GPS Early Warning System for S. California

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GPS RT Monitoring Applications

- Earthquake Geodesy (coseismic motions)
- GPS Seismology (dynamic motions)
- Volcano monitoring
- Landslide monitoring
- Tsunami warning
- Structural monitoring
- Glaciology

2004 Stromboli eruption

LA freeway after 1994 Northridge earthquake

Displacement waveforms, 2004 Parkfield event
- Stations span major faults of southern San Andreas fault system
- Combination of PBO and SCIGN stations
- Stations stream over dedicated radio links 1 Hz GPS data with a latency of a fraction of a second using HPWREN and other communications infrastructure
- Displacement waveforms are generated independently every second by instantaneous positioning

(http://sopac.ucsd.edu/projects/realtime/)
Imperial Valley Subnetwork

- Imperial Valley installations are ongoing (blue circles are active sites, gray ones will be upgraded)
- Latest addition to CRTN. Collaboration of PBO and SOPAC. Use HPWREN infrastructure
- Narrowest part of the North America – Pacific plate boundary in southern California
- Mw 6.4 strike slip earthquake in 1979 at a depth of 6 km, ruptured 45 km with 0.6 m slip

(http://sopac.ucsd.edu/projects/realtime/)
Typical CRTN Site Infrastructure

- Banner Communications Hub
- Ramona Airport (RAAP)
- Palomar Observatory (PMOB)
Triangulation Scheme

- Create a Delaunay triangulation of the network every second
- Compute relative positions of each triangle
- Convert to principal components of strain (2D)
- Establish detection criteria to isolate an event
- Determine an anchor point for computing absolute positions
Earthquake simulation – San Jacinto fault segment

- Thought to be active plate boundary in southern California, rather than San Andreas fault
- Mw 7.0, 1 m slip at 15 km depth, 90 km rupture
- Coseismic model can be established within a few seconds of event
- Possible early warning for Riverside and LA County communities
Earthquake simulation – Imperial fault segment

- Mw 6.6 strike slip at a depth of 6 km, ruptured 48 km with 0.6 m slip (similar to 1979 event)
- Coseismic model can be established within a few seconds of earthquake
- Can assist earthquake first responders