Current SCEC Simulations

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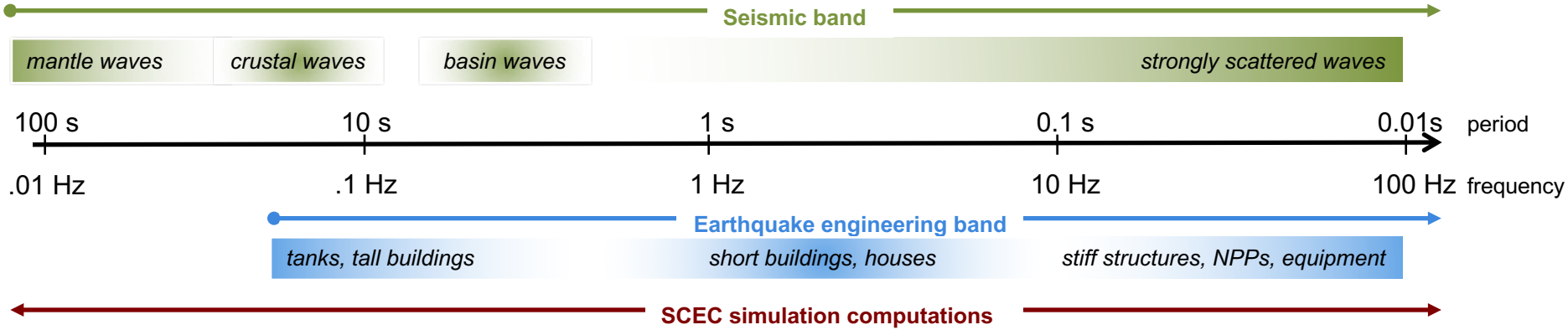
SCEC
an NSF+USGS center

SCEC ground-motion simulation platforms



BroadBand Platform — 1D Deterministic | Stochastic — **Development and production software (runs on clusters and PCs)**

CyberShake — 3D Deterministic — **Complete physics-based PSHA (runs on HPC)**

BroadBand CyberShake — 3D Deterministic CyberShake | Stochastic BroadBand Platform

High-F — 3D Deterministic — **Physics-based development for new physics (runs on HPC and clusters)**

BroadBand Platform (BBP) - current

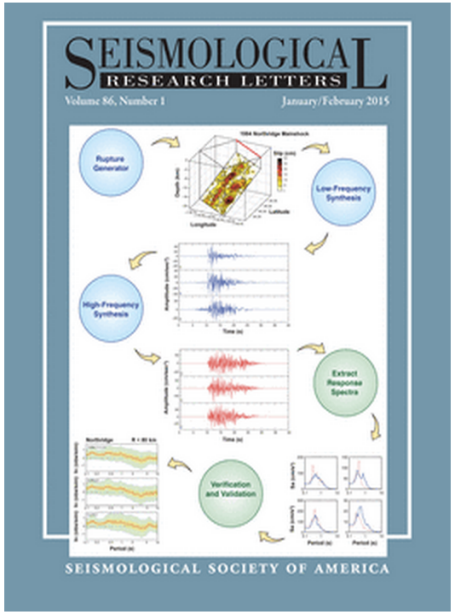
Validation products from BBP releases since 14.3.

Now at release 16.5

scec.usc.edu/it/Broadband_Release_16.5.0

bbpvault.usc.edu/bbp/

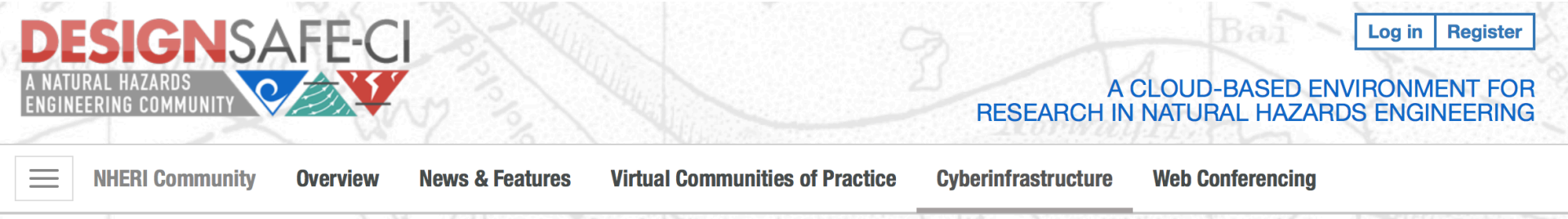
Time series made available to SCEC-funded researchers on demand



SRL Special Focus on BBP Validation – 9 papers - Jan. 2015

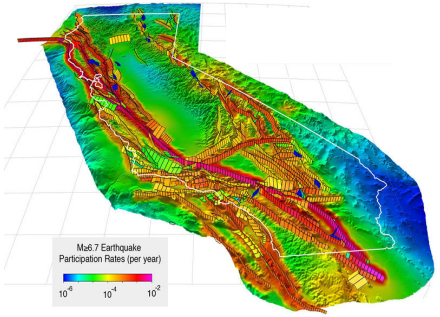
BroadBand Platform (BBP) – near future

BBP time series portal to be integrated into NHERI CI platform (TACC)



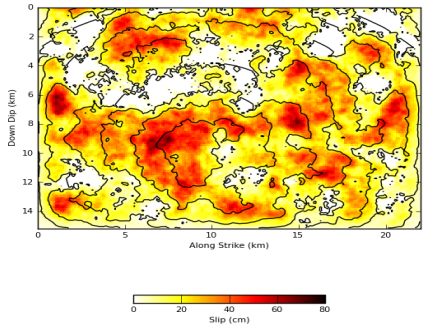
www.designsafe-ci.org/community/cyberinfrastructure/

CyberShake: PSHA from Physics-Based Simulations



Earthquake Rupture Forecast
(e.g. UCERF)

+



Kinematic source models

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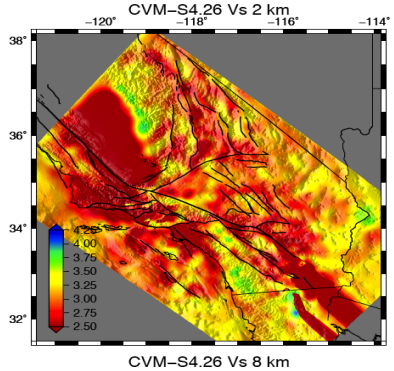
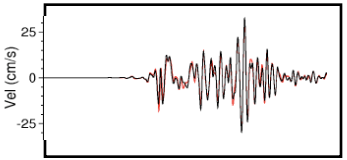
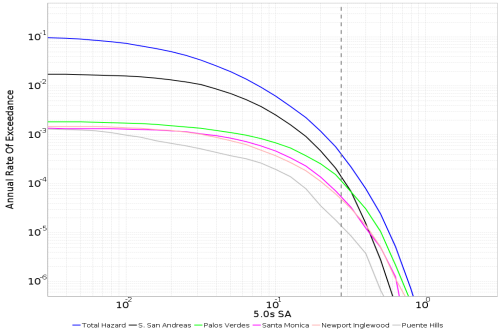


3D velocity model (from F3DT)

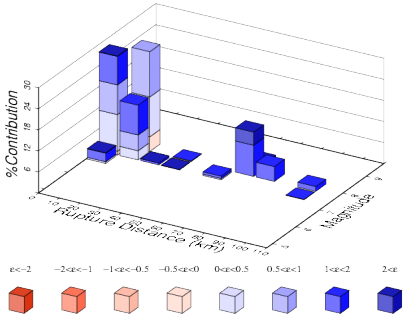
=



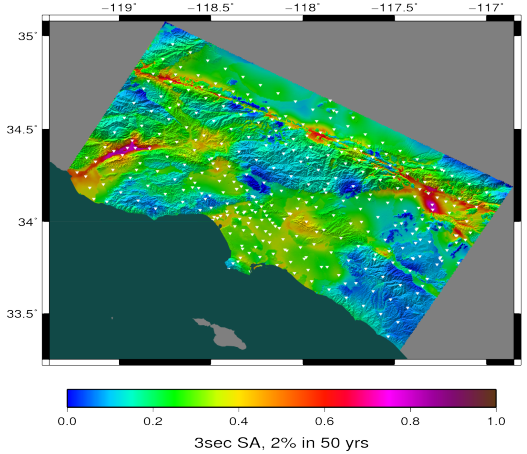
Seismograms
and intensity measures



Hazard Curves and
fault disaggregation



M, R, ε
disaggregation



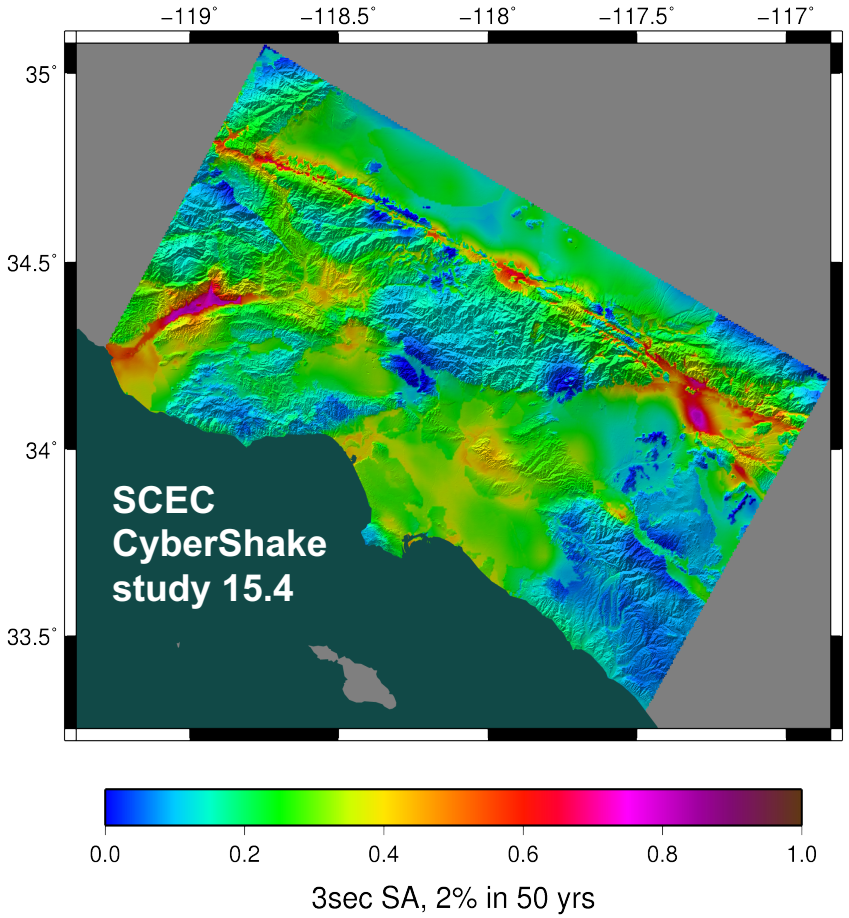
Hazard maps

CyberShake: first complete PSHA model derived from simulations

CyberShake 15.4 Study

Los Angeles urban seismic hazard model

- **Seismic frequency limit f_{max} increased to 1 Hz**
- **Spatial sampling increased to 336 sites**
  - **> 330 million synthetic seismograms**
  - **> 22 billion shaking intensity measures**
- **Run on NCSA *Blue Waters* and OLCF *Titan***
- **Computational makespan of 38 days**
  - **795,000 GPU-hours, 19 million CPU-hours**
    - **956,000 node-hours on NCSA *Blue Waters***
    - **428,000 node-hours on OLCF *Titan***
  - **3.2x code efficiency gain**
  - **post-processing file I/O reduced by 99.9%**
  - **> 1 petabyte of data managed**
- **Fully automated using workflow tools**
  - **42 concurrent workflows running on average**



CyberShake - current

scec.usc.edu/scecpedia/CyberShake

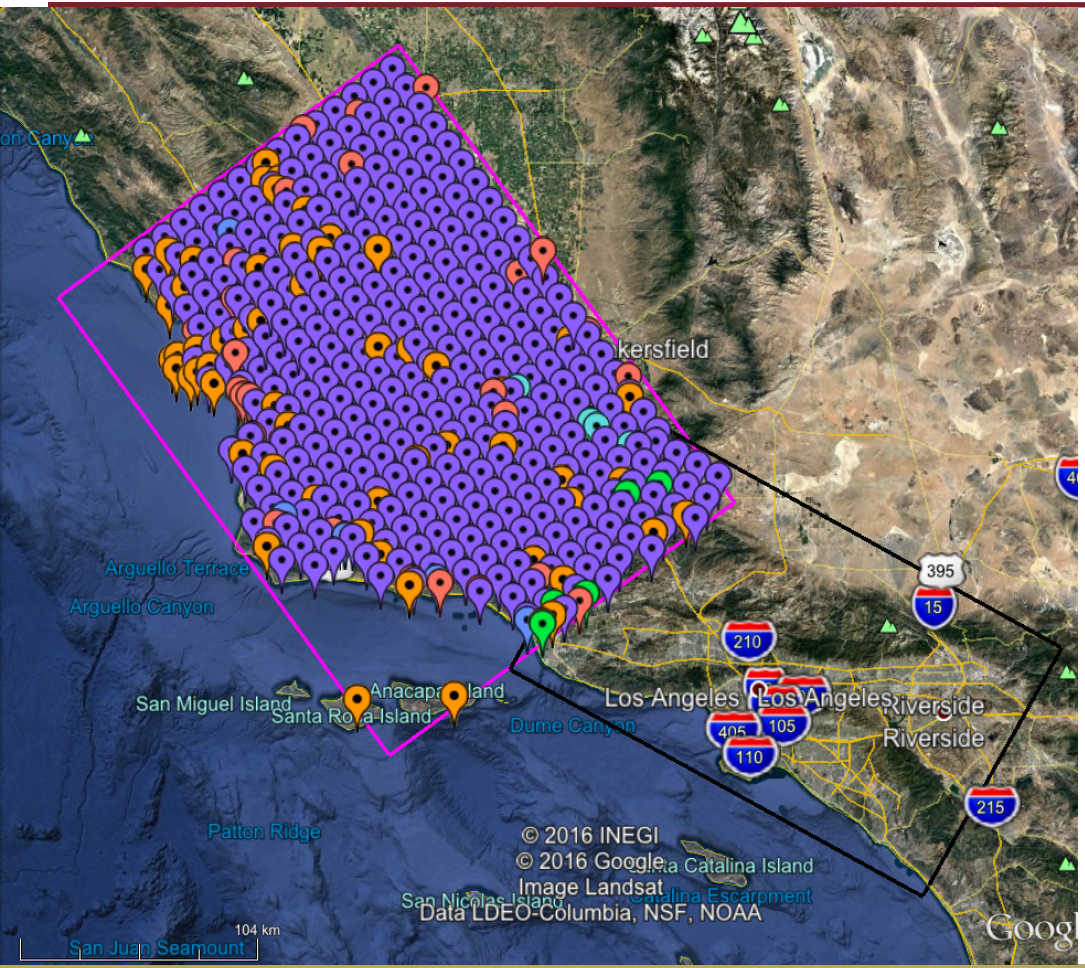
Study 15.4 (SoCal <1 Hz)

Study 15.12 (SoCal BroadBand)

Database with rupture M, variation, station, R, RotD50PSA at various periods

Time series made available to SCEC-funded researchers on demand

CyberShake – Study 16.9 CCA



- 1D and 3D velocity models
- 500,000 seismograms/ site
- 435 sites
  - 4 PG&E pumping stations (cyan)
  - 54 CISN broadband or PG&E stations (orange)
  - 30 cities from CA USGS Gazetteer (red)
  - 310 sites on a 10 km grid (purple)
  - 6 historic Spanish missions (blue)
  - 30 sites overlapping with previously computed Southern California sites for comparison

Data dissemination needs?

XSEDE
Extreme Science and Engineering
Discovery Environment

National
Science
Foundation

USGS
science for a changing world

U.S. DEPARTMENT OF
ENERGY

SDSC

U.S. DEPARTMENT OF ENERGY
INCITE
LEADERSHIP COMPUTING

BLUE WATERS
SUSTAINED PETASCALE COMPUTING

CEA
CALIFORNIA
EARTHQUAKE
AUTHORITY

PG&E

Argonne
NATIONAL LABORATORY
ALCF

USC ITS
Information Technology Services

OLCF
OAK RIDGE LEADERSHIP COMPUTING FACILITY

Thank you!

NCSA

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PITTSBURGH
SUPERCOMPUTING
CENTER

CRAY

NWSC
NCAR-Wyoming
Supercomputing Center

intel

Open Science Grid