Terrestrial Laser Scanning Survey Project for Part of the Landers Surface Rupture

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Scientific Objective and Results

Tectonic geomorphic markers such as fault scarps of recent and historic earthquakes form the basis for paleoseismic studies that aim to understand the spatiotemporal distribution of earthquakes, their magnitudes, and recurrences. The objective of this survey was to scan a section of the 1992 Landers earthquake fault scarp to document its original form and initial geomorphic modifications (Arrowsmith and Rhodes, 1994; 2000). See also http://lidar.asu.edu/KnowledgeBase/Landers_TLS/Landers_TLS_analysis.html.
This survey documented cm-scale erosional landforms developed by repeated winter storm-driven erosion, particularly in narrow channels crossing the fault scarp (Haddad et al., in review).

TLS System Description and Specifications

The survey was performed using a tripod-mounted Riegl LPM 321 terrestrial laser scanner:

See http://www.riegl.com/ for this scanner's detailed specifications.

Survey Area

The survey was carried out in an area covering ~200 m by ~250 m in the Carrizo Plain section of the San Andreas Fault (Fig. 1), and spanned a section of the fault scarp produced during the 1992 Landers earthquake.

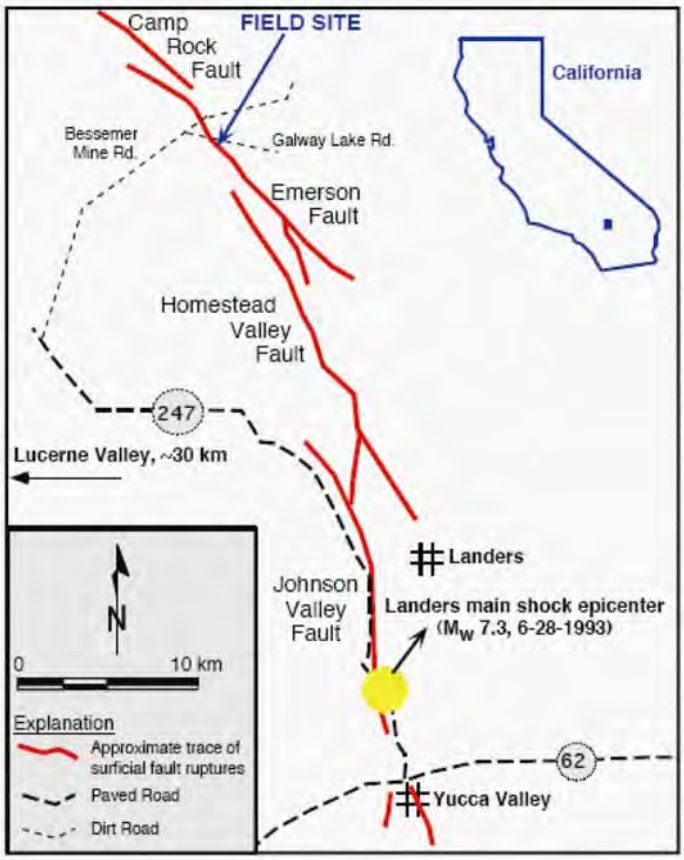

Figure 1. Location map of the TLS survey area (Arrowsmith and Rhodes, 1994).

Field Procedures

We used a Reigl LPM 321 terrestrial laser scanner to scan the study site. Eleven scan positions were tied together with as many as 18 control points and a total of 8.8 million points were detected (Fig. 2). Shot densities varied from ~1 to 3.8 x 10^4 m^{-2}. Given the absolute GPS control, we rotated and translated the survey data into the 2008 UTM Zone 11 NAD83 coordinate system using least squares (<10 cm error in the network adjustments).

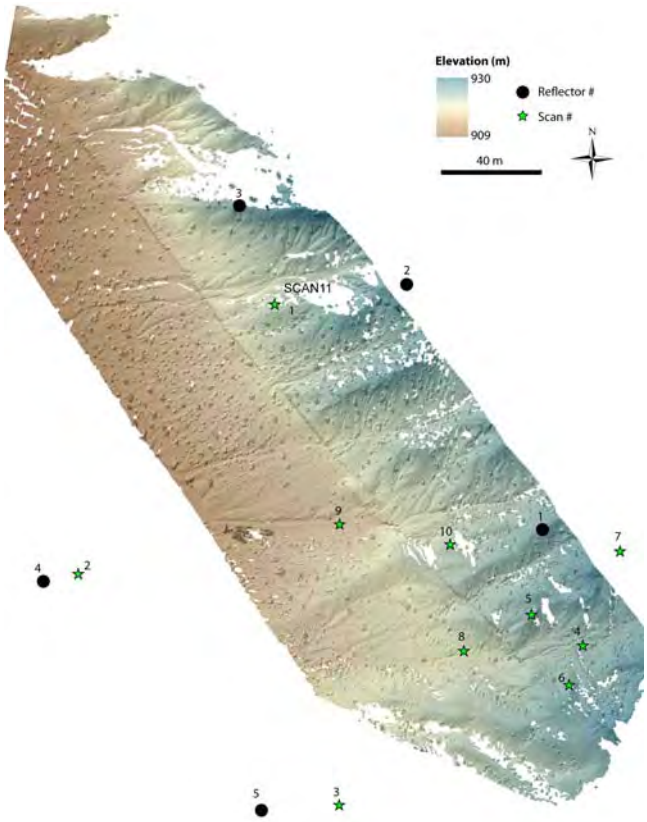

Figure 2. Location map of the 10 TLS scanner setups used in this survey overlain on a hillshade and colored elevation map derived from a 10 cm digital elevation model. Target types include reflectors and scan positions (individually numbered dots and stars).

Data Processing and File Formats

The final point cloud totaled 8.8 M points and was exported from RiProfile in ASCII format into the NAD83 reference frame and projected onto the UTM Zone 11 coordinate system. It was also converted to the binary LAS format using the libLAS toolkit (http://liblas.org/).

Gridded Digital Topographic Products

The high-resolution DEM was generated using a Linux version of the GEON LiDAR Workflow's Points2Grid utility (http://lidar.asu.edu; also available for MS Windows from the OpenTopography Tool Repository; Fig. 2; Crosby, et al., in review).

References

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