

2011 SCEC Short Course: Imaging and Analyzing Southern California's Active Faults with High-Resolution Lidar Topography

Conveners: Christopher Crosby (San Diego Supercomputer Center, UC San Diego), Mike Oskin (UC Davis), J Ramon Arrowsmith (Arizona State University)

Dates: October 24 and 25, 2011

Location: University of California, Davis

Course Website:

http://www.opentopography.org/index.php/resources/short_courses/11scec_course/

Summary:

The SCEC supported short course, *Imaging and Analyzing Southern California's Active Faults with High-Resolution Lidar Topography*, was held October 24-25, 2011 at the University of California, Davis. The primary course sponsor was SCEC, but UC Davis KeckCAVES and OpenTopography provided important additional support. As was the case with our 2009 SCEC supported lidar short course, demand far exceeded capacity. In 2011 we received over 90 applicants to fill the 40 allocated seats in the course. Participants were accepted based on the following criteria: Applicants who have attended previous SCEC or OpenTopography lidar courses were not accepted. Similarly, applicants who demonstrated advanced lidar skills or whose active area of research/application falls outside the earthquake and tectonics domain were also not accepted. In cases where we received a large number of applicants from a single organization or agency, we worked with those groups to determine the subset of applicants who would most benefit from attending the course. In the end, selected participants included twenty-three graduate students and postdocs, as well as faculty, and professional geoscientists from agencies such as Caltrans, California Geological Survey, and the USGS (see list of attendees below).

The short course was a great success, and provided an excellent opportunity for participants to get their hands dirty with lidar topography data analysis. As shown in the agenda below, we combined focused lectures with extensive hands-on training with software and data. The course also stimulated lots of discussion on lidar data applications to earthquake science, tectonics, and surface processes among the diverse group of participants. We performed a post-course survey of participants and feedback was overwhelmingly positive with regard to the course content, organization, and execution.

All short course materials, including lecture slides, exercises, and sample data are available on the course web site hosted by OpenTopography. (http://www.opentopography.org/index.php/resources/short_courses/11scec_course/). This page is an important community resource that expands the impact of the training materials beyond the 40 course participants.

Course Agenda:

Day One – October 24

- 8:30 Welcome and introductions (EPS 1316)
Goals of course and agenda review (Team)
Acknowledgements (Team)
- 9:00 1. Review of LiDAR technology and data acquisition (Crosby):
- GPS + IMU + scanning laser rangefinder
- Pulse rate, pulse density, spot size, number of returns
2. Overall LiDAR processing workflow - what happens at each step, who typically does it? (Crosby)
- Typical deliverables
- Data volumes, considerations for managing these datasets, projection issues, metadata, file formats and terminology.
3. What is the acquisition and processing parameter space that geoscience users should be aware of? What are possible sources of error/artifacts? (Crosby, Oskin)
- GPS control and dataset accuracy vs. quality – corduroy, scan line artifacts, etc.
- The role of vegetation in determining "quality" of the data (Crosby, Oskin)
4. Creating DEMs From Points (Crosby & Arrowsmith):
- Methods – local vs. global (Bin, TIN, IDW, spline, etc).
- What are advantages/disadvantages of each method? (artifacts, interpretability, computation time).
- 10:15-10:45 Break (Coffee outside EPS 1119, followed by walk to Hunt 253 for day)
- 10:45 – 12:00
EXERCISE 1: Basic visualization of LiDAR DEMs using ArcMap (Arrowsmith, Crosby, Oskin)
- DEM with color gradients
- DEM with hillshade
- Slope & slopeshade
- Generating Contours from DEMs
- 12 – 1:15 pm Lunch (Lunch at Segundo Dining Hall – See Map) Mention “Geology” when at Registers so lunch is charged to workshop
- 1:15 pm
EXERCISE 2: Extracting information from DEMs in ArcMap (Arrowsmith, Oskin):

- Point and profile queries
- Watershed analysis
- Visualization of channel networks

2:45 – 3:00 Break (Hunt Courtyard)

- 3:00 EXERCISE 3: Fault-zone mapping (Oskin)
- Fault-zone geomorphology
 - Change-detection with time-series LiDAR
 - Mapping fault-zone features

5:30 Stop

6:00 Optional no-host group dinner in downtown Davis. Details TBD.

Day Two – October 25th (Location EPS 1316)

8:30 Recap from yesterday, questions, intro to day two.

- 8:45 Online data LiDAR data sources (Crosby):
- General sources
 - OpenTopography intro.

EXERCISE 4: Accessing LiDAR via OpenTopography (Crosby).

9:45-10:00 Break (outside of EPS 1119)

ROTATING EXERCISES 5, 6, 7 – three groups, 1.75 hrs per exercise:

EXERCISE 5: LidarViewer (Oskin/UC Davis Group) (Mac Lab – EPS 2231)

EXERCISE 6: KeckCAVES (Oskin/UC Davis Group) (KeckCaves)

EXERCISE 7: LaDiCaoz —Matlab-based tool for computing small offsets along faults and discussion of results (Arrowsmith) (EPS 1119)

10:00-12:00 EXERCISE BLOCK 1

11:45 -1:00 Lunch (Dining passes at Tecero)

1:00 – 2:45 EXERCISE BLOCK 2 Page 3

2:45-3:00 Break (coffee break in 1119)

3:00-4:45 EXERCISE BLOCK 3

4:45-5:00 Wrap-up session / lingering question and answer session. (1119)

5:00 END – Thanks!

Course Participants:

LAST NAME	FIRST NAME	ORGANIZATION
Janecke	Susanne	Utah State
Sickler	Robert	USGS
Verdugo Madugo	Danielle	SDSU
Madden Madugo	Chris	Oregon State
Hecker	Suzanne	USGS
Paulson	Katie	U of Oregon
Gayatri Indah	Marliyana	ASU
Mann	Doerte	UNAVCO
Walter	Jacob	UCSC
Kim	HyunTae	ASU
Nissen	Edwin	ASU
Smathers	Billie	U of Utah
Liu	Zhen	JPL / Caltech
Meigs	Andrew	Oregon State
Cronin	Vince	Baylor
Sedki	Ziad	CSULB
Wicker	Cary	CSULB
Federschmidt	Sara	U of Kentucky
Li	Xiangyu	UCSB
Miller	Brendan	U of Washington
Thoms	Evan	USGS / Alaska Science Center
Yang	Hongfeng	WHOI
Bufe	Aaron	UCSB
Chen	Rui	CGS
Crempien	Jorge	UCSB
Dulberg	Ranon	Fugro Consultants
Griffin	Julie	UC Davis
Hernandez	Janis	CGS
Kemp	Chris	Fugro Consultants
Kleber	Emily	BLM
Lajoie	Lia	UCSB
McCrink	Tim	CGS
Merriam	Martha	Caltrans
Moclock	Leslie	UC Davis
Olson	Brian	CGS
Roffers	Pete	CGS
Rose	Liz	USGS
Sousa	Frank	Caltech
Wang	Xin	UC Davis / IDAV
Yoder	Mark	UC Davis