

2016 SCEC-ERI-DPRI International Summer School on Earthquake Science

July 24-27, 2016

Lake Arrowhead Resort, Lake Arrowhead, California

The [Southern California Earthquake Center \(SCEC\)](#), the [Earthquake Research Institute of the University of Tokyo \(ERI\)](#), and the [Disaster Prevention Research Institute \(DPRI\) at Kyoto University](#) will organize a Summer School in Earthquake Science July 24 through 27, 2016. The theme for the Summer School will be “Large crustal earthquakes: fault geometry, dynamic rupture, and strong ground motion”. The summer school program will be a combination of lectures and hands-on exercises, led by experts in earthquake seismology, ground motion prediction, rupture and wave propagation, earthquake source parameterization, active tectonics, quantitative structural geology and geomorphology. The program is divided into three sessions:

Day 1 will focus on “Ambient-Field Measurements for Ground Motion Prediction.” We will cover the generation of the ambient field; measurements and sources of bias; applications for recovering site response, deterministic and stochastic representations of Earth structure; imaging wavefields to understand response in complex environments; and direct estimation of ground motion. Anticipated lecturers include: Kiwamu Nishida (University of Tokyo), Norimitsu Nakata (Stanford University), Tomotaka Iwata (Kyoto University), Marine Denolle (Harvard University), Hiroshi Kawase (Kyoto University), Shinichi Matsushima (Kyoto University), and Kim Olsen (San Diego State University).

Day 2 focuses on “High-resolution topographic imaging of faulting and earthquake deformation,” including recent advances in high-resolution topographic imaging, its potential for improving mapping of fault zones, and topographic differencing. We will emphasize the use of topographic differencing to improve understanding of the near field displacements along recent significant earthquakes (e.g. faulting and deformation in the *M*7.2 El Mayor Cucupah and *M* 7.0 Kumamoto, Japan earthquake sequence) and its potential for the study of continental faulting more generally. The hands-on exercises will be a “light” version of the established [OpenTopography short course](#). Anticipated lecturers include: Ramon Arrowsmith (Arizona State University), Michael Oskin (University of California, Davis), Edwin Nissen (Colorado School of Mines), Koji Okumura (University of Hiroshima), and Tadashi Maruyama (Geological Survey of Japan).

Day 3 will be a half-day session exploring the progress in understanding geometric fault complexity – characterizing non-planar faulting and accounting for its effects on earthquake dynamics and the generation of strong ground motion. Capabilities from the first two sessions of the summer school will inform this session. Anticipated lecturers include: Jim Mori (Kyoto University) and Eric Dunham (Stanford University).

Each participant at the summer school is encouraged to present a poster to share his/her research during evening sessions.

The school will be held at the [Lake Arrowhead Resort](#) in California, about 90 miles east of Los Angeles International Airport and 44 miles from Ontario International Airport.

Participants will be expected to arrive July 24, 2016 and depart around noon on July 27 after the morning lectures. We encourage PhD students and postdoctoral researchers to apply. The number of participants is limited to 35. For those selected to participate, SCEC will cover the cost of staying at Lake Arrowhead Resort. A limited number of travel support grants will be provided (1) by SCEC for selected participants from US universities and (2) by ERI for selected participants from Japan.

Steering committee: Greg Beroza (Stanford), Jim Mori (DPRI), Masa Kinoshita (ERI), Judi Chester (TAMU), Christine Goulet (USC), Tran Huynh (USC), Mark Benthien (USC)

Program committee: Marine Denolle (Harvard), Kiwamu Nishida (ERI), Tomotaka Iwata (DPRI), Aitaro Kato (ERI), Ramon Arrowsmith (ASU), Ed Nissen (Colorado School of Mines), Koji Okumura (University of Hiroshima)

Sunday, July 24, 2016

15:00 Check-in at Lake Arrowhead Resort

18:00-21:00 Welcome Dinner

Monday, July 25, 2016

07:00-08:00 Breakfast

08:00-10:00 Ambient noise Green's functions (Kiwamu Nishida, University of Tokyo)

- Introduction to the excitation of microseisms
- Methods to construct Green's functions
- Phase and amplitude information in the cross correlations
- Arrival time and dispersion analysis, anisotropy, amplitudes, stability of measurements

10:00-12:00 Structural imaging using the ambient seismic field (Victor Tsai, Caltech)

- Surface-wave tomography (FWI, adjoint methods, eikonal tomography)

12:00-13:00 Lunch

13:00-15:00 Seismic amplification and scattering in sedimentary basins

(Norimitsu Nakata, Stanford University)

- Complex wave propagation sedimentary basins and waveguides, fundamental and first overtone surface waves
- Imaging deterministic and stochastic representations of elastic structure

15:00-17:00 Virtual Earthquakes (Marine Denolle, Harvard University)

- Reproducing waveforms from past earthquakes using the ambient field: case studies from Japan (Kanto, Hi-net) and Los Angeles.

18:00-20:00 Group Dinner

20:00-22:00 Poster Viewing

Tuesday, July 26, 2016

07:00-08:00 Breakfast

08:00-10:00 Motivation: Kumamoto Earthquake sequence, prior geological work, and high resolution topography in Japan (Koji Okumura, Hiroshima University)

Introduction to High Resolution Topography and applications to active faulting (Ramon Arrowsmith, Arizona State University)

- Fault zone mapping
- Landscape Reconstruction
- Geomorphic response to rock uplift
- Overview of technology
- Introduction to OpenTopography

10:00-12:00 Surface rupture complexity from El Mayor Cucupah Earthquake (Mike Oskin, UC Davis)

- Lecture and demonstration

12:00-13:00 Lunch

13:00-15:00 Introduction to topographic differencing (Edwin Nissen, Colorado School of Mines)

- Lecture
- El Mayor-Cucupah earthquake demonstration: vertical differencing
- Kumamoto earthquake demonstration: rupture mapping, vertical differencing, local 3D differencing

18:00-20:00 Group Dinner

20:00-22:00 Poster Viewing

Wednesday, July 27, 2016

07:00-08:00 Breakfast

08:00-10:00 Site Amplification from micro tremor (Hiroshi Kawase, Shinichi Matsushima, Kyoto University)

10:00-12:00 **Complex faulting, dynamics, and ground motion**

The Effect of geometry on earthquake rupture (Eric Dunham, Stanford University)

Ambient noise measurements and the Kumamoto earthquake (Jim Mori, Kyoto University)

Wrap-Up Session (Greg Beroza, Stanford University)

12:00-13:00 Lunch

13:00 Depart Lake Arrowhead Resort