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UNAVCO Event response capabilities: Four 2010 earthquakes that advanced hazards science

M Meghan Miller
UNAVCO, Inc., Headquarters, Boulder, United States (meghan@unavco.org)

M. Meghan Miller, Frederick Blume, Fran Boler, Adrian Borsa, Jim Normandeau, and Christian Walls
UNAVCO, Inc., 6350 Nautilus Drive, Boulder Colorado 80301

UNAVCO is a non-profit university-governed consortium that facilitates geoscience research and education using geodesy. UNAVCO supports its research community in the study of significant geophysical events such as earthquakes, volcanic activity, landslides, glacial and ice-sheet movements, unusual uplift or subsidence, and extreme meteorological events. Resources include field engineering support; permanent, real-time/high rate, and campaign GPS deployment; data communications and power systems; borehole tiltmeter, strainmeter, and seismometer deployments; ground-based LiDAR measurements and airborne LiDAR project management; InSAR data acquisition; assistance with education and outreach activities; and data archiving and processing services.

As part of the 2008 and 2009 Shake Out earthquake drills in southern California, UNAVCO's organizational event response capabilities were tested and refined to ensure robust protocols for decision-making and geodetic observations in the wake of a natural disaster, with the goal of preparedness for rapid deployments when geodetic observations are required to strengthen geohazards science.

In 2010 four significant earthquakes have tested this capability, requiring adaptive management of response protocols. These include the January 12, 2010 Mw=7.0 Haiti, February 27, 2010 Mw=8.8 Maule (Chile), April 4, 2010 Mw=7.2 El Mayor – Cucapah (Baja California, Mexico), and September 3, 2010 Mw=7.0 South Island of New Zealand earthquakes. For the ShakeOut drills and each of these earthquakes, a different UNAVCO staff member served as Event Response Coordinator, to manage communications, support requests, logistics and decision-making.

For the Haiti earthquake, community scientists requested support for short-term field deployments and to download high-rate buffers from continuously observing networks in the region. A response coordinator was appointed, a central web page was created, special GPS, borehole strainmeter, and borehole seismometer data sets were posted, a new discussion forum devoted to the event was created, a GEO Event Supersite was created and hosted, and a Science Highlight was posted with contributions from community scientists. Field deployments included campaign and the installation of continuous GPS stations. A full debrief and adaptive refinement of response protocols was implemented prior to the occurrence of the February event in Chile.

For the Maule earthquake, four UNAVCO member institutions secured NSF-RAPID support to build 25 post-seismic GPS deployments in Chile and Argentina. UNAVCO shipped 25 complete GPS systems within a week of the event. UNAVCO secured NSF-RAPID support to develop and install telecommunications using a combination of different systems for rapid data retrieval. This deployment allows for daily downloads of 15-second files and 1 Hz data over a 1-year period, and spurred further investments by Ohio State University, University of Memphis, Universitad de Concepcion, and Trimble in an additional 18 sites for a total of 43. The UNAVCO effort developed CGPS data communication systems appropriate for rapid deployment anywhere in the world.

The El Mayor – Cucapah earthquake occurred close to the Mexico – U.S. border, at the edge of the EarthScope – Plate Boundary Observatory (PBO) footprint. UNAVCO was one of several community organizations to support event response, providing co-seismic observations from PBO's CGPS stations, borehole strainmeters and seismometers, the shipment of a Terrestrial LiDAR Scanner, and the acquisition of InSAR data through the UNAVCO-hosted WInSAR consortium. In addition, UNAVCO supported a member proposal deploying continuous GPS stations for post-seismic observations. These stations are installed, maintained, and data analyzed

by UNAVCO/PBO in coordination with CICESE.

For the South Island of New Zealand earthquake, UNAVCO's primary was coordination of SAR data acquisition coupled with a science discussion forum. As with the Haiti event, a GEO Event SuperSite was created and hosted; the site again became a showcase for early science results provided by the community.

These events have led to the testing and refinement of response protocols and decision-making, optimizing UNAVCO's ability to aid the collection of key data sets for the advancement of hazards science.