Real-Time In Situ Measurements for Earthquake Early Warning and Spaceborne Deformation Measurement Mission Support

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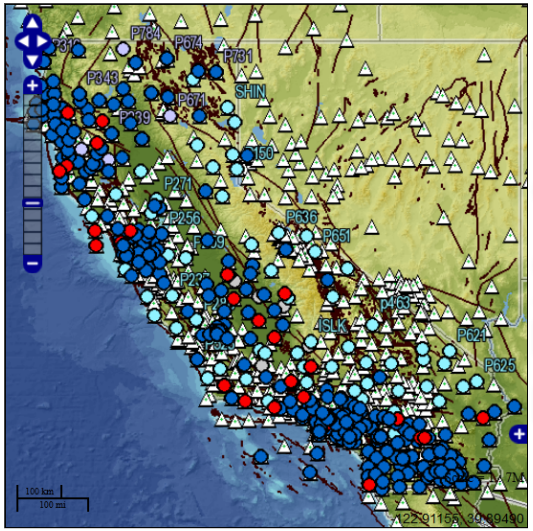
Objective

- Develop publicly available real-time ground deformation data system fusing two in-situ network data sources: low latency (1 s) high-rate (1 Hz or greater) continuous GPS (CGPS) and traditional seismic data.
- Enable rapid access to absolute displacement waveforms, replay capability, and modeling of significant events related to global geological hazards.
- Enable detection and preliminary modeling of signals of interest to help mission planners exploit less-frequent, higher resolution Interferometric Synthetic Aperture Radar (InSAR) observations.
- Demonstrate using GPS data products to calibrate InSAR measurements for atmospheric and orbital errors, significantly increasing the accuracy of interferograms.



△: active CGPS stations not yet upgraded to CRTN
●: active CRTN (real-time) stations
●: inactive CRTN (real-time) stations
○: proposed CRTN stations
—: geologic faults
■: recent seismicity (Magnitude > 3.0)
■: recent seismicity (Magnitude < 3.0)

Current distribution of CGPS stations in the project region

Accomplishments

- Demonstrated fusion of CGPS and seismic data and successful integration for 2010 El-Mayor Cucapah earthquake. Demonstrated P-wave seismic velocity estimation on 2011 Tohoku-oki earthquake.
- Developed, implemented, demonstrated three transient detection algorithms. Demonstrated detection of Earthquake Tremor and Slip (ETS) transients on the Cascadia margin near Vancouver Island.
- Developed InSAR tropospheric correction capabilities using CGPS-derived zenith troposphere delays and pressure.
- Earthquake Early Warning
  - Expanded California Real Time Network (CRTN) to 304 stations
  - Developed a data format for streaming displacement waveforms

Co-Is/Partners:
Sharon Kedar, Frank Webb, JPL; Robert Clayton, Caltech

TRL_{in} = 3 **TRL_{out} = 6**