Imaging and Analysis of Large Space Geodetic Data Sets for Monitoring, Research, and Response


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Abstract

The ARIA Data System

The ARIA team designed and documented an architecture for the prototype system, using a loosely coupled architecture that would allow for scaling up required for operational implementation and simple upgrading when new algorithms are developed. We have defined architecture layers as well as the event, job and resource management description.

The protocols for InSAR workflow and data management for ALOS data was completed in our first year. In the second year, Envisat and GPS data management workflows were added. We have documented the processing capabilities of the data system, including staging canned frame data. Having the event manager identify contiguous frames and create jobs.

Over the next year, we will be developing the triggered product generation capability within the data system. In the third year, the ALOSA tool will be developed. We will also be working on integrating InSAR time series code and cloud computing capabilities (Diagram to the right).

Geodetic Imaging for Hazard Assessment and Situational Awareness

JPL

We applied our prototype damage proxy map algorithm to February 2011 M6.5 Christchurch earthquake in New Zealand using ALOS PASAR data (01/10/10 - 01/11/10 - 01/12/10 - 03/02/10). A number of detected damage sites, including the ones covered in media, were confirmed with Google earth images provided by GeoEye (figures on right). Three different types of damage - liquefaction, building collapse, and landslide - appear as red pixels.

The ARIA Project

ARIA-EQ is a 3 year project to develop an earthquake hazards geodetic imaging prototype system that will be capable of producing reliable near real-time earthquake science and assessment products. In the process of developing this data system, we are capturing scientific knowledge into reliable software models to enable automation of geodetic imaging products. The ARIA-EQ team is an interdisciplinary group composed of earth scientists, system and software engineers.

The project began in October 2010, and the focus has been on system requirements, architecture design and developing the prototype system for automated InSAR processing and GPS earthquake product generation. In addition, we have developed algorithms for using SAR coherence and amplitude change to image damage from an earthquake (as well as other disasters) and enhanced existing GPS software for automated analysis to include sub-daily processing.

In June 2012, we began a NASA funded AIST project to develop hazard monitoring capabilities (e.g. time series for SAR and GPS) and to enable cloud-based computing and data management. In October 2012 we initiated a NASA funded Science Disasters.

October 2011 M7.1 Van, Turkey Earthquake

Goldern Guardian Exercise

At the request of seismologist Dr. Marino Protti, of Costa Rica Volcanological and Seismological Observatory (OVSCORI), and U.S. colleagues, we provided coseismic (black vector) and postseismic (red vector) GPS displacements for the Sept 5, 2012 M7.6 earthquake in Costa Rica (figure right). These data provide critical constraints on how much of the subduction zone fault had slipped and understanding whether a larger earthquake is possible.

August 2012 Brawley Seismic Swarm

On August 26, 2012 a seismic swarm began in the area known as the Brawley Seismic Zone in southern California. The two largest earthquakes were a M5.3 at 12:31 pm and a M5.5 at 1:15 pm, over thirty events over M3.5 occurred. The ARIA GPS processing system was automatically getting data from sites available hourly (P499) and generating 30 second point positioning results with JPL’s Ultra Rapid Orbits and Clocks (5 min). The earthquake offset was below the noise level for these preliminary results. Monday, August 27, 2012, the ARIA processing system automatically updated the positions for P499 and other sites in the region now available. We posted 30 second PPF time series using JPL’s Rapid Orbits and High Rate Clocks (30 sec), and these results showed “cm level horizontal offsets at P499, P495, PS02, PS06 (see vector plot to the right).