

From Simulation to Validation: Filling Data Gaps with the SCEC CyberShake Platform

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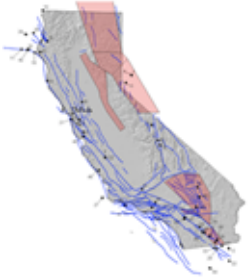
13NCEE, Portland, OR
July 13, 2026



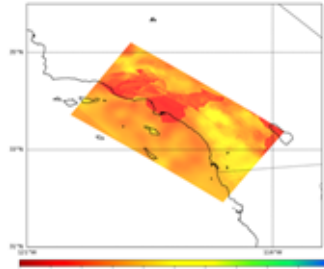
CyberShake provides simulation-based seismic hazard analysis

CyberShake leverages the available knowledge about crustal structure, wave propagation, and source complexity.

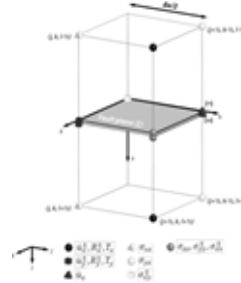
ERF
(UCERF2;
Field et al. 2009)



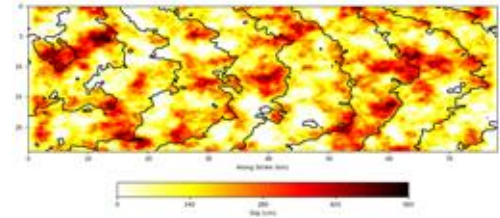
3D Velocity Models



Anelastic Wave Propagation
(Cui et al. 2010;2013)



Rupture Generator
(Graves and Pitarka, 2010;2016)



Ground Motions

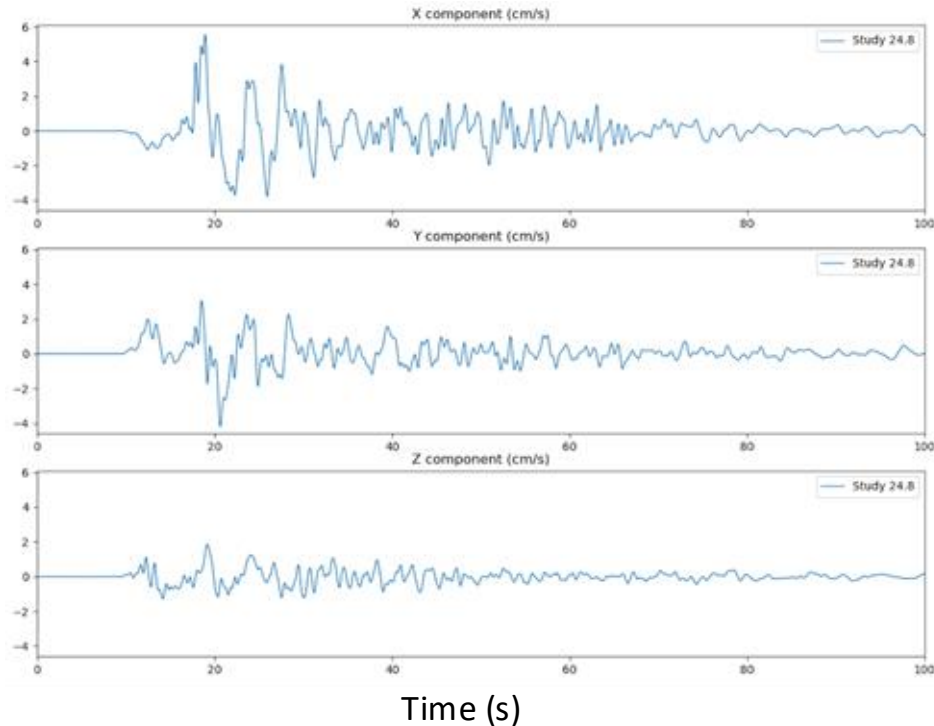
>1 s deterministic
<1 s stochastic

- Seismograms
- Hazard curves
- Intensity measures
- Hazard maps



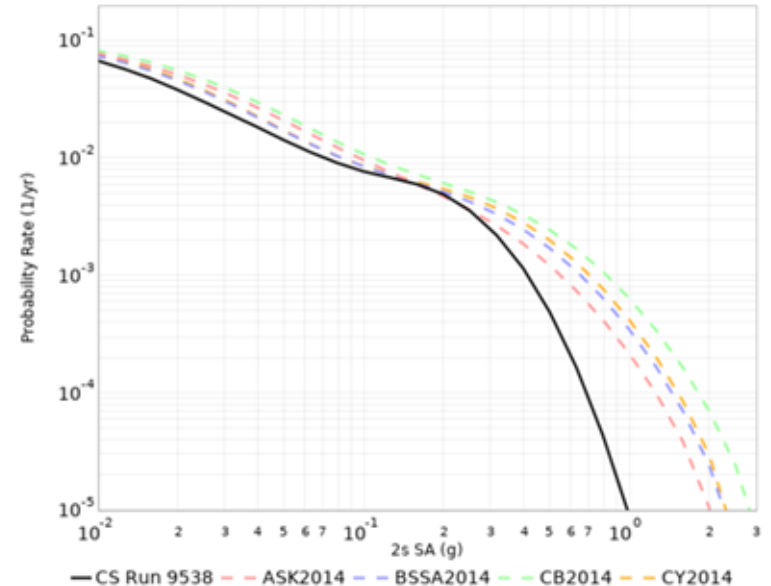
CyberShake produces various data products (IMs, seismograms, hazard curves)

Three-component seismograms

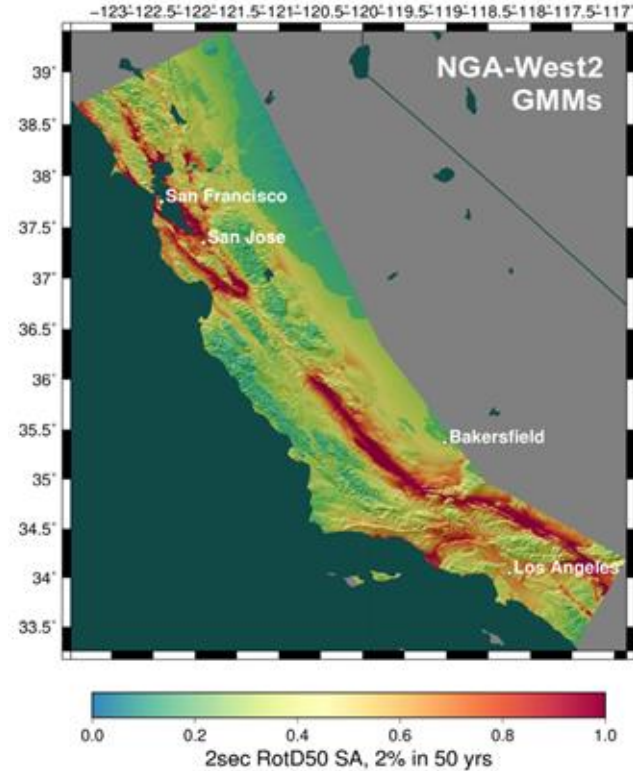
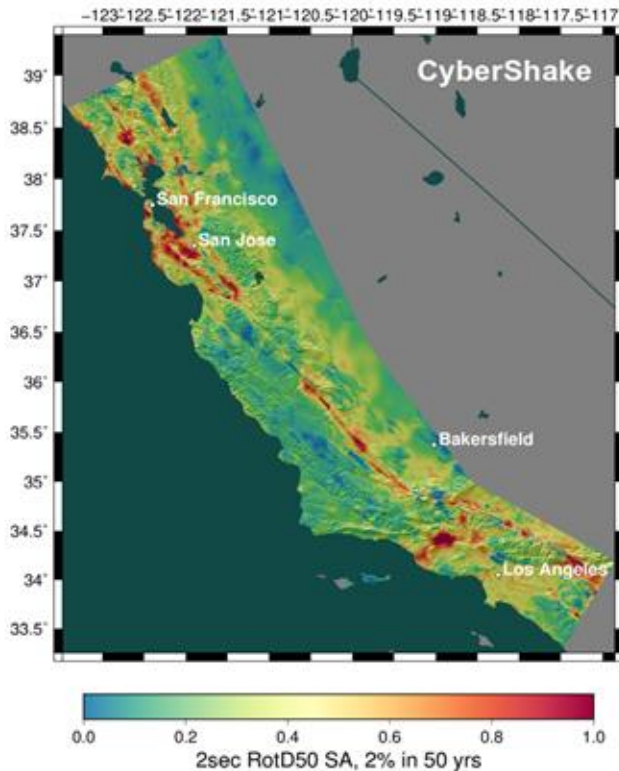


Hazard curves

LAPD, ERF36, genslip-v5.5.2, AWP_ODC_SGT GPU, CVM-S4.26.M01 with taper



California seismic hazard map is interpolated from CyberShake studies





Multiple ways to access CyberShake data products

- **CyberShake Data Access Tools**

- <https://github.com/SCECcode/cs-data-tools>
- IMs; Seismograms (S. Cal. study only); Metadata
- Optimized to filter a small subset of data

- **Flatfiles**

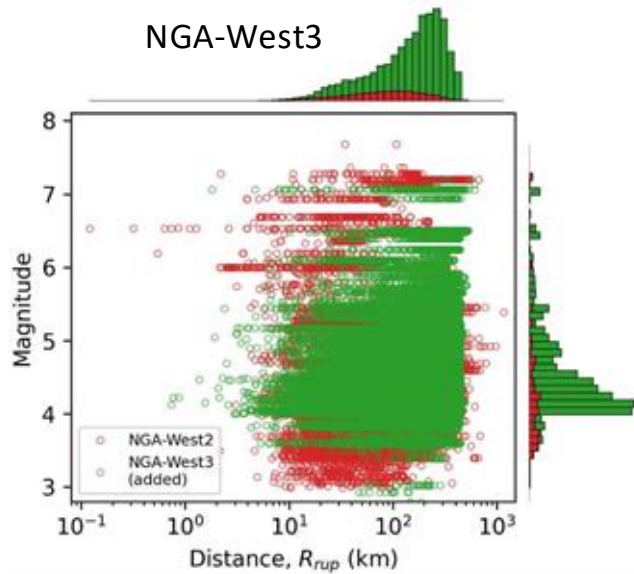
- On request
- IMs; Metadata
- ~100 GB

- **Globus**

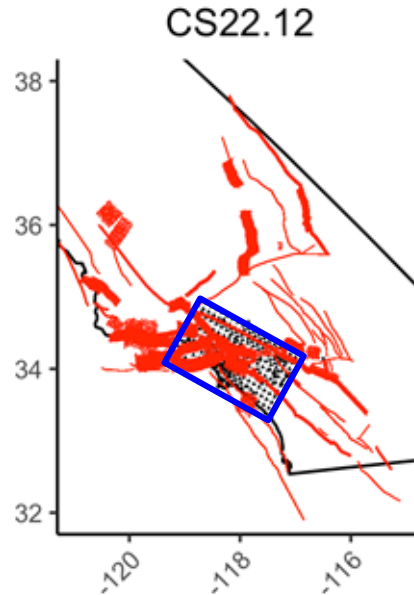
- Collection name: SCEC CyberShake Study 22.12 LF; SCEC CyberShake Study 22.12 BB
- IMs; Seismograms



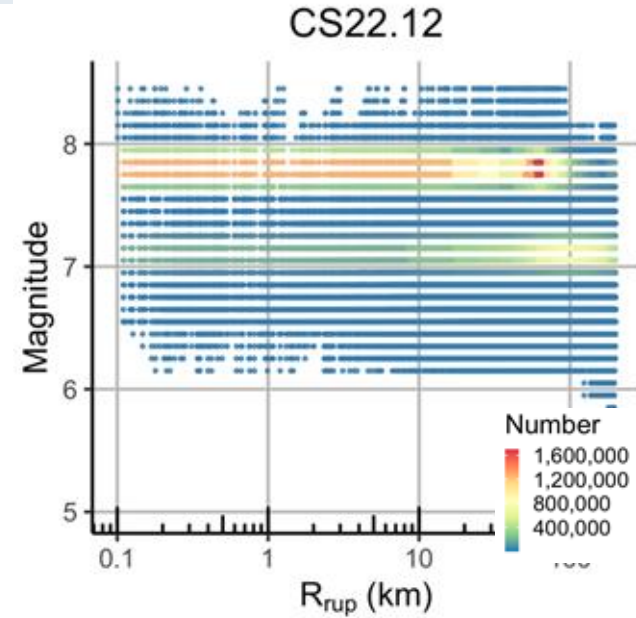
CyberShake fill the data gaps in the empirical ground motion dataset



Stewart et al., 2024



547,466 events
335 sites
~600 million seismograms



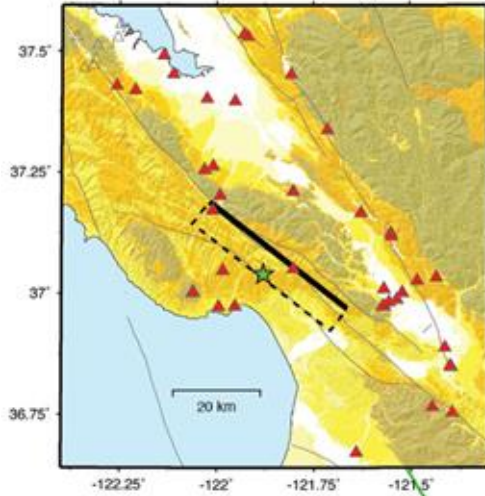
Goulet et al., in prep



CyberShake simulation matches well with recorded ground motions

7 historical large earthquakes in California

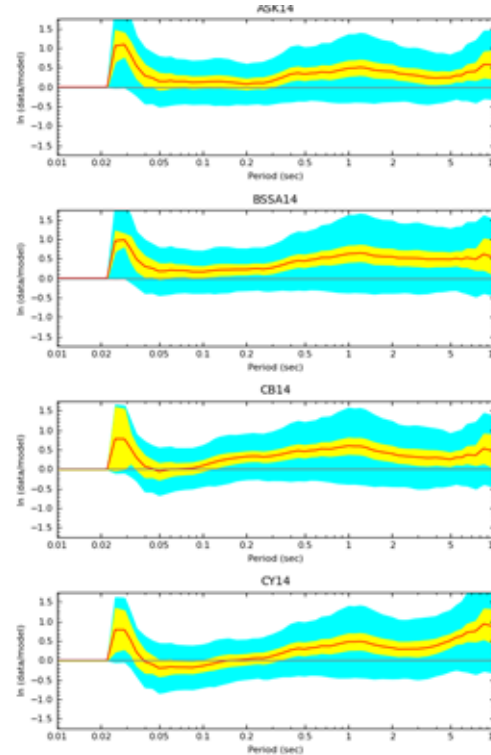
Loma Prieta M_w 6.9



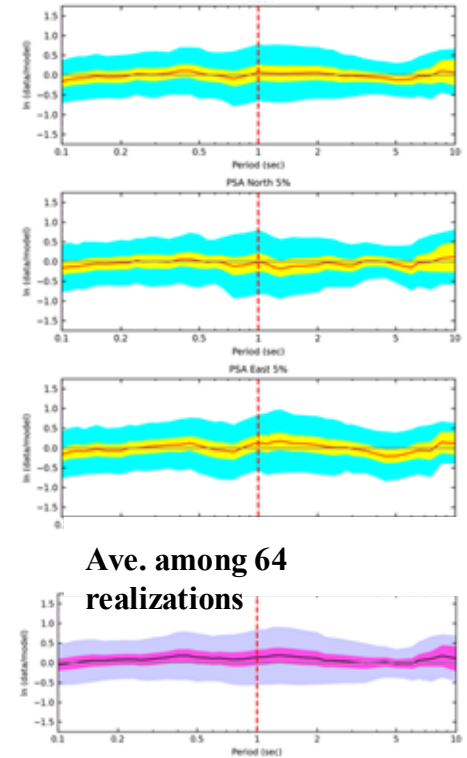
Graves, 2022

Callaghan et al., 2026

NGA-W2 GMMs vs. recordings

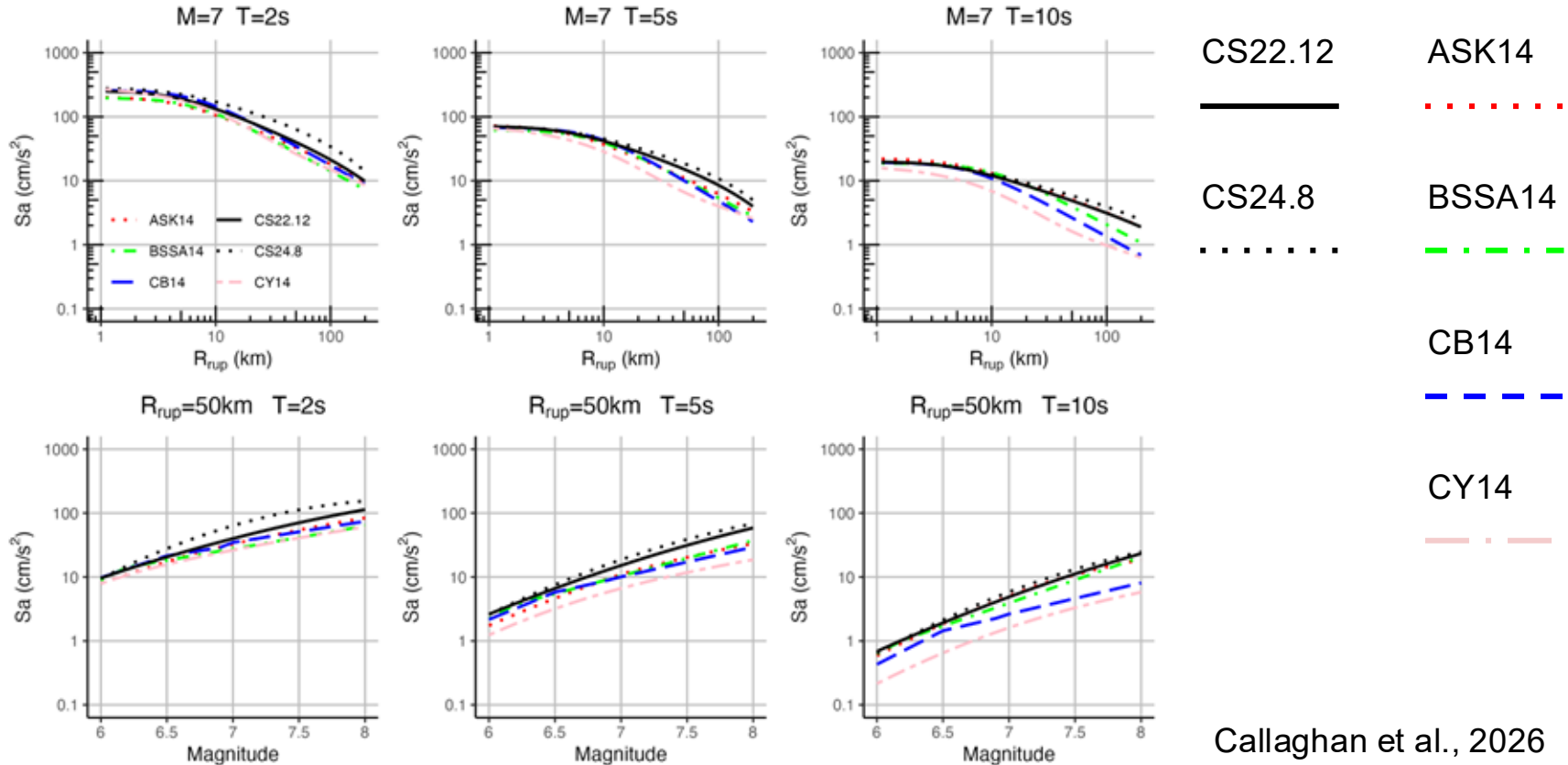


Best CyberShake realization





CyberShake-based GMMs are in general agreement with NGA-West2 GMMs



Callaghan et al., 2026



Thank you!

If you are interested in learning more about CyberShake, please direct any inquiry to scec-software@usc.edu or talk to me in person at 13NCEE (xiaofenm@usc.edu)