrowClust Locations**
- **Magnitudes decrease with time, implying greater completeness**





Discerning Structures From Catalogs

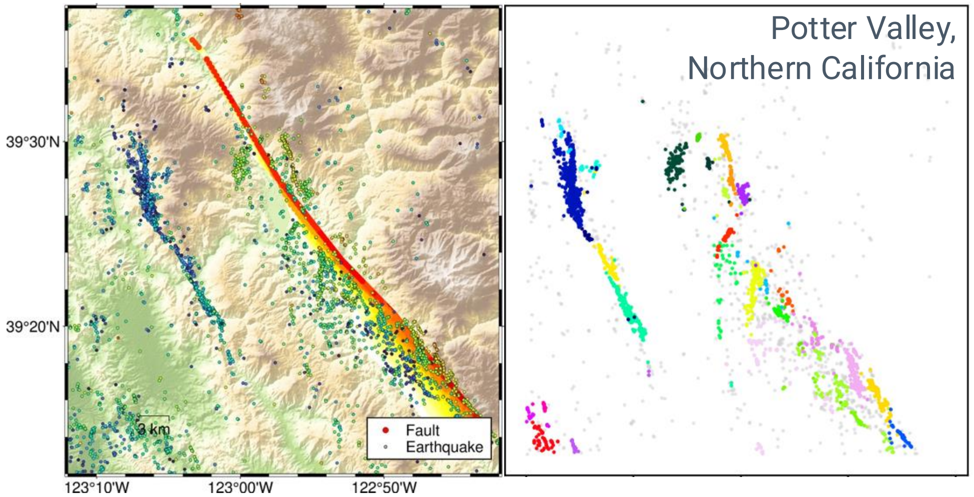
Poster #005
Hu and Beroza



Use Deep Learning (PointNet++) to discern fault structures within seismicity point clouds.

Alternative approach by Alongi, Skoumal, Shelly, and Hatem; Poster #170; Non-planar 3D fault models from earthquake hypocenters

Finer fault geometry than CFM7.0



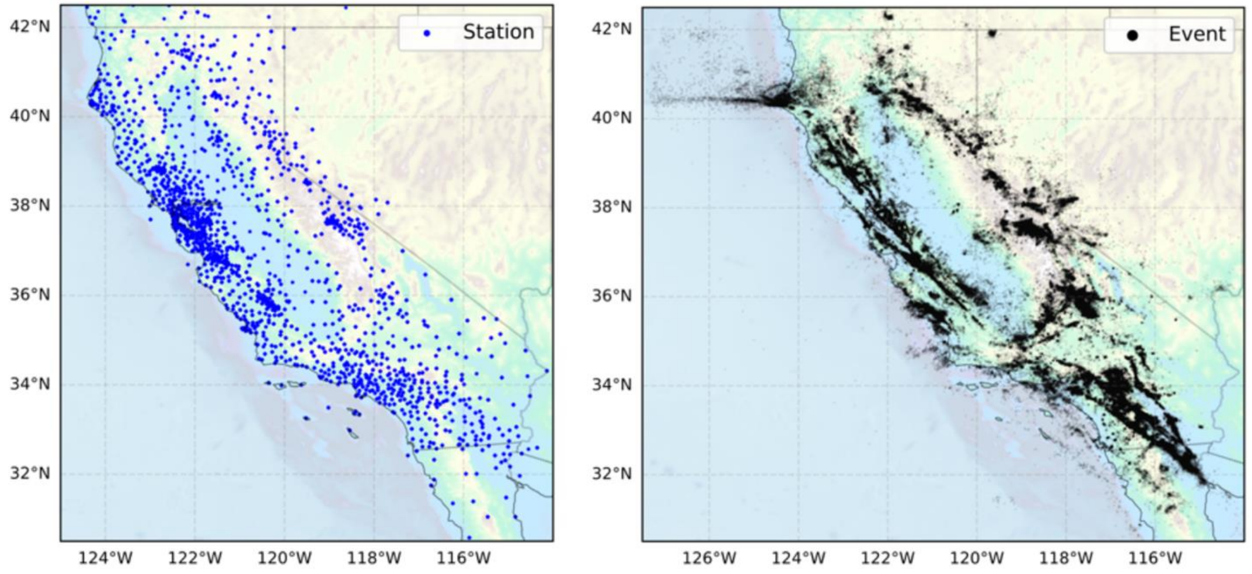
See also Yoon, Skoumal, Hardebeck, Catchings, Goldman, Chan, and Sickler Poster #025 on the Almanor Fault

Statewide California Earthquake Dataset for Machine Learning

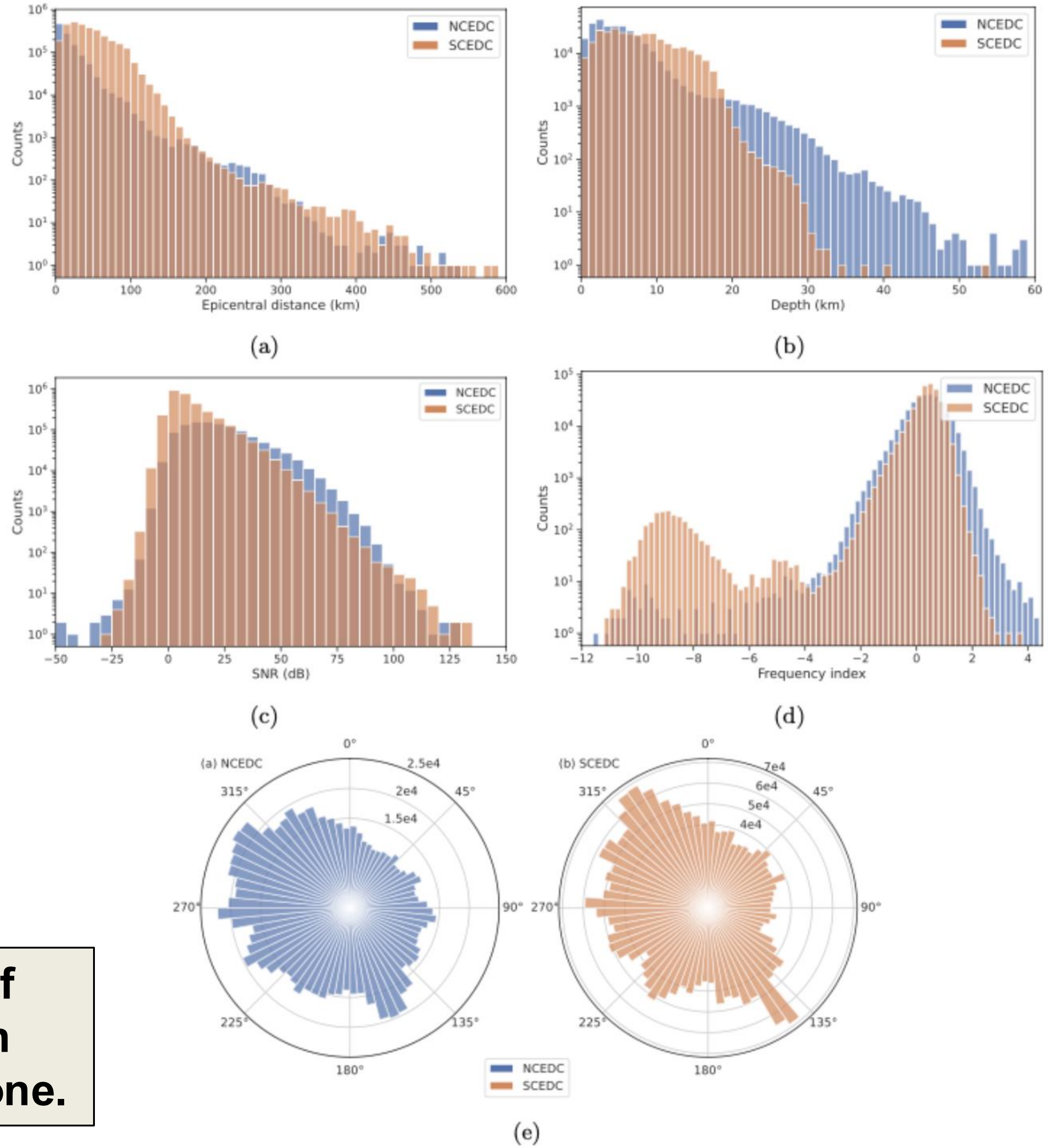
24133; Zhu

California Earthquake Event Dataset (CEED) with Statewide coverage

Other data modalities (GNSS, DAS) to follow



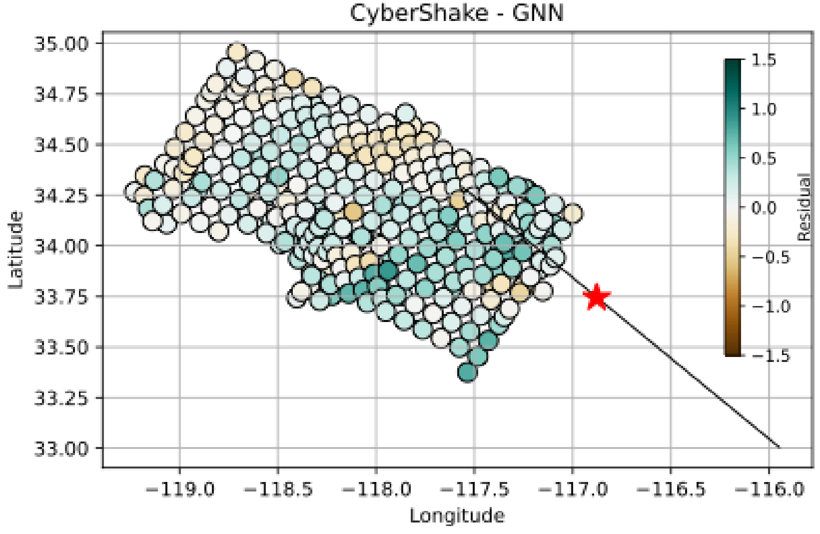
See also Poster #123 "AI-ready, multi-modal dataset of offset landforms along the Carrizo segment of the San Andreas fault" Brigham, Scott, Arrowsmith, and Johnstone.



Modeling Nonergodic Ground Motions using a Graph Neural Network

Eduardo J. Arzabala[1,2], Kyle B. Withers[1], Morgan P. Moschetti[1], Tim Clements[1], Ian W. McBrearty[3]

Poster #234



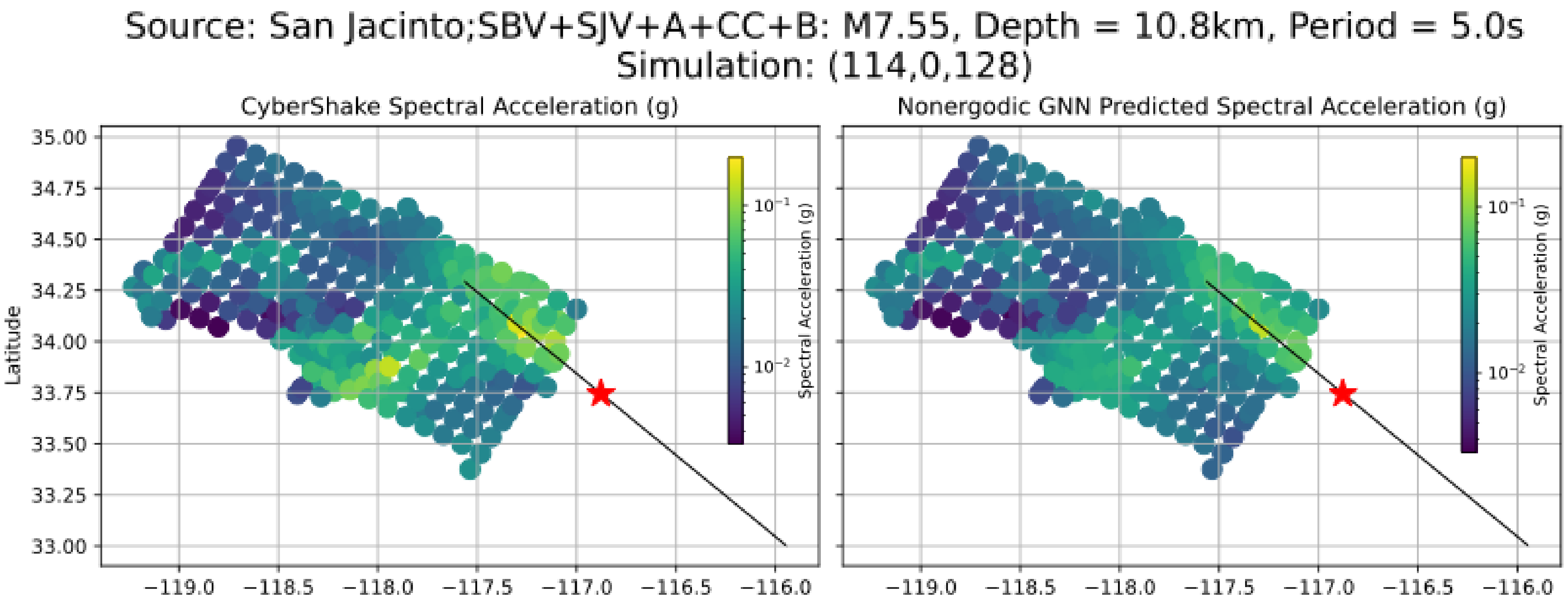


Figure 5. Example of a M7.55 earthquake (red star) on the San Jacinto fault at **T = 5.0s** from the test dataset. Panels show CyberShake-GNN residual, SA (g) for CyberShake and SA (g) GNN prediction at all 334 sites in southern California. The GNN model can **generalize** to different earthquake sources in southern California and may provide useful insights for future updates of GMMs.

Preliminary Conclusions

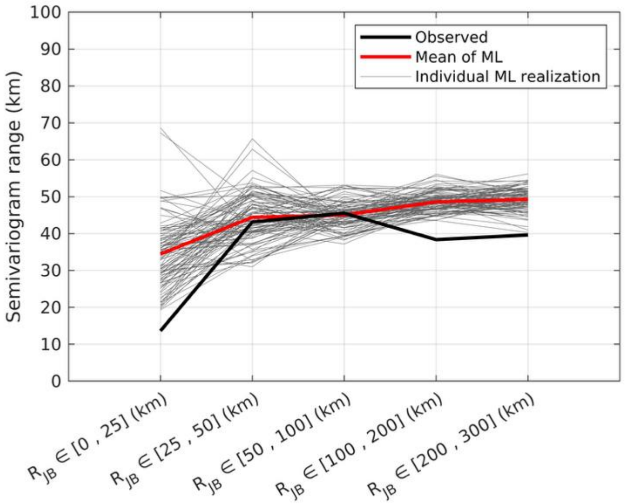
- This work successfully demonstrates the **capability** of GNNs to model **nonergodic** ground motions.
- GNN-based models capture **site-specific effects** like basin amplification of ground motions and **azimuthal variations** of ground motion with respect to the fault, features that are often missed by traditional GMMs.
- These results suggest that GNNs offer a powerful and **flexible alternative** to other nonergodic GMM approaches.
- All test models have a *nonergodic* aspect due to the way GNNs pass information **locally** along the edges of graph connections.

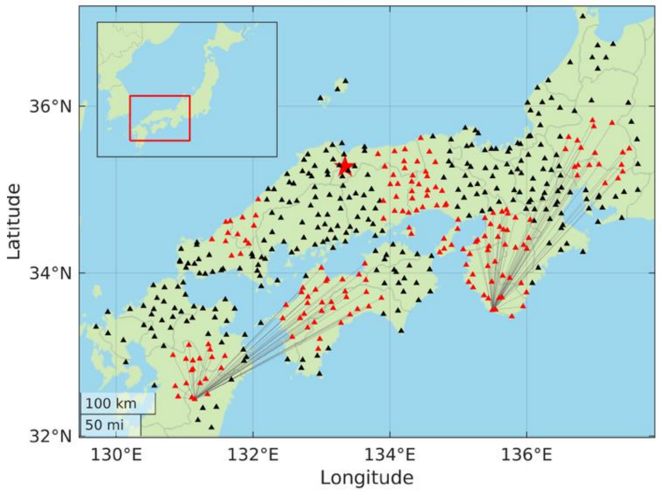
Distance-Dependent Spatial Correlation of Ground-Motion Residuals using a Graph-Based Generative Approach

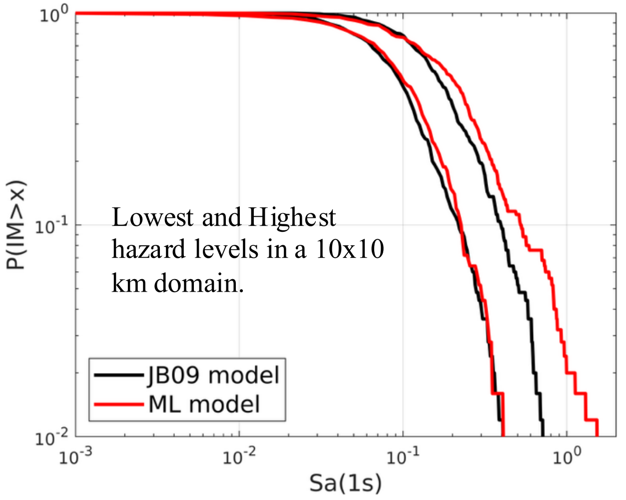
King Abdullah University of Science and Technology

Aquib and Mai, Poster #224

Improve spatial correlation models of ground-motions







1. 62 Japanese earthquake recordings show distance-dependent variability

- High variability (low range) close to fault
- Within-event residuals extracted and used for training.

2. Graph-based generative ML model structure.

- Stations modeled as nodes.
- Dynamic station network with clustered stations.
- Message passing encodes distance/azimuth dependence.

3. Hazard implications?

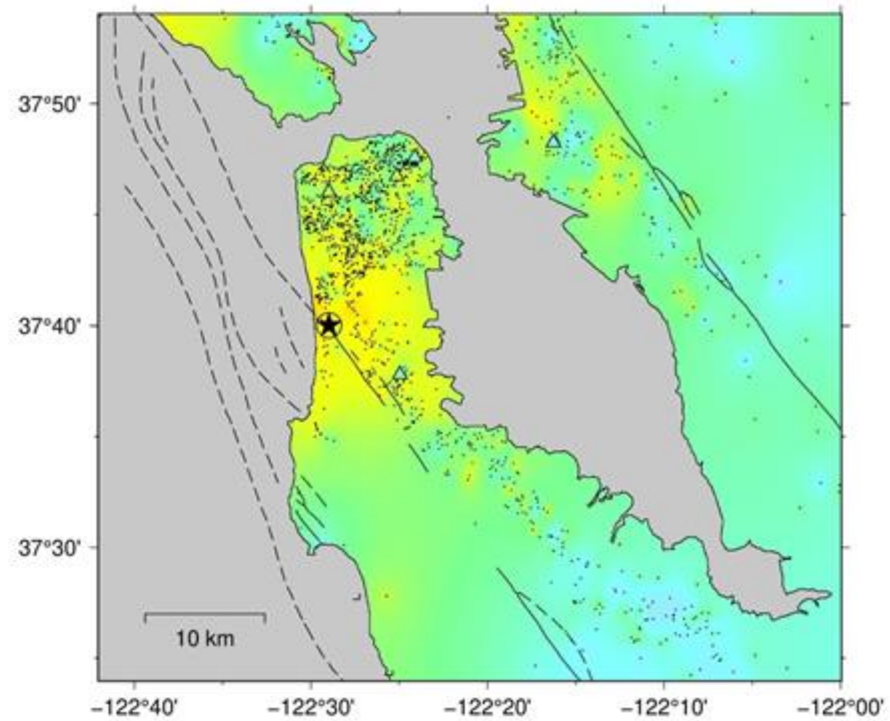
- Increased hazard levels in the near field.
- Increased variability.

Automating Legacy Macroseismic Data Processing with LLMs

Problem: Legacy macroseismic data are valuable but underutilized

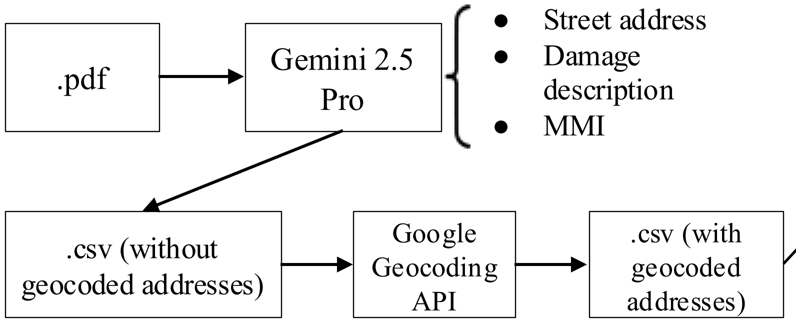
Solution: A scalable pipeline using Google's Gemini large language model

Case Study: Validated on the 1957 M5.3 Daly City, CA earthquake



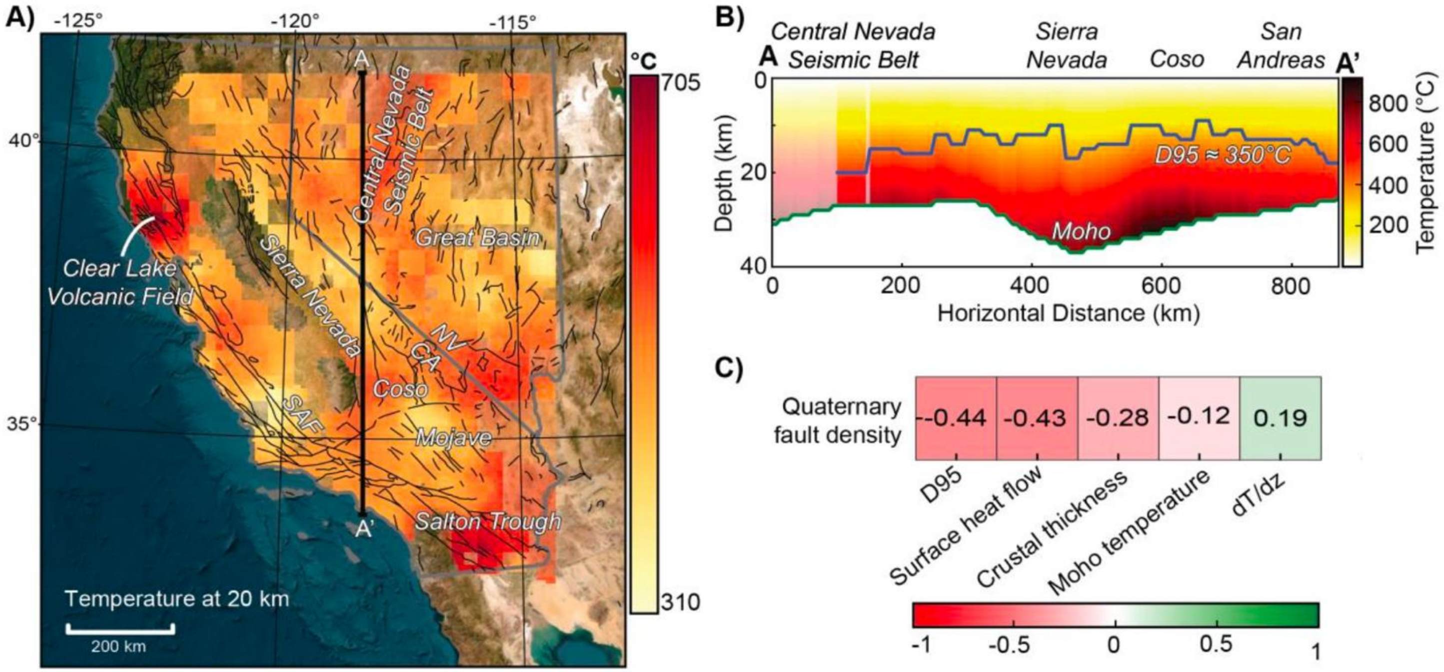
Poster #233

Agrawal, Hough, Mousavi, Hlaing, Yoon, and Blanco



Location	MMI Rating	Description
4563 Utah Dr, El Sobrante, CA 94803	4	Motion rapid. Faint earth noises heard. Bird cage rocked. Ground: Soil, sloping.
3977 Clay Street, San Francisco, CA 94118	7	Chimney fell at 3977 Clay Street.
Alemany Store, San Francisco, CA 94112	6	Plate glass windows buckled at the Alemany Store.
…	…	…

CEMs Expanding Statewide

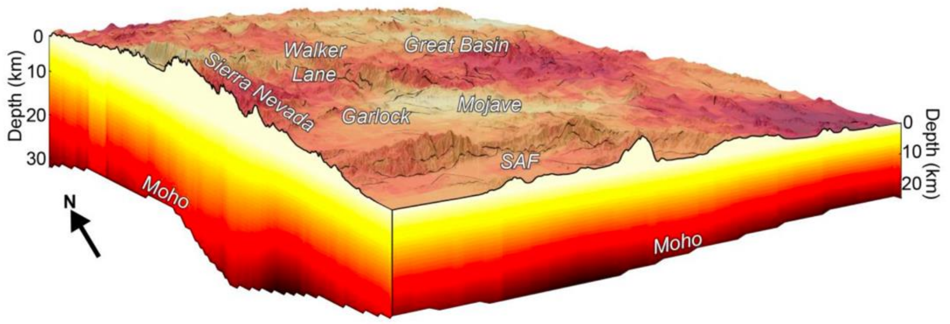


CTM

- Integrating surface heatflow
- Depth of Seismicity
- Crustal thickness
- Moho temperature inferred from Pn observations

Poster #319

Lee, Zuza, Trugman, Vlaha, and Cao

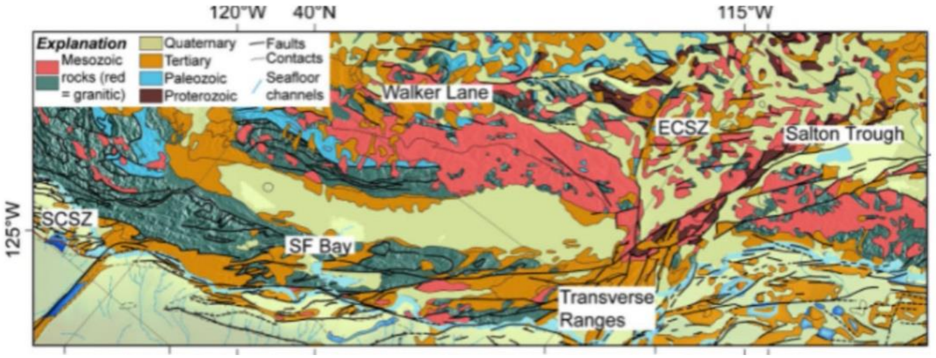


SCEC Community Models will be covered in the talk that follows (Marshall and Persaud)

SCEC Science Plan: Organized Around Themes

A: Improving observations and closing critical data gaps

1. Near-Fault Studies
2. The Dynamic and Nonlinear Shallow Crust
3. Geodata for Earthquake Science
4. Integrated Multi-Scale Community Models



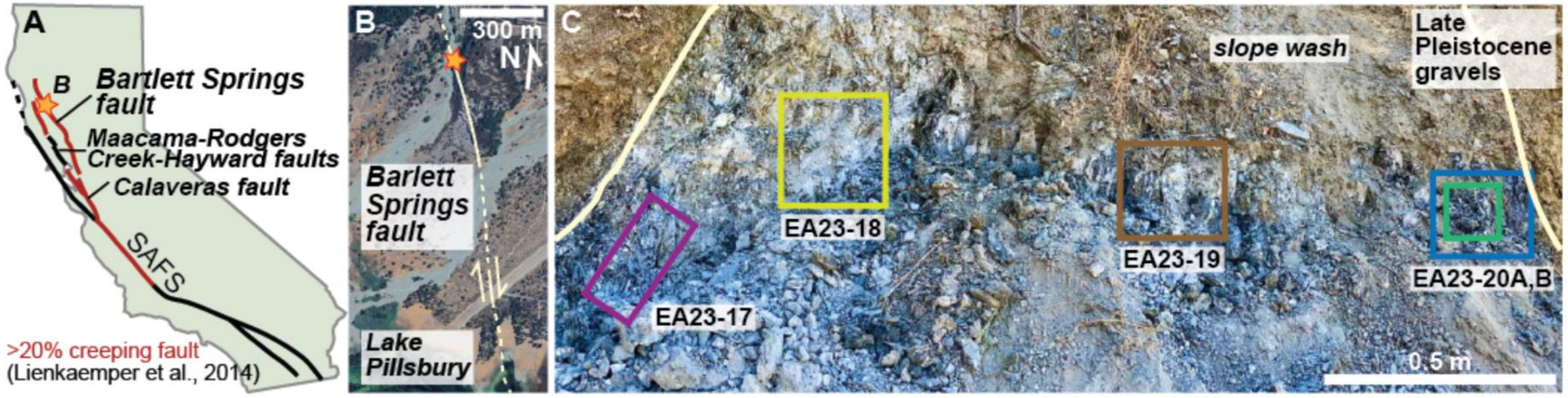
B. Developing rheologies that bridge scales and conditions

5. **Effective Constitutive Laws for Brittle Deformation of Fault Zone Materials**
6. **Effective Constitutive Laws for Long-Term, Large-Scale Deformation**

Behavior of Serpentinite Gouge

24119 and Poster #129

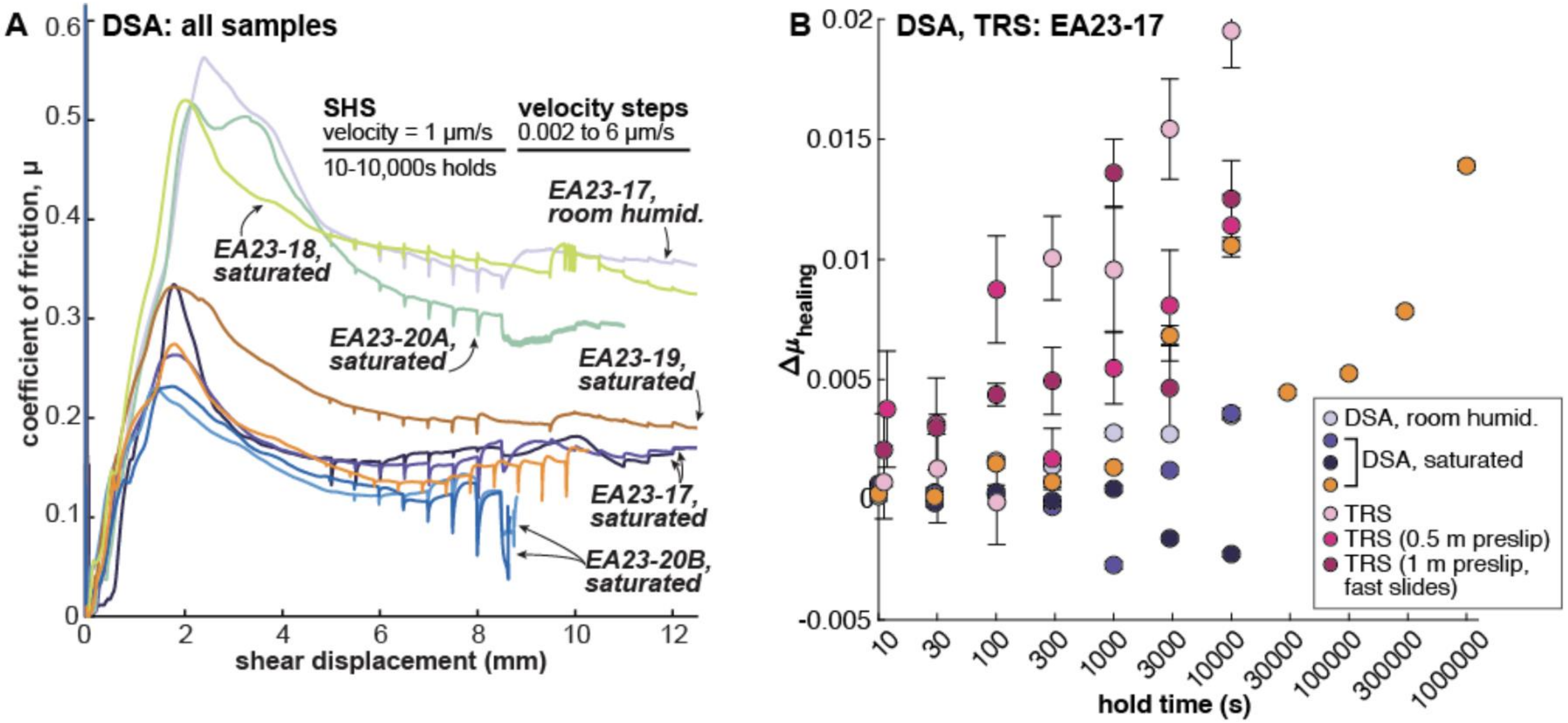
Armstrong, Barbery, Ault, Hirth, Shreedharan, and MacDonald



Explore relationship between fabric development and healing rate for fault-zone materials from creep faults

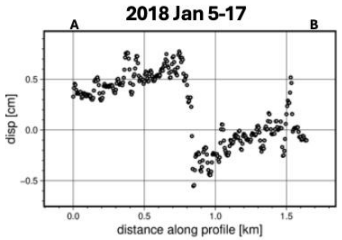
Suggest rapid short-term healing but limited long-term healing

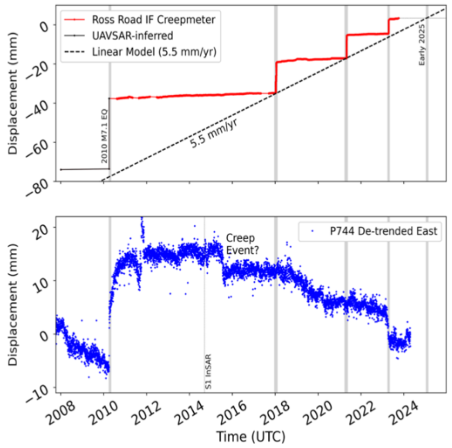
Potential for ruptures to propagate through this material remains unclear

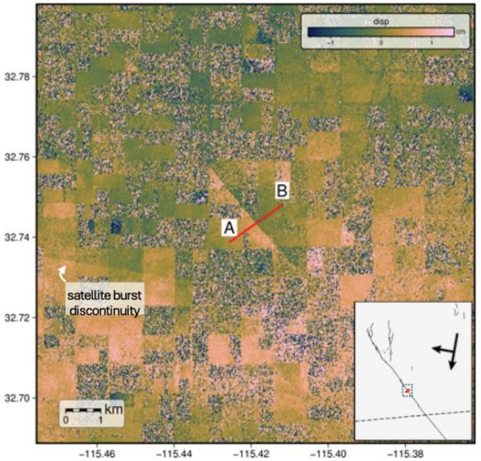


Towards an Integrated Catalog of Creep Events on the Imperial Fault

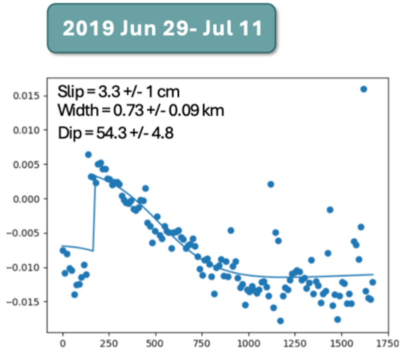
Creep events discerned with InSAR

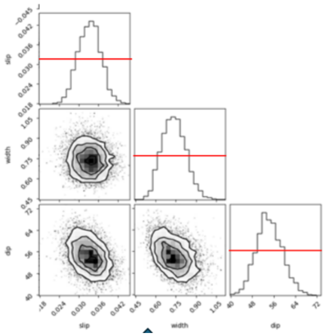






Compiled a catalog that includes 17 new creep events





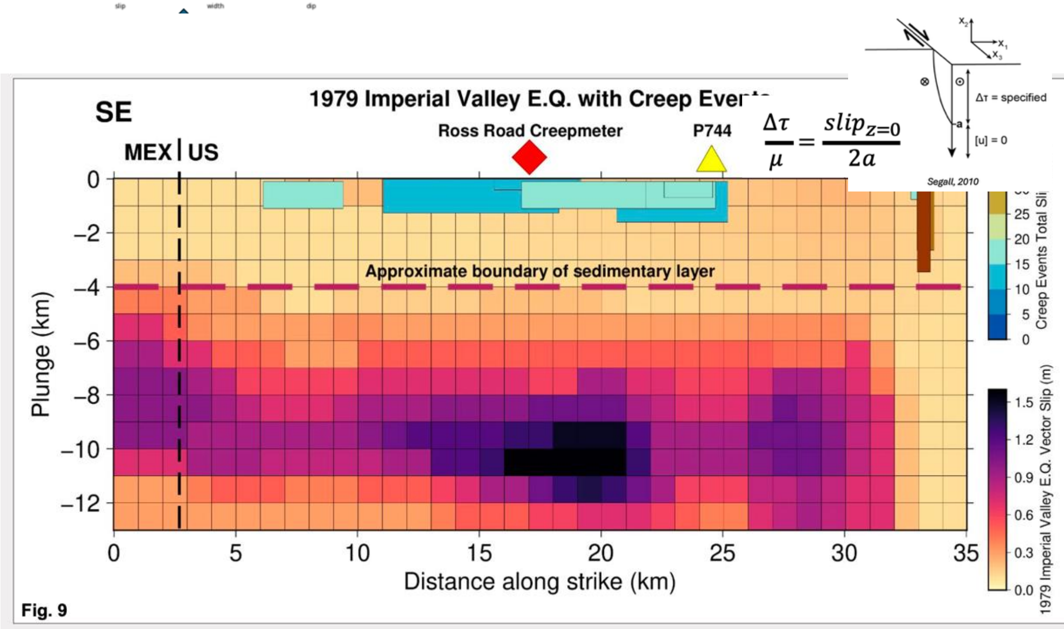
Tan, Materna, Bilham, Gittins, Genero;

Poster #077

Creep events on the IF not segmented, suggesting they're not controlled by geologic features or boundaries

Modeling indicates depth of creep is 1-2 km, significantly shallower than the seismogenic layer

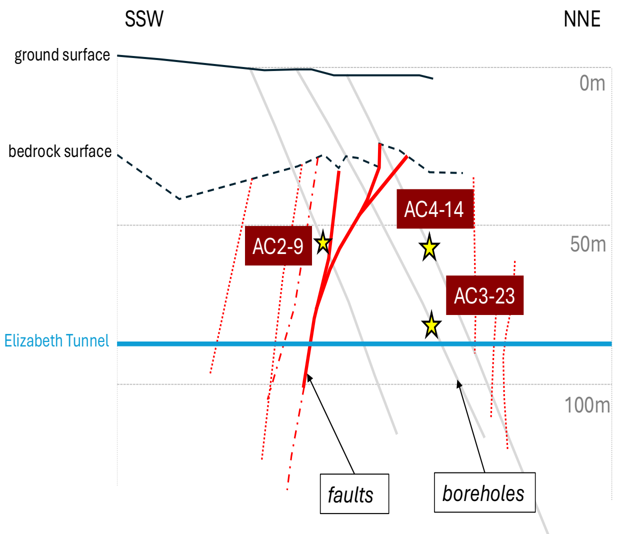
The 2019 Ridgecrest earthquake triggered previously unknown creep along many segments of the Imperial fault system

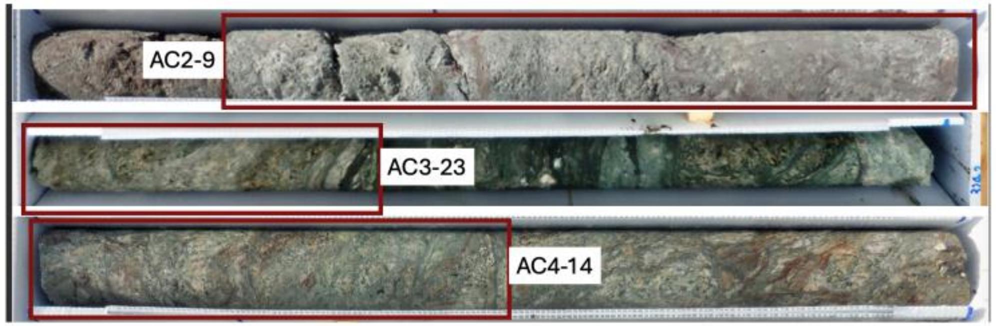


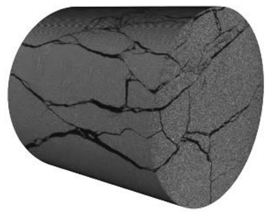
1979 Slip distribution from Archuleta et al., 1984

Measurement of Viscoplastic Rock Properties

Nairong Du, Hiroki Sone
Univ. Wisconsin-Madison
Posters #094 and #098





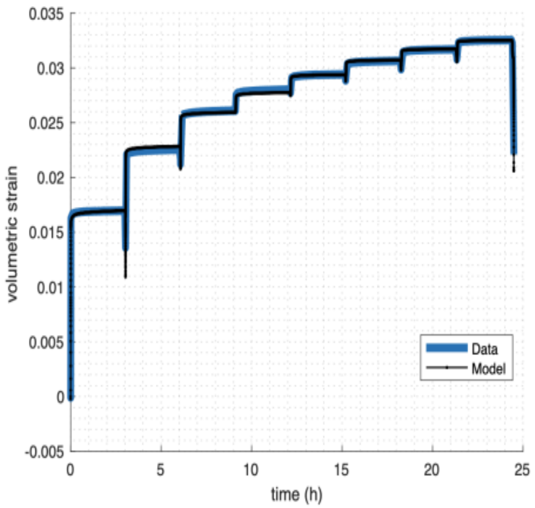


Triaxial creep experiments using natural and analog fault rocks

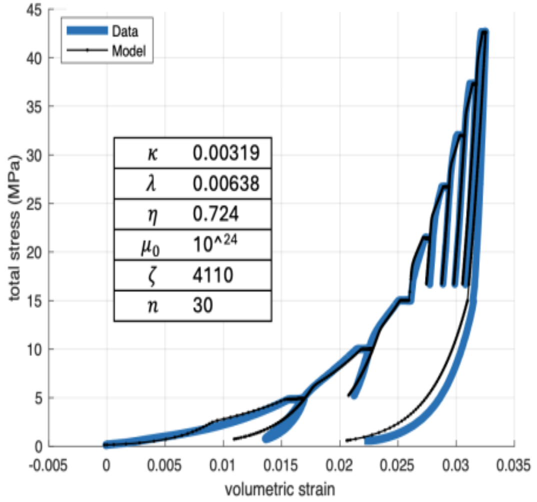
Rocks with (fracture) porosity exhibit bulk ductile behavior even under shallow brittle conditions

Time-dependent viscoplastic behavior described very well by [Perzyna Viscoplasticity] + [Modified Cam-Clay]

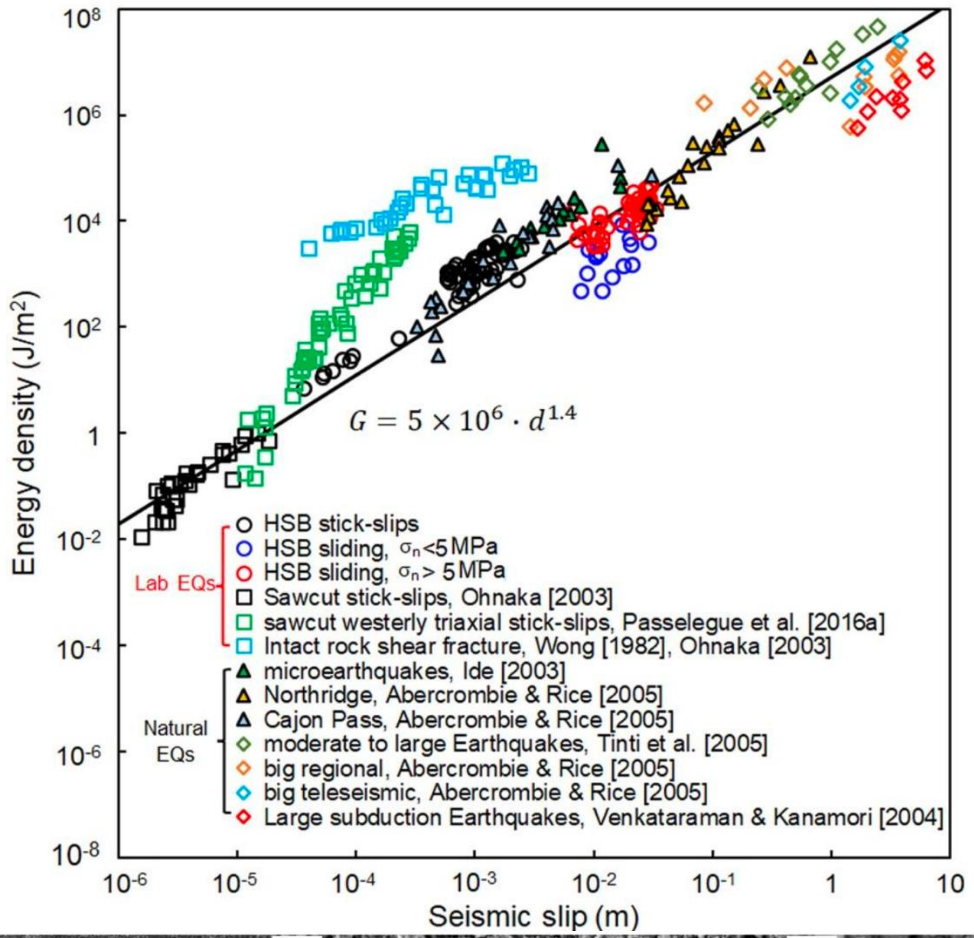
Strain vs. Time



Stress vs. Strain



Transition from Dynamic Rupture to Frictional Sliding



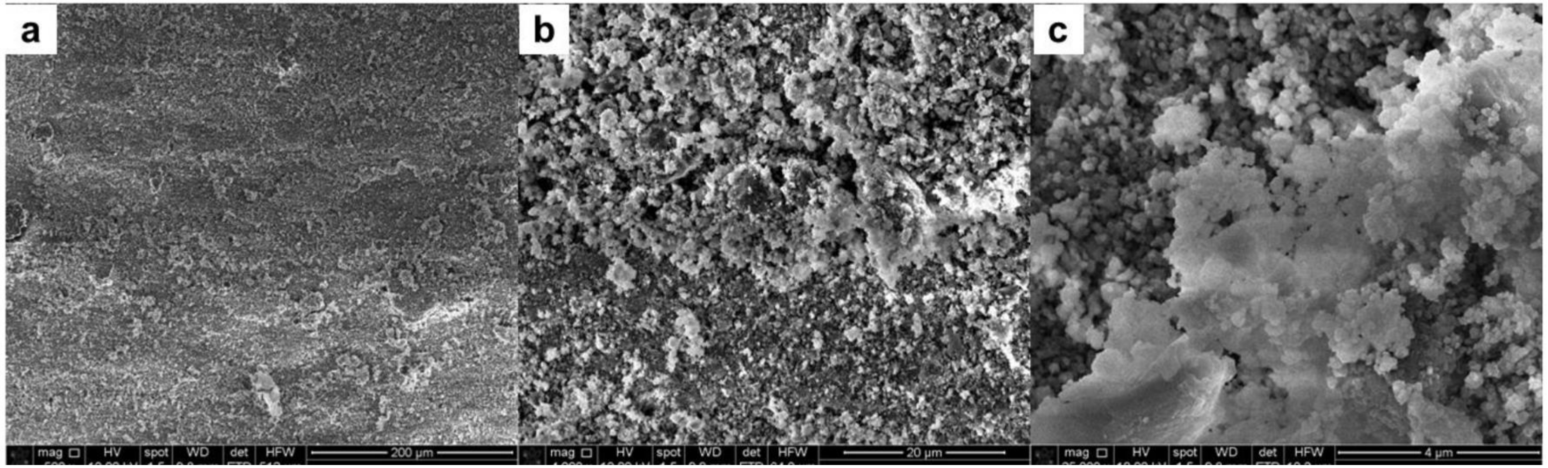
24113; Chen and Chester

Experiments to probe interaction of fracturing and friction during earthquakes.

Observe velocity weakening followed by re-strengthening during fault deceleration.

Find 1/V dependence of rock friction as described previously

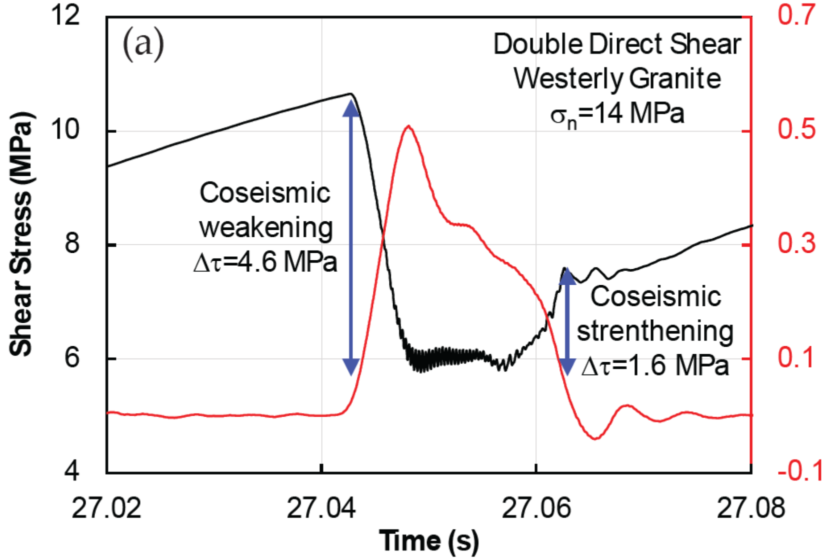
Deviation from 1/V relation during fault acceleration is attributed to fracturing during slip initiation (supported by SEM).

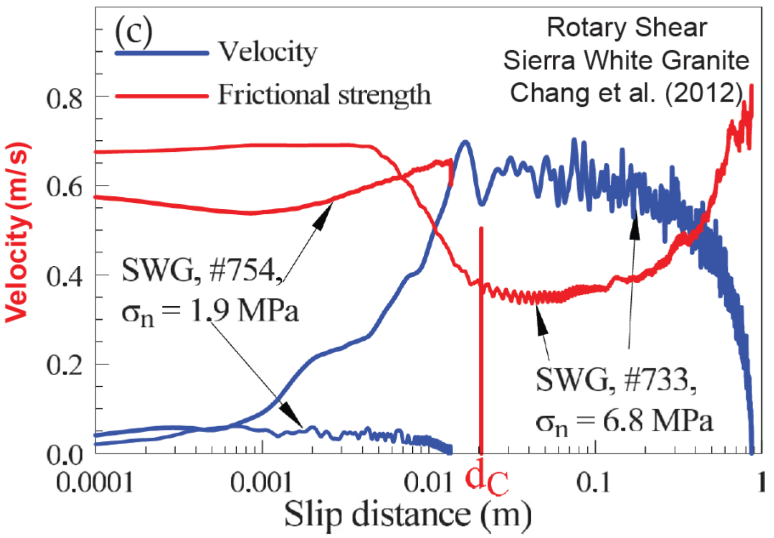


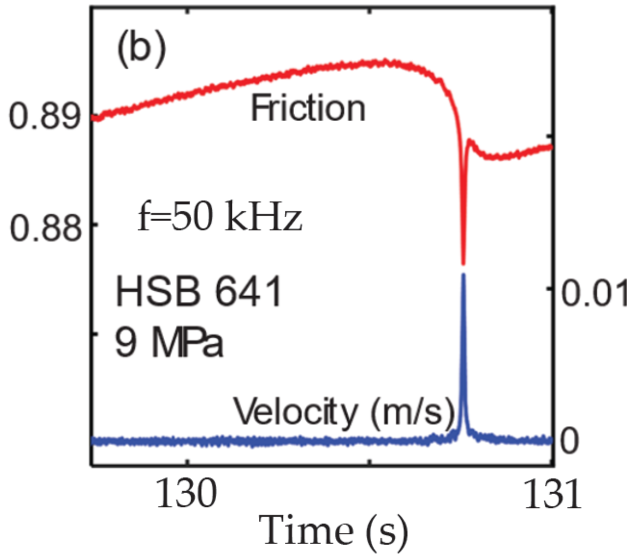
Coseismic Fault Strengthening

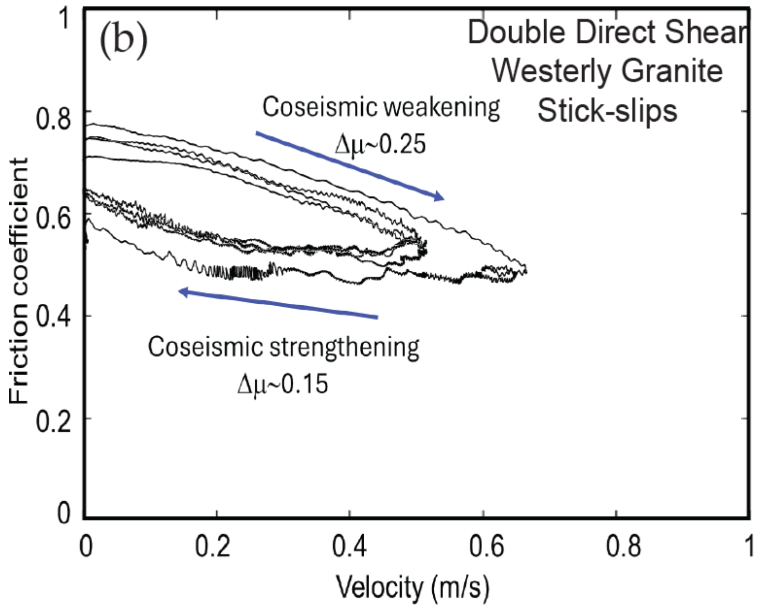
poster #155

- Rapid coseismic shear stress recovery as fault slip slows down following dynamic weakening.
- Coseismic strengthening can restore up to 100% of the dynamic stress drop.
- Seismic events nucleate on locked and creeping faults.
- Strengthening μ-V relations follows flash-heating trend.



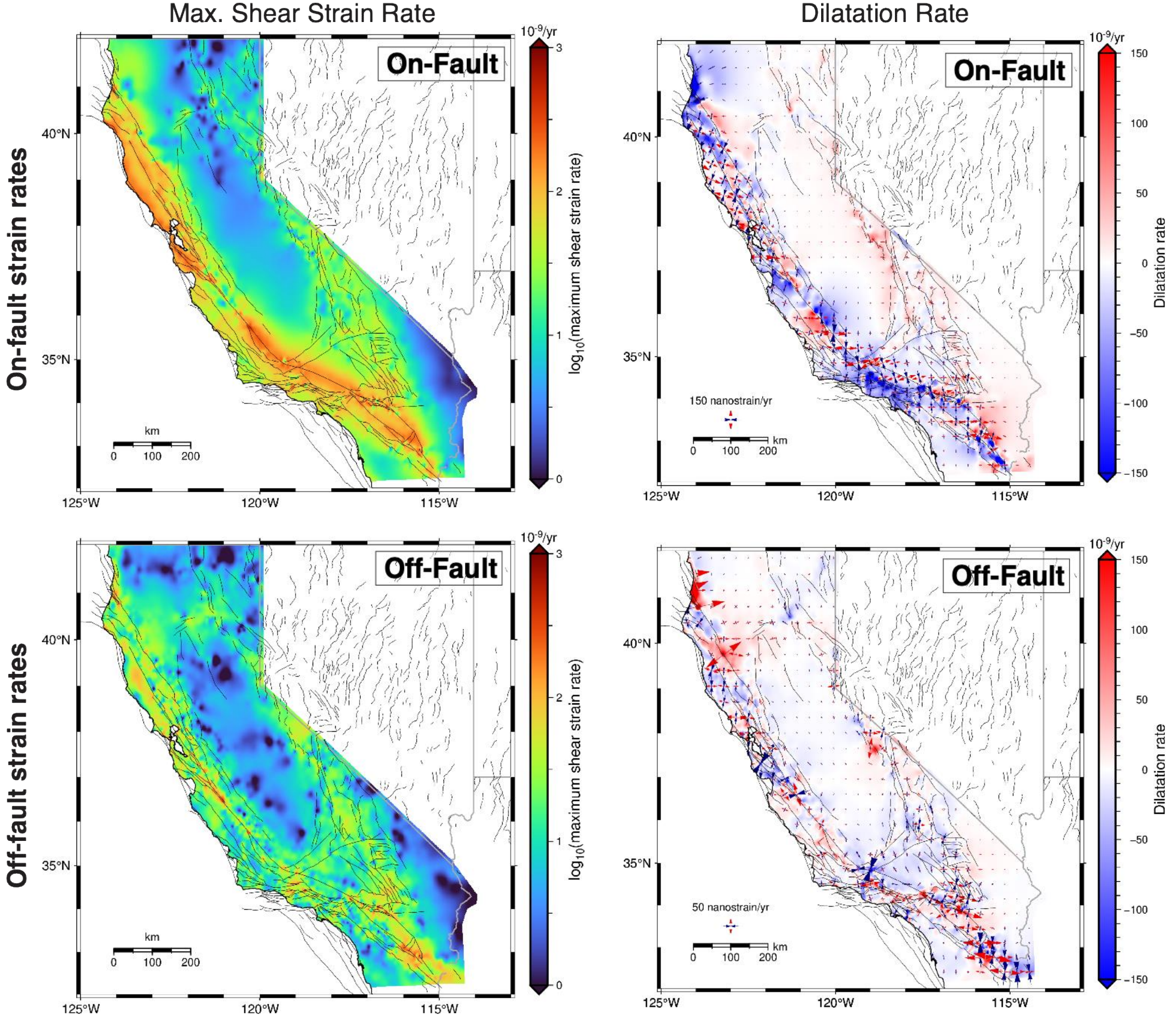






Disentangling On-Fault and Off-Fault Contribution to Strain Rates

Perdomo and Johnson
Poster #066

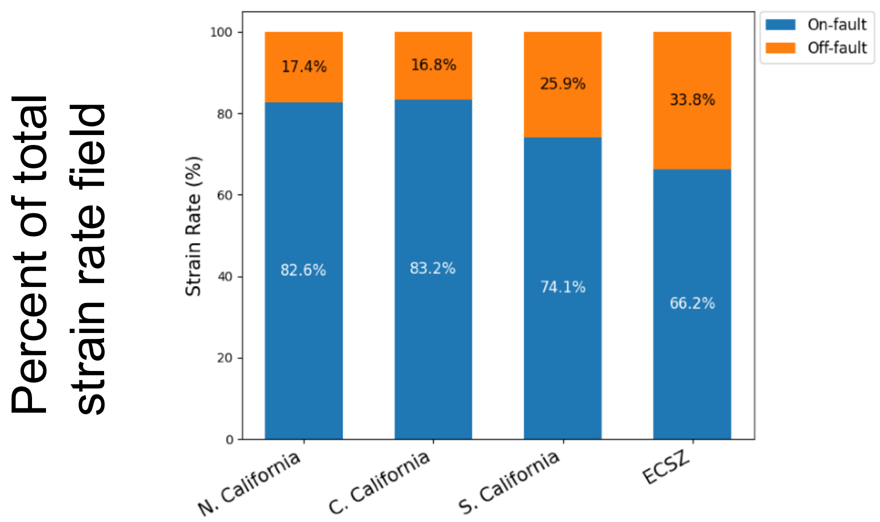


Method to separate strain rate field due to inter-seismic coupling on faults from that due to distributed off-fault deformation.

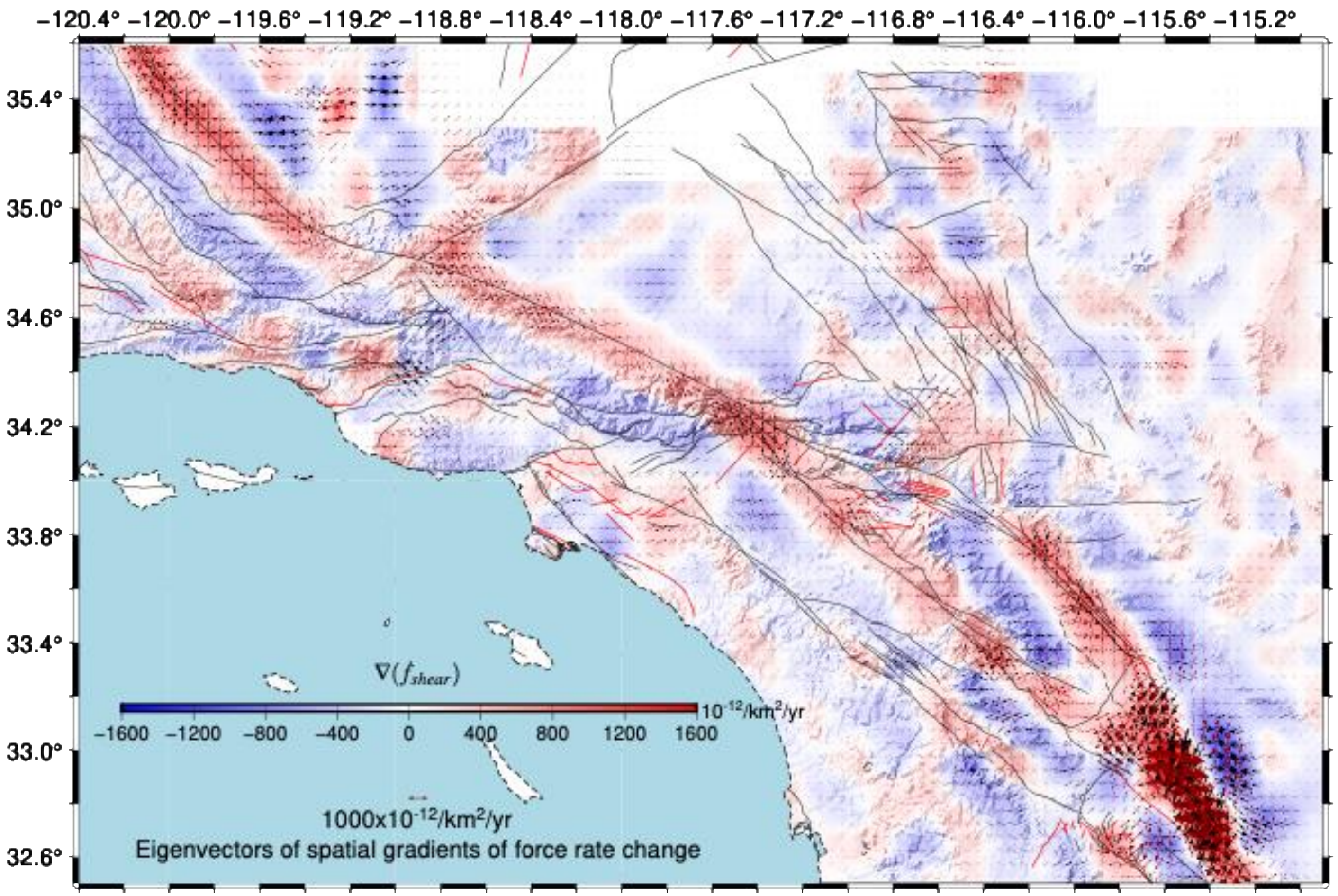
74-84% of observed strain rate field can be mapped to faults along the SAF.

In the ECSZ/Walker Lane, about 34% of the strain rate is accommodated by off-fault sources.

INDIANA UNIVERSITY



Insights and Emerging Directions from Force-Balance-Based Joint Inversion of GNSS and InSAR



Poster #072
Vashishtha, Holt, and Kim

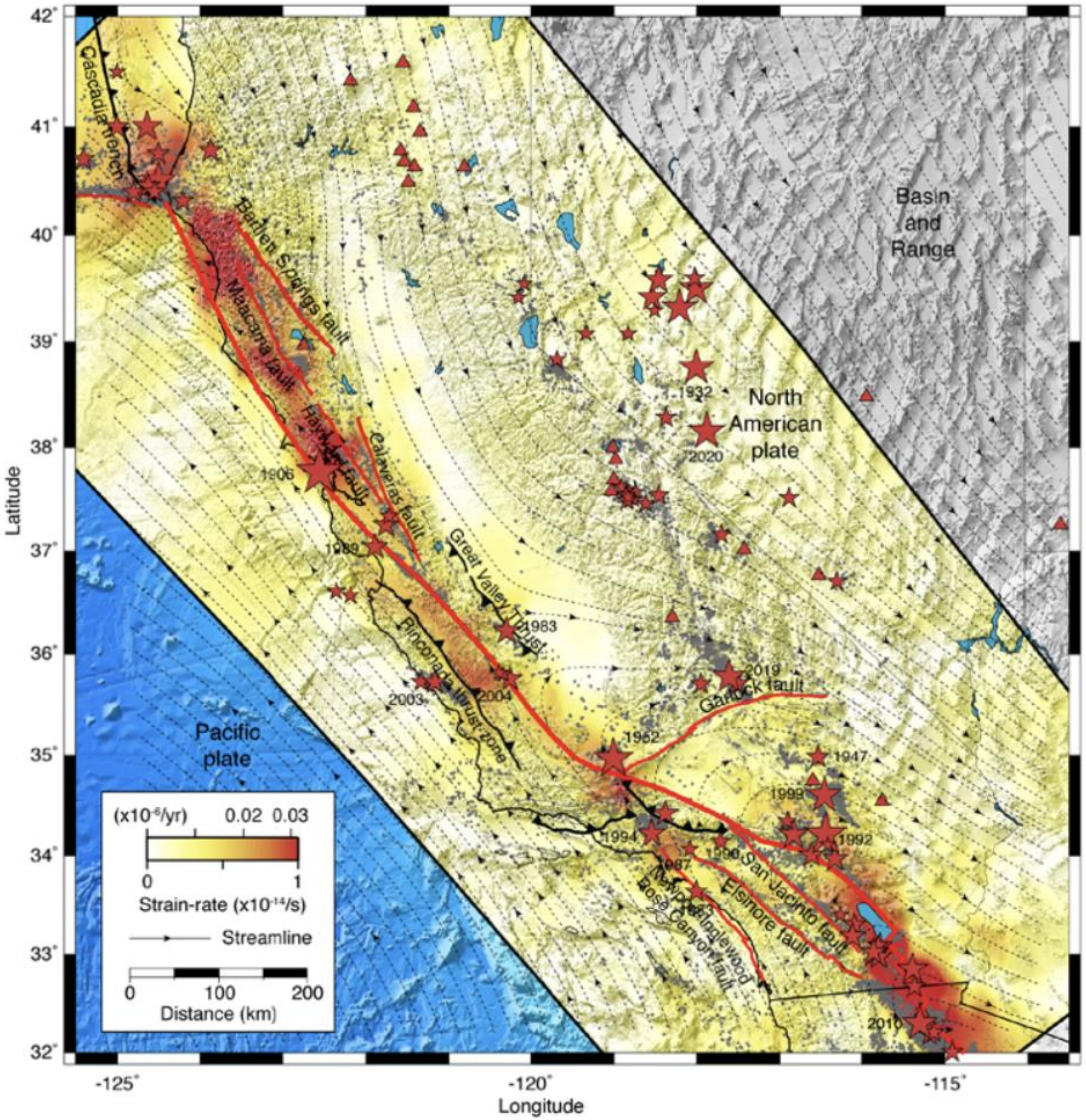
- **Force balance approach that satisfies GNSS and InSAR velocities**
- **3-D velocity and strain rates**
- **Fault locking depths and slip rates**
- **Resolves vertical gradients of horizontal shear.**
- **Insight into off-fault deformation**

Spatial Gradients of Force Rates Shows Elastic Response to Fault Locking

Imaging the distribution of plastic flow beneath the California margin

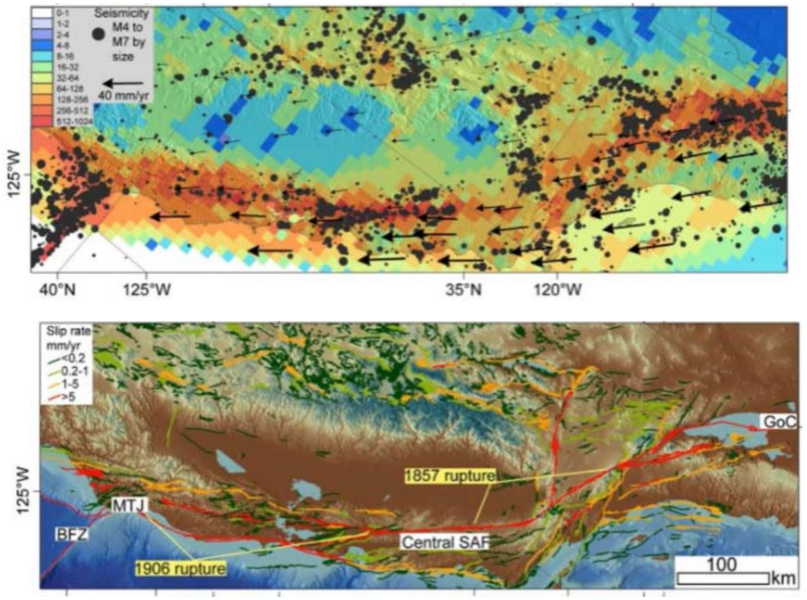
24057; Barbot

- **Model crustal deformation observations assuming horizontal, incompressible, viscous flow**
- **Deep shear is localized under faults.**
- **Shear flow broadens across the Big Bend**



C. Developing advanced modeling frameworks

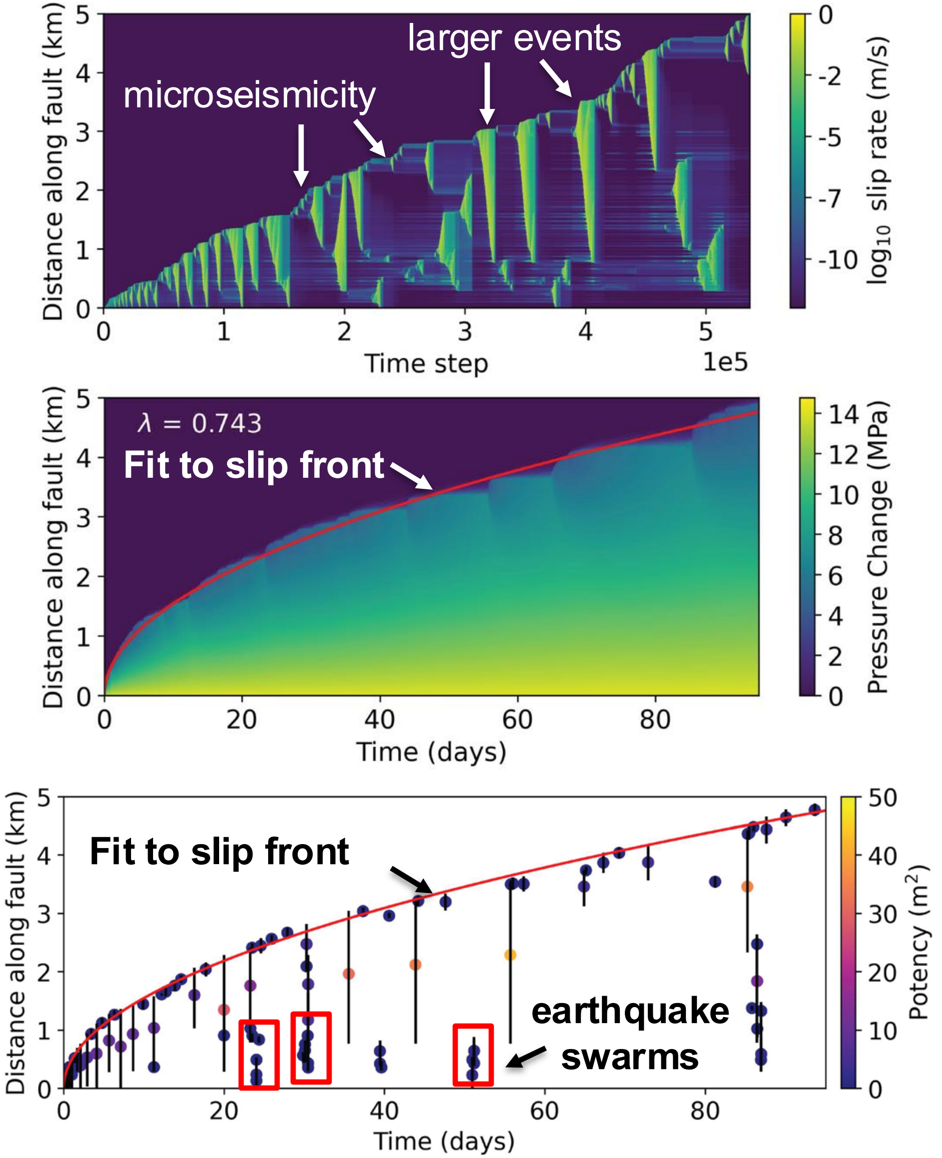
7. **Integrated Tectonic Modeling**
8. **Coupled Evolution of Earthquakes and Faults**
9. **Estimates of Seismic Hazard in California**



Modeling permeability enhancement by earthquakes and fault slip to study fluid-driven earthquake swarms in California

Natalia Berrios-Rivera, So Ozawa, & Eric Dunham, Poster #149

- What are the fundamental controls on **earthquake swarms and pore pressure at seismogenic depths**?
- New **earthquake sequence models with fluid transport**
- Slip front expansion and slip distribution is **independent of slip type,** allowing the use of velocity-strengthening friction for **more efficient** forward simulations and inversions.
- Seismic sequences driven primarily by fluid pressure diffusion and elastic stress transfer from seismic slip, **challenging current ideas about the importance of aseismic slip in fluid-driven swarms**



Influence of Key Modeling Parameters on Bias in Physics-Based 3D Ground Motion Simulations

Chukwuebuka Nweke, Sajan K C, Rob Graves, & Jonathan Stewart, Poster #250

- **Systematic validation of 3D ground motion simulations to quantify how modeling choices** (Vs,min, velocity model, fault area, Qs–Vs scaling) affect bias in engineering-relevant output
- Parametric sensitivity tests for the 2008 Chino Hills and 2014 La Habra earthquakes (<1 Hz) using CVM-S4.26.M01 with variations in Vs,min (200–500 m/s), velocity taper, source scaling, and Qs–Vs ratios
- Best agreement with observations for Vs,min = 200 m/s, Qs–Vs = 100, 700 m near-surface taper, and finite-fault source parameters

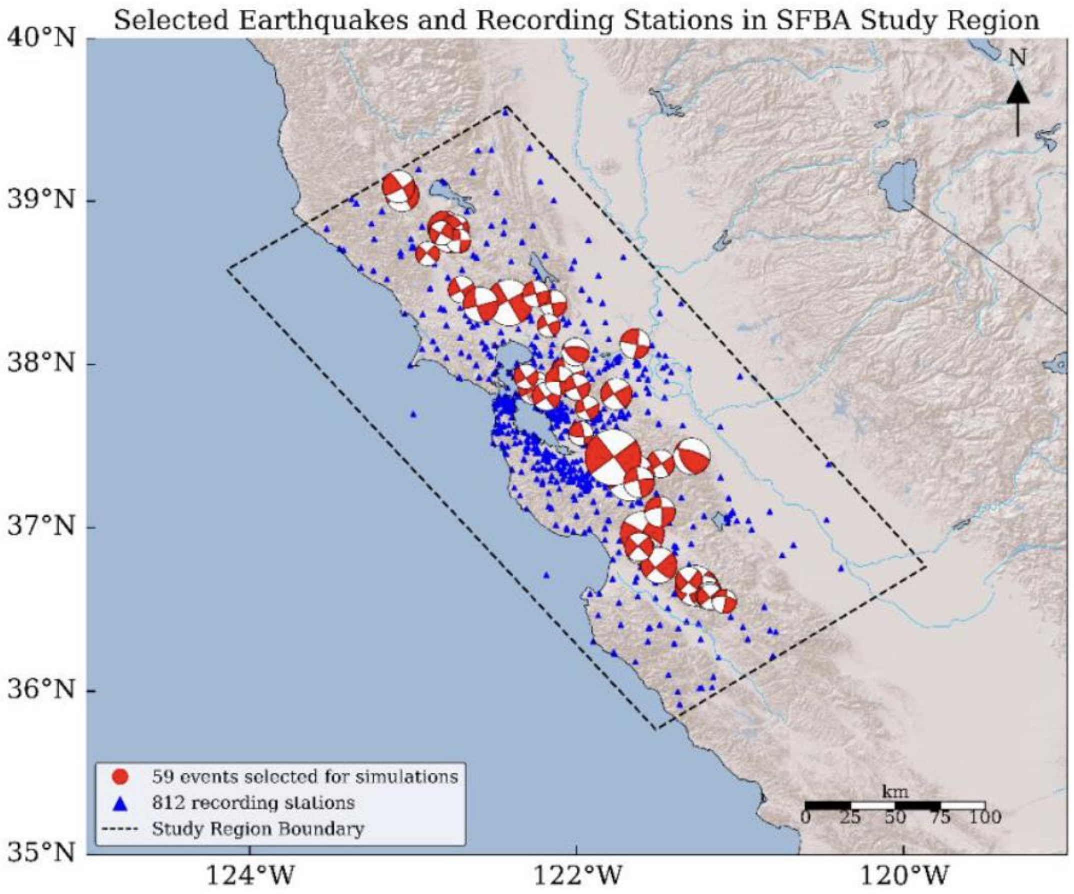
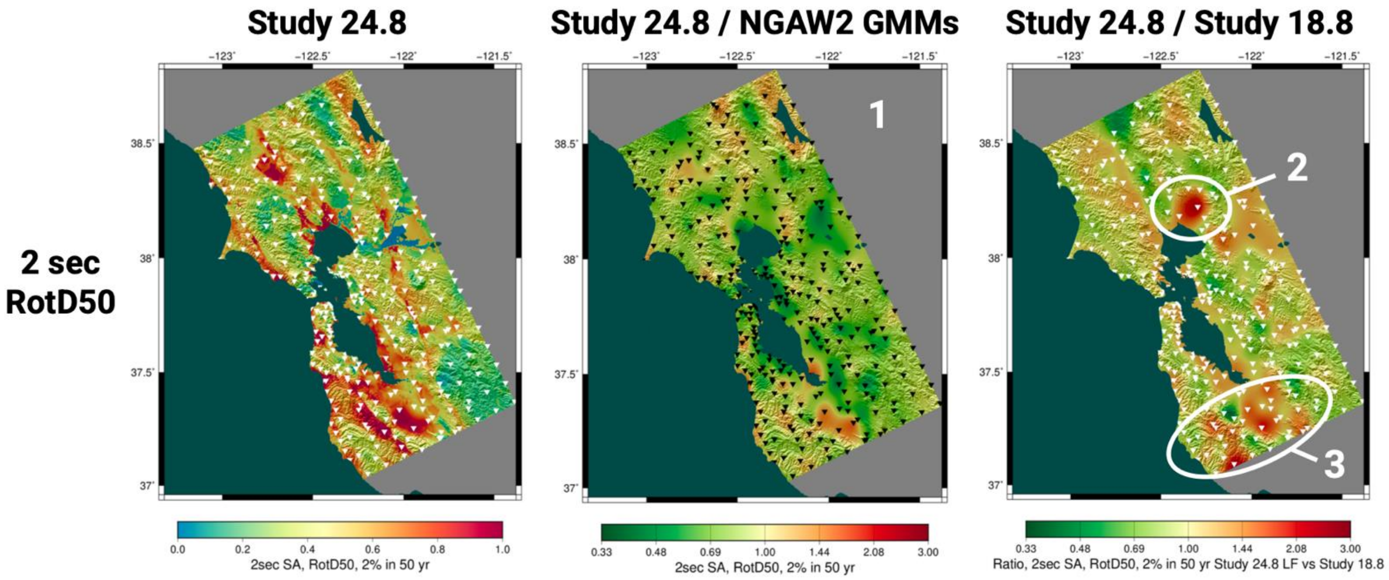


Figure 2: Map showing all recording stations (blue triangle) in the study region from the selected 59 events for simulation (red balls).

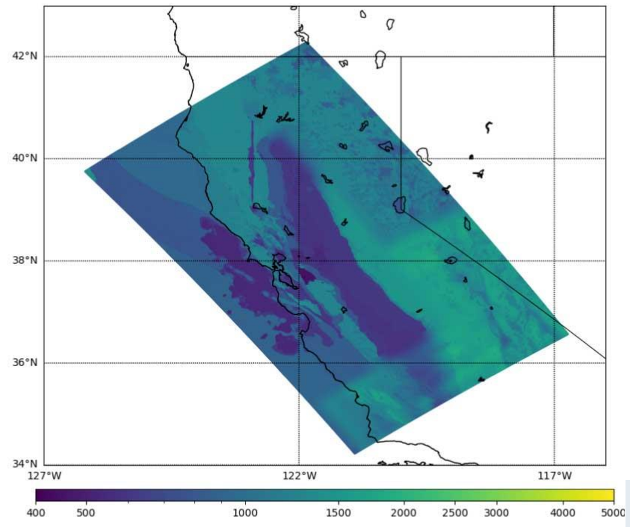
CyberShake Study 24.8 PSHA Model for Northern California

Scott Callaghan et al., Poster #241

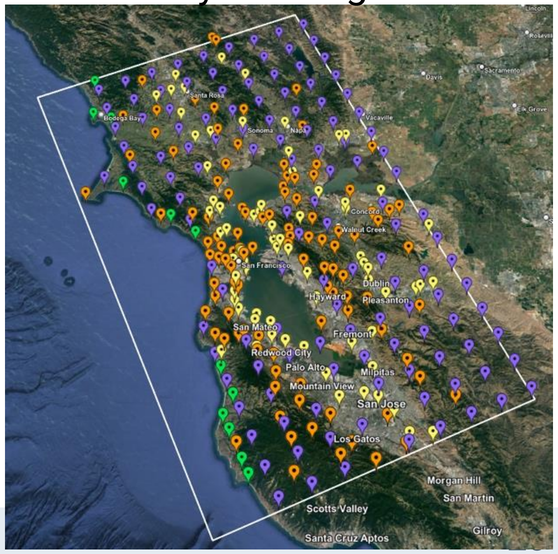
- 3D physics-based PSHA at **315 sites** using Frontier and Frontera; produced **127M seismograms and 34B intensity measures**
- Regional 3D velocity model with improved basin representation; broadband hazard up to **25 Hz** using GPU-enabled AWP-ODC; new outputs include vertical seismograms, response spectra, and duration measures.
- Generally **lower hazard** than CyberShake 18.8 and NGA-West2 GMMs, except **localized higher long-period hazard** in Livermore basin and near San Pablo Bay; ongoing work explores rupture direction effects on site-specific hazard



Hazard curve at SFO (2 sec)



Study 24.8 region



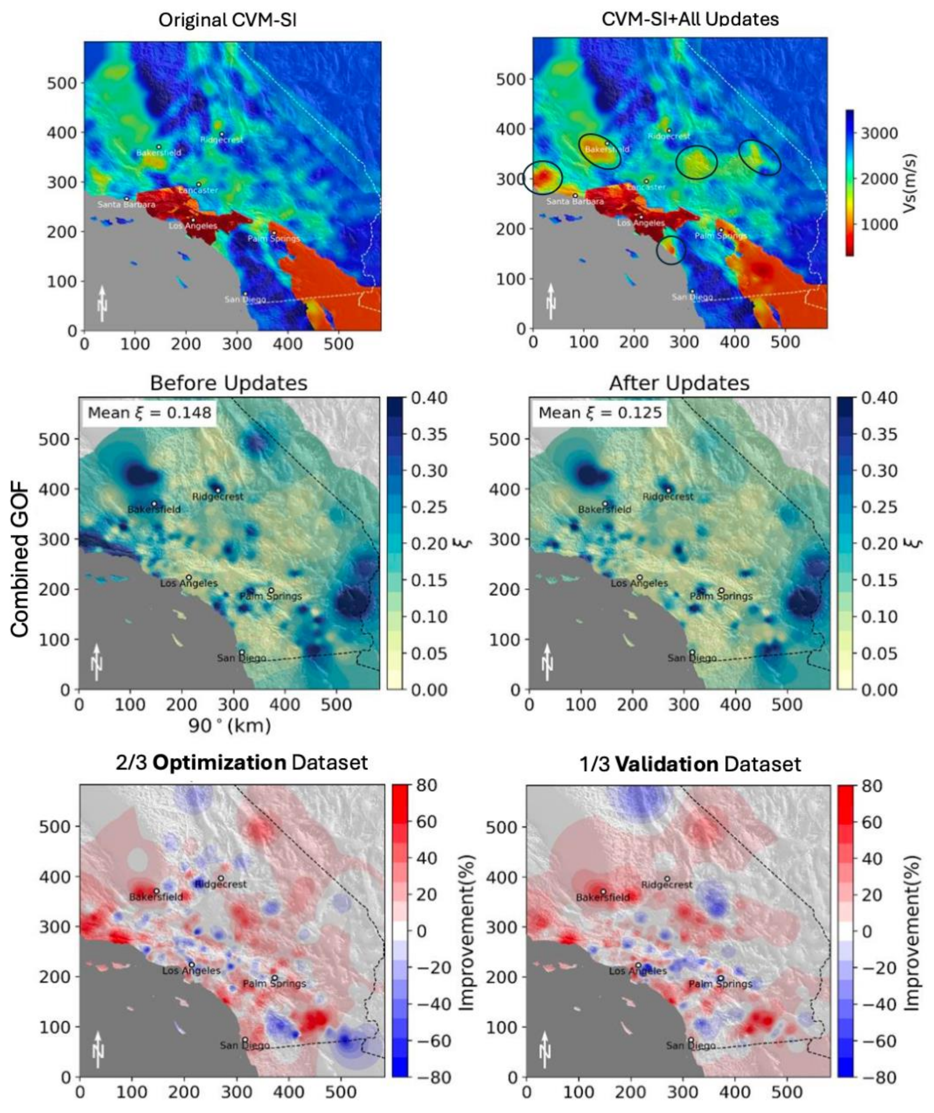
Preliminary Multi-scale Community Velocity Model for Southern California Improves Fit to Seismic Recordings

Kim Olsen & Te-Yang Yeh, Poster #322

- New bias-informed method merges multiple velocity models into a single **3D multi-scale CVM** for Southern California.

- Validation with ~60 M4.2–4.6 events shows 15–32% **reduction in overall bias**; largest improvements (60–80%) in Santa Barbara, Central Valley, High Desert, and Salton Trough.

- Approach retains model sections that fit observations and discards poor ones, yielding better ground motion prediction capability



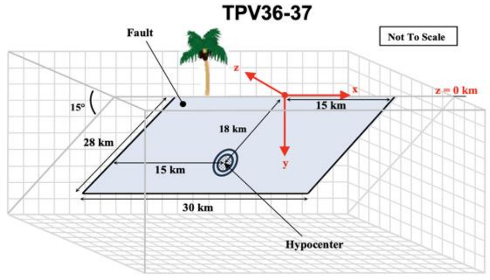
Overall bias reduced by 16%, 32% inside modified areas

Overall bias reduced by 15%, 29% inside modified areas

Workshop: Getting to the Surface of the Dynamic Rupture Problem!

Ruth Harris et al., Poster #162

- A Dynamic Rupture Benchmark **for Shallowly-Dipping Faults Near Earth's Surface** to simulate the complex interactions of sustained rupture propagation occurring very close to Earth's surface
- Workshop involved more than 50 participants, half of whom were students and postdocs
- Eight modeling groups compared; results show strong cross-code agreement
- Recently extended to Tsunami generation in collaboration with **CRESCENT**



Contour plot metrics for tpv36

File: cplot (rupture contour plot)

RMS difference in rupture time (milliseconds)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) barall		84.7	19.7	29.7	38.4	13.1	36.2	75.3
(2) dliu.3	84.7		65.5	60.0	59.5	72.7	54.4	28.2
(3) imran	19.7	65.5		12.3	24.3	10.1	18.0	56.4
(4) kutschera.2	29.7	60.0	12.3		19.4	19.7	7.4	48.3
(5) li.2	38.4	59.5	24.3	19.4		29.7	19.0	48.0
(6) ma	13.1	72.7	10.1	19.7	29.7		25.7	64.0
(7) wzhang.2	36.2	54.4	18.0	7.4	19.0	25.7		42.0
(8) yang.2	75.3	28.2	56.4	48.3	48.0	64.0	42.0	

RMS rupture time difference (ms)

10.1 – 75.3

Contour plot metrics for tpv37

File: cplot (rupture contour plot)

RMS difference in rupture time (milliseconds)

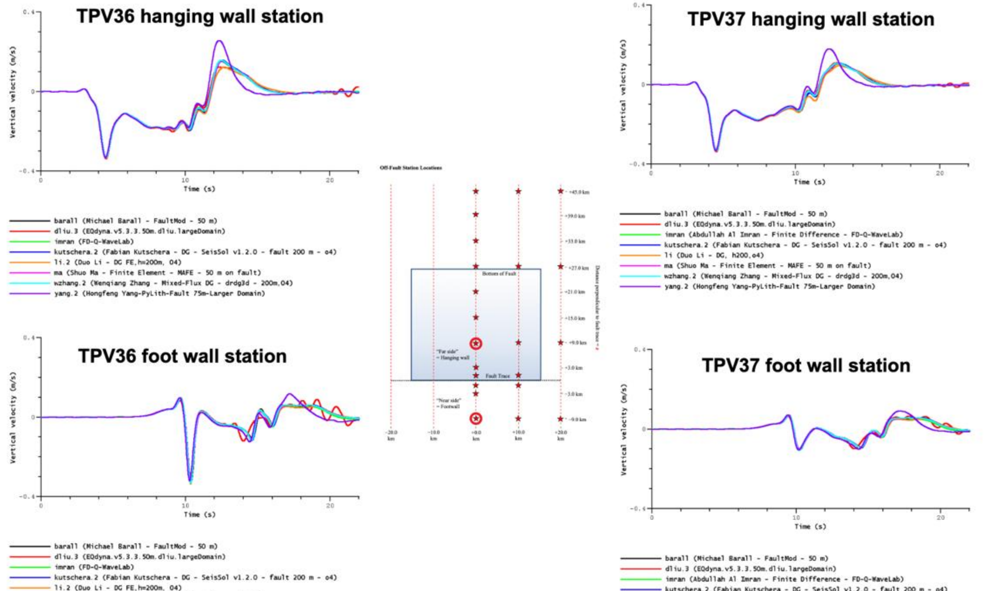
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) barall		82.6	19.7	31.1	31.4	12.8	38.1	76.1
(2) dliu.3	82.6		63.4	56.5	40.9	71.0	50.4	27.1
(3) imran	19.7	63.4		13.4	15.9	10.7	19.6	57.3
(4) kutschera.2	31.1	56.5	13.4		5.8	21.2	7.9	47.7
(5) li	31.4	40.9	15.9	5.8		24.2	4.0	40.0
(6) ma	12.8	71.0	10.7	21.2	24.2		27.7	65.4
(7) wzhang.2	38.1	50.4	19.6	7.9	4.0	27.7		40.7
(8) yang.2	76.1	27.1	57.3	47.7	40.0	65.4	40.7	

RMS rupture time difference (ms)

5.8 – 76.1

Figure 2. Schematic of the benchmark exercises TPV36 and TPV37, the case of a shallowly dipping fault reaching Earth's surface. The fault dips 15 degrees. In TPV36 the rupture is allowed to reach Earth's surface. In TPV37 increased cohesion (relative to TPV36) prevents the rupture from reaching the Earth's surface. The detailed benchmark descriptions are available at https://strike.scec.org/cvws/tpv36_37docs.html

Results from 8 modeler groups - Seismograms *(1 Hz filter)*



Peng Zhai, Yihe Huang, & Jean-Paul Ampuero, Poster #142

- **Dynamic seismic cycle models with off-fault damage** show that weak fault zones generate both large and small earthquakes.
- Interaction of main fault slip with distributed damage produces **cascading sequences** (foreshocks, mainshocks, aftershocks) matching observed magnitude–frequency scaling, invariant stress drop, and fracture energy trends.
- Results suggest many natural fault zones **are intrinsically weak**; monitoring evolving material properties is key for understanding seismic hazard.

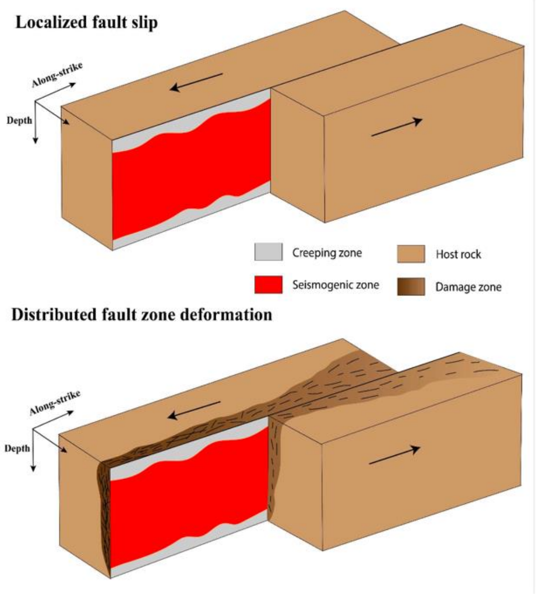
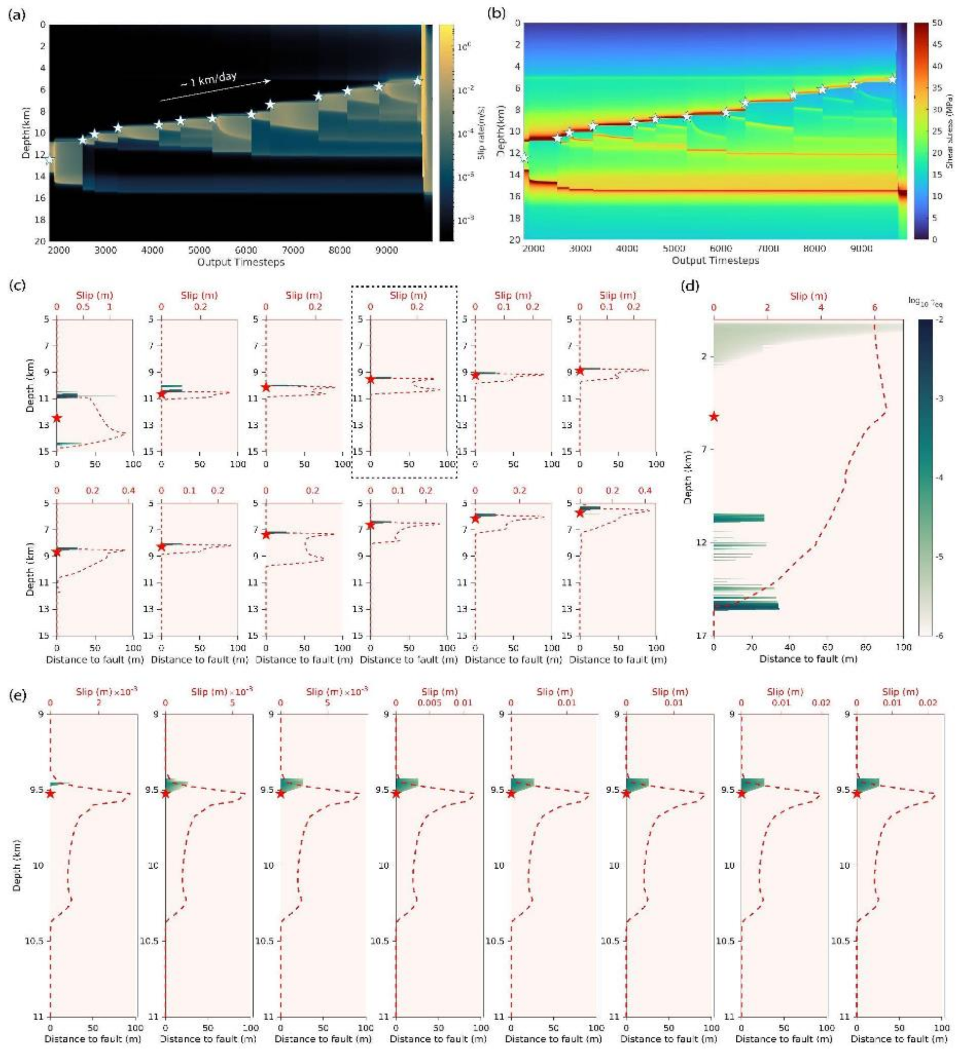


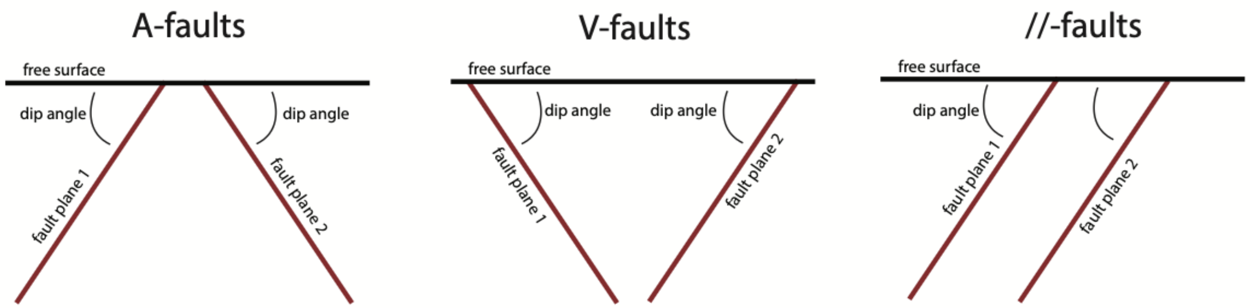
Figure 1. Comparison between classical view-localized (main) fault slip and the coevolution model of (main) fault slip and distributed fault zone damage.

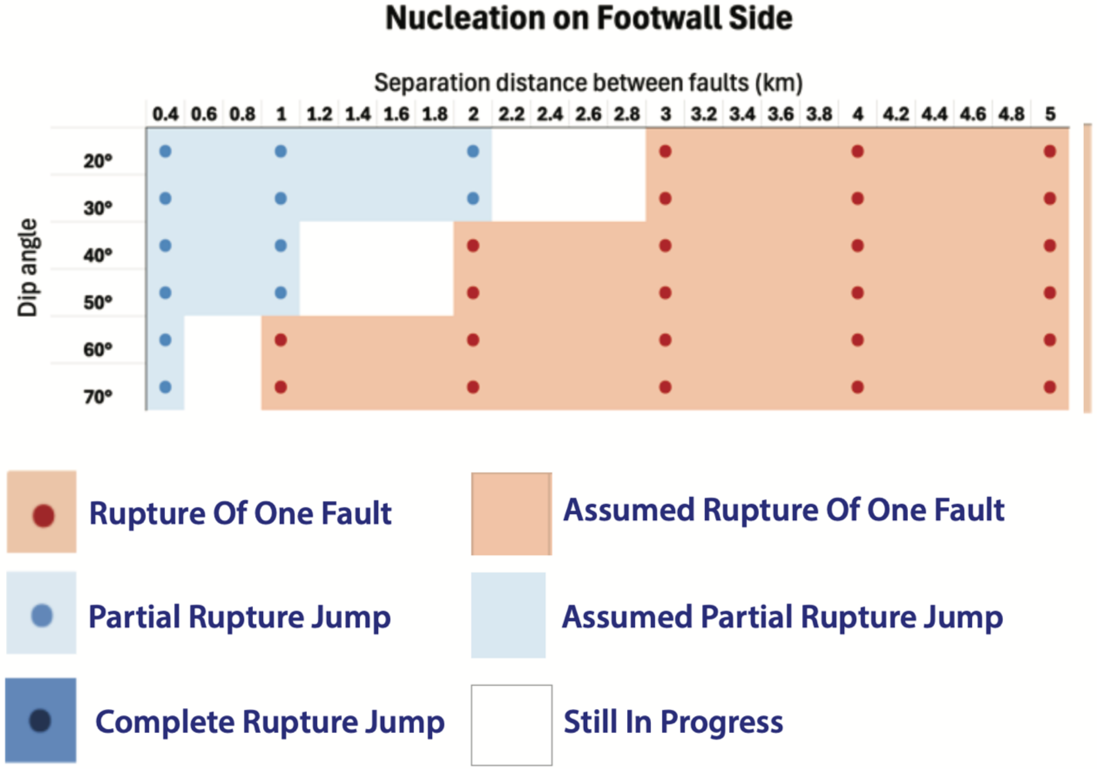


Jumping Rupture Between Parallel Thrust Faults - A Geometrical Parameter Study

William Kalman & Julian Lozos., Poster #169

- Dynamic rupture simulations of parallel thrust faults test how dip angle, separation, and nucleation side control multi-fault rupture
- Hanging-wall nucleations promote rupture jumping across wider separations; footwall nucleations show a simpler pattern, with shallower dips enabling longer jumps
- Hanging-wall results are more complex: shallowest and steepest dips favor jumps, while intermediate dips suppress them; further simulations will test robustness under different stress conditions

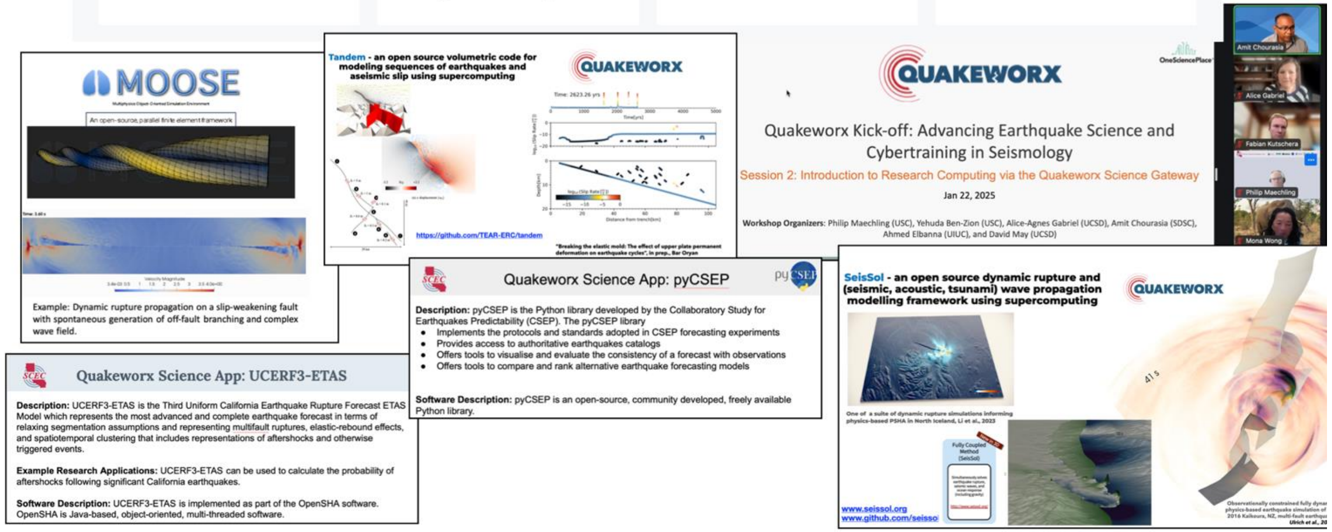




The Quakeworx Science Gateway

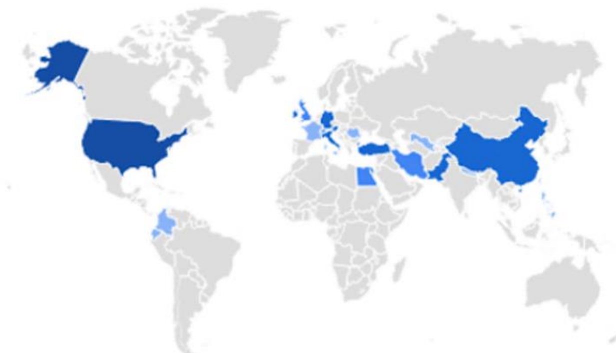
- Amit Chourasia et al., **Poster #304**
- Web-based platform for **running, sharing, and publishing earthquake simulation and data-analysis tools**; supports FAIR and reproducibility
- Curated apps (SeisSol, Tandem, UCERF3-ETAS, pyCSEP, HFQsim, & more) and datasets available; jobs can run on HPC or cloud systems
- Community engagement: 2025 kick-off workshop (65 participants, 16 countries), Tandem Hackathon, integration into teaching; **>1,300 unique visitors**
- Next steps: production launch, user-contributed apps, FAIR publishing with DOIs
- **Early user invited to the Quakeworx gateway**. Visit the website for how to log-in.

Reduce barriers	Catalyze & empower	Scale	Advance Science
to access, expertise, software, compute and data resources.	community wide reuse & sharing of research products.	your research, education and workforce development efforts.	Rupture forecasts, Earthquake physics & Hazard estimates.



Quakeworx Workshop Google Analytics from Jan 21-24, 2025

(over 1,300 visitors worldwide)

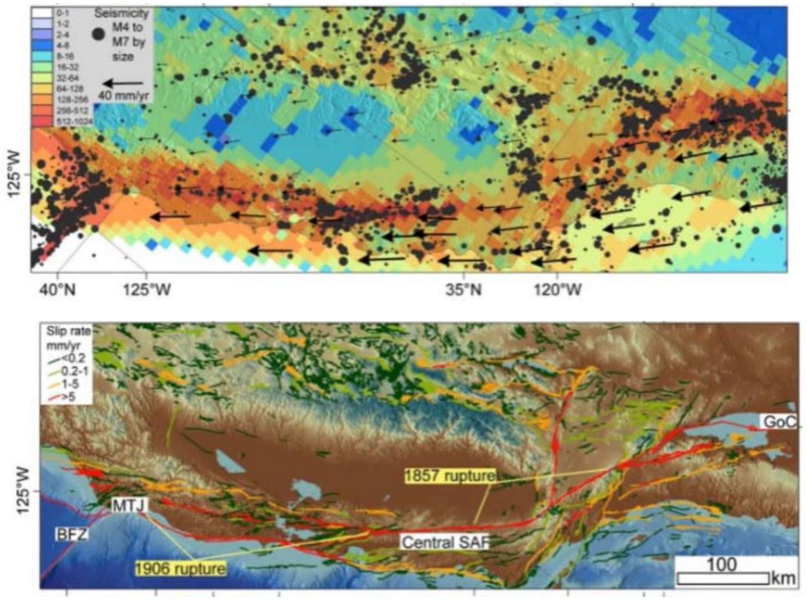


COUNTRY	ACTIVE USERS
United States	1.3K
Germany	5
Austria	4
Ireland	4
China	3
Italy	3
Pakistan	3

SCEC Science Plan: Organized Around Themes

C. Developing advanced modeling frameworks

7. Integrated Tectonic Modeling
8. Coupled Evolution of Earthquakes and Faults
9. Estimates of Seismic Hazard in CA



D. Improving predictive analyses of seismicity

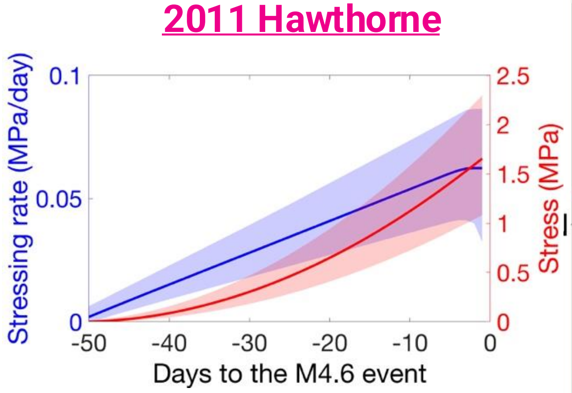
10. Forecasting of Seismicity (“Beyond ETAS”)
11. Tracking preparation processes of large earthquakes
12. Induced seismicity: Opportunities to investigate earthquake physics and test time-dependent forecasting

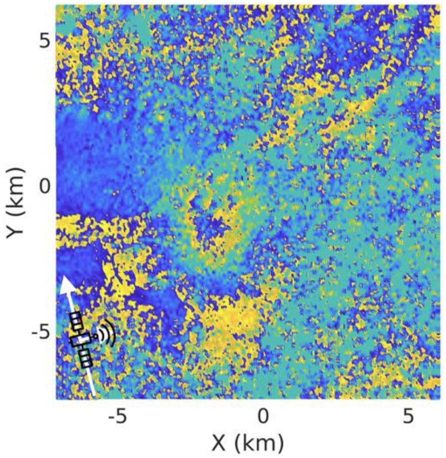
Examining precursory stress changes during earthquake swarms in California and Nevada from seismicity rate observations

- Yu Jiang, & Daniel T. Trugman,
  Poster #212
- Novel Bayesian framework links seismicity rate changes to precursory stress evolution using rate-and-state friction

- Applied to eight swarms in California and Nevada; six show elevated pre-event seismicity with cumulative stress changes of 0.01–2 MPa.

- Independent GPS and InSAR signals support inferred precursory slip, offering new insights into earthquake nucleation physics.





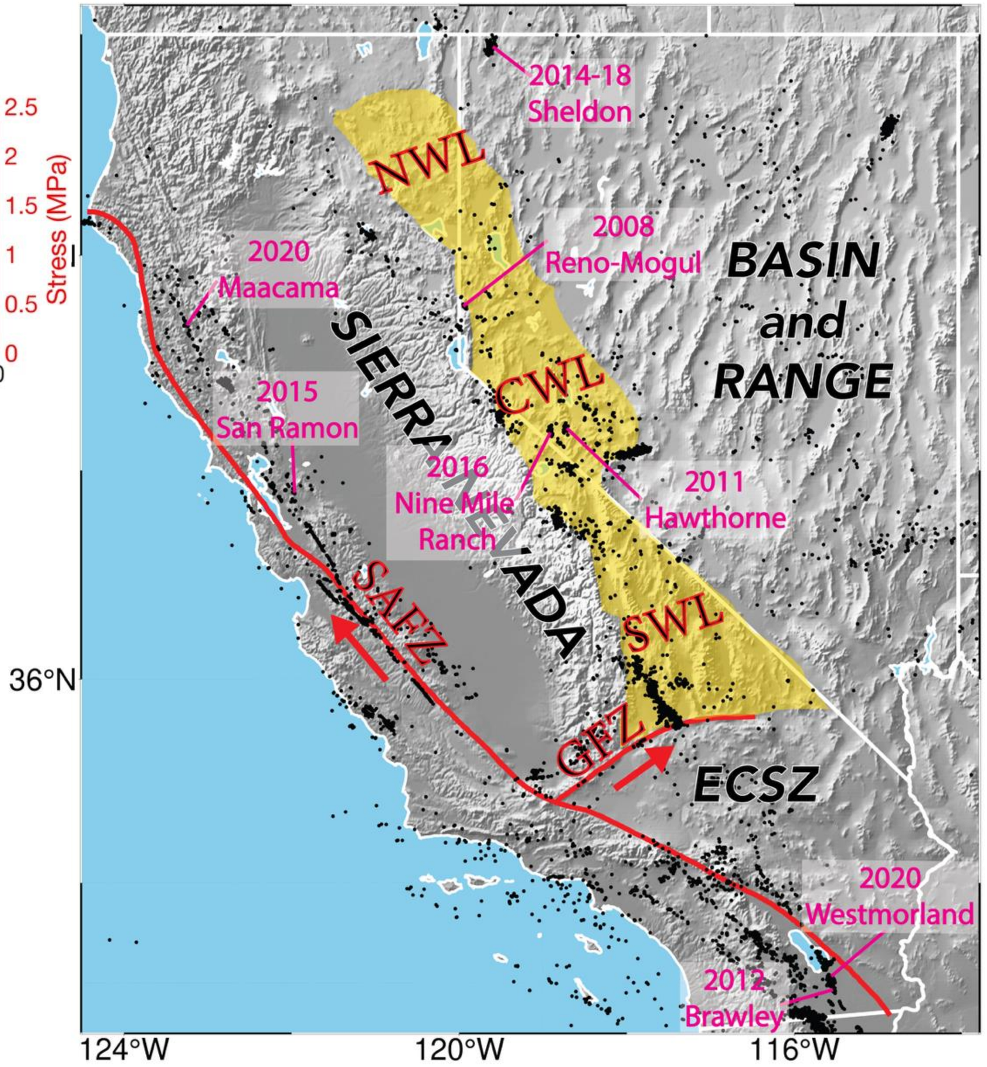


Figure 1: Earthquake swarms with magnitude > 3 in California and Nevada (2004-2024).

Geodetic imaging fault creep over the northern Rodgers Creek Fault and simulating the stabilizing effect of poro-elastic transients from the nearby Geyser geothermal production, Northern California

- Jay Sui Tung & Manoochehr Shirzaei, **SCEC Award #24192**
- Geodetic imaging of the northern Rodgers Creek Fault shows creep rates of 1.9–6.7 mm/yr, lower than neighboring faults, implying limited aseismic strain release and a 32% probability of an M > 6.7 rupture in 30 years.

- Sentinel-1 InSAR (2015–2023) reveals up to 10 mm/yr subsidence over The Geysers; additional analyses with ALOS2 and improved atmospheric corrections are underway to refine creep estimates

- Finite-element poroelastic models incorporating geothermal production wells indicate negative Coulomb stress changes on the southern Rodgers Creek Fault, suggesting **geothermal activity may stabilize fault slip.**

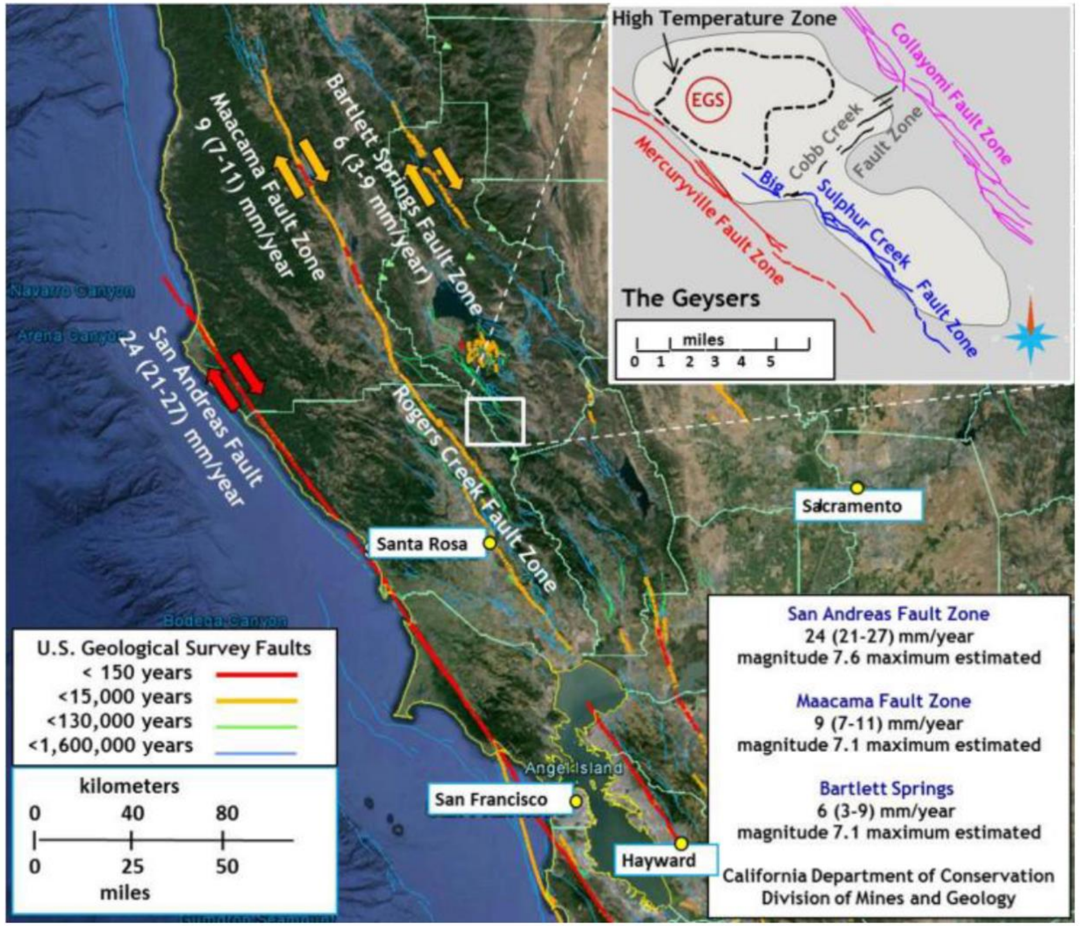


Figure 1. Overview of seismic hazard and creep rate over the fault systems in the Northern California surrounding Geyser geothermal site (Hartline et al., 2019).

Workshop: Collaboratory for the Study of Earthquake Predictability (CSEP)

https://www.scec.org/events/2024-scec-csep-workshop/

- Maximilian Werner, Sam Stockman, Weixi Tian, & Yongxian Zhang, **Poster #208**
- State of CSEP & New Frontiers:
- Neural network–based forecasts benchmarked with the new **EarthquakeNPP** dataset (quality-controlled catalogs + ETAS baseline).
- Forecasting less routinely reported forms of fault slip, e.g., **low-frequency earthquakes** along the creeping San Andreas segment
- Benchmark database of ten years of prospective next-day earthquake forecasts in California: **over 50,000 daily forecasts generated by 25 models between 2007 and 2018;** Serafini et al. (2025) includes the database, analysis tools and a tutorial for benchmarking new models

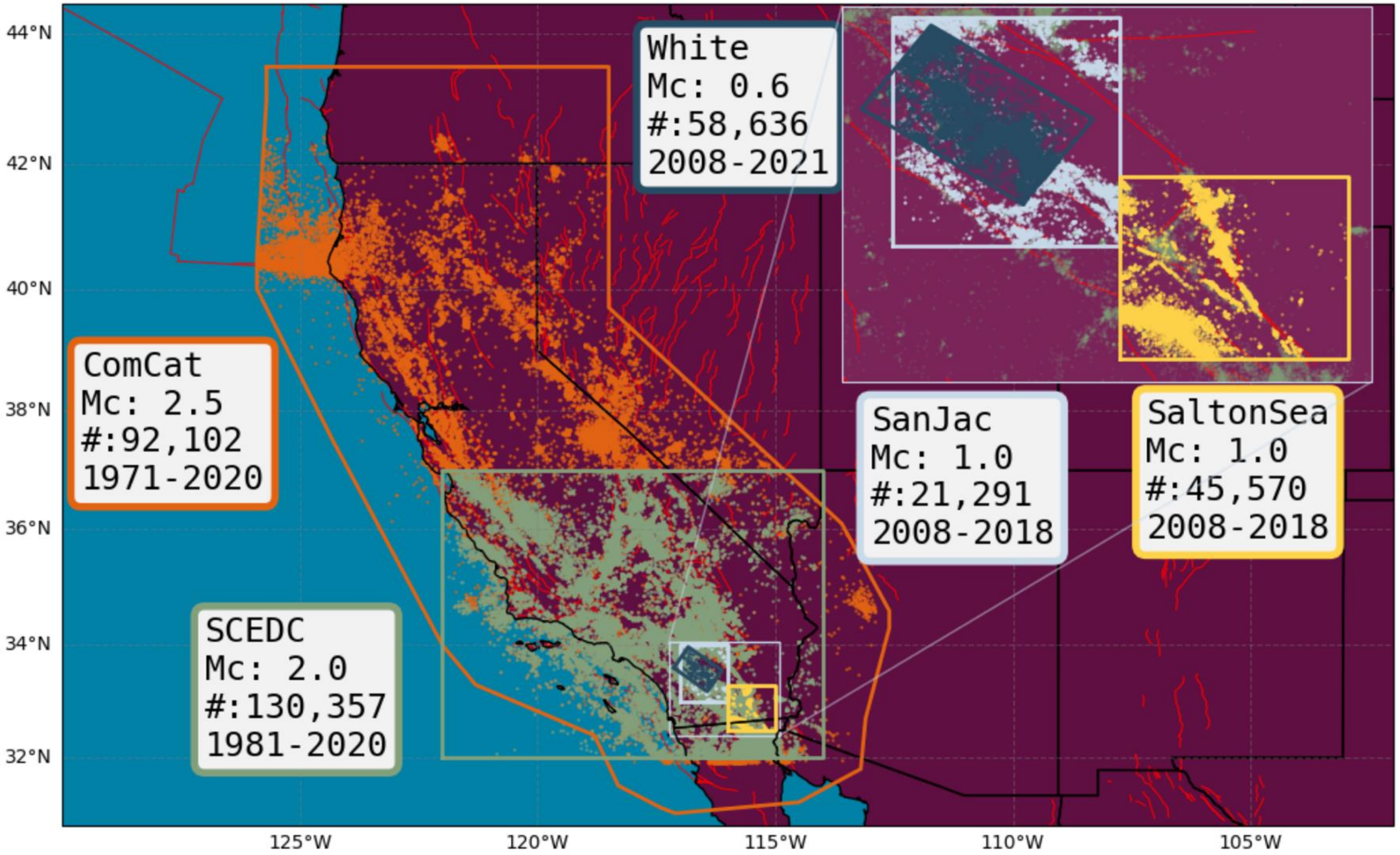


Figure 3: Illustration of the EarthquakeNPP benchmark datasets developed for earthquake forecasting with neural point processes along with a credible baseline ETAS model (taken from Stockman et al. 2024, in review).

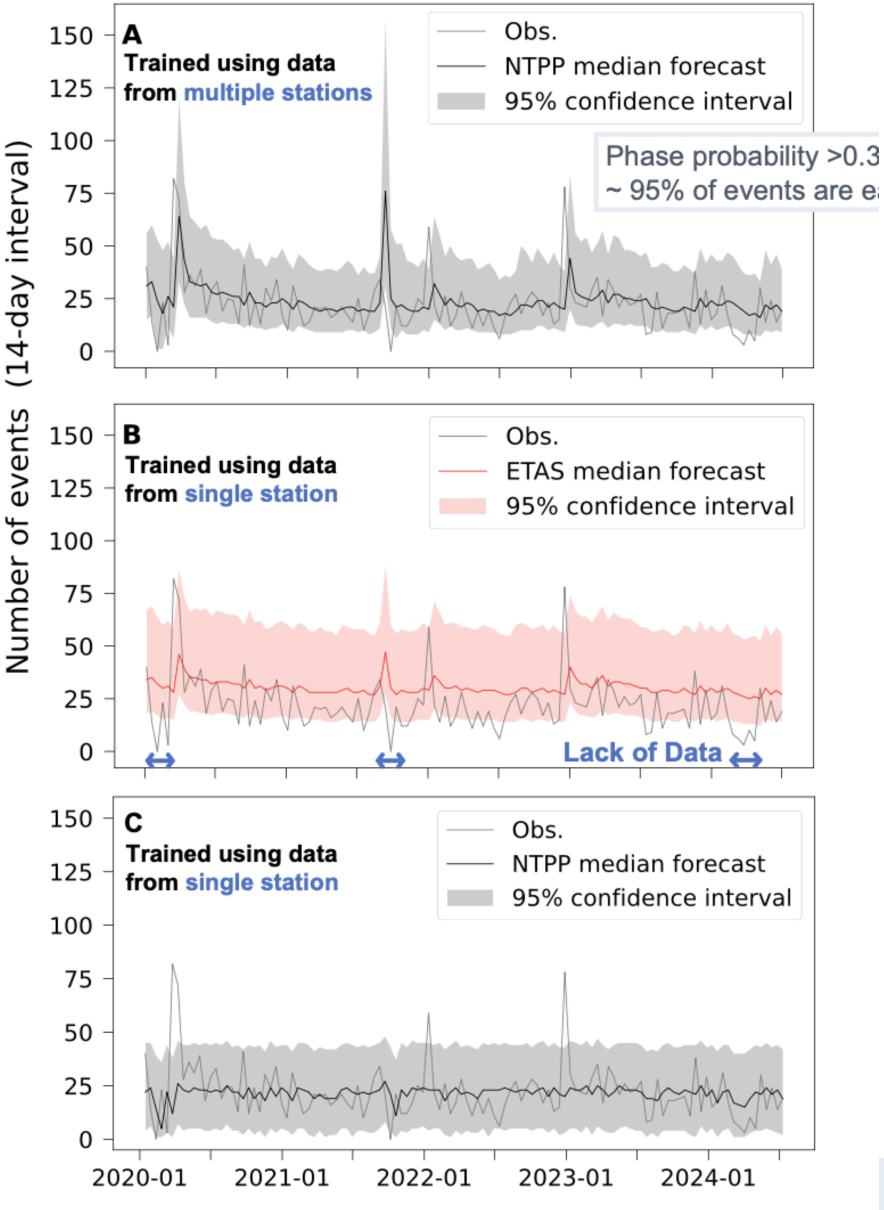
Earthquake Forecasting Using Single-Station Waveform Detection Without Reliance on Event Catalogs

- Yuriko Iwasaki, Emily Brodsky, & Kelian Dascher-Cousineau, **Poster #199**
- Forecasting earthquakes directly from waveforms captures information lost in traditional catalogs, including small/undetected events.
- Single-station PhaseNet detections provide phase picks, hypocenters, and magnitudes, integrated into RECAST deep-learning forecasting.
- Proof-of-concept shows performance comparable to catalog-based RECAST, with added potential in poorly instrumented regions.

Results

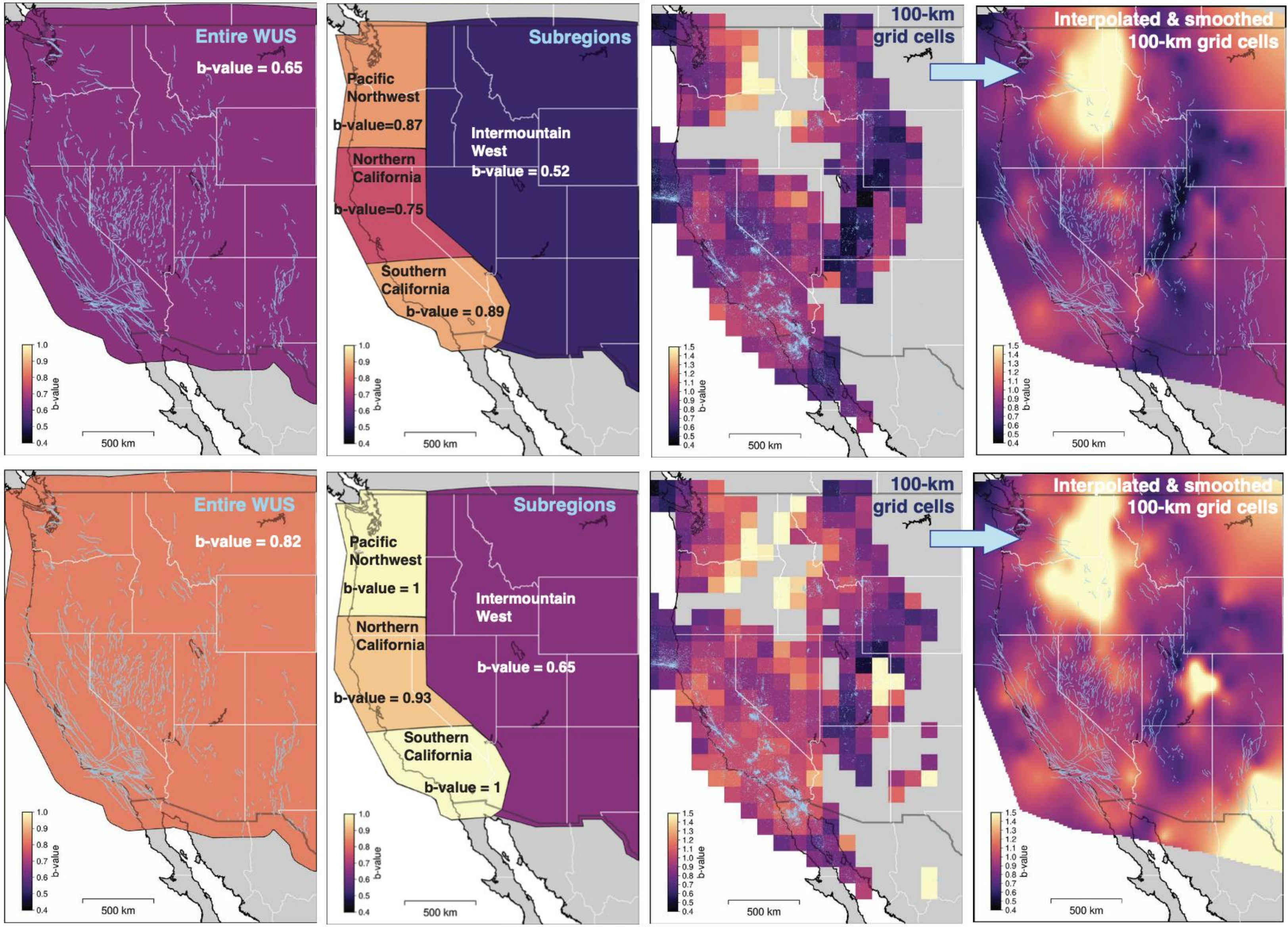
Single-station prediction is effective.

- RECAST surpasses ETAS.
- Multi-station training outperforms single-station training
  - Even when the stations are in close proximity



Spatial variability of b-values in the western United States: Implications for seismic hazard modeling

- Heather Crume, Jessica Velasquez, & Jochen Woessner, **Poster #195**
- Comparative analysis at three scales (regional, subregional, 100 km grid) shows **strong spatial variability in b-values** across the Western US
- A single regional b-value (0.65–0.82) obscures **significant heterogeneity**; subregions and grids reveal irregular zones tied to tectonic structure
- Using the b-positive method avoids completeness estimates; results stress need for **adaptive, data-driven zonation in PSHA**



SCEC Workshop: Earthquakes and Related Hazards in the Santa Barbara-Ventura Area

Commemorating the 1925 Santa Barbara Earthquake

https://www.scec.org/events/2025-santa-barbara-earthquake-workshop/

Date: June 29-30, 2025
Location: University of California, Santa Barbara
Workshop Organizers: Chen Ji (UCSB), Craig Nicholson (UCSB) and Tom Rockwell (SDSU)
SCEC Award: 25139

- Craig Nicholson, Chen Ji, Larry D. Gurrola, Marc J. Kamerling, Christopher C. Sorlien, & Kaj M. Johnson, **Poster #331**
- Centenary of **1925 M6.5 Santa Barbara earthquake** to integrate geology, seismology, geodesy, and modeling to reassess hazards in the Santa Barbara–Ventura region
- Field trip incl. uplifted terraces, tsunami deposits, fault scarps, downtown damage tour
- Science sessions incl. seismic & tsunami hazards, 3D fault geometry, uplift/subsidence patterns, dynamic rupture modeling

SCEC 2025 Budget

In 2025, SCEC received funding from the NSF, USGS, DOE, NASA and PG&E to support the annual SCEC Collaboration Plan. To align with sponsors' priorities and contract terms, SCEC matches funded proposals to the most suitable prime award.

We achieved a balanced budget and create an impactful project portfolio for 2025, while maintaining scientific continuity with limited funding.

2024

$2,921,525 requested

89 proposals
126 investigators

$2,066,529 funded

69 proposals
includes 25 multi-PI projects, 37 single PI projects, 6 workshops, and 1 skills training

110 investigators
includes 442 (non-unique) project participants. Projects involving: ECRs (52%), grad students (58%), ugrads (16%), and RPU/MSI/PUI (32%).

2025

$3,835,414 requested

117 proposals
160 investigators

$1,932,377 to fund

72 proposals
includes 36 multi-PI projects, 29 single PI projects, 7 workshops, and 0 skills trainings

111 investigators
includes 451 (non-unique) project participants. Projects involving: ECRs (61%), grad students (51%), ugrads (18%), and RPU/MSI/PUI (38%).

2026

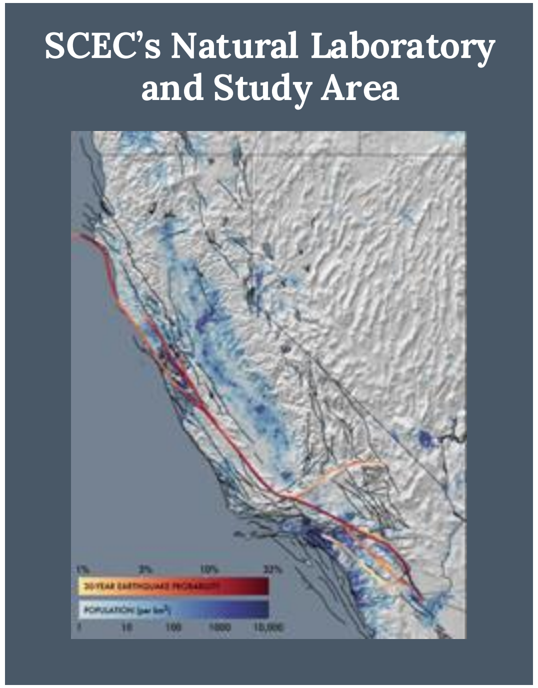
$TBD requested

TBD proposals
TBD investigators

Funding Sources for the 2025 SCEC Collaboration Plan

NSF	Y2/3	$659,670
USGS	Y2/2	$733,653
DOE	Y3/3	$250,000
NASA	Y2/3	$161,638
PGE	N/A	$130,434

Projects recommend for funding include:



Of those with a specific **geographic focus**:

- 15 focused on **Northern California/Nevada**
- 6 focused on **Southern California**

9 projects that feature **machine learning for earthquake science applications** spanning: ground motion prediction, earthquake forecasting, fault structure from seismicity, landform mapping, …

Projects recommend for funding include:

RESEARCH ARTICLE | DECEMBER 17, 2024 Early Publication

SCEC/USGS Community Stress-Drop Validation Study: How Spectral Fitting Approaches Influence Measured Source Parameters

Elizabeth S. Cochran; Annemarie Baltay; Shanna Chu; Rachel E. Abercrombie; Dino Bindi; Xiaowei Chen; Grace A. Parker; Colin Pennington; Peter M. Shearer; Daniel T. Trugman

+ Author and Article Information

Bulletin of the Seismological Society of America (2024)
https://doi.org/10.1785/0120240140 Article history

7 workshops (at $86,614):

- Community Stress Drop Validation Project
- Dynamic rupture and fault friction
- Santa Barbara-Ventura Area Science Workshop & Field Trip
- Integrating friction into the Community Rheology Model
- Earthquake rupture and creep in shallow earth materials
- Statewide Geologic Framework and Community Thermal Models
- CSEP Workshop: Physics-Based Earthquake Forecasting

SCEC Statewide California Earthquake Center

Thank you!