

# 2011 EARTHQUAKE SIMULATORS WORKSHOP REPORT

## Workshop on Earthquake Simulators, Number 5

PI: Terry E. Tullis, Brown University

### SUMMARY

This was a workshop again to bring together those in the SCEC community who are working on various types of computer simulators of earthquake sequences. The principal purposes of the workshop were 1) to compare our first results for an all-California fault model and 2) to prepare for a joint workshop with the WGCEP in June, 2011. The purpose of that joint June workshop is to consider the value that Earthquake Simulators might play in developing UCERF3 and subsequent versions of UCERF. The SCEC workshop was held at the end of an ACES meeting, the last day of which had a focus on earthquake simulations. Thus that last day involved more general presentations on our earthquake simulators and was attended by many of the ACES participants. Then, after that last day of the ACES workshop, a subsequent day was specifically devoted to considering how the results of our different simulators compare and to prepare for the joint workshop in June.

Note that in the AGENDA below the presentations with an \* preceding their time on May 4 are those that we regard as part of this SCEC workshop. As can be seen, some of these occur on the last day of the ACES workshop, due to its focus on "Quake Simulations." Everything on May 5 is part of the SCEC workshop.

### AGENDA

#### SCEC Earthquake Simulators Workshop 5

May 4-5, 2011

#### Makena Beach and Golf Resort, Maui, HI

**Wednesday, May 4th**  
**Time**

**Session/Talk Title**

**Speaker**

**Computational Technology & Quake Simulations**

8:30 am

Complex Faulting Across the Los Angeles Portion of the Pacific-North American Plate Boundary

Andrea Donnellan

8:50 am

The OpenQuake InfoMall

Geoffrey Fox

9:10 am

E-DECIDER: Experiences Developing Earthquake Disaster Decision Support and Response Tools

Marlon Pierce

9:30 am	Analysis of 30 Minute Resolution GPS Time Series from the Tohoku-Oki Earthquake via Statistical Modeling	Robert Granat
9:50 am	Web-Based Approach to Multihazard Analysis	James Holliday
* 10:10 am	Virtual California: Inner Workings, Recent Results and Future Development	Michael Sachs
10:30 am	<b>Break</b>	
11:00 am	Scientific Visualization for Earthquake Science and Simulation	Louise Kellogg
11:15 am	Simple Slip Models from Differential InSAR Images	Jay Parker
11:30 am	Reconciling Precariously Balanced Rocks with Large Earthquakes on the San Andreas Fault System in S. California	Lisa Ludwig Grant
11:50 am	E-DECIDER: Experiences Developing Earthquake Disaster Decision Support and Response Tools	Maggi Glasscoe
12:10 pm	<b>Lunch</b>	
	<b>Simulators &amp; UCERF</b>	
* 1:30 pm	Use of Earthquake Simulators by WGCEP	Ned Field
* 2:30 pm	RSQSim – A Regional Scale Earthquake Simulator	Keith Richards-Dinger
* 2:50 pm	Virtual California: A Guided Tour	John Rundle/Michael Sachs
3:10 pm	<b>Break</b>	
* 3:20 pm	Summary of the SCEC Simulators Project	Terry Tullis
* 4:00 pm	ALLCAL: An Earthquake Simulator for All of California	Steven Ward
* 4:20 pm	Structural Maturity of Faults and How it Affects Seismic Fault Behavior	Olaf Zielke

4:40 pm	<b>Discussion</b>	Ned Field and Terry Tullis
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**Thursday, May 5th**

<b>Time</b>	<b>Session/Talk Title</b>	<b>Speaker</b>
	<b>SCEC Simulators Workshop and Discussions</b>	
8:30 am	Discussion	
9:00 am	Epistemic uncertainty in California-wide simulations of synthetic seismicity	Fred Pollitz
9:20 am	Interactions in Virtual California	Michael Sachs
9:40 am	First Report on SCEC Earthquake Simulator Comparisons for an All-California Fault Set	Terry Tullis
10:30 am	Discussion	
12:00 pm	Lunch	
1:30 pm	Discussion	
5:00 pm	End	

For those wanting details of the presentations, the PowerPoint files can be found at [http://scec.usc.edu/research/eqsims/workshop\\_2011\\_05\\_05.html](http://scec.usc.edu/research/eqsims/workshop_2011_05_05.html)

**VENUE AND ATTENDEES**

The workshop was held at the Makena Beach and Golf Resort, Maui, HI. Those in attendance were:

Michael Barall	Invisible Software	mbinv@invisiblesoft.com
Andrea Donnellan	JPL	andrea.donnellan@jpl.nasa.gov
Ned Field	USGS	nfield@usgs.gov
Lisa Grant Ludwig	UC Irvine	lgrant@uci.edu
Dave Jackson	UCLA	djackson@ucla.edu
Louise Kellogg	UC Davis	kellogg@ucdavis.edu
Sylvain Barbot	Caltech	sbarbot@caltech.edu
Junle Jiang	Caltech	jjle@gps.caltech.edu
Jay Parker	JPL	jay.w.parker@jpl.nasa.gov
Keith Richards-Dinger	UC Riverside	keithrd@ucr.edu
John Rundle	UC Davis	rundle@ucdavis.edu

Michael Sachs	UC Davis	
Terry Tullis	Brown	Terry_Tullis@brown.edu
Don Turcotte	UC Davis	turcotte@geology.ucdavis.edu
Steve Ward	UC Santa Cruz	ward@es.ucsc.edu
Olaf Zielke	ASU/ Potsdam	olaf.zielke@asu.edu

### **BRIEF SUMMARY OF RESULTS**

Clearly one of the biggest tasks facing the simulator community is to determine how meaningful are their simulations. During our 2011 workshop it became evident that two of the simulators (ALLCAL and RSQSim) behave quite similarly and are similar to observations, whereas two others (VIRTCAL and ViscoSim) behave somewhat differently, but in opposite ways. We were able to identify likely reasons for these differences and this led to ongoing work to explore what modifications might be appropriate to bring them into better agreement with observations. The VIRTCAL simulator shows more characteristic earthquakes, with more large events and fewer smaller events as compared to the other simulators. This is a result of setting a parameter that encourages ruptures to propagate once started in a way that encourages rupture propagation more than do the other simulators. In contrast, ViscoSim shows fewer large events and more frequent smaller ones, a result of it's not having a parameter that encourages rupture propagation.

We discussed how the frequency magnitude plots for the different simulators compare with one another and with the observations for magnitudes between 5 and 6, a range in which there seemed to be more deviations from the observations than for events greater than M6. We concluded that the 3 km grid size being used in these simulations was not fine enough to give good resolution for magnitudes less than M6, so we decided not to present results for less than M6 until we reduce our grid sizes.

More details of the results can be found in the presentations made at the workshop at: ([http://scec.usc.edu/research/eqsims/workshop\\_2011\\_05\\_05.html](http://scec.usc.edu/research/eqsims/workshop_2011_05_05.html)). Also, more of the results of the research can be found in our annual report for our 2011 grant "A Collaborative Project: Comparison, Verification, and Validation of Earthquake Simulators."