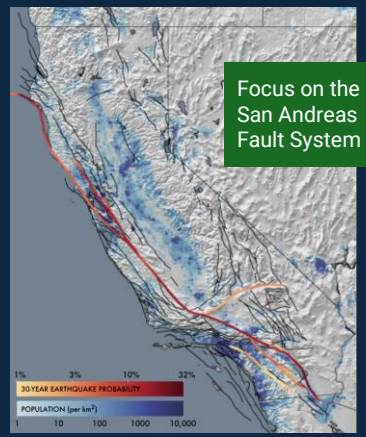
Statewide California Earthquake Center

A collaborative research and education hub that brings together experts across geoscience and related fields (started in 1991 as the Southrern CA EQ. Center)

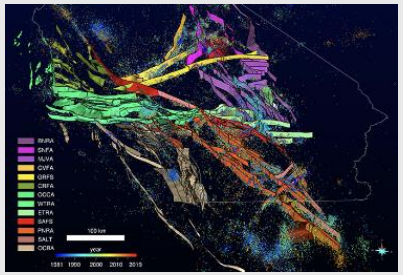
SCEC is a consortium of about 100 institutions and a **community of over a thousand individuals**, guided by diverse leadership teams to fulfill the Center's mission.

SCEC's mission is to develop and share cutting-edge earthquake system science to enhance the resilience of society and to educate & inspire future scientists.

SCEC's Natural Laboratory and Study Area



Earthquake System Science and Innovation



SCEC integrates new research and technologies to enhance predictive system-level models and simulations to synthesize knowledge and quantify seismic hazards.

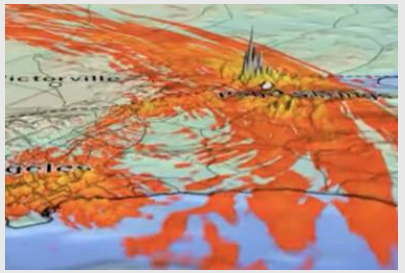
Education and Workforce Development

SCEC prepares the next generation of scientists through transformative research experiences, community building, and professional skills development.

Outreach and Community Engagement

SCEC engages stakeholders across geoscience and related fields through workshops, drills, and collaborations to advance earthquake science, education, and preparedness.

Earthquake Preparedness and Risk Reduction



SCEC bridges the gap between cutting-edge science and preparedness for a more resilient California, through education, research, and more realistic earthquake simulations.

www.SCEC.org

U.S. National Science Foundation

USGS science for a changing world

U.S. DEPARTMENT OF ENERGY

NASA

FEMA

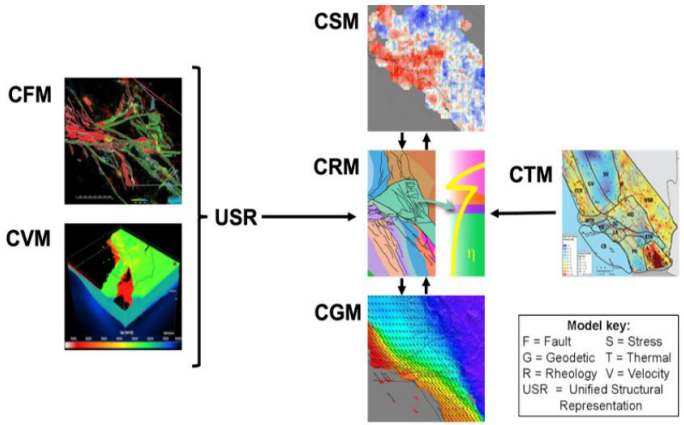
Cal OES GOVERNOR'S OFFICE OF EMERGENCY SERVICES

PG&E

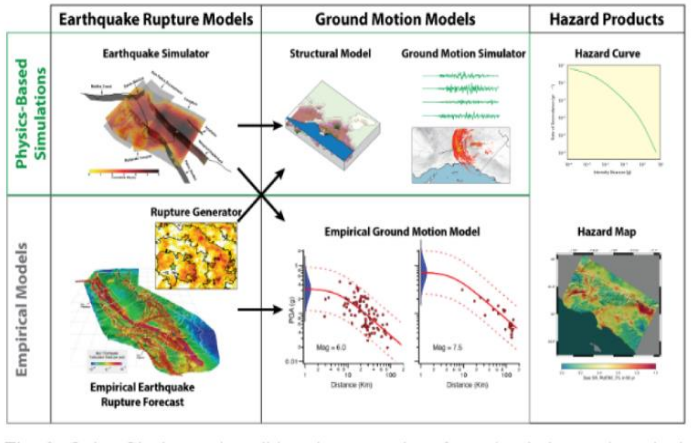
USC

Products and Activities (highlights)

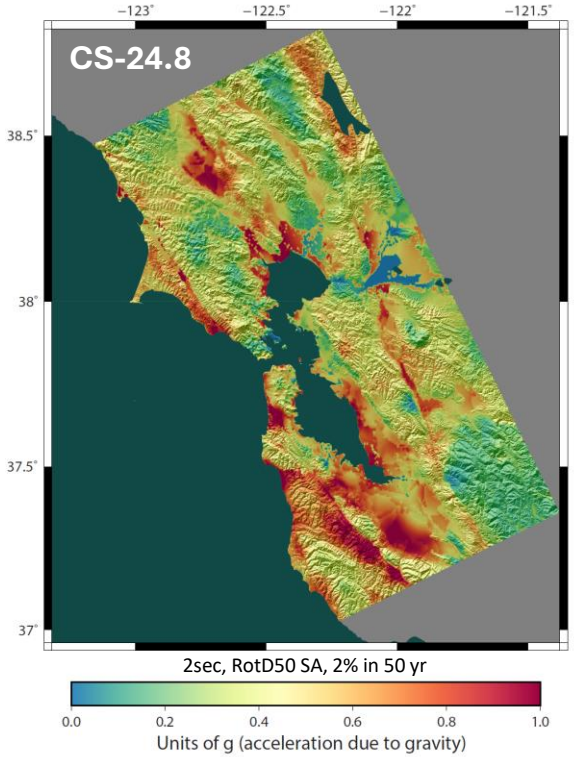
Community Earth Models



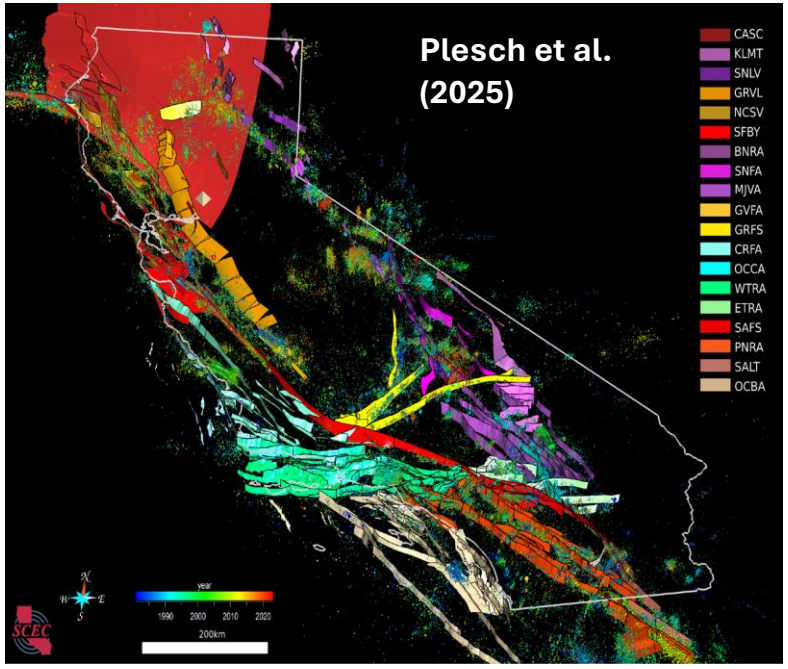
Computer Simulation platforms



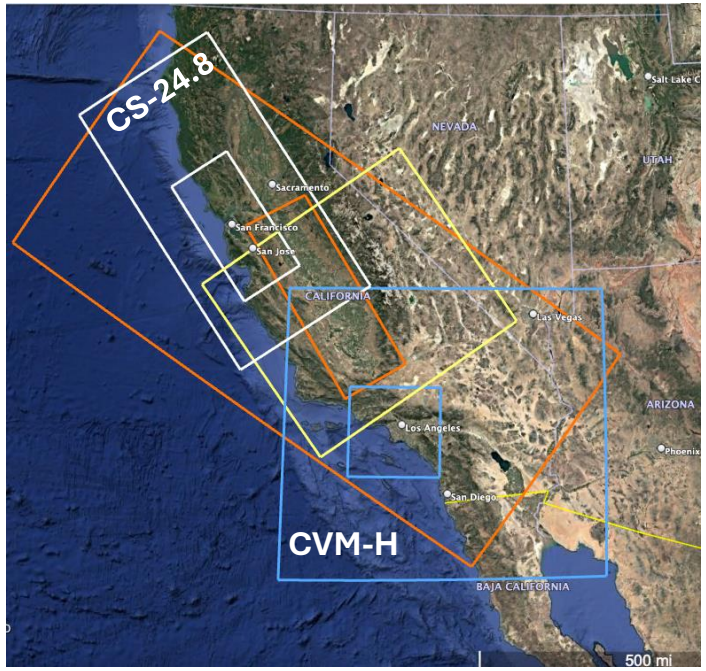
Seismic Hazard models



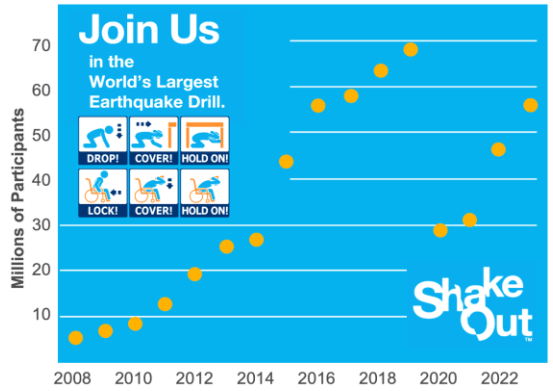
CFM



CVM

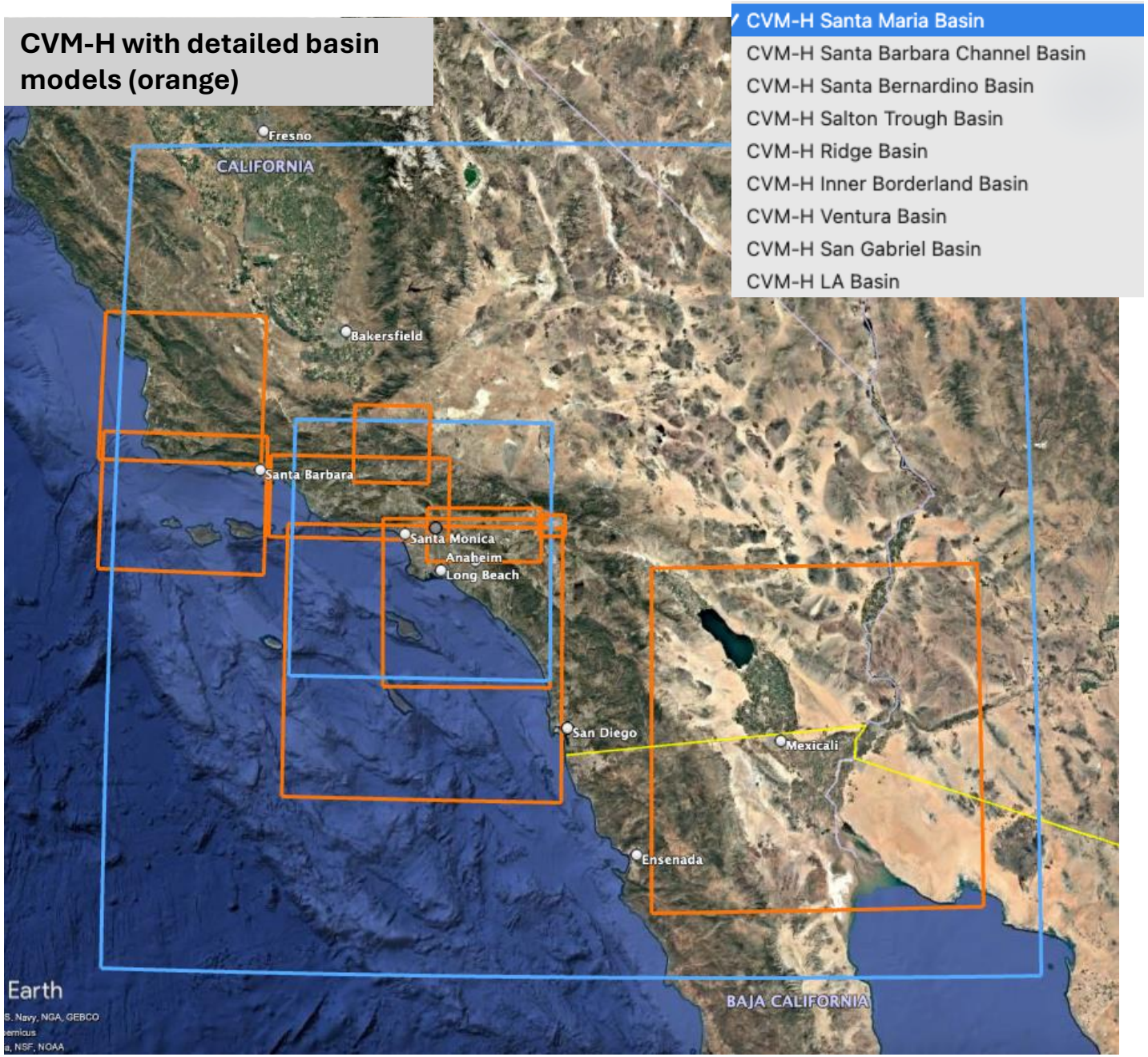


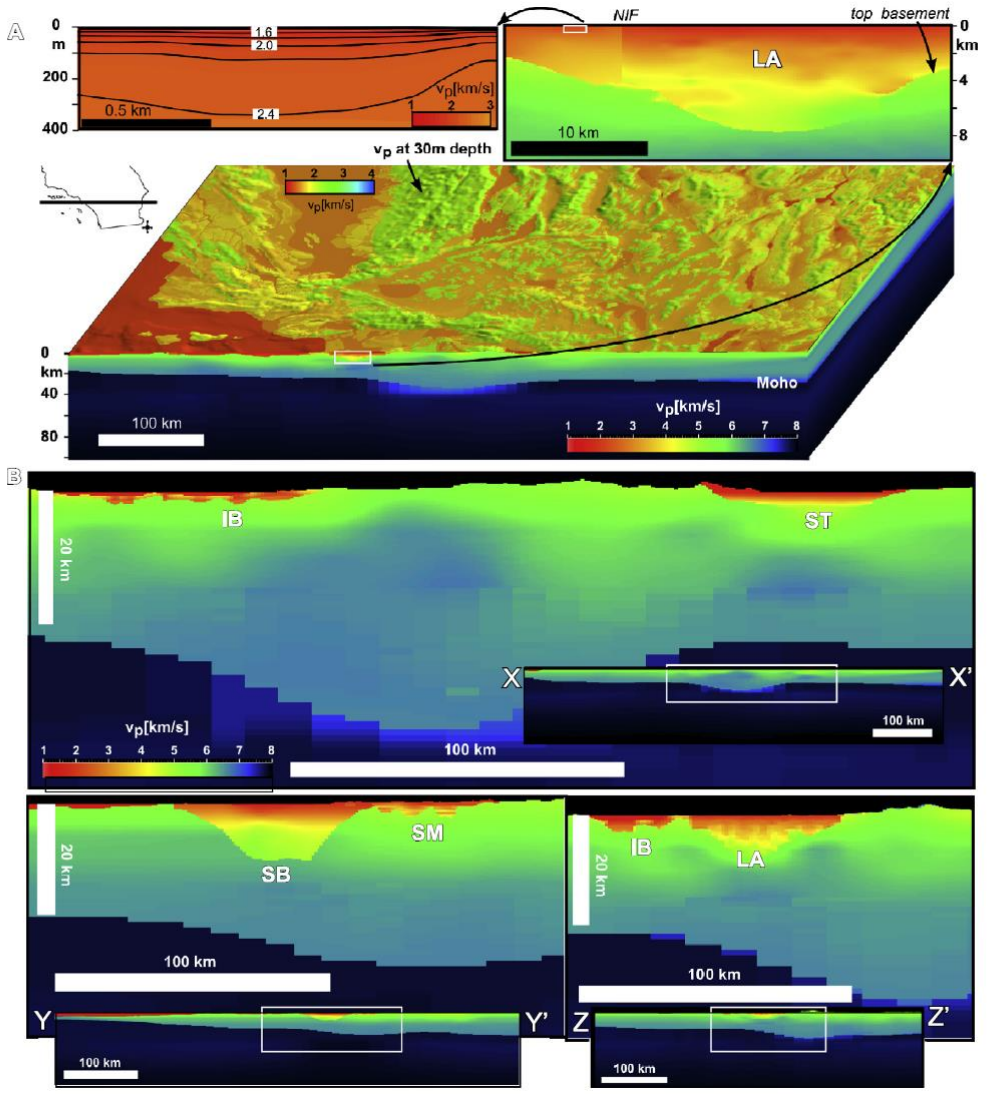
Community preparedness & education



Unified Structural Representation of southern California crust and upper mantle (Shaw et al., EPSL, 2015)

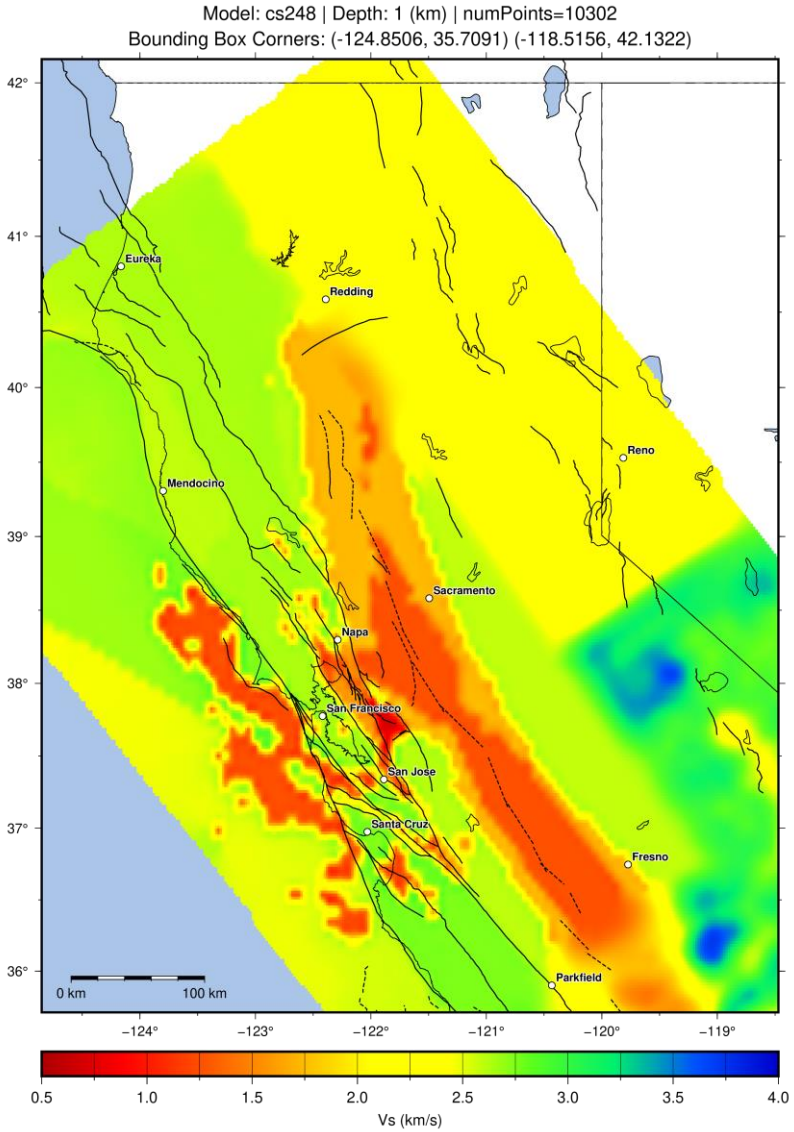
CVM-H with detailed basin models (orange)



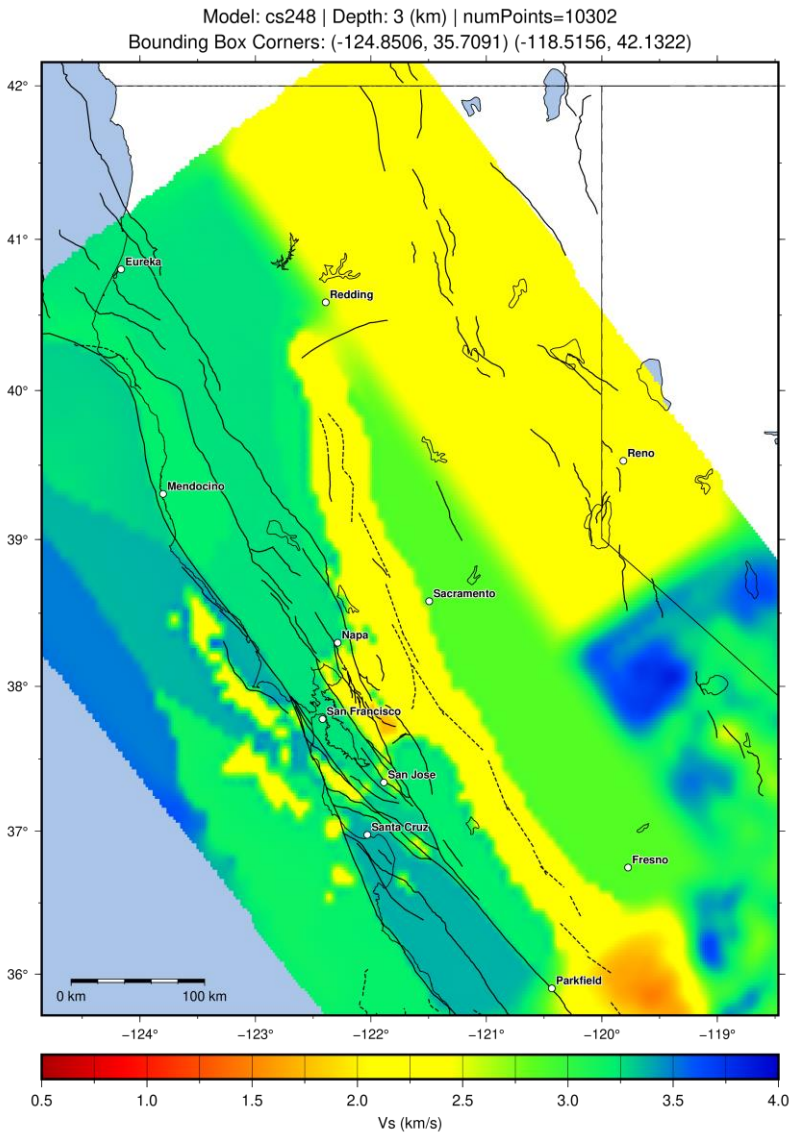


Additional detailed basin structures in SCEC CVMs: Imperial Valley, Coachella Valley, Sacramento valley

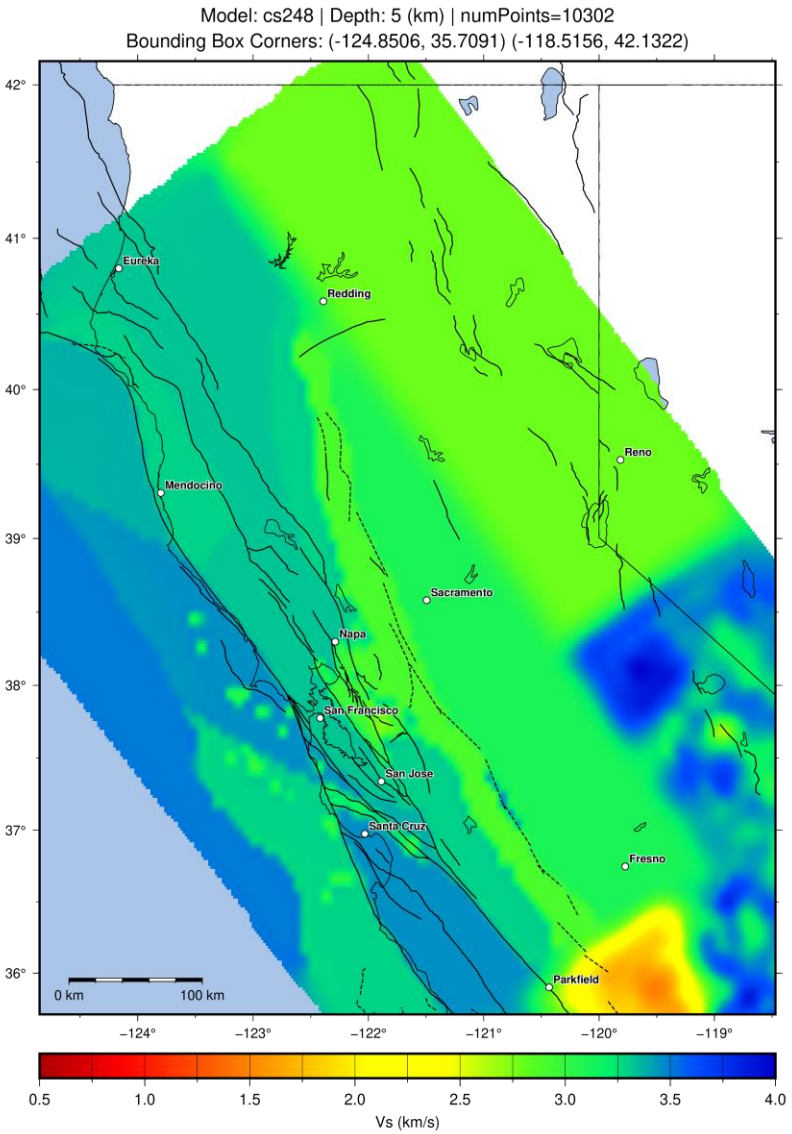
CyberShake 24.8 Model for the SF bay area (based on the USGS SF Bay v21.1 model)



Vs at 1km

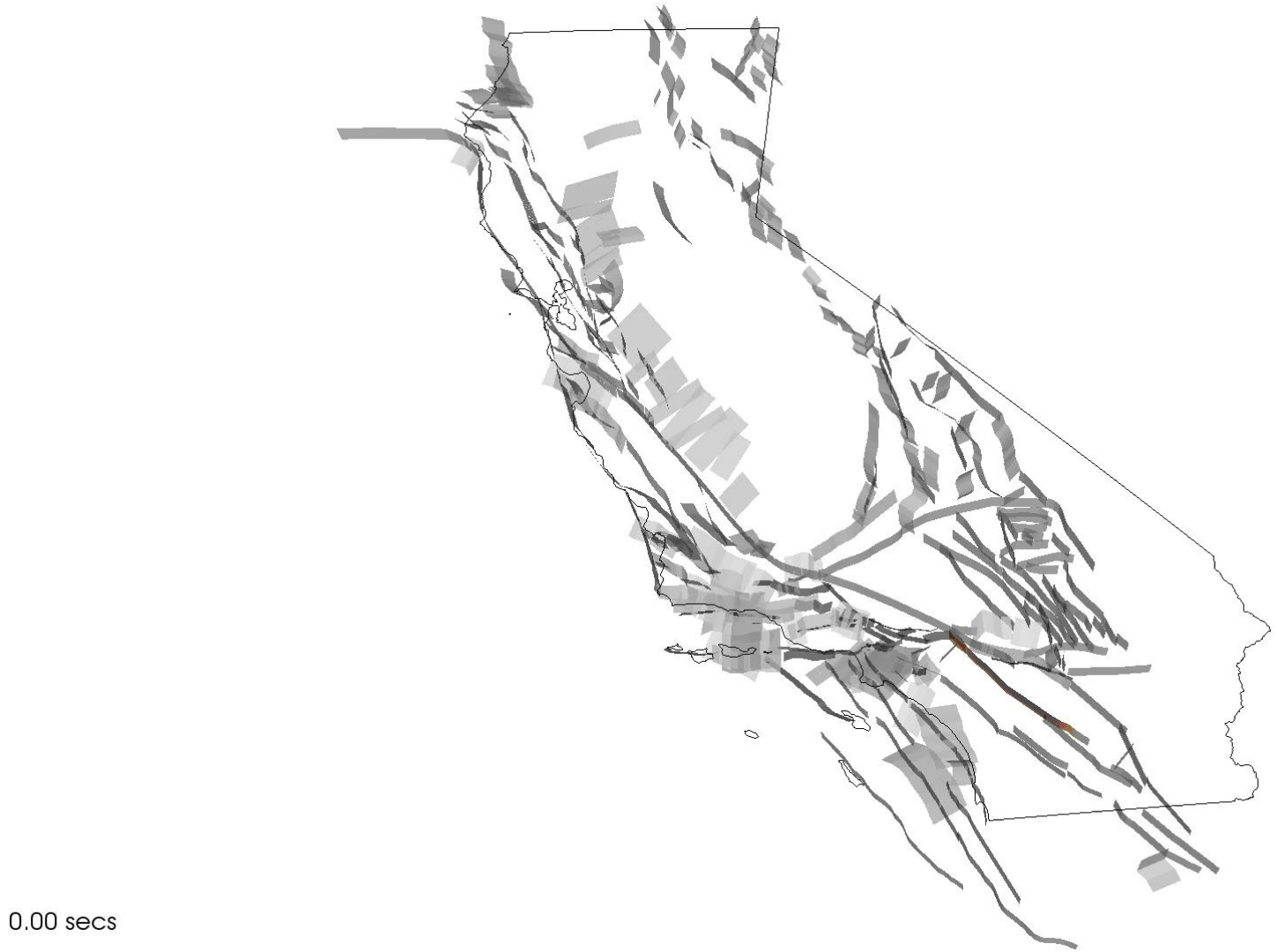


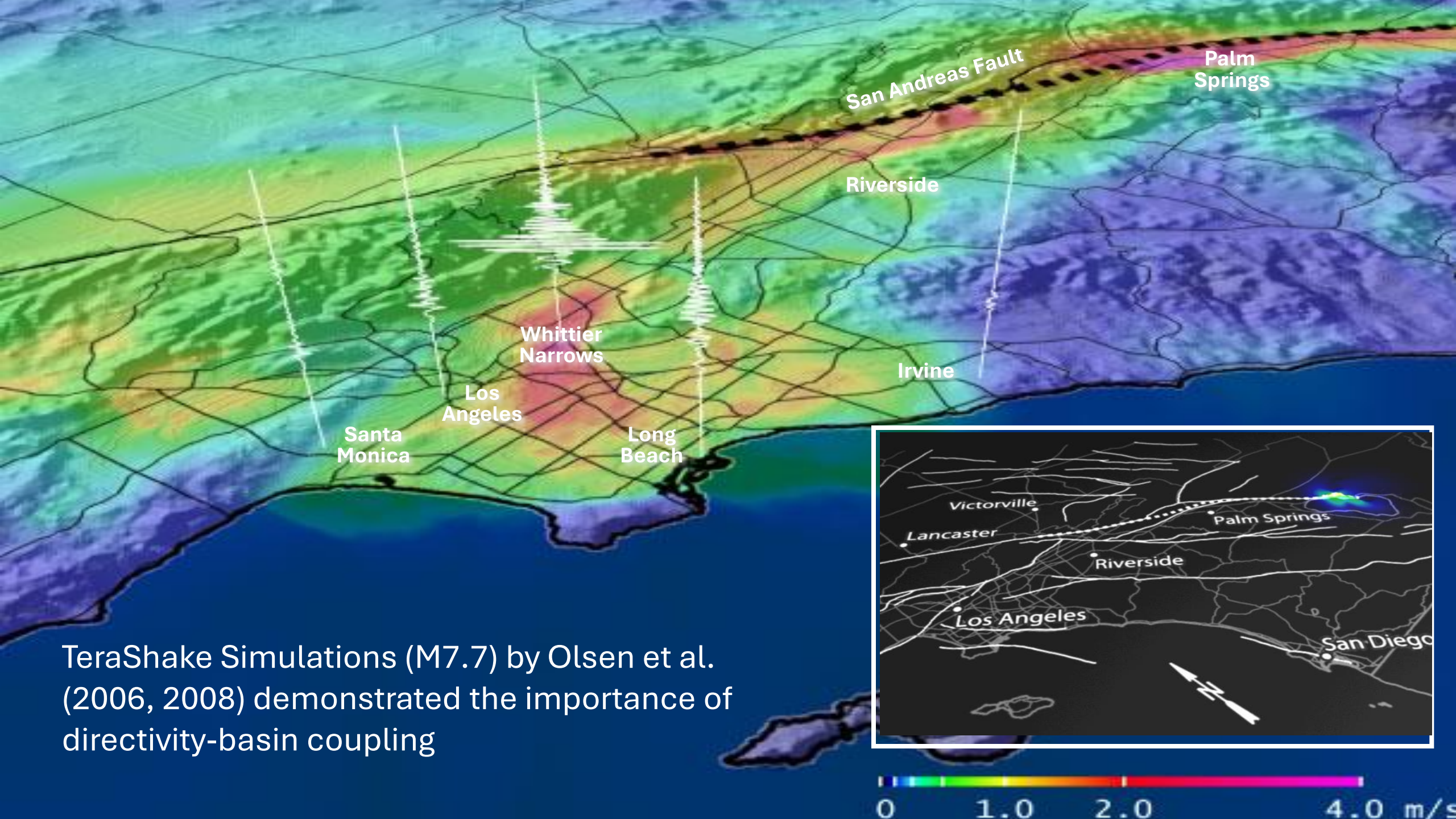
Vs at 3km



Vs at 5km

Simulated 800,000 Years of California Earthquake History to Pinpoint Risks (SCEC group led by K. Milner). HPCwire Editors' Choice Award for "Best use of HPC in Physical Sciences", 2021





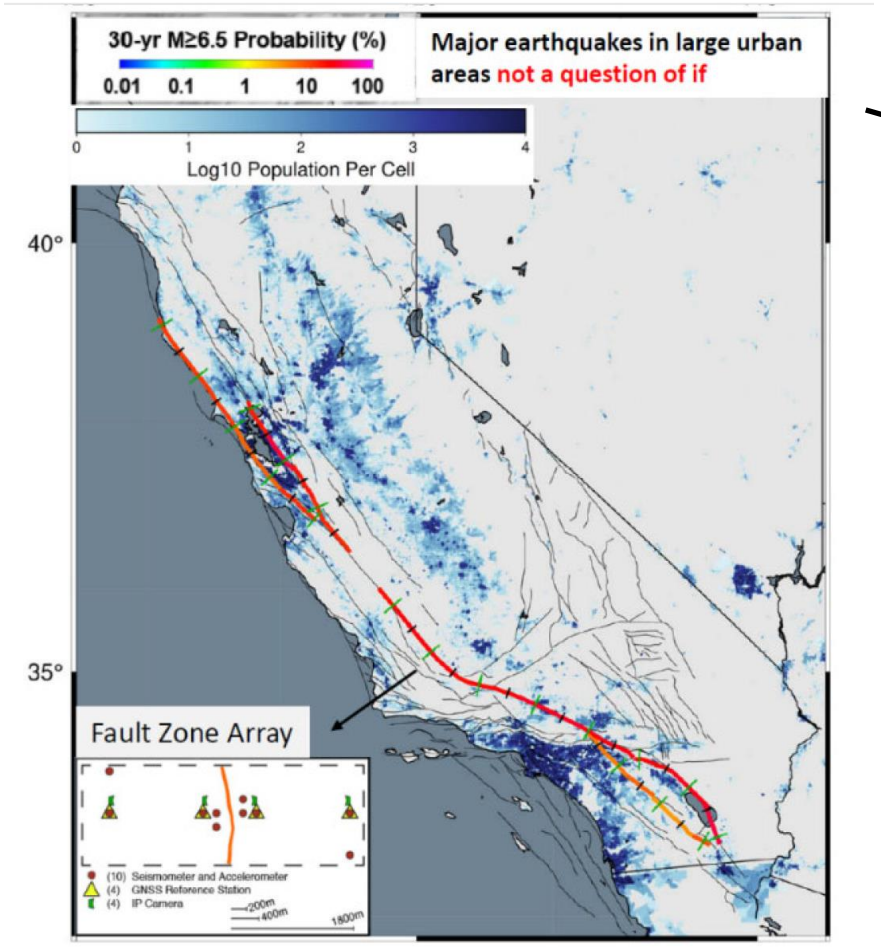
TeraShake Simulations (M7.7) by Olsen et al. (2006, 2008) demonstrated the importance of directivity-basin coupling

How can we increase the resilience of communities and critical infrastructure to earthquakes?

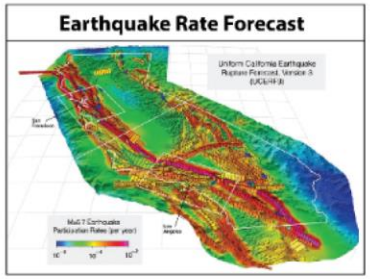
- **Large earthquakes can have devastating effects:** 2023 events in Turkey (>65,000 fatalities, >$115B economic loss) and other catastrophic earthquakes demonstrate impacts to societies for millennia.
- **California is highly vulnerable to significant damage and loss of life:** A large earthquake in SoCal or the Bay Area can result in direct economic losses of over $100B-$250B, 1000s of fatalities, and further cascading consequences. According to FEMA, CA accounts for 65% of total U.S. future earthquake losses.
- **Standard practice for seismic risk reduction:**
  - Construct structures for some shaking levels based on highly incomplete and averaged observations
  - Wait a long time to see which structures are damaged in earthquakes
  - Adjust building codes and designs; wait for future earthquakes to test new designs
- **Advanced modeling approach:**
  - Use computer simulations constrained by dense data of many (ensemble) scenario earthquakes to test critical structures (e.g., power plants, dams, transportation systems) and designs, cutting the learning period for design improvement from decades to months. Repeat as new data become available.
  - Testing structures with simulations (rather than earthquakes) will save lives and billions of dollars.

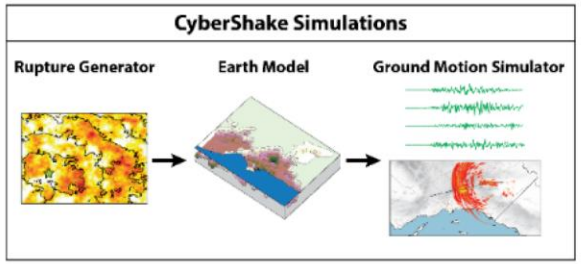
Improved data and advanced simulations will provide critical information for designing more resilient structures

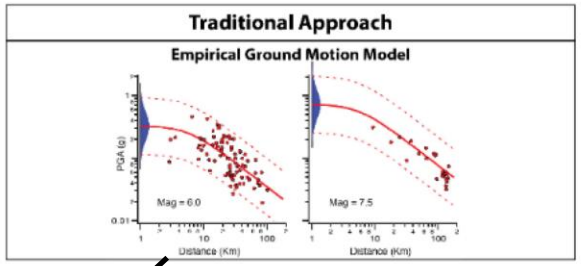
RuFZO

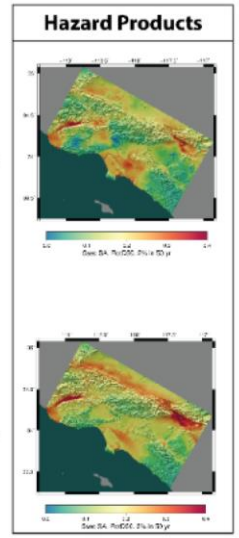


CyberShake

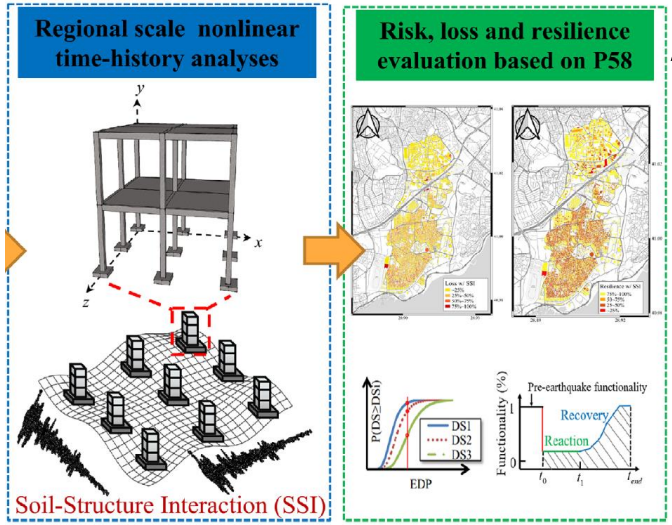








Structural response



- Construct better earth models using dense near-fault sensors
- Simulate the transfer of seismic energy from faults at frequencies (e.g. 0.05-10 Hz) relevant to structures
- Simulate structural responses to the seismic wavefield
- Create earthquake-resilient designs and structures based on simulations

Coalition for an Earthquake Resilient California (CERC)

Thank you