

# *2013 SCEC Annual Meeting*

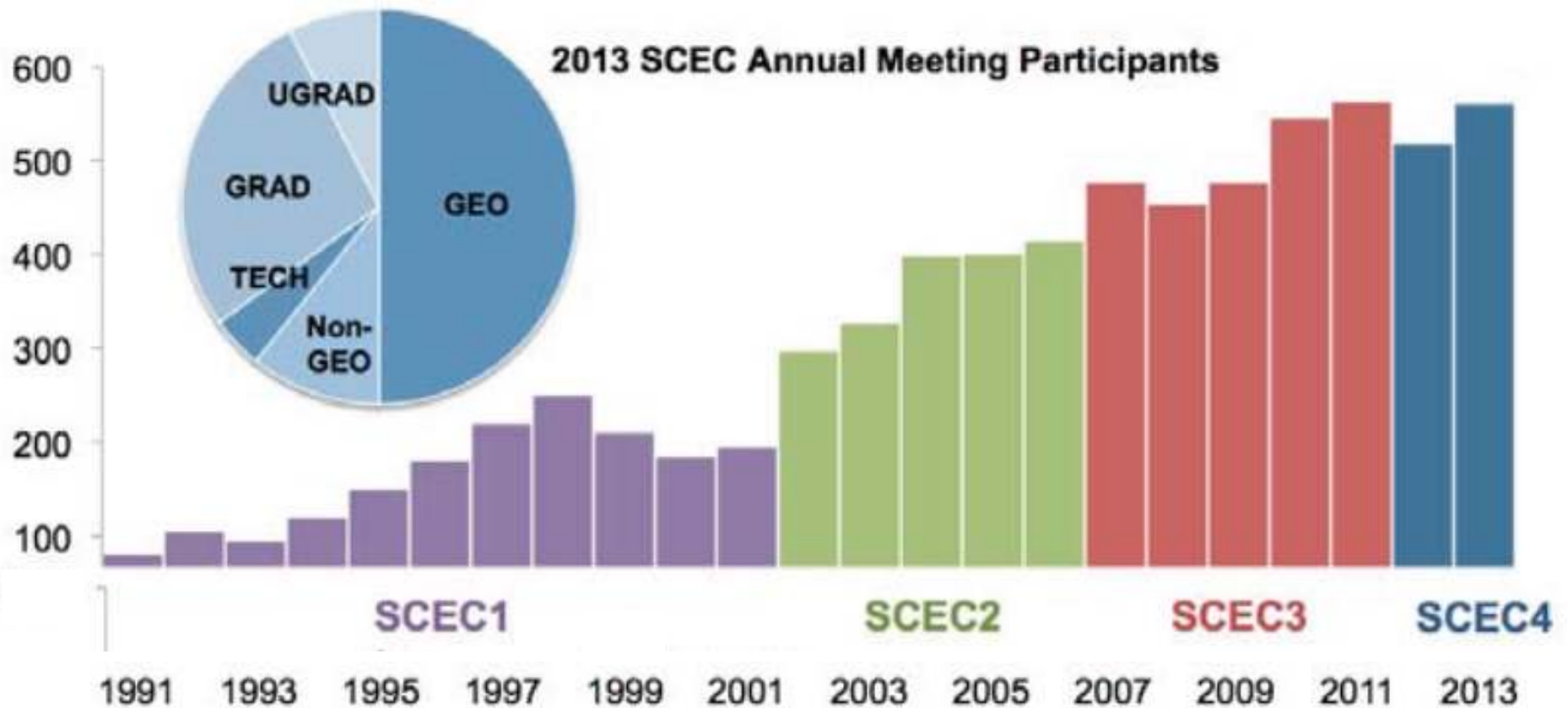
*Hilton Palm Springs, California*

*8-11 September 2013*



an NSF + USGS center

# *Welcome to Palm Springs!*



# *Welcome to Palm Springs!*

Mon



102° 78°

Tue



100° 79°

Wed



101° 81°

## *Goals of the Annual Meeting*

- **Discuss SCEC collaborative research**
  - Learn about new advances in earthquake science
  - Share research results and collaboration plans
- **Assess progress on key SCEC4 objectives**
  - Special Fault Study Areas
  - Community Geodetic Model & Community Stress Model
  - Earthquake Engineering Implementation Interface
  - Virtual Institute for the Study of Earthquake Systems (VISES)
- **Provide input to the 2013 annual science plan**
  - PC to finalize annual plan by Oct 1
  - Review SCEC4 milestones
- **Have some fun!**



## ***SCEC Member Institutions (Sept 1, 2013)***

### **17 Core Institutions and Representatives**

USC, Lead Tom Jordan	Harvard Jim Rice	UC Los Angeles Peter Bird	UC Santa Cruz Emily Brodsky	USGS Pasadena Rob Graves
Caltech Nadia Lapusta	MIT Tom Herring	UC Riverside David Oglesby	UNR Glenn Biasi	
CGS Chris Wills	SDSU Steve Day	UC San Diego Yuri Fialko	USGS Golden Jill McCarthy	
Columbia Bruce Shaw	Stanford Paul Segall	UC Santa Barbara Ralph Archuleta	USGS Menlo Park Ruth Harris	

### **37 Domestic Participating Institutions and Representatives**

Appalachian State Scott Marshall	Colorado Sch. Mines Edwin Nissen	Smith John Loveless	U Illinois Karin Dahmen	U Wisconsin Madison Clifford Thurber
Arizona State J Ramon Arrowsmith	Cornell Rowena Lohman	SUNY at Stony Brook William Holt	U Kentucky Sean Bemis	URS Corporation Paul Somerville
Brown Terry Tullis	Georgia Tech Zhigang Peng	Texas A&M Judith Chester	U Massachusetts Michele Cooke	Utah State Susanne Janecke
CalPoly Pomona Jascha Polet	Indiana Kaj Johnson	U Alaska Fairbanks Carl Tape	U Michigan Ann Arbor Eric Hetland	Utah Valley Nathan Toke
CSU Fullerton David Bowman	JPL Andrea Donnellan	UC Berkeley Roland Bürgmann	U New Hampshire Margaret Boettcher	WHOI Jeff McGuire
CSU Long Beach Nate Onderdonk	Oregon State Andrew Meigs	UC Davis Michael Oskin	U Oregon Ray Weldon	
CSU San Bernardino Sally McGill	Penn State Eric Kirby	UC Irvine Lisa Grant Ludwig	U Texas El Paso Bridget Smith-Konter	
Carnegie Mellon Jacob Bielak	Purdue Andrew Freed	U Cincinnati Lewis Owen	U Texas Austin Whitney Behr	

### **10 International Participating Institutions**

Academia Sinica (Taiwan)	ERI Tokyo (Japan)	Nat'l Central U (Taiwan)	U Western Ontario (Canada)
CICESE (Mexico)	ETH Zürich (Switzerland)	Nat'l Chung Cheng (Taiwan)	
DPRI Kyoto (Japan)	IGNS (New Zealand)	Nat'l Taiwan U (Taiwan)	

## ***SCEC Member Institutions (Sept 1, 2013)***

**For those of you attending this meeting who don't see your institution on this list, please note that it's easy to apply.**

*We just need a letter from a cognizant official (e.g., your department chair or dean) that requests this status and appoints an institutional representative who will act as the point-of-contact with SCEC.*

### **37 Domestic Participating Institutions and Representatives**

Appalachian State	Colorado Sch. Mines	Smith	U Illinois	U Wisconsin Madison
Scott Marshall	Edwin Nissen	John Loveless	Karin Dahmen	Clifford Thurber
Arizona State	Cornell	SUNY at Stony Brook	U Kentucky	URS Corporation
J Ramon Arrowsmith	Rowena Lohman	William Holt	Sean Bemis	Paul Somerville
Brown	Georgia Tech	Texas A&M	U Massachusetts	Utah State
Terry Tullis	Zhigang Peng	Judith Chester	Michele Cooke	Susanne Janecke
CalPoly Pomona	Indiana	U Alaska Fairbanks	U Michigan Ann Arbor	Utah Valley
Jascha Polet	Kaj Johnson	Carl Tape	Eric Hetland	Nathan Toke
CSU Fullerton	JPL	UC Berkeley	U New Hampshire	WHOI
David Bowman	Andrea Donnellan	Roland Bürgmann	Margaret Boettcher	Jeff McGuire
CSU Long Beach	Oregon State	UC Davis	U Oregon	
Nate Onderdonk	Andrew Meigs	Michael Oskin	Ray Weldon	
CSU San Bernardino	Penn State	UC Irvine	U Texas El Paso	
Sally McGill	Eric Kirby	Lisa Grant Ludwig	Bridget Smith-Konter	
Carnegie Mellon	Purdue	U Cincinnati	U Texas Austin	
Jacobo Bielak	Andrew Freed	Lewis Owen	Whitney Behr	

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DPRI Kyoto (Japan)	IGNS (New Zealand)	Nat'l Taiwan U (Taiwan)	



# Core Institutions & Board of Directors



**University of Southern California**  
Tom Jordan, *Chair*



**California Institute of Technology**  
Nadia Lapusta, *Vice-Chair*



**California Geological Survey**  
Chris Wills



**Columbia University**  
Bruce Shaw



**Harvard University**  
Jim Rice



**Massachusetts Institute of Technology**  
Tom Herring



**San Diego State University**  
Steve Day



**Stanford University**  
Paul Segall



**University of California, Los Angeles**  
Peter Bird



**University of California, Riverside**  
David Oglesby



**University of California, San Diego**  
Yuri Fialko



**University of California, Santa Barbara**  
Ralph Archuleta



**University of California, Santa Cruz**  
Emily Brodsky



**University of Nevada, Reno**  
Glenn Biasi



**U.S. Geological Survey, Golden**  
Jill McCarthy (*liaison, non-voting member*)



**U.S. Geological Survey, Menlo Park**  
Ruth Harris (*liaison, non-voting member*)



**U.S. Geological Survey, Pasadena**  
Rob Graves (*liaison, non-voting member*)

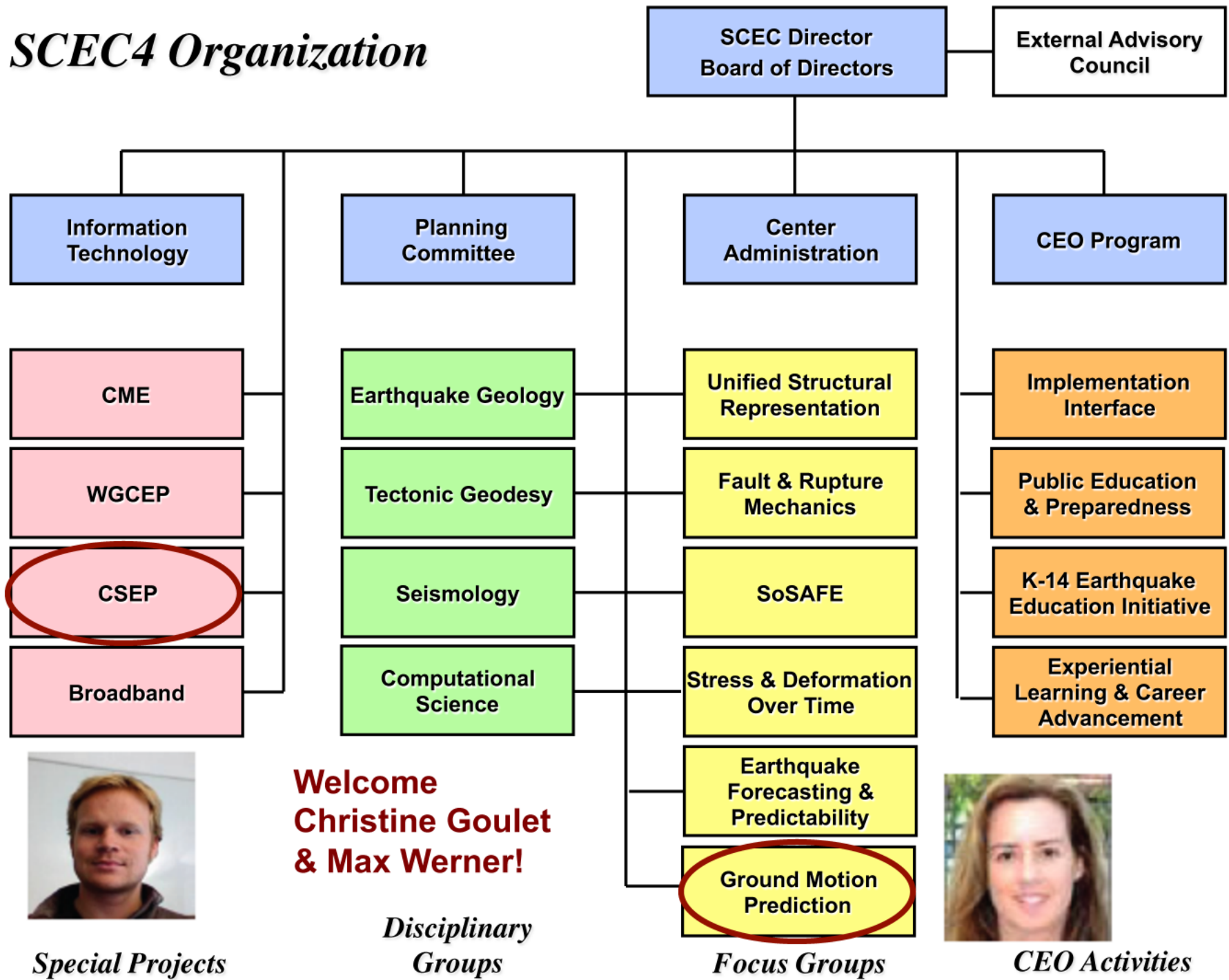


**At-Large Member**  
Judi Chester (TAMU)



**At-Large Member**  
Roland Burgmann (UCB)

# *SCEC4 Organization*







**Deputy Director, PC Chair**

Greg Beroza \*\*

## ***Working Groups & Planning Committee***

### **Disciplinary Committees**



#### **Seismology**

Egill Hauksson \*\*

Elizabeth Cochran



#### **Earthquake Geology**

Lisa Grant Ludwig \*\*

Mike Oskin



#### **Tectonic Geodesy**

Jessica Murray \*\*

Dave Sandwell



#### **Computational Science**

Yifeng Cui \*\*

Eric Dunham

### **Special Projects**



#### **Community Modeling Environment**

Phil Maechling \*\*



#### **Working Group on California Earthquake Probabilities**

Ned Field \*\*



#### **Collaboratory for the Study of EQ Predictability**

Max Werner \*\*

Danijel Schorlemmer



**Deputy Director, PC Chair**

Greg Beroza \*\*

## ***Working Groups & Planning Committee***

### **Interdisciplinary Focus Groups**



#### **Unified Structural Representation**

John Shaw \*\*

Brad Aagaard



#### **Fault and Rupture Mechanics**

Judi Chester \*\*

Jean-Paul (Pablo) Ampuero



#### **So. San Andreas Fault Evaluation**

Kate Scharer \*\*

Ramon Arrowsmith



#### **Stress and Deformation Over Time**

Kaj Johnson \*\*

Thorsten Becker



#### **EQ Forecasting and Predictability**

Jeanne Hardebeck \*\*

Ilya Zaliapin



#### **Ground Motion Prediction**

Kim Olsen \*\*

Christine Goulet

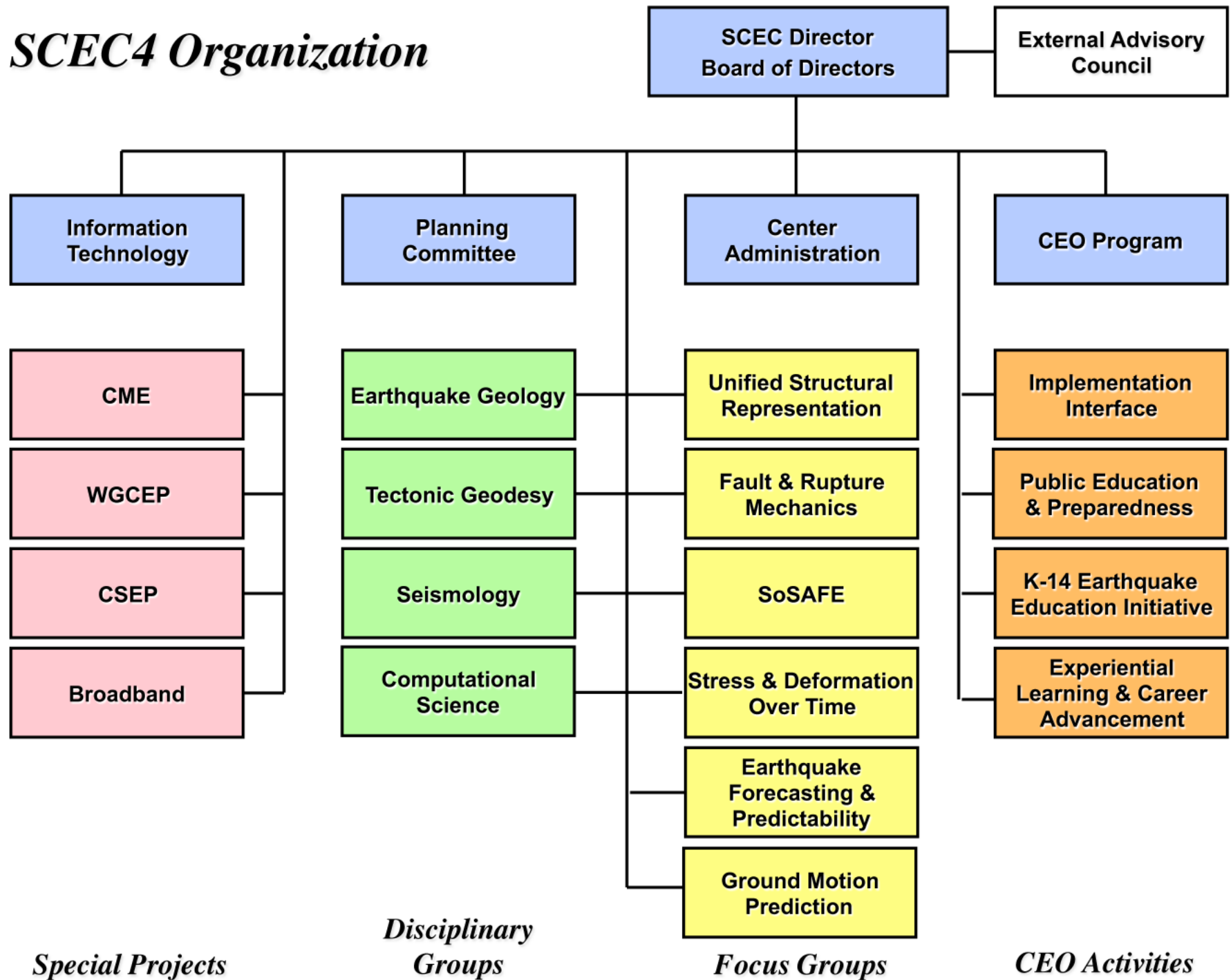


#### **EQ Eng. Implementation Interface**

Jack Baker \*\*

Jacobo Bielak

# ***SCEC4 Organization***



# Southern California Earthquake Center

## External Advisory Council



Jeff Freymueller, *Chair*  
*U of Alaska Fairbanks*



Donna Eberhart-Phillips  
*U of California Davis*



Farzad Naeim  
*John A Martin and Assoc*



Gail Atkinson  
*U of Western Ontario*



Bob Lillie  
*Oregon State U*



John Vidale  
*U of Washington*



Roger Bilham  
*U of Colorado Boulder*



Kate Long  
*CalEMA*



Andrew Whittaker  
*University at Buffalo*



Susan Cutter  
*U of South Carolina*



M. Meghan Miller  
*UNAVCO*



## Center Administration



**Associate Director**  
John McRaney



**Special Projects and  
Events**  
Tran Huynh



**Contracts and Grants**  
Karen Young



**Admin Coordinator**  
Deborah Gormley

## Communication, Education, and Outreach



**Associate Director**  
Mark Benthien



**Education Programs**  
Bob de Groot



**Digital Products**  
John Marquis

## Information Technology



**Associate Director**  
Phil Maechling



**Research  
Programmer**  
Scott Callaghan



**Research  
Programmer**  
David Gill



**Research  
Programmer**  
Masha Liukis



**Research  
Programmer**  
Kevin Milner

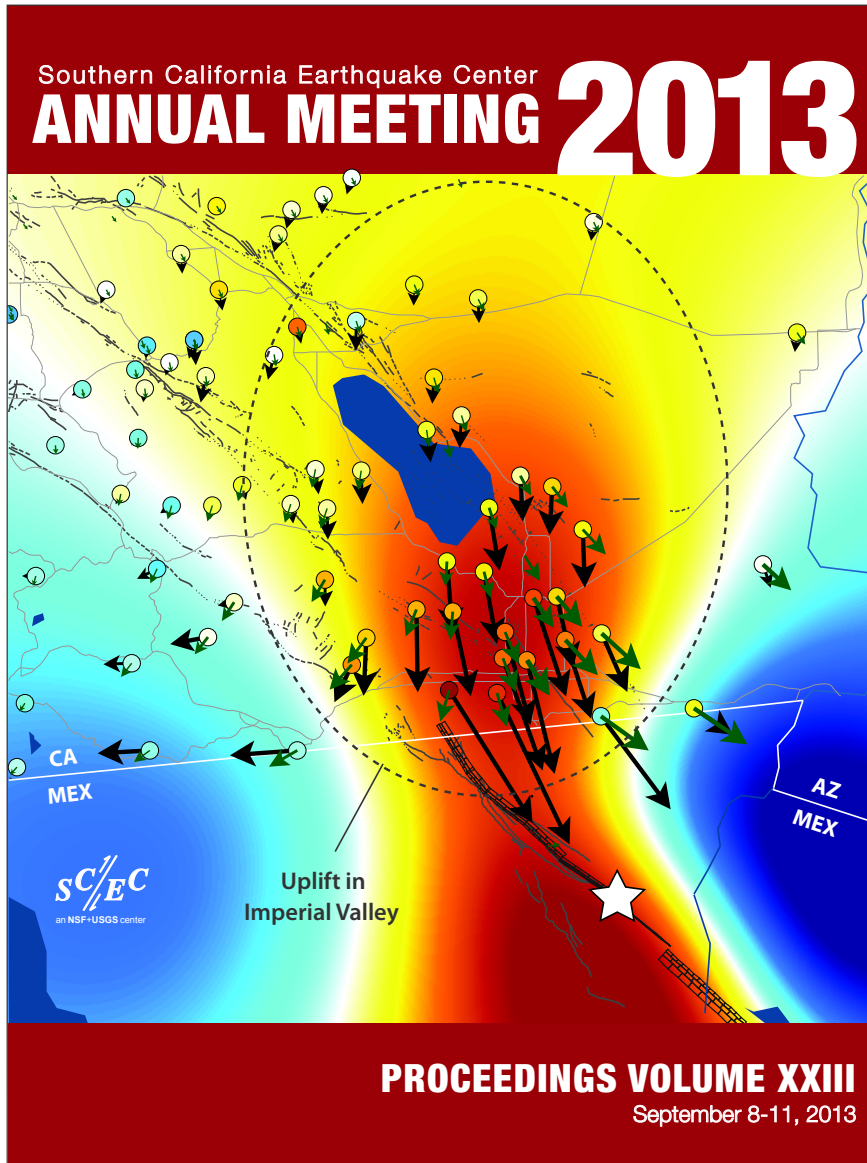


**Research  
Programmer**  
Fabio Silva



**Systems  
Programmer**  
John Yu

*Southern California Earthquake Center*  
**Staff**



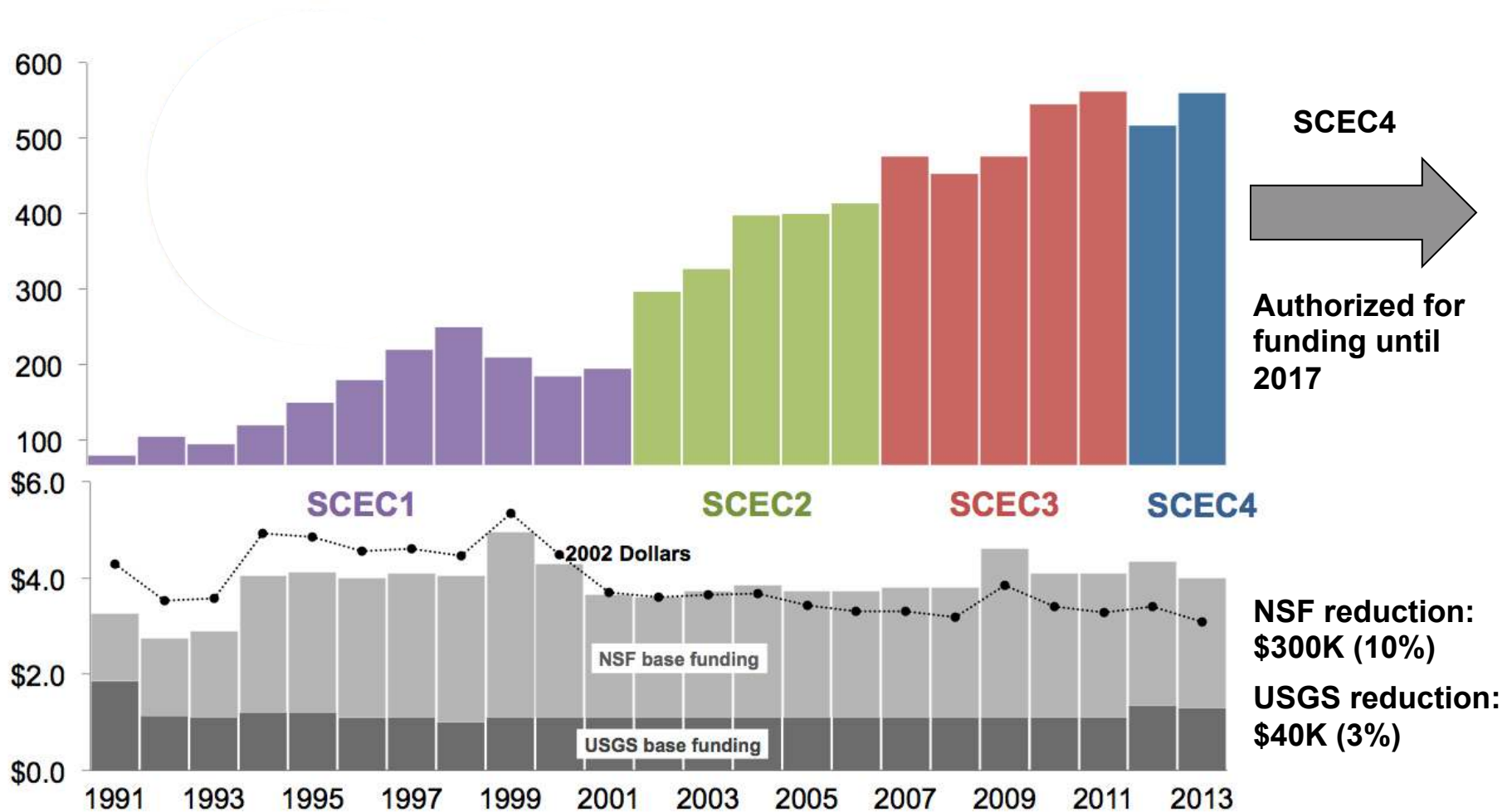
## AVAILABLE FOR DOWLOAD

**[www.scec.org/meetings/2013am/SCEC2013Proceedings.pdf](http://www.scec.org/meetings/2013am/SCEC2013Proceedings.pdf)**

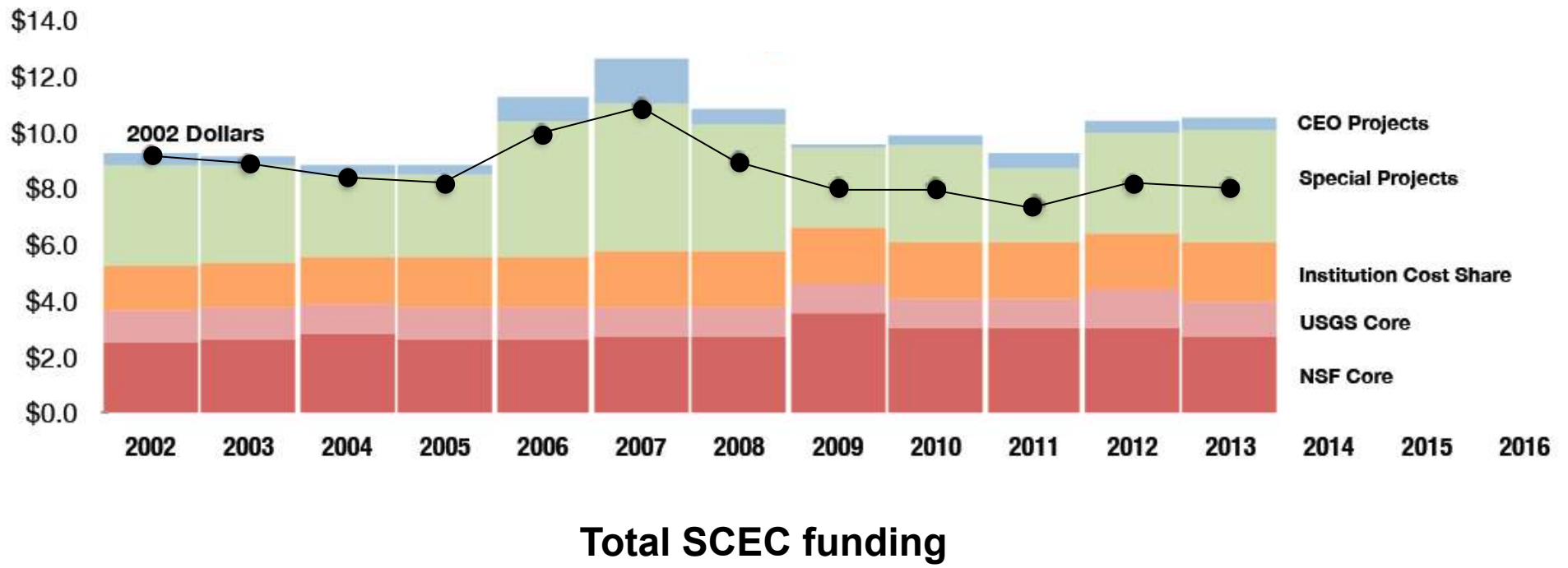
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# *SCEC Base Program*



# All SCEC Programs



## *Budget Situation*

- **Budget present**
  - USGS cut the 2013 SCEC budget by \$40K relative to 2012 (3%)
  - NSF cut the 2013 SCEC budget by \$300K relative to 2012 (10%)
    - final funding amount not confirmed by NSF until July
  - To meet these reductions, cuts were made to
    - Director's reserve, administration, CEO, infrastructure, IT, and travel
    - SCEC science program cut by only \$51K (15% of total cut)
- **Budget future**
  - Unknown, but perhaps larger, cuts must be considered, given the federal budget situation
    - “easy cuts” have already been made; some are not sustainable
  - New sources of funding should be developed
    - 32 of the last 33 SCEC proposals have been fully funded or almost fully funded, including SEISM (NSF), Geoinformatics (NSF), VISES (NSF), UseIT (NSF), and CSEP (USGS, DHS)

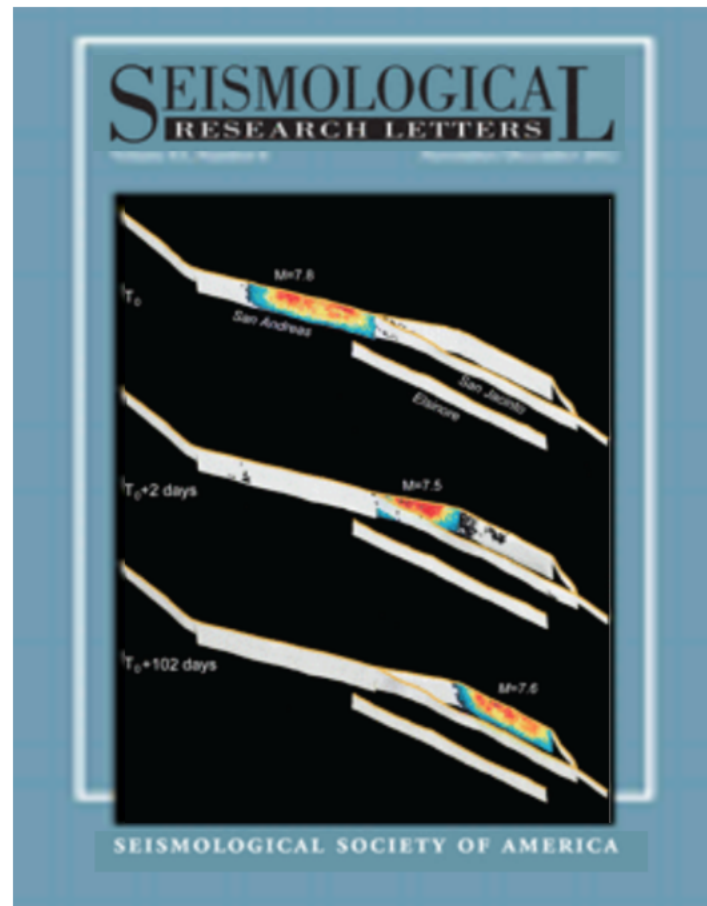
## *Science Results!*

- **The awesome sweep of research organized through the SCEC Base Program is amply illustrated in the PC's report**
  - Highlighted throughout this meeting
- **Excellent progress has been made on the major SCEC4 initiatives in a remarkably short amount of time**
  - Two Special Fault Study Areas (SFSAs) have been inaugurated
  - Workshops have been held to develop the new Community Geodetic Model (CGM) and Community Stress Model (CSM)
- **Banner year for the SCEC Communication, Education, and Outreach (CEO) program**
  - 9.4 million people registered for the 2012 California ShakeOut
  - 7.8 million have already registered for the 2013 California ShakeOut

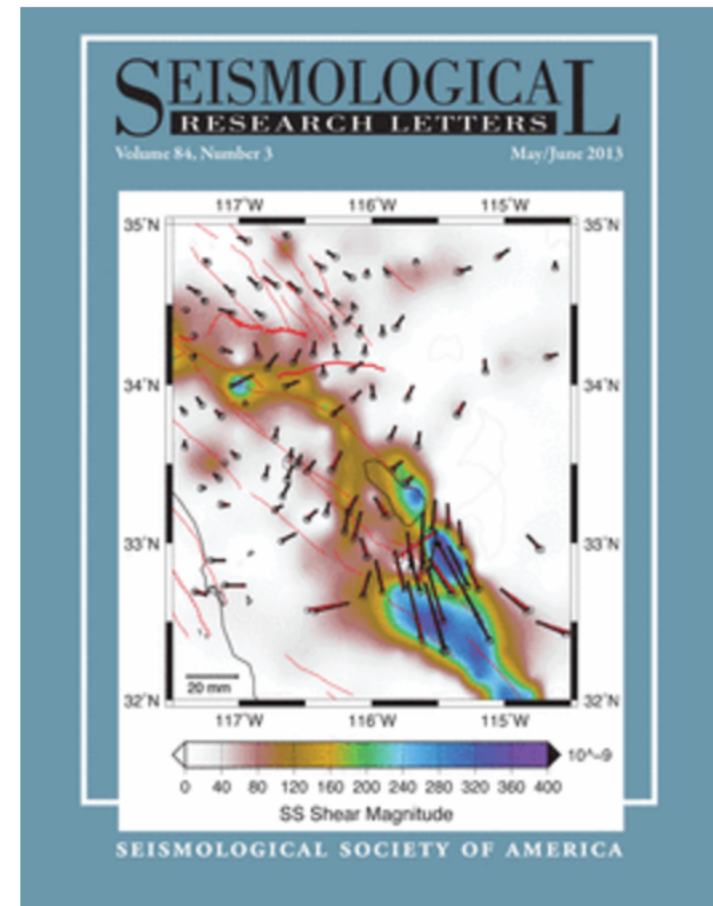
*You should register TODAY!*



## Two Important TAG Publications



Focus Section on Earthquake Simulators  
in *Seismol. Res. Lett.*, Nov/Dec 2012



Focus Section on the SCEC Geodetic  
Transient-Detection Validation Exercise  
in *Seismol. Res. Lett.*, May/June 2013

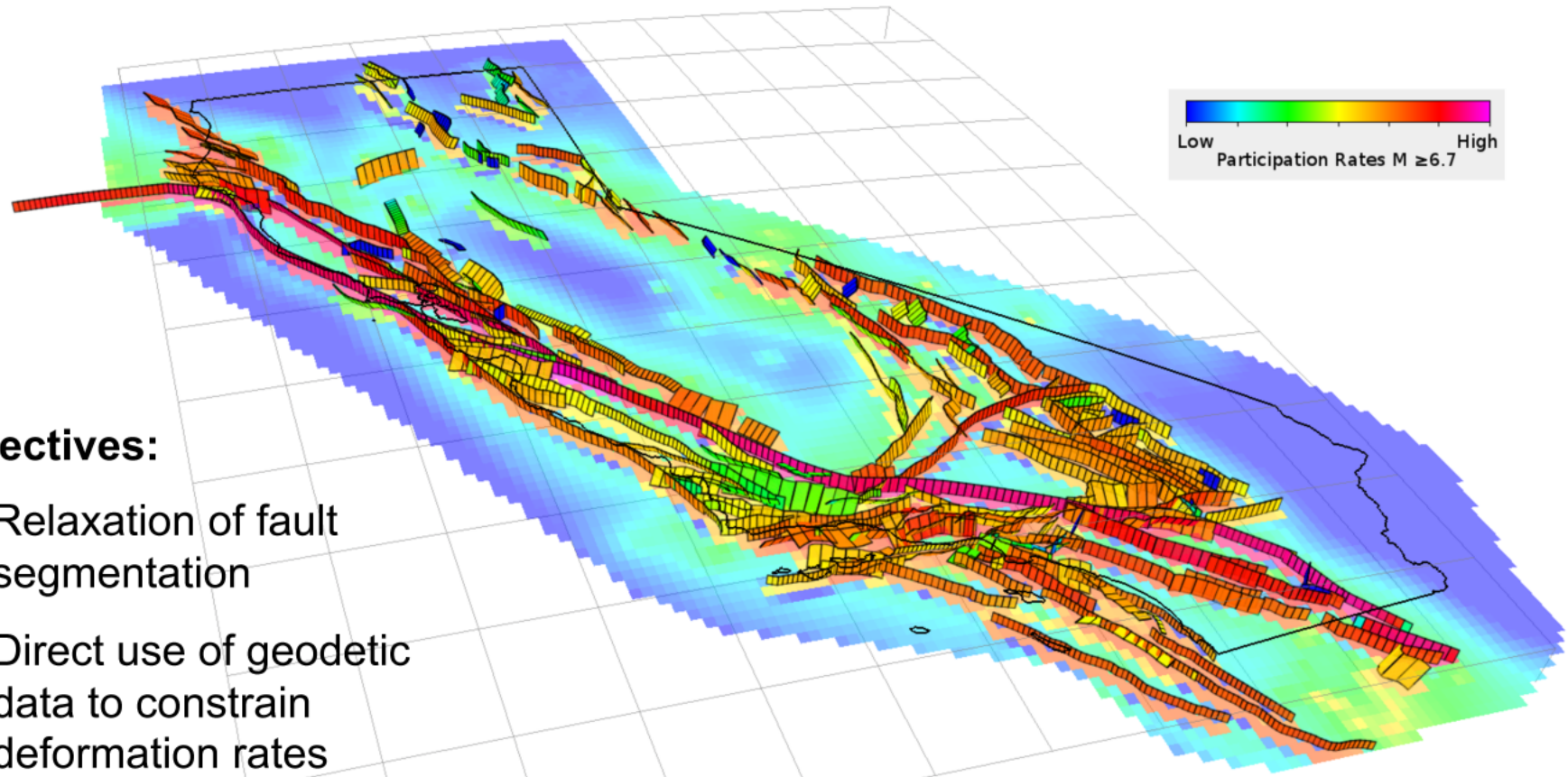
## ***SCEC Workshops, Jan-May, 2013***

- **Community Online Resource for Statistical Seismicity Analysis**
  - *Conveners: Jeremy Zechar and Jiancang Zhuang, 01/21/13, Tokyo, Japan*
- **UCERF3.2 Fault-by-Fault Evaluation Meeting**
  - *Convenor: Ned Field, 01/24/13, Menlo Park*
- **Workshop on Use of UCERF3 in the National Seismic Hazard Maps**
  - *Convenor: Ned Field, 02/21/13 Menlo Park*
- **SCEC Rupture Dynamics Code Validation Workshop**
  - *Convenor: Ruth Harris, 03/15/13, Menlo Park*
- **Ground Motion Simulation Validation TAG Workshop**
  - *Conveners: Nico Luco and Sanaz Razaeian, 04/03/13, Los Angeles*
- **SCEC Committee for Utilization of Ground Motion Simulations**
  - *Conveners: C. B. Crouse and Tom Jordan, 04/03/2013 Los Angeles*
- **Ductile Rheology of the Southern California Lithosphere**
  - *Conveners: Wayne Thatcher, Yuri Fialko, Elizabeth Hearn, and Greg Hirth, 05/01/2013, Menlo Park*
- **SCEC CSEP Workshop on Testing External Forecasts and Predictions**
  - *Convenors: Tom Jordan, Max Werner, Andy Micheal, and Tom Bleier, 05/07/13, Los Angeles*



## ***SCEC Workshops, May-Sept, 2013***

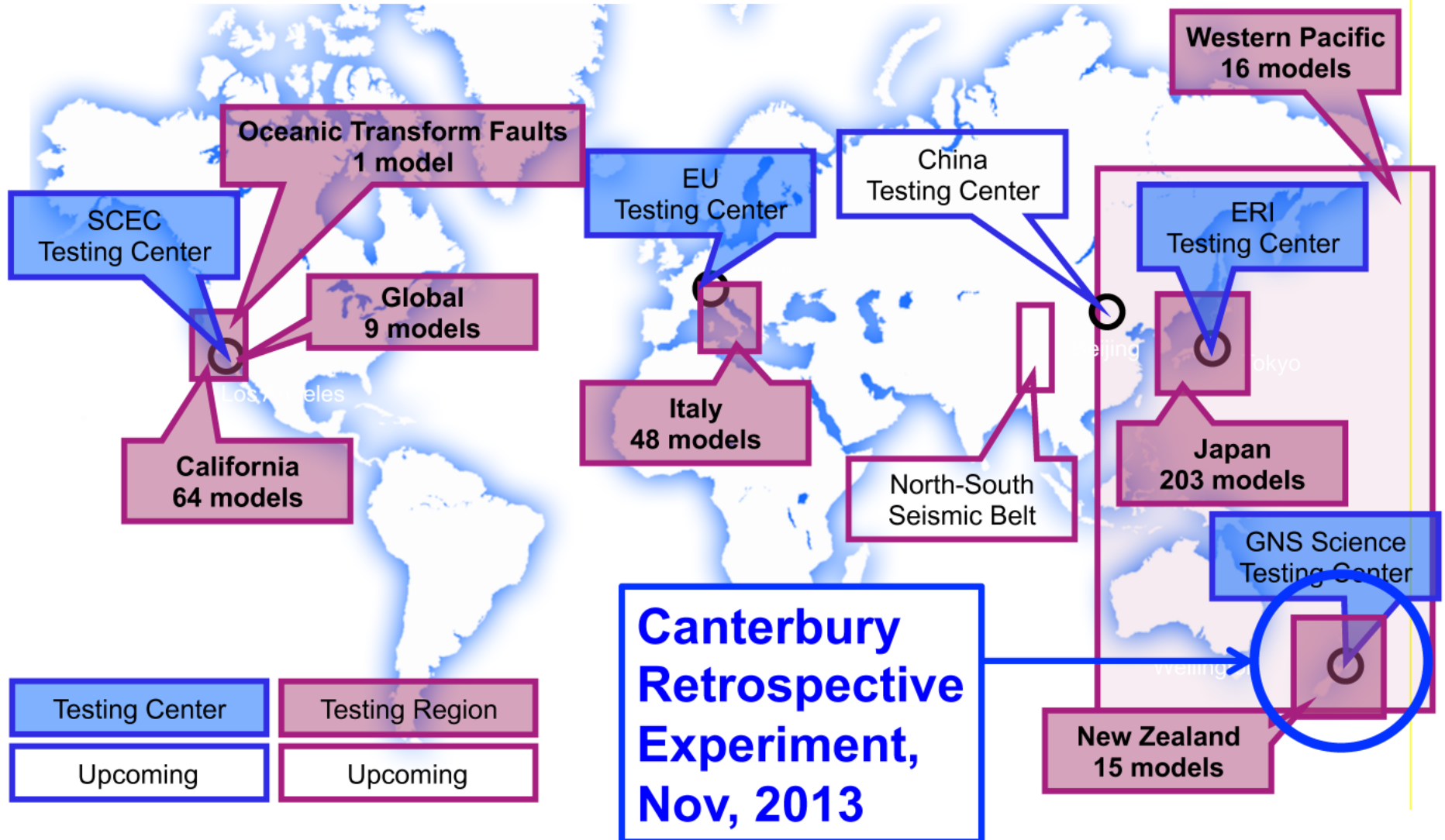
- **Community Stress Model Workshop**
  - *Convenors: Jeanne Hardebeck, Brad Aagaard, Thorsten Becker, David Sandwell, Bruce Shaw, and John Shaw, 05/29/13, Menlo Park*
- **Community Geodetic Model Workshop**
  - *Convenors: Jessica Murray, David Sandwell, and Rowena Lohman, 05/30/13, Menlo Park*
- **Community Modeling Environment Workshop**
  - *Convenor: Phil Maechling, 06/02/13, Palm Springs*
- **The Ventura Special Fault Study Area**
  - *Convenors: James Dolan, John Shaw, and Thomas Rockwell, 08/15/13, Ventura*
- **Source Inversion Validation (SIV) Workshop**
  - *Convenors: Martin Mai, Danijel Schorlemmer, and Morgan Page, 09/08/13, Palm Springs*
- **Workshop on Broadband Platform and Ground Motion Simulations**
  - *Convenors: Norm Abrahamson and Christie Goulet, 09/08/13, Palm Springs*
- **Workshop on Comparison and Validation of Earthquake Simulators**
  - *Convenor: Terry Tullis, 09/08/13, Palm Springs*
- **Ground Motion Simulation Validation Workshop**
  - *Convenors: Nico Luco and Sanaz Rezaeian, 09/08/13, Palm Springs*

*Working Group on California Earthquake Probabilities (2013)**Uniform California Earthquake Rupture Forecast (UCERF3)***Objectives:**

- Relaxation of fault segmentation
- Direct use of geodetic data to constrain deformation rates
- Incorporation of two types of time dependence:
  - Reid renewal
  - Omori-Utsu clustering
- **UCERF3.3 (time-independent) has been finalized and submitted to NSHMP.**
- **Time-dependent components are under active development.**

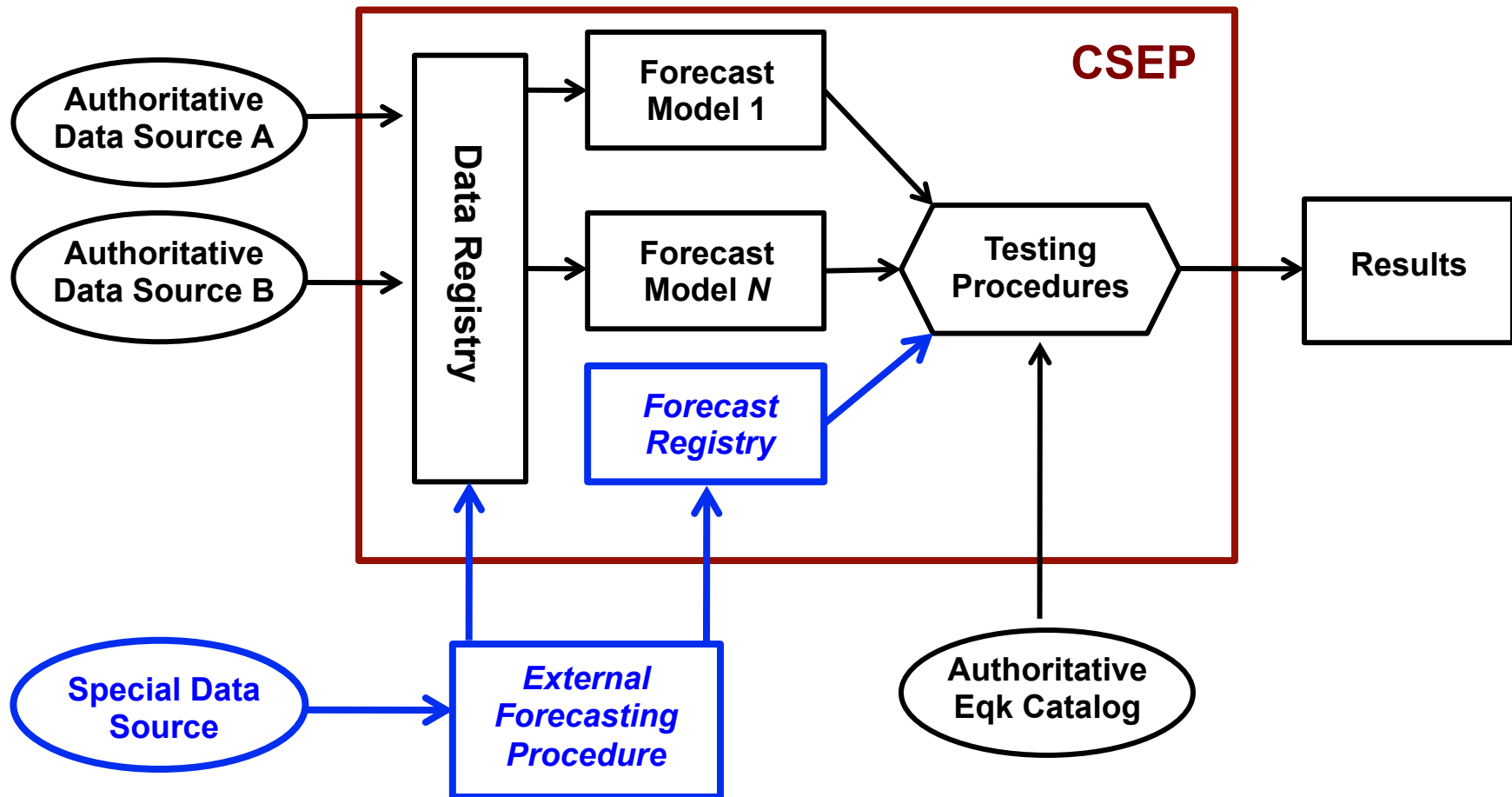
# Collaboratory for the Study of Earthquake Predictability

Infrastructure for automated, blind, prospective testing of forecasting models in a variety of tectonic environments and on a global scale



# CSEP Structure

## Accommodation of External Forecasting

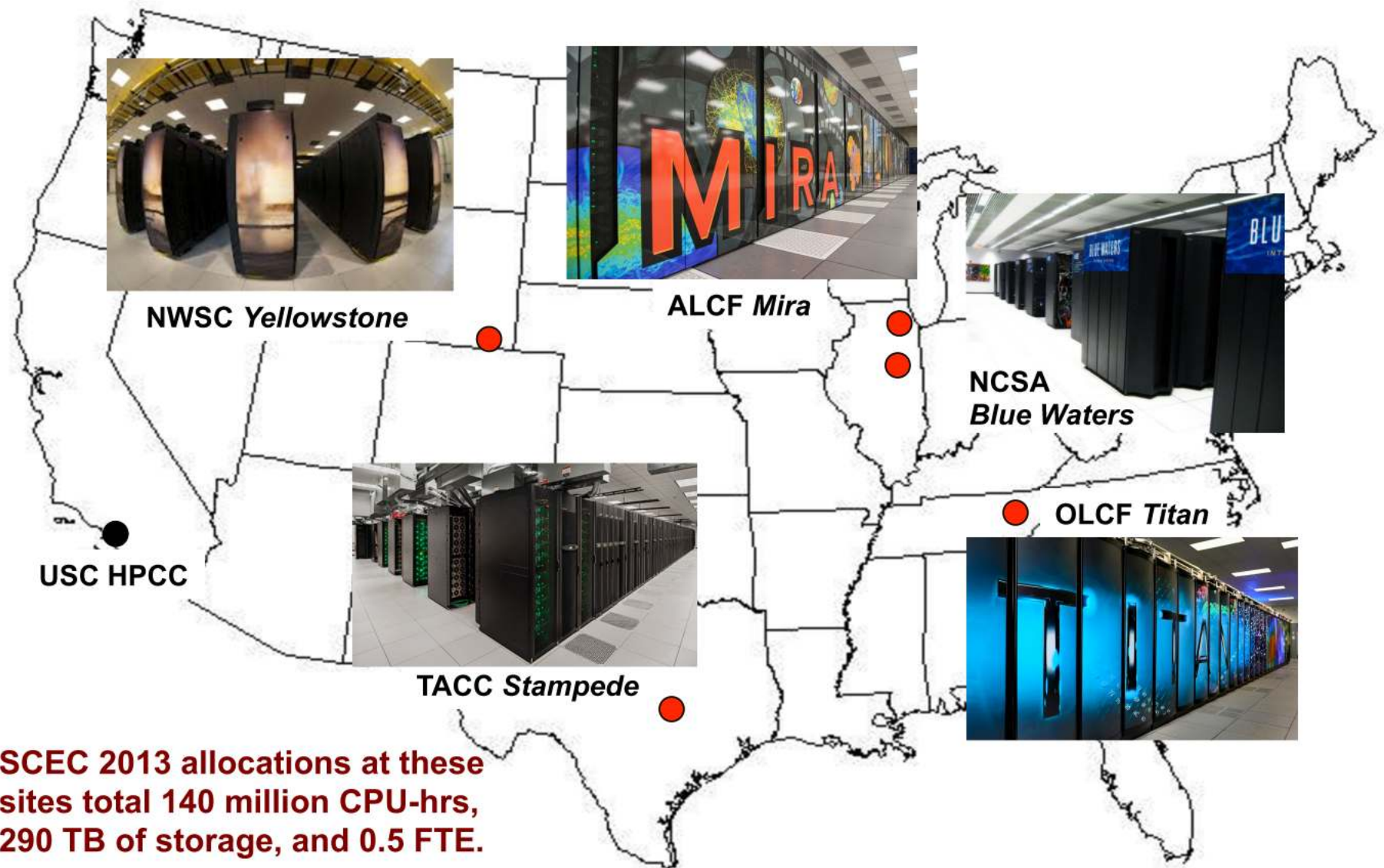


# *Community Modeling Environment*

- **Broadband Platform validation project underway**
  - Report by SCEC evaluation committee, chaired by Doug Dreger
- **New array of CyberShake hazard models**
  - New rupture model, multiple codes, CVM-S4 and CVM-H11.9
  - New techniques have been developed to understand and compare the CyberShake results with GMPE-based hazard models
- **Tomographic platforms have been developed to improve the Community Velocity Models used in earthquake simulations.**
  - New version of the CVM-S developed by Po Chen (U. Wyoming) and his colleagues is being implemented into the Unified California Velocity Model (UCVM) framework for use in CyberShake and other earthquake simulation projects
- **High-F Project has deployed the AWP-ODC and Hercules codes on the world's most powerful supercomputers and extend simulations to 5 Hz and beyond**
  - Must account for source complexity, scattering by small-scale, near-surface heterogeneities, frequency-dependent  $Q$



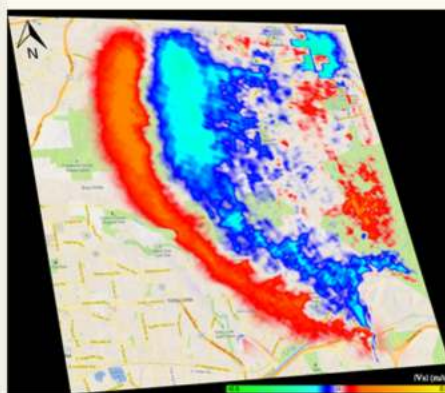
## *New HPC Resources Used by SCEC CME Collaboration*



# Results from “Early Science” Systems

## UC San Diego Team Achieves Petaflop-Level Earthquake Simulations on GPU-Powered Supercomputers

Accelerated Code Cuts Time and Cost in Seismic Modeling



The image shows a snapshot of ground motion of the 2008 magnitude-5.4 Chino Hills earthquake in an east-to-west direction; the red-yellow and green-blue colors depict amplitude of shaking. The simulation indicates that small-scale heterogeneities (causing the highly irregular pattern in the image) may significantly affect ground motion.

A team of researchers at the San Diego Supercomputer Center (SDSC) and the Department of Electronic and Computer Engineering at the University of California, San Diego, has developed a highly scalable computer code that promises to dramatically cut both research times and energy costs in simulating seismic hazards throughout California and elsewhere.

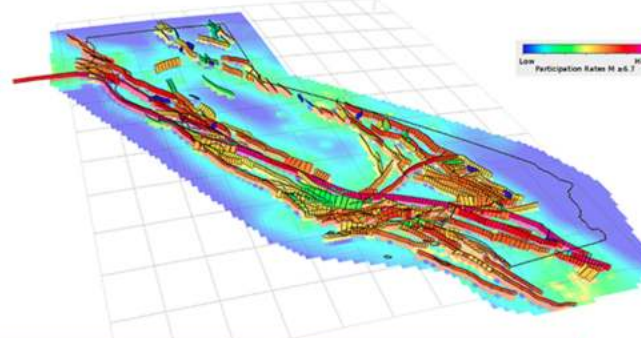
The team, led by Yifeng Cui, a computational scientist at SDSC, developed the scalable GPU (graphical processing units) accelerated code for use in earthquake engineering and disaster management through regional earthquake simulations at the petascale level as part of a larger computational effort coordinated by the Southern California



Earth Science on Stampede

### Predicting Earthquakes in California

Thomas Jordan, Director, Southern California Earthquake Center



#### Connect



#### Science on Stampede

- Texas Unleashes Stampede for Science
- CO<sub>2</sub> Capture and Conversion
- Improving Brain Tumor Imaging
- Ice Streams from Antarctica
- Stampede as a “Computational Microscope”
- Predicting Earthquakes in California
- The Chemistry of Water
- Stampede for the Humanities!

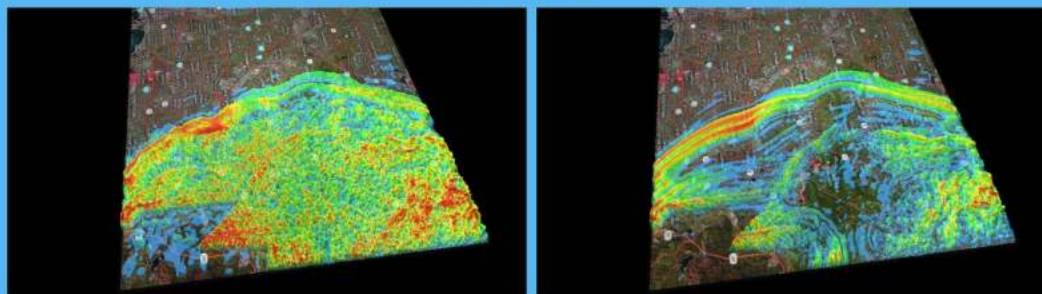
#### Feature Stories Archive

#### Contact Us

Aaron Dubrow  
Science and Technology Writer  
aaron.dubrow@tacc.utexas.edu

## Simulated Wave Propagation for the Mw5.4 Chino Hills, CA, Earthquake, Including a Statistical Model of Small-Scale Heterogeneities

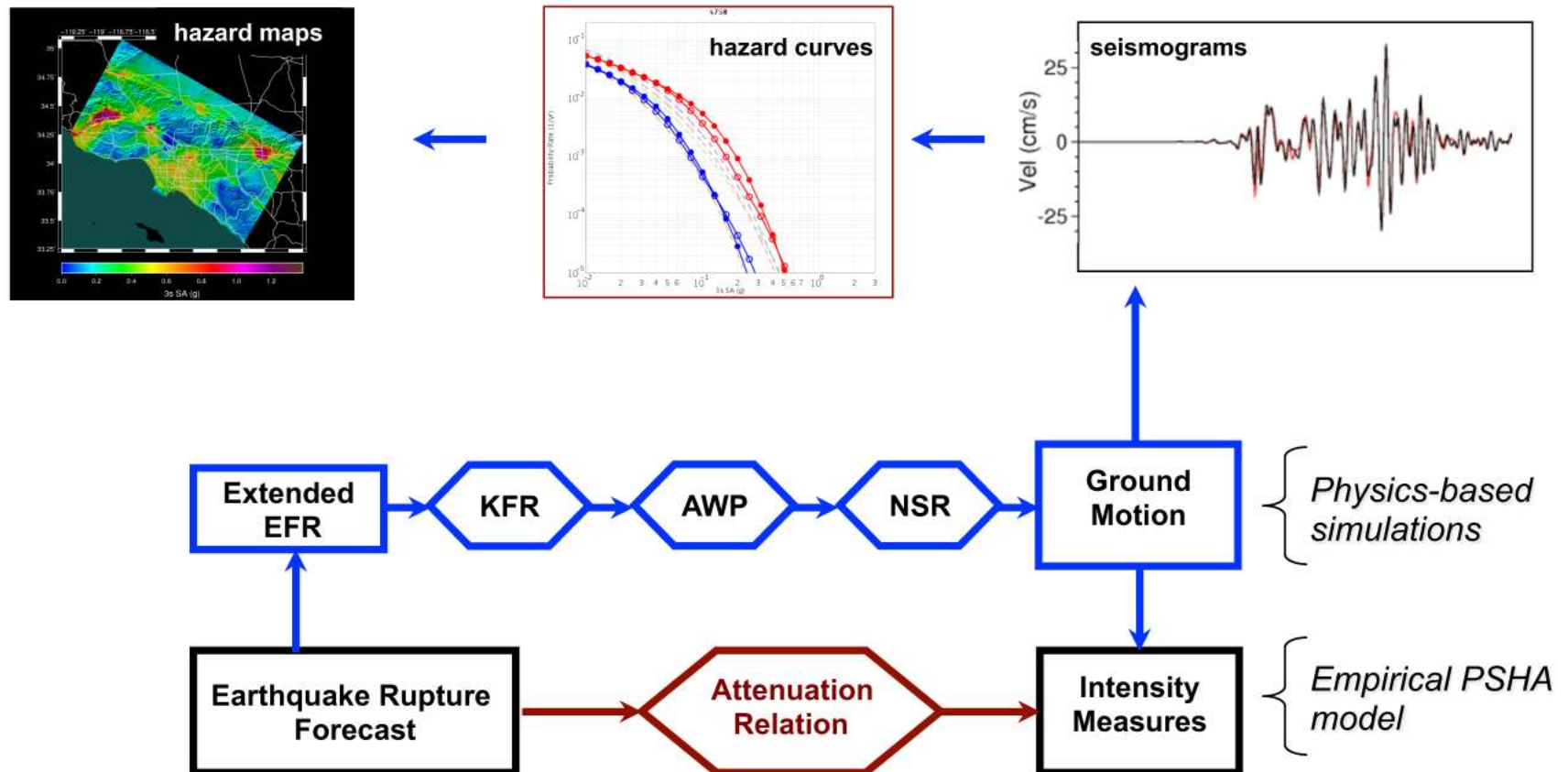
t=10 sec



For the two simulations shown, all differences can be attributed to the impact of the geological structural models. The animation on the right shows a Chino Hills simulation with unmodified SSEC Community Velocity Model (CVM-S v11.2). The animation on the left shows a Chino Hills simulation that uses a modified version of CVM-S v11.2 that contains more realistic small-scale complexities. The animations show that the more complex velocity structure used in the left simulation, clearly impacts that ground motion distribution, the levels of peak ground motion, and the duration of shaking. The next scientific step is to compare both simulation results against observed data for this event to determine which velocity model most closely reproduces the observed ground motions for this earthquake.



# CyberShake Platform: Physics-Based PSHA



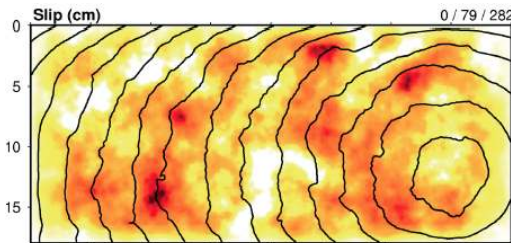
KFR = kinematic fault rupture model

AWP = anelastic wave propagation model

NSR = nonlinear site response



# Dependence of Directivity Effects on Rupture Complexity

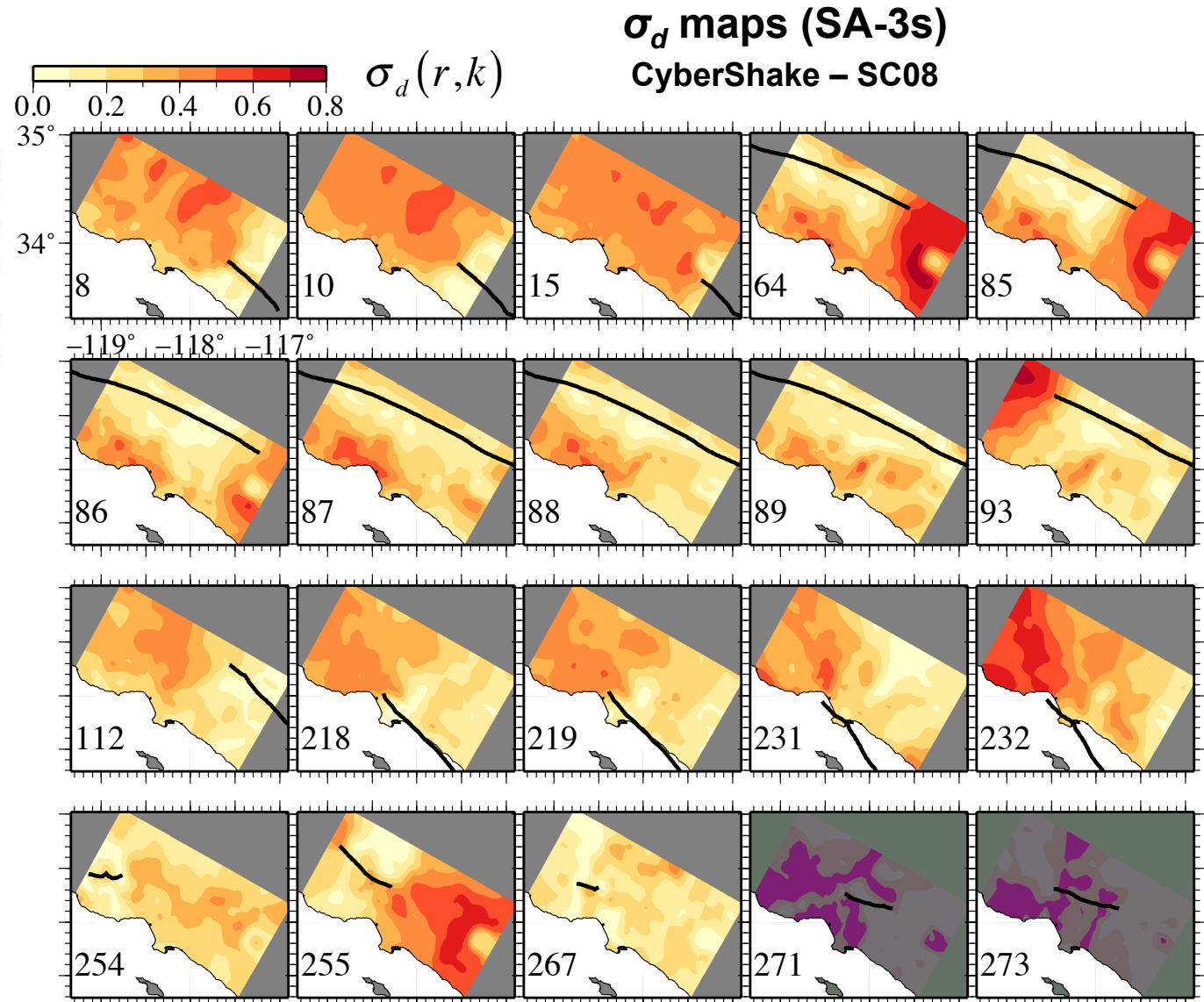


**GenSlip v2.1**

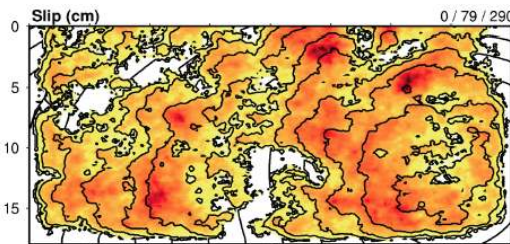
**Graves & Pitarka (2007)**

$$\bar{\sigma}_d = \langle \sigma_d(r, k) \rangle_{K, R}$$

Model	$\bar{\sigma}_d$
v2.1 raw	0.41
v2.1-SC08	0.31



# Dependence of Directivity Effects on Rupture Complexity

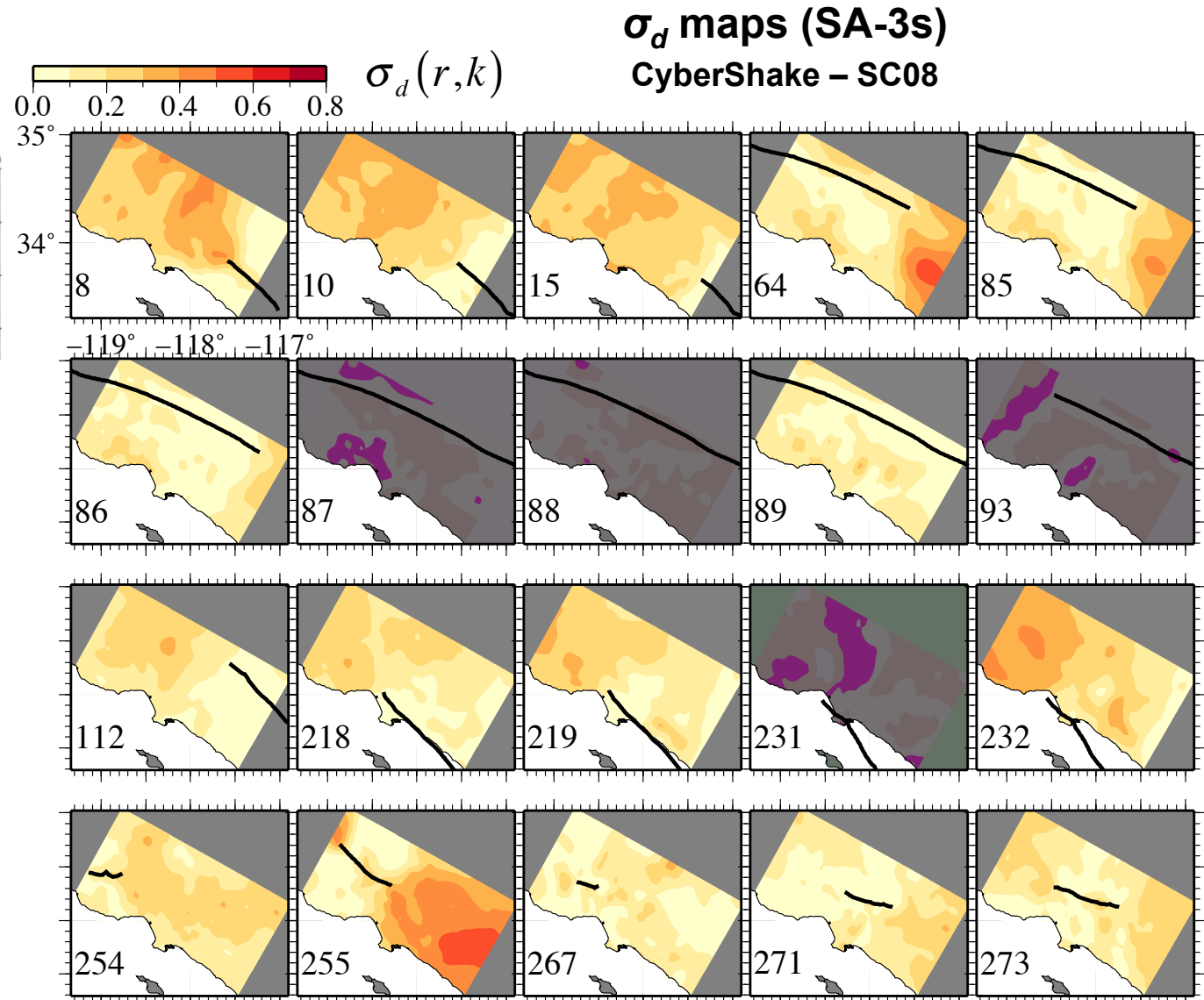


GenSlip v3.2

Graves & Pitarka (2010)

$$\bar{\sigma}_d = \langle \sigma_d(r, k) \rangle_{K, R}$$

Model	$\bar{\sigma}_d$
v2.1 raw	0.41
v2.1-SC08	0.31
v3.2 raw	0.26
v3.2-SC08	0.17

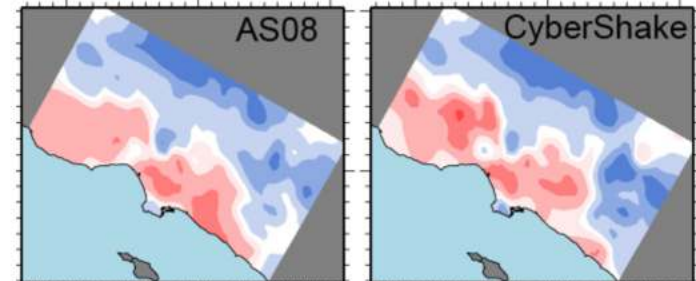
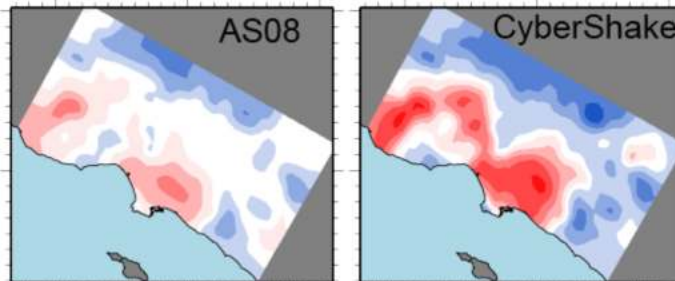


# Dependence of Basin Effects on Velocity Structures (SA corrected for $V_{s30}$ )

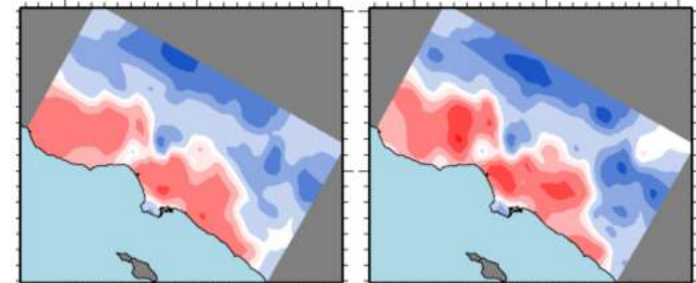
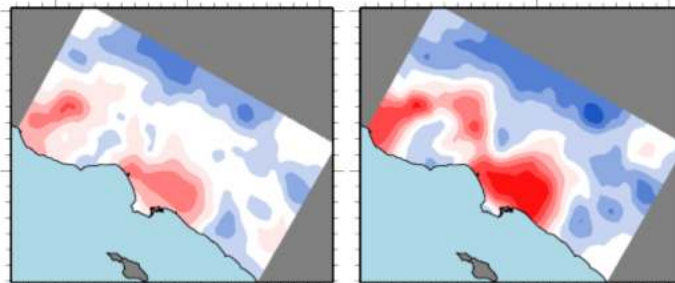
**CVM-S4**

**CVM-H11.9**

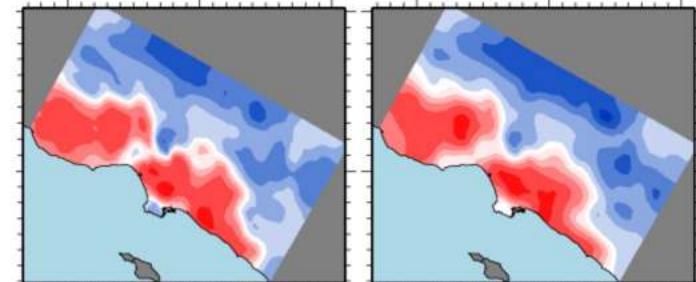
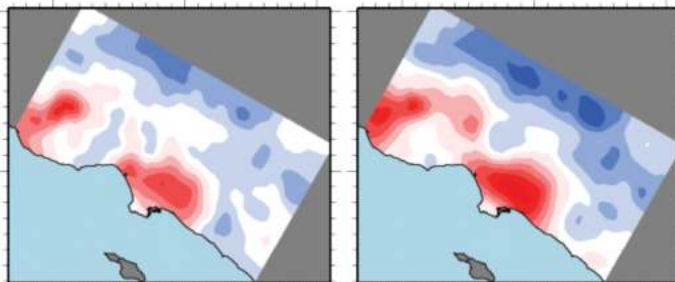
**T=3.0s**



**T=5.0s**



**T=10.0s**



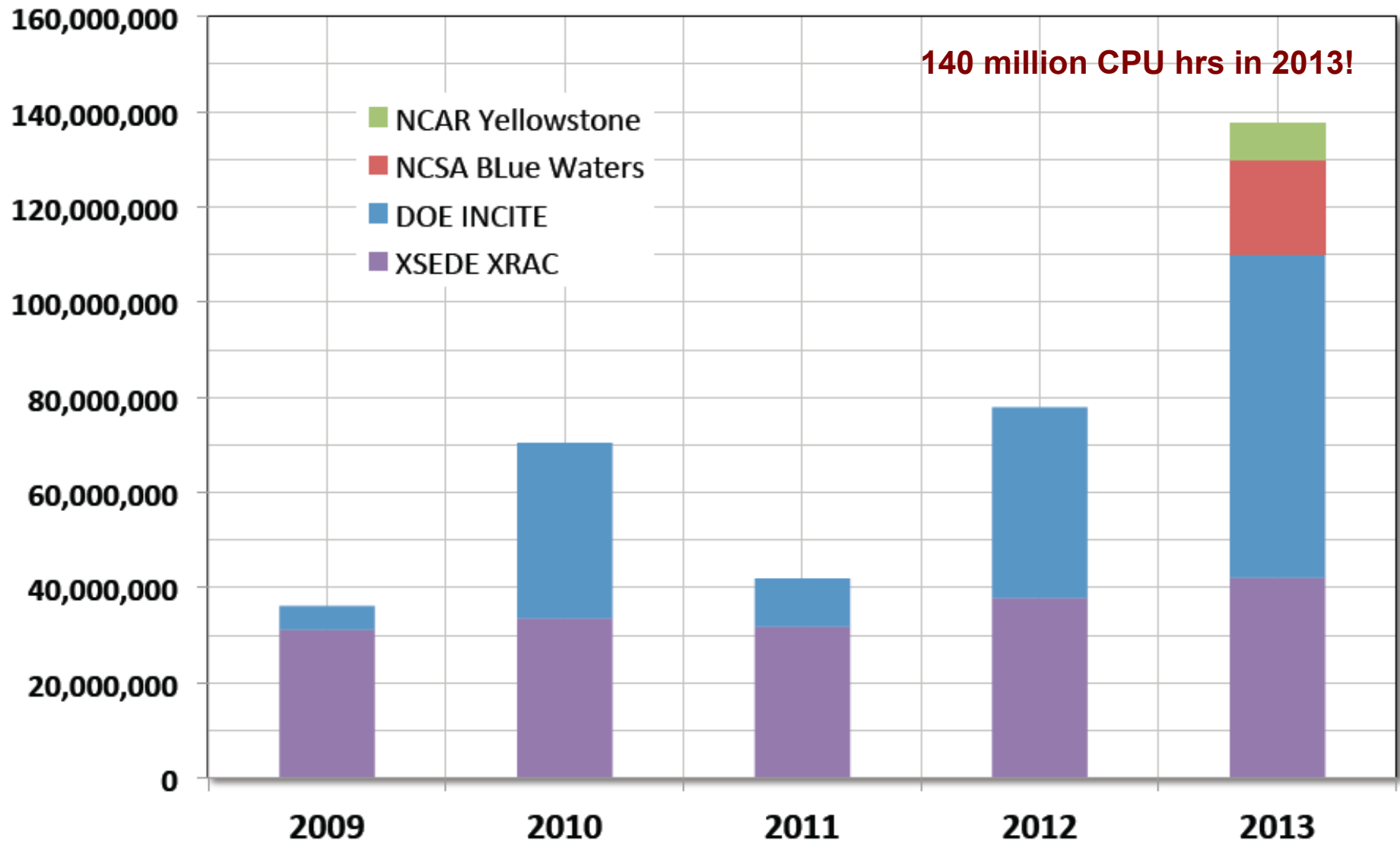
Abrahamson & Silva  
(2008) NGA GMPEs

CS11

Abrahamson & Silva  
(2008) NGA GMPEs

CS13

# *SCEC NSF/DOE Allocation Awards* (CPU hours)





## *Growth and Spread of ShakeOut Drills*

**2008: 5.4 million**

Southern California

**2009: 6.9 million**

California, New Zealand West Coast

**2010: 7.9 million**

California, Nevada, Guam

**2011: 12.5 million**

CA, NV, GU, OR, ID, BC, and Central US (AL, AR, GA, IN, IL, KY, MI, MO, OK, SC, TN)

**2012: 19.4 million**

All above plus: AK, AZ, Southeast (DC, GA, MD, NC, SC, VA), UT, WA, Puerto Rico, Japan (central Tokyo), New Zealand, Southern Italy (US naval bases and surrounding areas), and “Global” site for all other areas



**2013: 20+ million?**

All above except New Zealand, plus: Rocky Mountain region (CO, WY, MT), HI, OH (added to Central U.S. region), WV & DE (added to the Southeast region), Northeast region (CT, PA, MA, ME, NH, NJ, NY, RI), American Samoa, U.S. Virgin Islands, Commonwealth of the Northern Marianas Islands. Charlevoix region of Quebec, and expansion across Japan



# SeismicWaves

How the National Earthquake Hazards Reduction Program Is Advancing Earthquake Safety

September 2013

## Great ShakeOut Earthquake Drills

Now in a State (or Country) near You!

The 2008 “Great Southern California ShakeOut” was planned as a one-time event to motivate millions of people to practice “Drop, Cover, and Hold On” and to get prepared at work, school, and home for the potential of a major earthquake. With the involvement of many partner organizations, the ShakeOut program has since expanded to include 42 states and U.S. territories, plus four other countries. More than 19.5 million people participated in 2012.

### ShakeOut Origins

Beginning in 2007, Dr. Lucy Jones of the U.S. Geological Survey (USGS) led more than 300 scientists, engineers, and others to create the “ShakeOut Scenario,” a comprehensive study of how a magnitude 7.8 earthquake on the San Andreas Fault would directly affect southern California (and economically the entire country). This became the basis of a state-led exercise held in November 2008. To involve the general public in the exercise, the Earthquake Country Alliance<sup>1</sup> (ECA) organized a set of activities including the first ShakeOut drill on November 13, 2008. The Southern California Earthquake Center (SCEC), with funding from the National Science Foundation (NSF) and the USGS, developed supercomputer simulations of this earthquake as the basis for loss estimation in the scenario, and to communicate the intensity of expected ground shaking



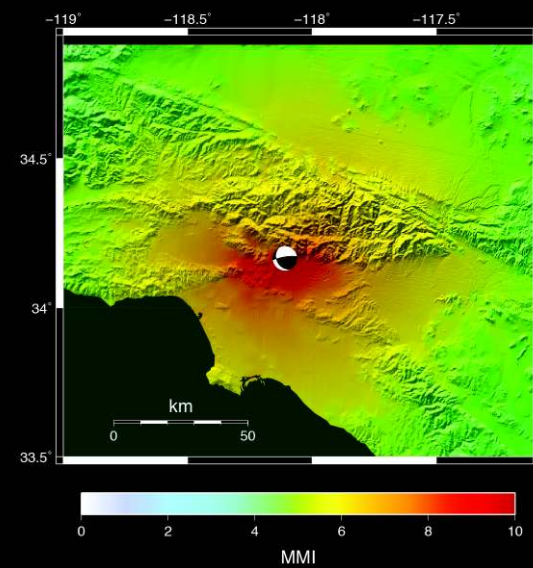
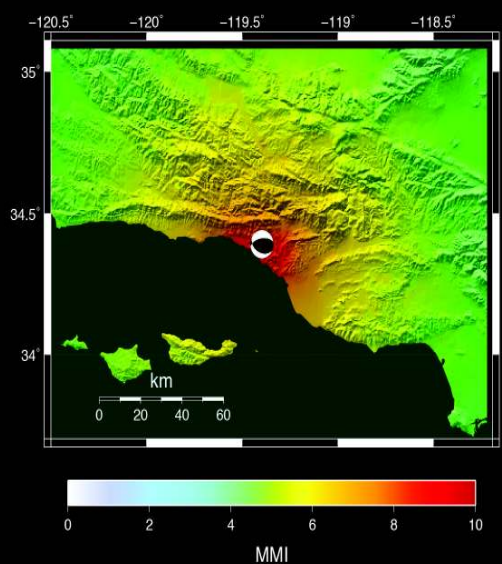
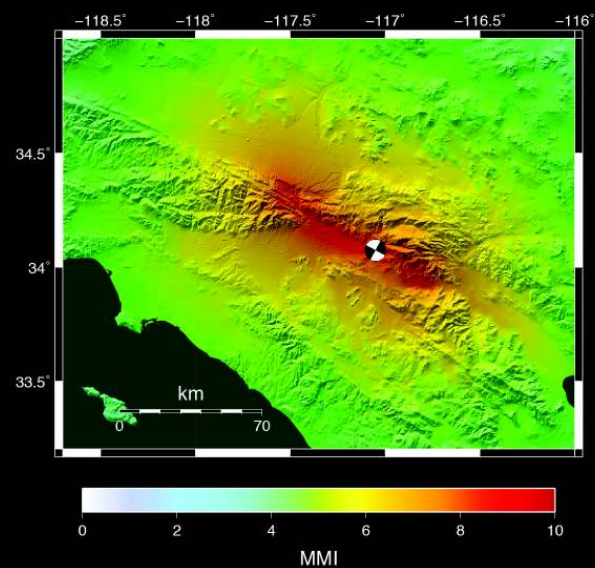
ShakeOut website at [www.shakeout.org](http://www.shakeout.org). Courtesy of SCEC.



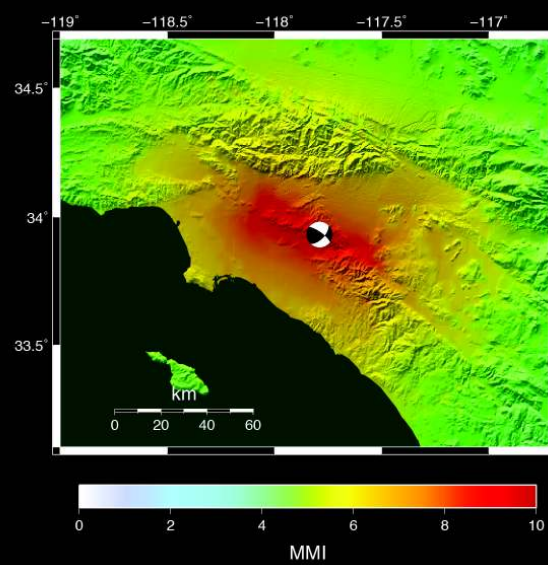
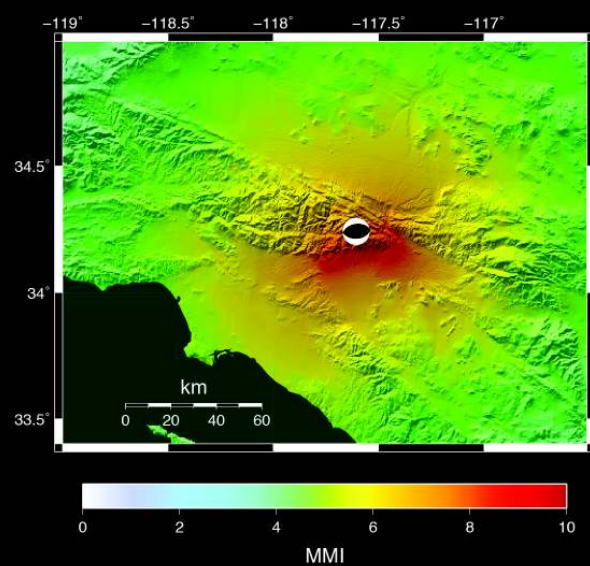
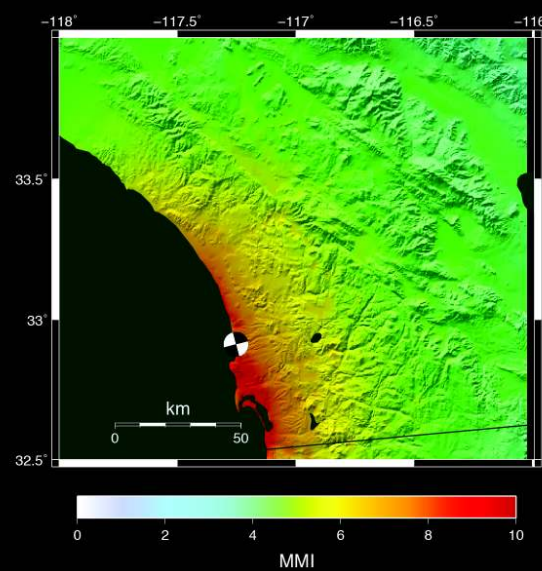
## *Undergraduate Studies in Earthquake Information Technology (UseIT)*



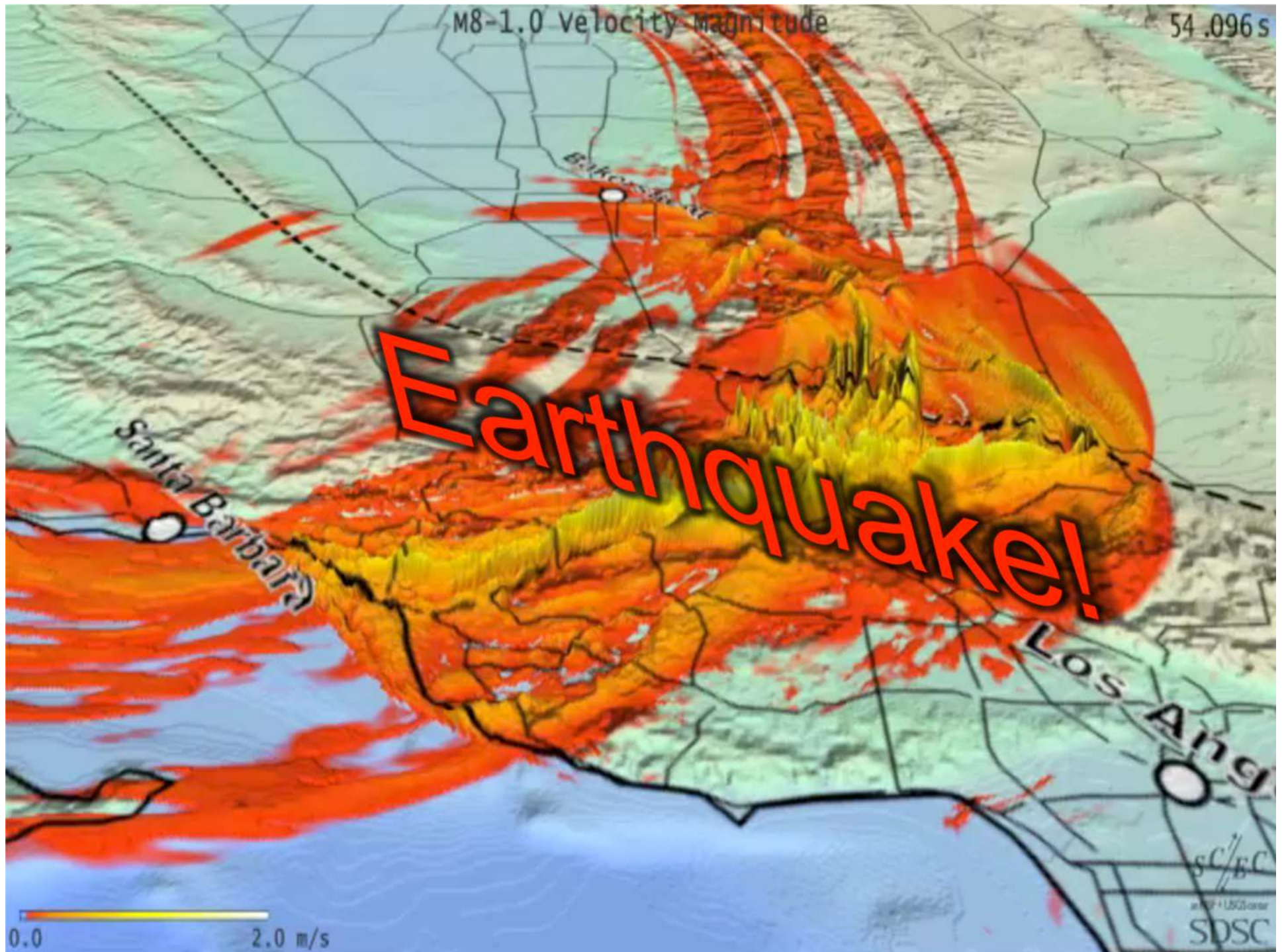
**2013 Grand Challenge: *Explore UCERF3.3 and produce visualizations of the earthquake hazard in Southern California for public education during the 20th Anniversary of the 1994 Northridge earthquake***



## 2013 SCEC Annual Meeting - Scientific Response Scenario Activity









Parkfield seismic network

M8-1.0 velocity magnitude

54.096 s

**T = 54 s**

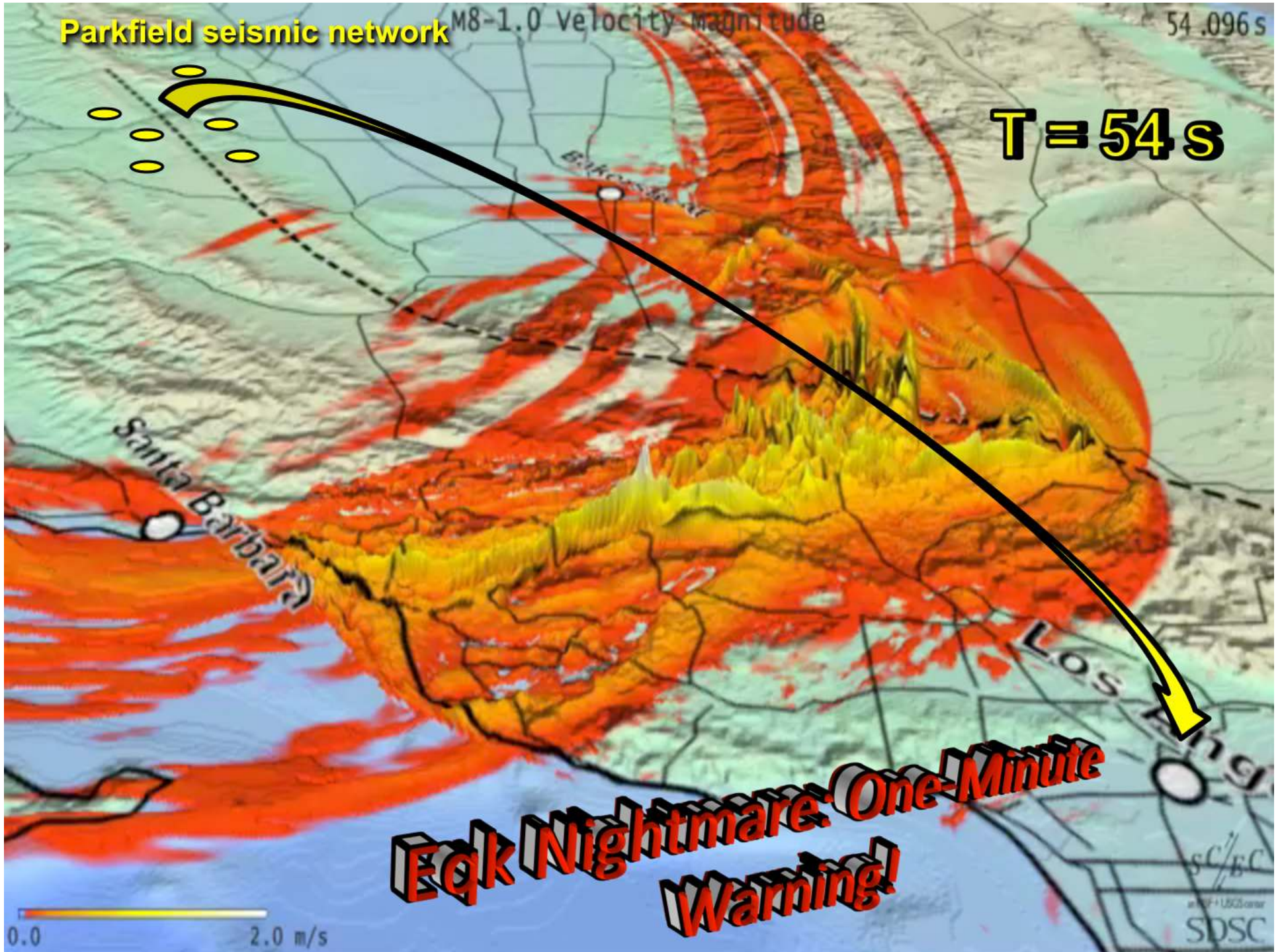
Santa Barbara

Los Angeles

**Eqk Nightmare: One-Minute  
Warning!**

0.0 2.0 m/s

SC/EC  
at USGS center  
SDSC





Uh-oh, earthquake coming!

Me!



## *‘Northridge Near You’ Scenarios*

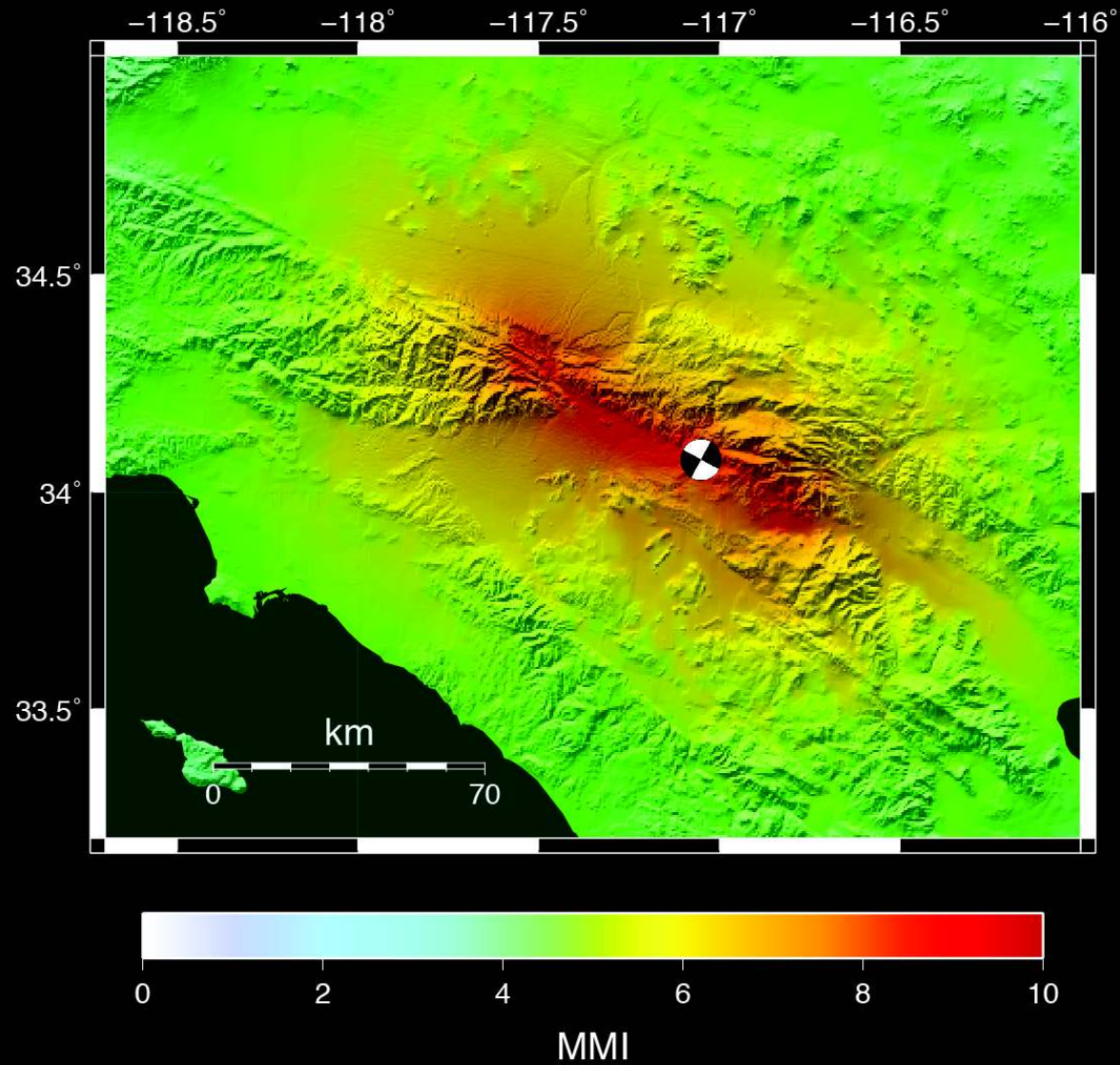
- **At this Annual Meeting, we will use six of the ‘Northridge Near You’ scenarios as a set of earthquake response exercises**
- **Focus on scientific goals of post-event research**
  - Obtain synoptic overview of main rupture and significant secondary effects
  - Capture perishable data such as surface faulting, landslide, liquefaction, etc.
  - Observe aftershock patterns and characterize statistics of their occurrence
  - Capture deformation transients

## *‘Northridge Near You’ Scenarios*

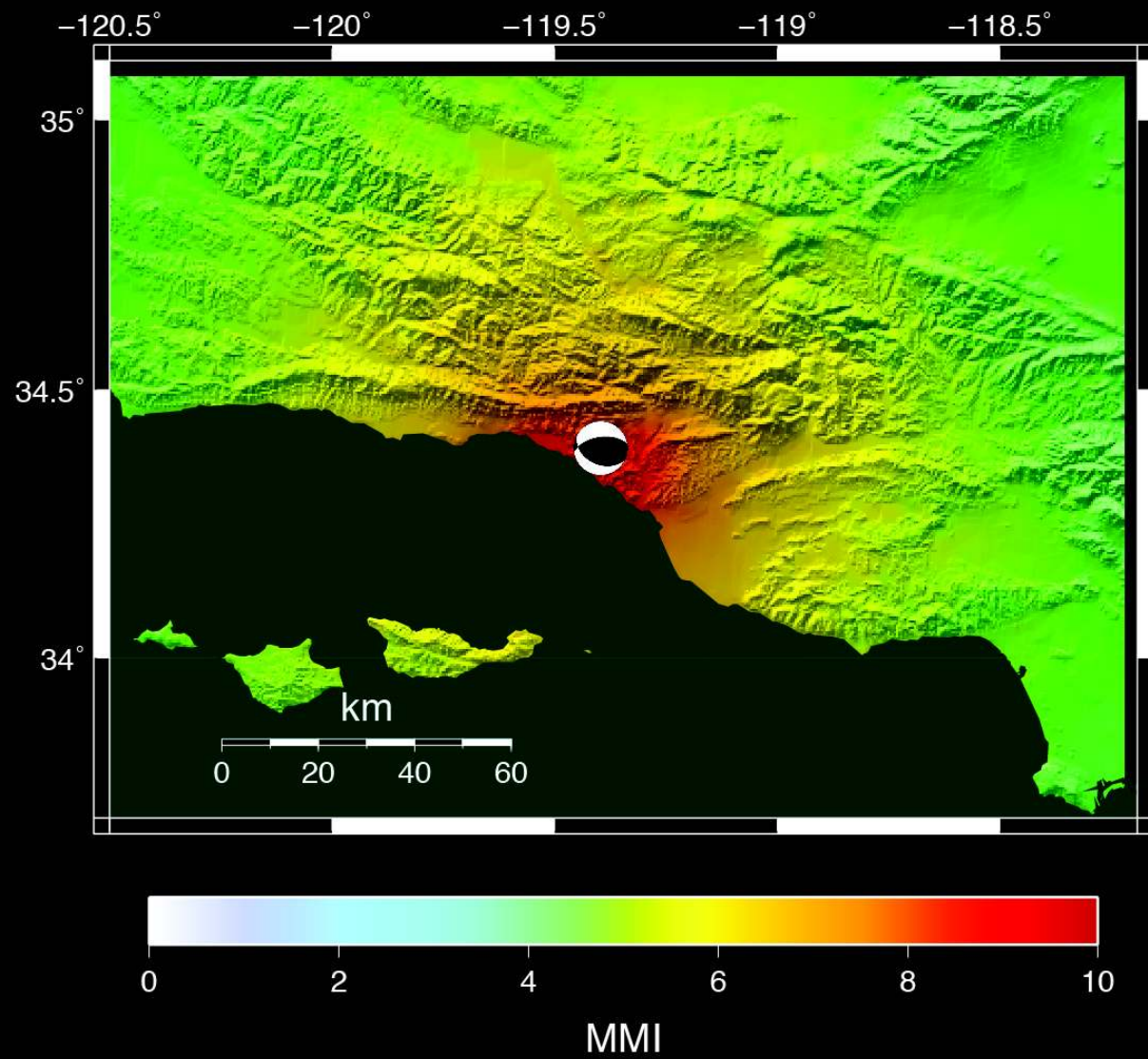
- **These exercises will contribute to the planning of scientific observations that to be made after future earthquakes in Southern California**
  - **How should the scientific community respond?**
  - **In what ways can advanced (and rapid) planning result in improved scientific data acquisition?**
  - **What key observations are needed to answer remaining big questions in earthquake science?**
  - **For each scenario, think it over and interact with the interns and your colleagues in lobby**



- 1) San Gorgonio: M 6.85, right-lateral strike slip (local thrusting)  
34.116, -117.112, depth = 7 km



2) Ventura M 6.55, thrust  
34.401, -119.235, depth = 12 km



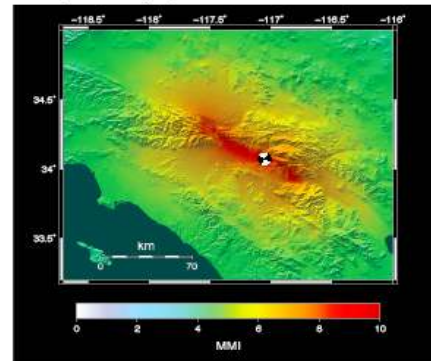
# SCEC Community Post-Earthquake Science Response Exercise

## ① What scientific questions can be answered?

- thru geologic observations?
- thru geodetic observations?
- thru seismologic observations?
- thru other geophysical methods (e.g. drilling)?
- thru theoretical and numerical modeling?

## ③ What new observational systems should be developed? How can the current systems be improved?

**San Bernardino–San Andreas**  
M 6.85, right-lateral strike slip (local thrusting)  
34.116, -117.112, depth = 7 km



## ② What data should be acquired?

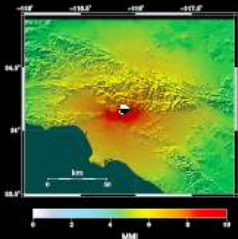
- by instrument deployments?
- by field observations?
- by remote sensing?

## ④ What method do you use for sharing data? (e.g. response.scec.org, CA Earthquake Clearinghouse, data centers, etc.)

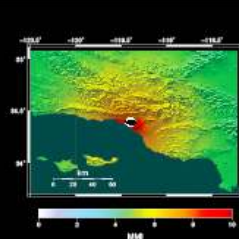
**How should we respond to the earthquake scenario above?** Review, discuss, and respond in the space provided above. Go to the SCEC UseIT Demo to learn more about this “Northridge Near You” scenario.

# How should we respond to a “Northridge Near You” scenario?

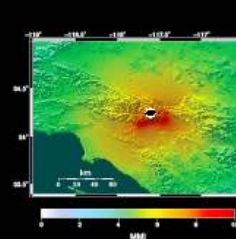
**Pasadena–Raymond (Downtown LA)**  
M 6.65, oblique, thrust & left-lateral  
34.179, -118.137, depth = 9 km



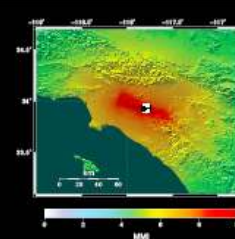
**Santa Barbara–Red Mountain (Ventura)**  
M 6.55, thrust  
34.401, -119.235, depth = 12 km



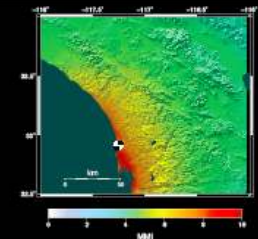
**Ontario–Cucamonga (Rialto)**  
M 6.55, thrust  
34.240, -117.517, depth = 7 km



**Santa Ana–Elsinore (Whittier)**  
M 6.85, oblique, thrust & right-lateral  
33.944, -117.811, depth = 7 km



**Mission Valley–Rose Canyon (San Diego)**  
M 6.75, right-lateral strike slip  
32.898, -117.259, depth = 6 km



①

②

③

④

①

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③

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③

④

**Write your answers in the space above. Numbers 1–4 refer to the questions from the poster to the left. Go to the SCEC UseIT Demo for more information on these earthquake scenarios.**



## Hilton Palm Springs Plaza Ballroom

### Sunday, September 8, 2013

08:00 - 20:00 Poster Set-Up  
17:00 - 18:00 Meeting Ice-Breaker (BAR, water station)  
21:00 - 22:30 Poster Viewing (Water Station)

### Monday, September 9, 2013

16:00 - 17:30 Poster Viewing (Water Station)  
21:00 - 22:30 Poster Viewing (Water Station)

### Tuesday, September 10, 2013

16:00 - 17:30 Poster Viewing (Water Station)  
21:00 - 22:30 Poster Viewing (Water Station)

### Wednesday, September 11, 2013

07:00 - 08:00 Poster Removal

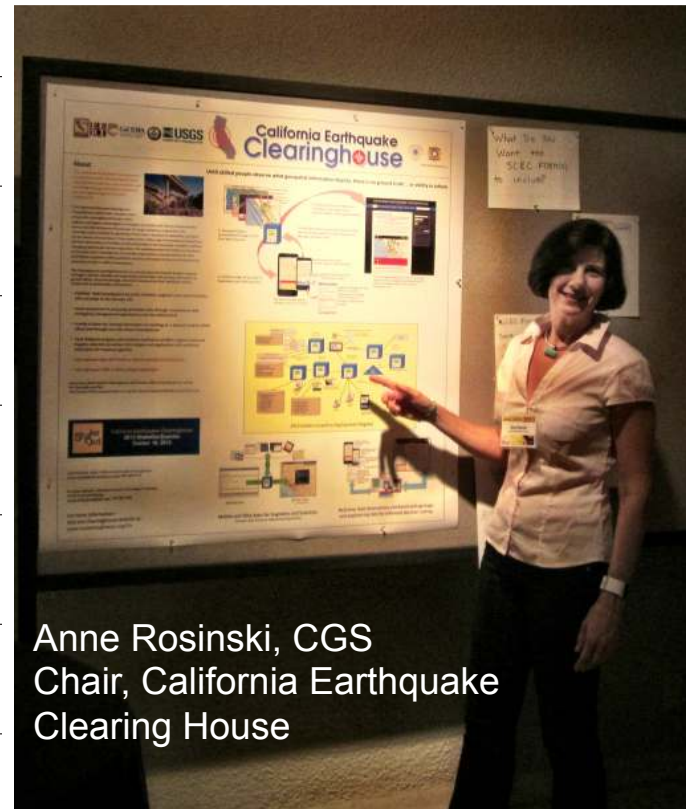
Two Posters per Poster Board

Maximum Poster Size:  
45 in high x 45 in wide

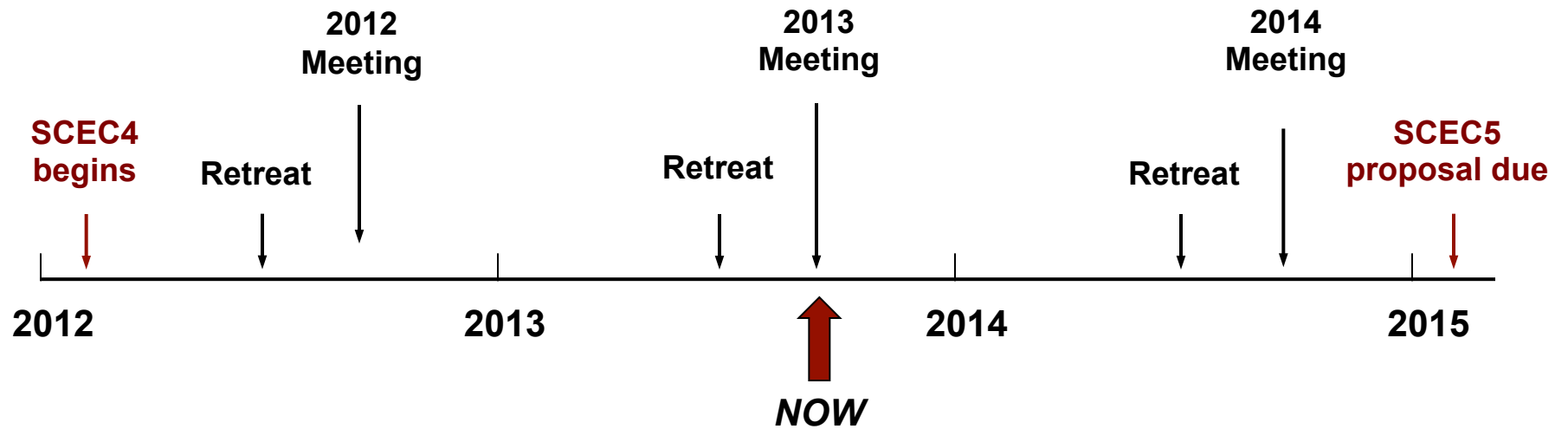
UseIT  
Demo

Egk  
Response  
Poster

Water Station



## ***SCEC4 Timeline***





# Agenda

## Monday, September 9

07:00 - 08:00	<b>SCEC Annual Meeting Registration &amp; Check-In</b> at Hilton Lobby
07:00 - 08:00	<b>Breakfast</b> at Hilton Poolside
08:00 - 11:00	<b>The State of SCEC</b> <u>Location:</u> Horizon Ballroom, Hilton Palm Springs
08:00	Welcome and State of the Center (Tom Jordan)
08:30	Report from the National Science Foundation (Greg Anderson)
08:45	Report from the U.S. Geological Survey (Bill Leith)
09:00	Communication, Education, & Outreach (Mark Benthien)
09:30	SCEC Science Accomplishments and Collaboration Plan (Greg Beroza)
11:00 - 11:30	Break
11:30 - 13:00	<b>Stress Transfer from Plate Motion to Crustal Faults: Long-Term Fault Slip Rates</b> <u>Moderator:</u> Kaj Johnson (Indiana) <u>Location:</u> Horizon Ballroom, Hilton Palm Springs
13:00 - 14:30	<b>Lunch</b> at Hilton Restaurant, Tapestry Room, and Poolside
14:30 - 16:00	<b>Stress-Mediated Fault Interactions and Earthquake Clustering: Evaluation of Mechanisms</b> <u>Moderator:</u> Jeanne Hardebeck (USGS) <u>Location:</u> Horizon Ballroom, Hilton Palm Springs
16:00 - 17:30	<b>Poster Session 2</b> in Plaza Ballroom
19:00 - 21:00	<b>SCEC Honors Banquet</b> at Hilton Poolside
21:00 - 22:30	<b>Poster Session 3</b> in Plaza Ballroom

### Science Session 1 (Monday 11:30)

**New paleoseismic data from SoSAFE: time dependency and rupture patterns on the San Andreas and San Jacinto Faults,**  
Kate Scharer (USGS) – see p.10

**Beyond the Time-Independent Uniform California Earthquake Rupture Forecast: Where Should SCEC Go From Here?**  
Bill Ellsworth (USGS) – see p.11

### Science Session 2 (Monday 14:30)

**Recent Results from the Collaboratory for the Study of Earthquake Predictability (CSEP),** Max Werner (Princeton) – see p.11

**Variable seismic response to fluid injection in central Oklahoma,** Katie Keranen (Cornell) – see p.12

# Agenda

## Science Session 3 (Tuesday 08:00)

**Insights into subduction thrust structure and mechanics from drilling the rupture zone of the 2011 Tohoku-oki earthquake,**  
*Fred Chester (Texas A&M) – p.12*

**Uncovering the Mysteries of Tsunami Generation and Anomalous Seismic Radiation in the Shallow Subduction Zone,**  
*Shuo Ma (SDSU) – p.12*

## Science Session 5 (Tuesday 11:30)

**4D maps of fault aseismic slip obtained through multitemporal InSAR and time-dependent modeling,**  
*Manoochehr Shirzaei (ASU) – see p.14*

**Toward a Continuous Monitoring of the Horizontal Displacement Gradient Tensor Field using oGPS Observations from PBO,**  
*Bill Holt (SUNY Stony Brook) – see p.14*

## Science Session 6 (Tuesday 14:30)

**High-frequency rupture dynamics and ground motion prediction,**  
*Steve Day (SDSU) – see p.14*

**Using Ambient Noise Correlations for Studying Site Response,**  
*Victor Tsai (Caltech) – see p.15*

## Tuesday, September 10

07:00 - 08:00	<b>Breakfast</b> at Hilton Poolside
08:00 - 09:30	<b>Evolution of Fault Resistance During Seismic Slip: Scale-Appropriate Laws for Rupture Modeling</b> <u>Moderator:</u> Eric Dunham (Stanford) <u>Location:</u> Horizon Ballroom, Hilton Palm Springs
09:30 - 11:00	<b>Structure and Evolution of Fault Zones and Systems: Relation to Earthquake Physics</b> <u>Moderator:</u> Emily Brodsky (UCSC) <u>Location:</u> Horizon Ballroom, Hilton Palm Springs
11:00 - 11:30	Break
11:30 - 13:00	<b>Causes and Effects of Transient Deformations: Slow Slip Events and Tectonic Tremor</b> <u>Moderator:</u> Rowena Lohman (Cornell) <u>Location:</u> Horizon Ballroom, Hilton Palm Springs
13:00 - 14:30	<b>Lunch</b> at Hilton Restaurant, Tapestry Room, and Poolside
14:30 - 16:00	<b>Seismic Wave Generation and Scattering: Prediction of Strong Ground Motions</b> <u>Moderator:</u> Jean-Paul Ampuero (Caltech) <u>Location:</u> Horizon Ballroom, Hilton Palm Springs
16:00 - 17:30	<b>Poster Session 4</b> in Plaza Ballroom
19:00 - 21:00	<b>Dinner</b> at Hilton Poolside
19:00 - 21:00	<b>SCEC Advisory Council Meeting</b> in Boardroom
21:00 - 22:30	<b>Poster Session 5</b> in Plaza Ballroom

# Agenda

## Wednesday, September 11

### Science Session 7 (Wednesday 08:00)

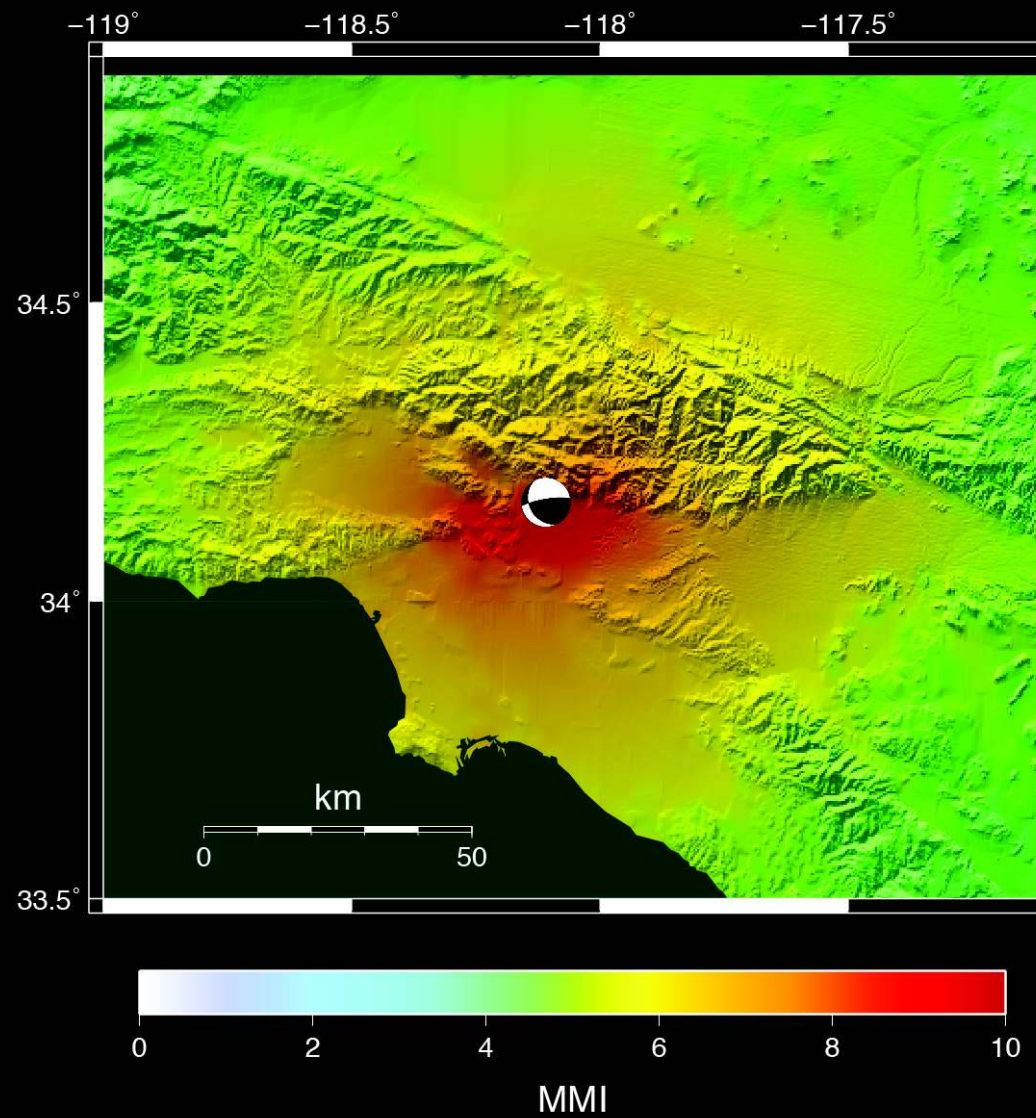
**Earthquake early warning: Now, or after the next big quake?** *Richard Allen (UC Berkeley)*  
– see p.15

**Setting the stage for early earthquake alerts and warnings,** *Ann Bostrum (U Washington)*  
– see p.16

07:00 - 08:00	<b>Poster Removal</b> from Plaza Ballroom
07:00 - 08:00	<b>Breakfast</b> at Poolside
08:00 - 09:30	<b>Earthquake Early Warning and Risk Communication</b> <u>Moderator:</u> Lucy Jones (USGS) <u>Location:</u> Horizon Ballroom, Hilton Palm Springs
09:30 - 11:00	<b>The Future of SCEC</b> <u>Location:</u> Horizon Ballroom, Hilton Palm Springs
09:30	2014 Science Collaboration Planning (Greg Beroza)
10:30	Report from the SCEC Advisory Council (Jeff Freymueller)
11:00	Adjourn
11:30 - 13:30	<b>SCEC Planning Committee Lunch Meeting</b> in Palm Canyon Room
11:30 - 13:30	<b>SCEC Board of Directors Lunch Meeting</b> in Tapestry Room

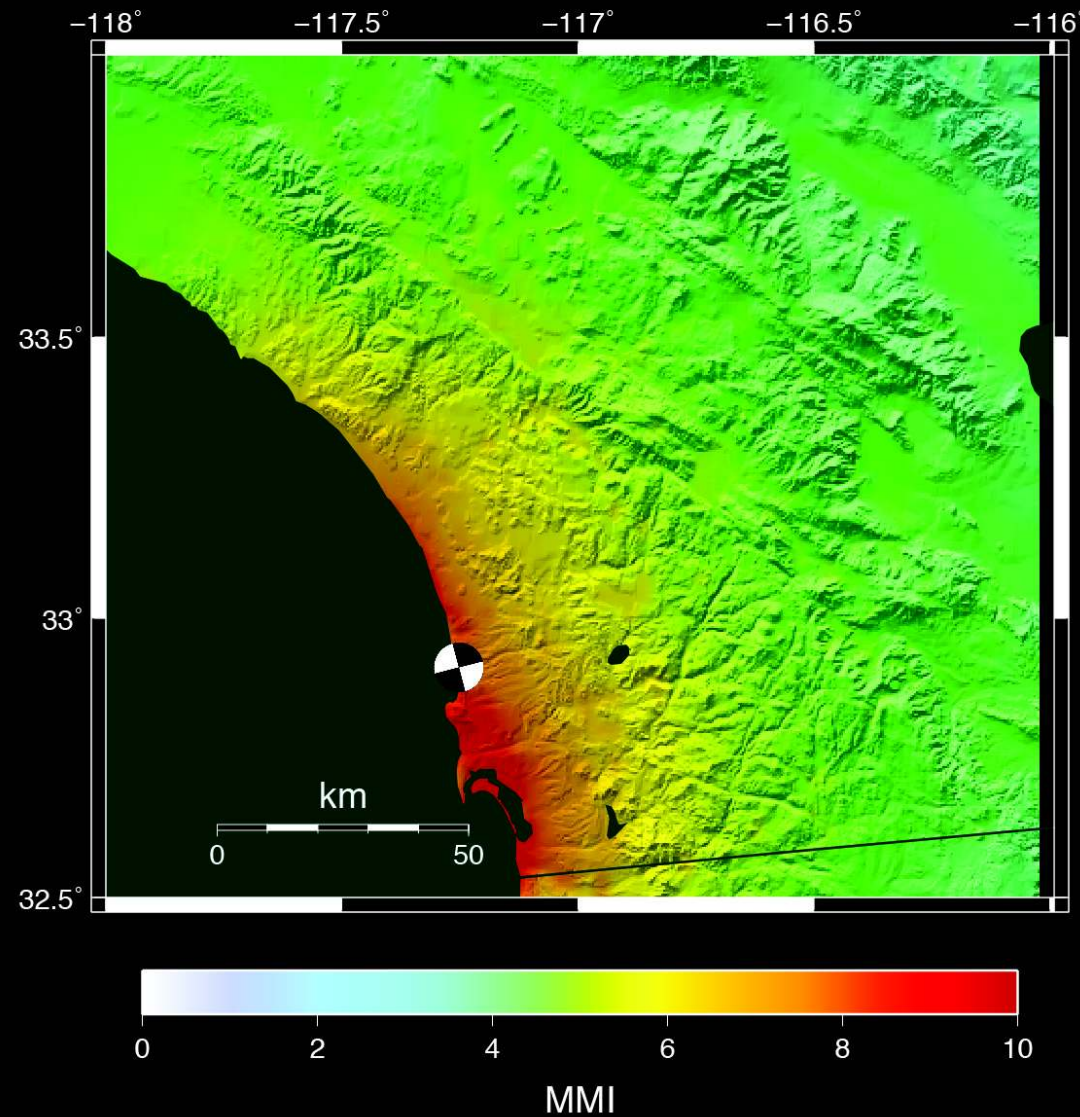
*Enjoy the meeting!*

3) Pasadena - Raymond (Downtown LA); M 6.65, oblique, thrust & left-lateral  
34.179, -118.137, depth = 9 km

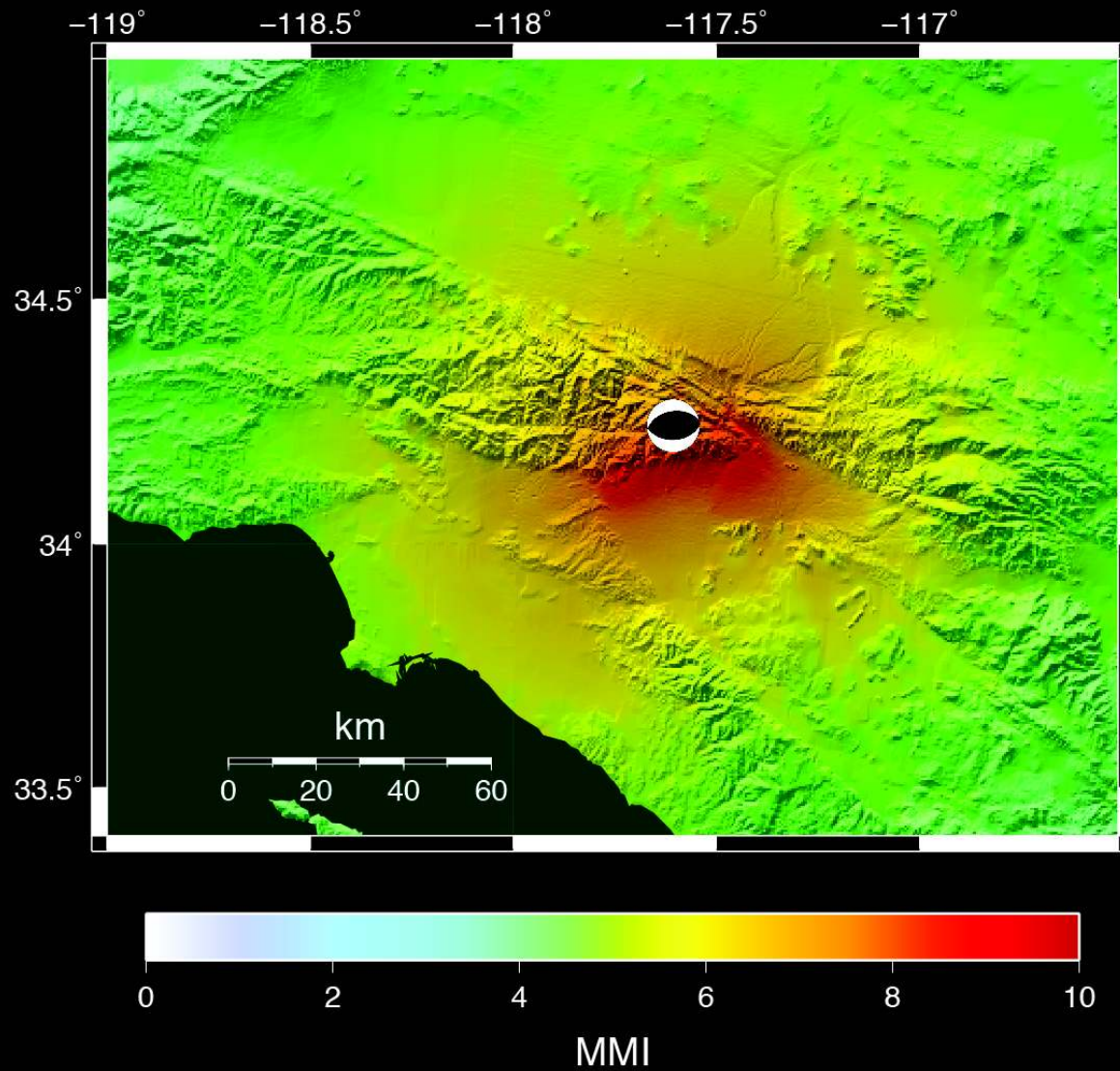




4) Mission Valley – Rose Canyon (San Diego); M 6.75, right-lateral strike slip  
32.898, -117.259, depth = 6 km



5) Ontario – Cucamonga (Rialto); M 6.55, thrust  
34.240, -117.517, depth = 7 km



6) Santa Ana – Elsinore (Whittier); M 6.85, oblique, thrust & right-lateral  
33.944, -117.811, depth = 7 km

