

GPS Early Warning System for S. California

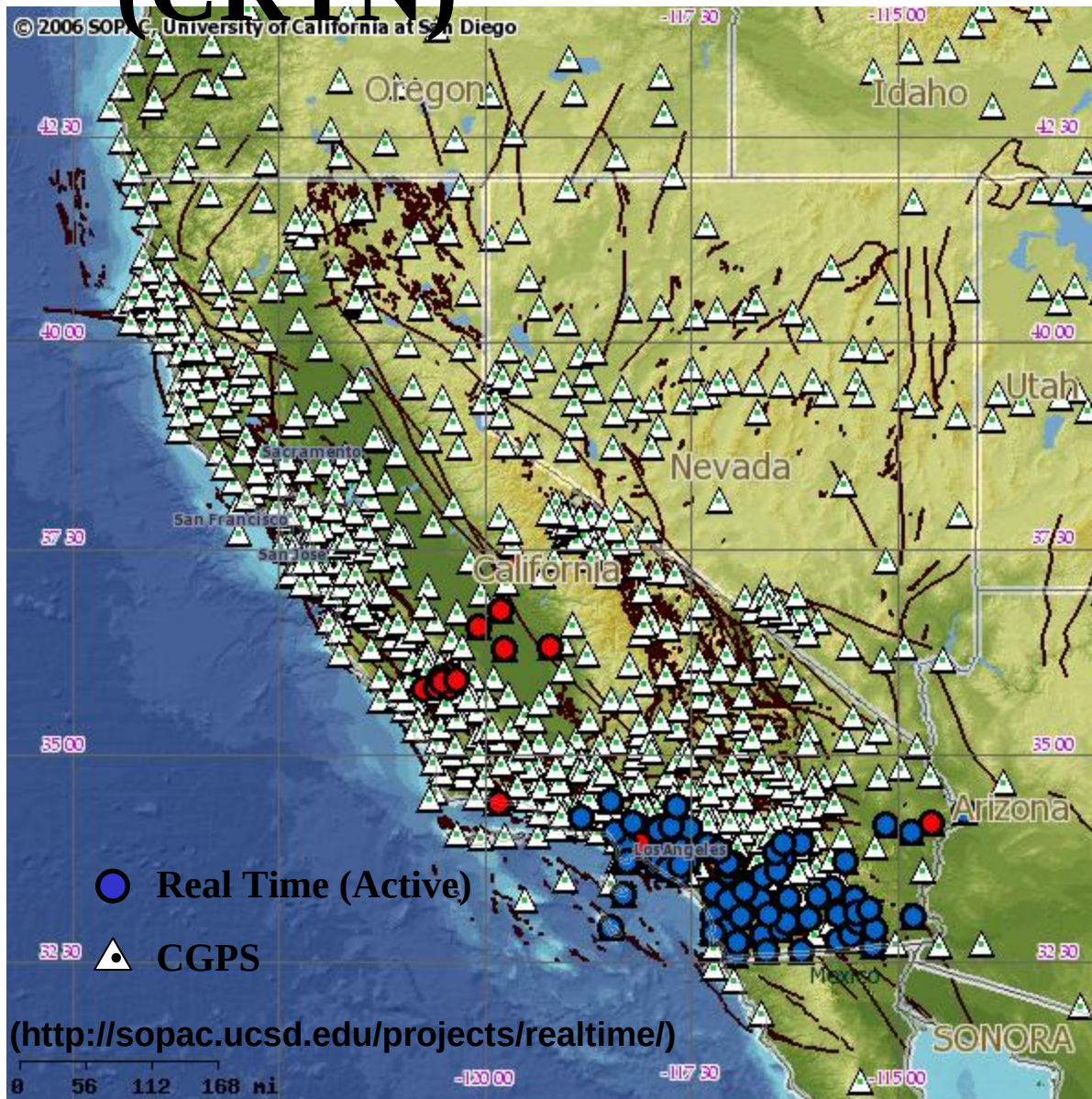
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Scripps Institution of Oceanography
La Jolla, California

2008 HPWREN Users Meeting
Pala Native American Reservation
November 19, 2008

California Real Time Network (CRTN)



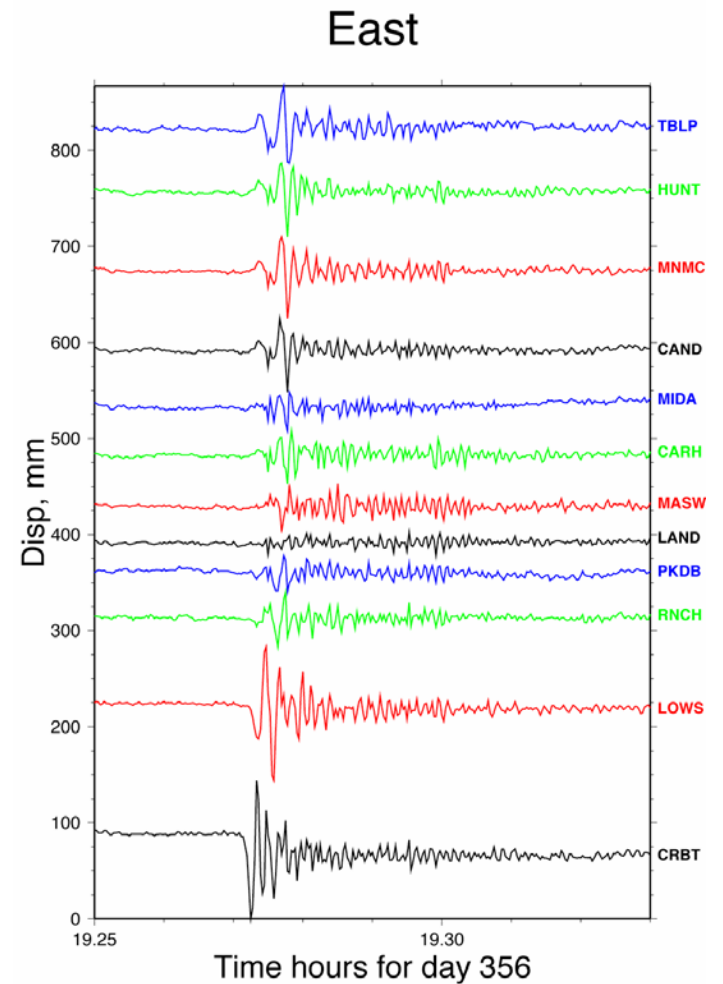
- Stations span major faults of southern San Andreas fault system
- Raw GPS data streamed over dedicated radio links (including HPWREN) with a latency of a fraction of a second
- Total displacement waveforms are generated independently every second by instantaneous positioning
- 10-20 Hz data rates have been demonstrated

Test Bed for Early Warning Systems

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



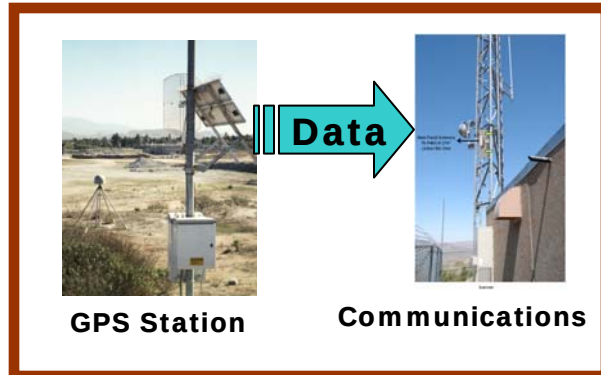
*LA freeway after 1994
Northridge earthquake*



*Displacement waveforms,
2004 Parkfield event*

CRTN Components

Network

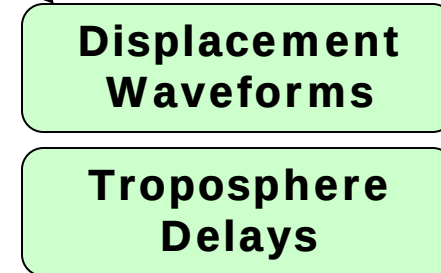
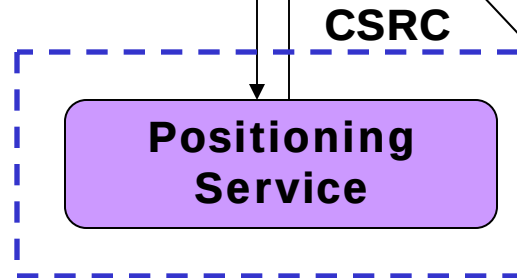
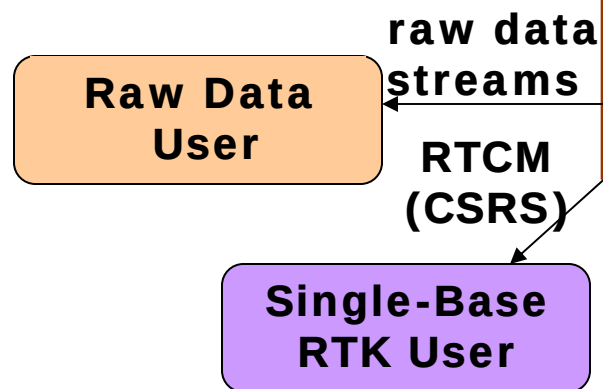


Server

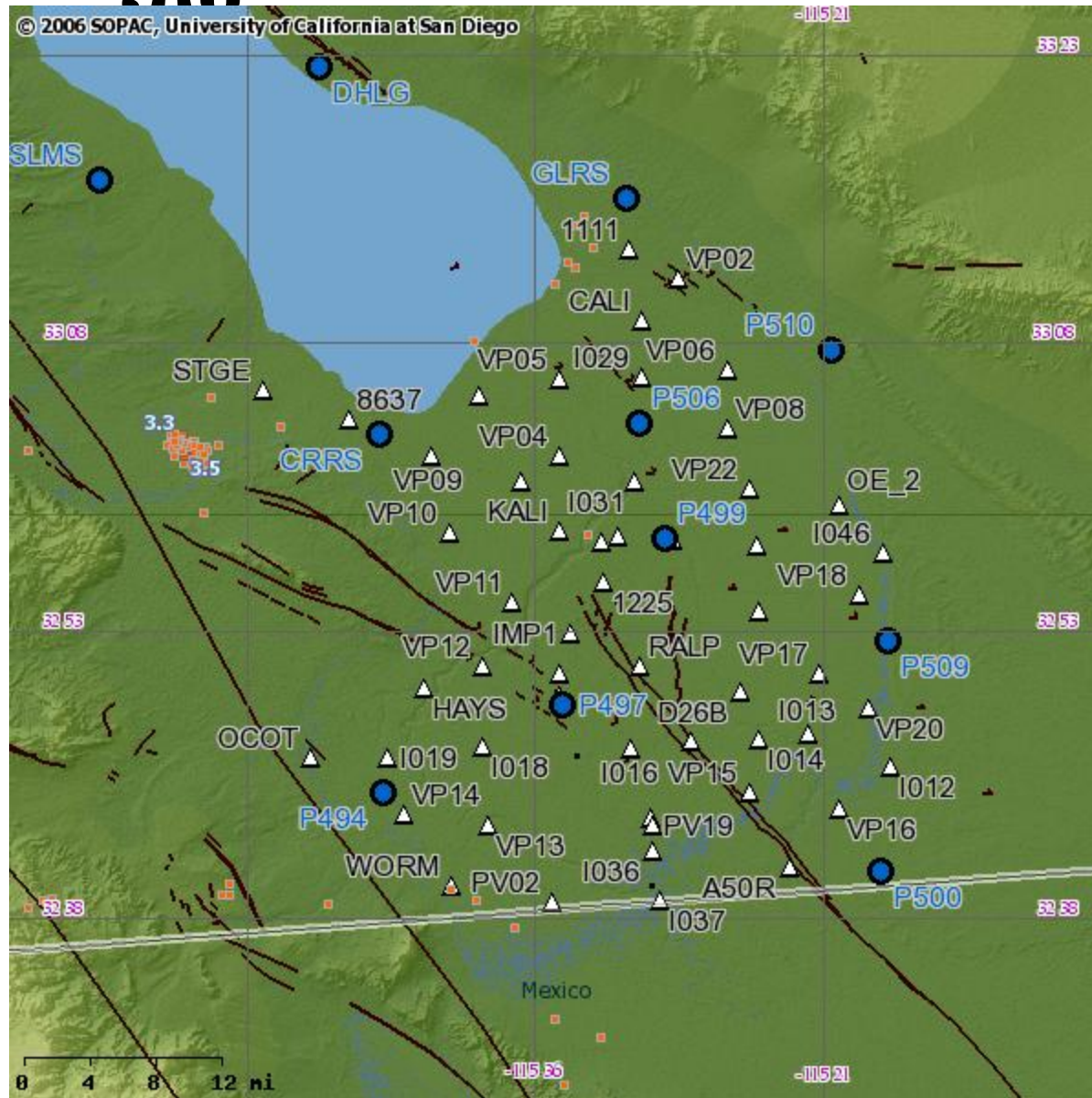
RTD Server,
SOPAC Database,
Web Services,
GPS Explorer
SOPAC Utilities

Models

- SECTOR CGPS Coordinates
- HTDP Crustal Motion Model
- NGS Geoid Model
- Ionosphere Model
- IGS Precise Orbits
- NOAA Troposphere Model
- SOPAC Archive / Metadata



Imperial Valley Survey – October

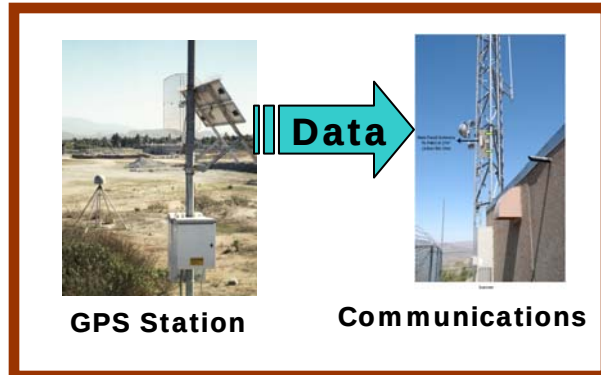


- Three autonomous teams surveyed about 20 geodetic monuments each in 2-3 days
- Two 15-minute occupations of each monument
- Used CRTN Positioning Service to compute ITRF2005 coordinates
- Positions available at the end of each occupation
- Ideal for post-earthquake surveys

http://sopac.ucsd.edu/projects/caltrans_iv2008.html

CRTN Components

Network

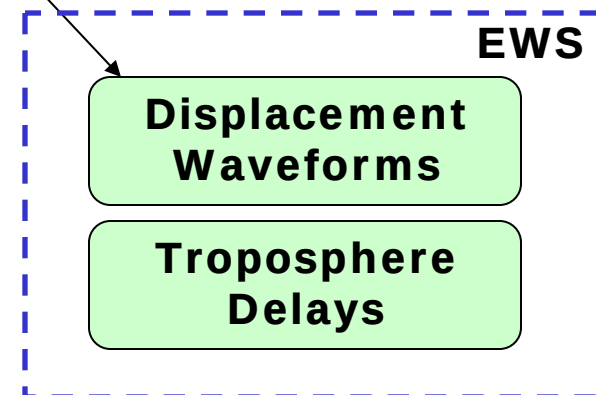
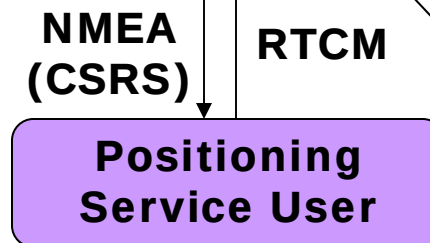
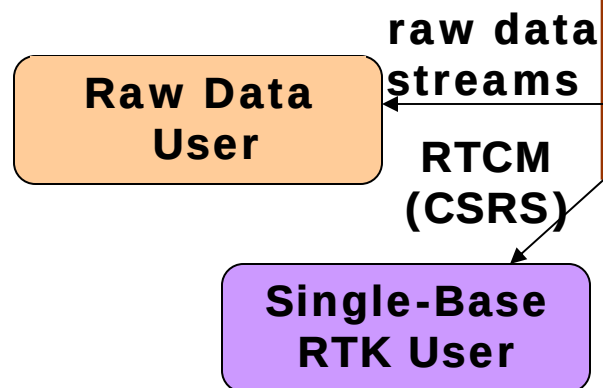


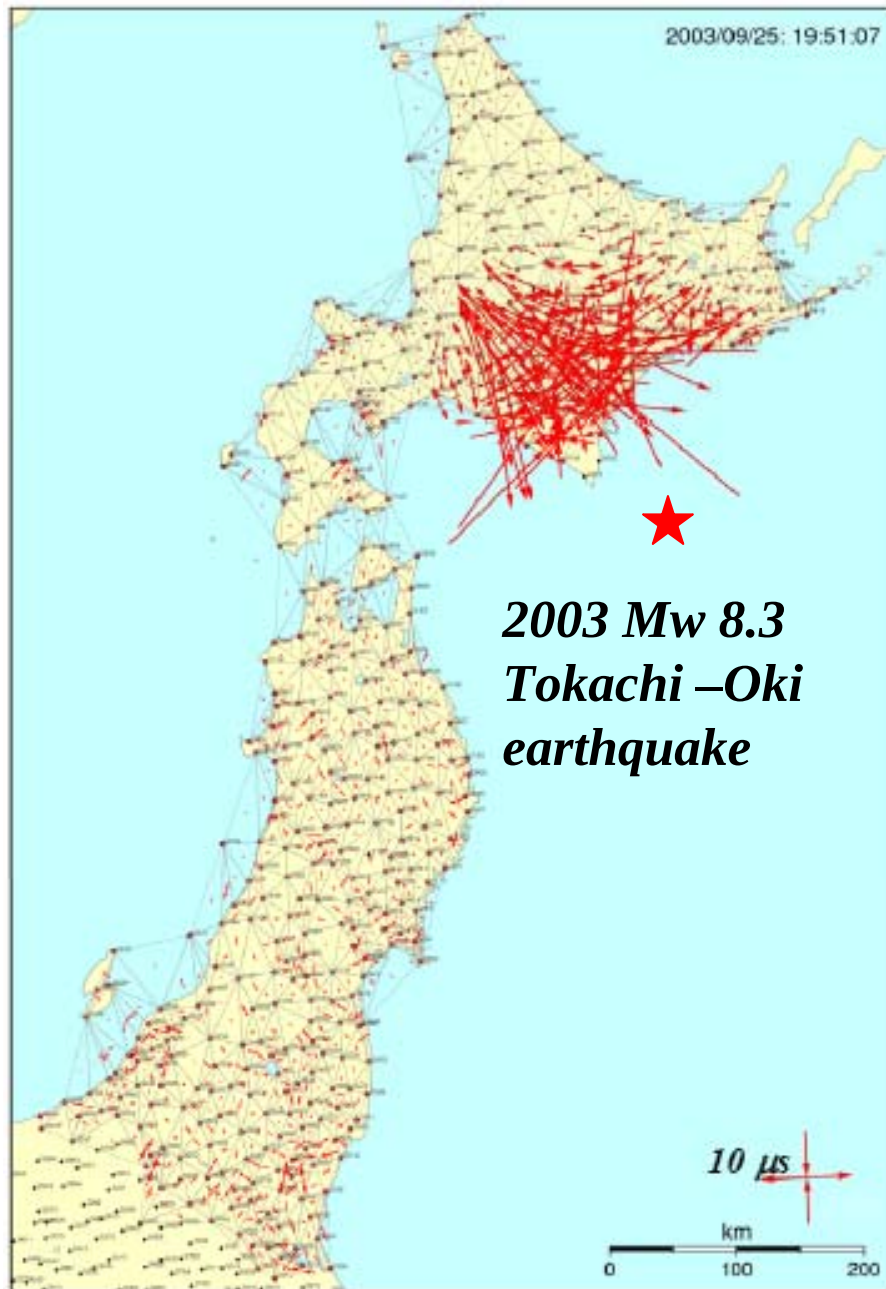
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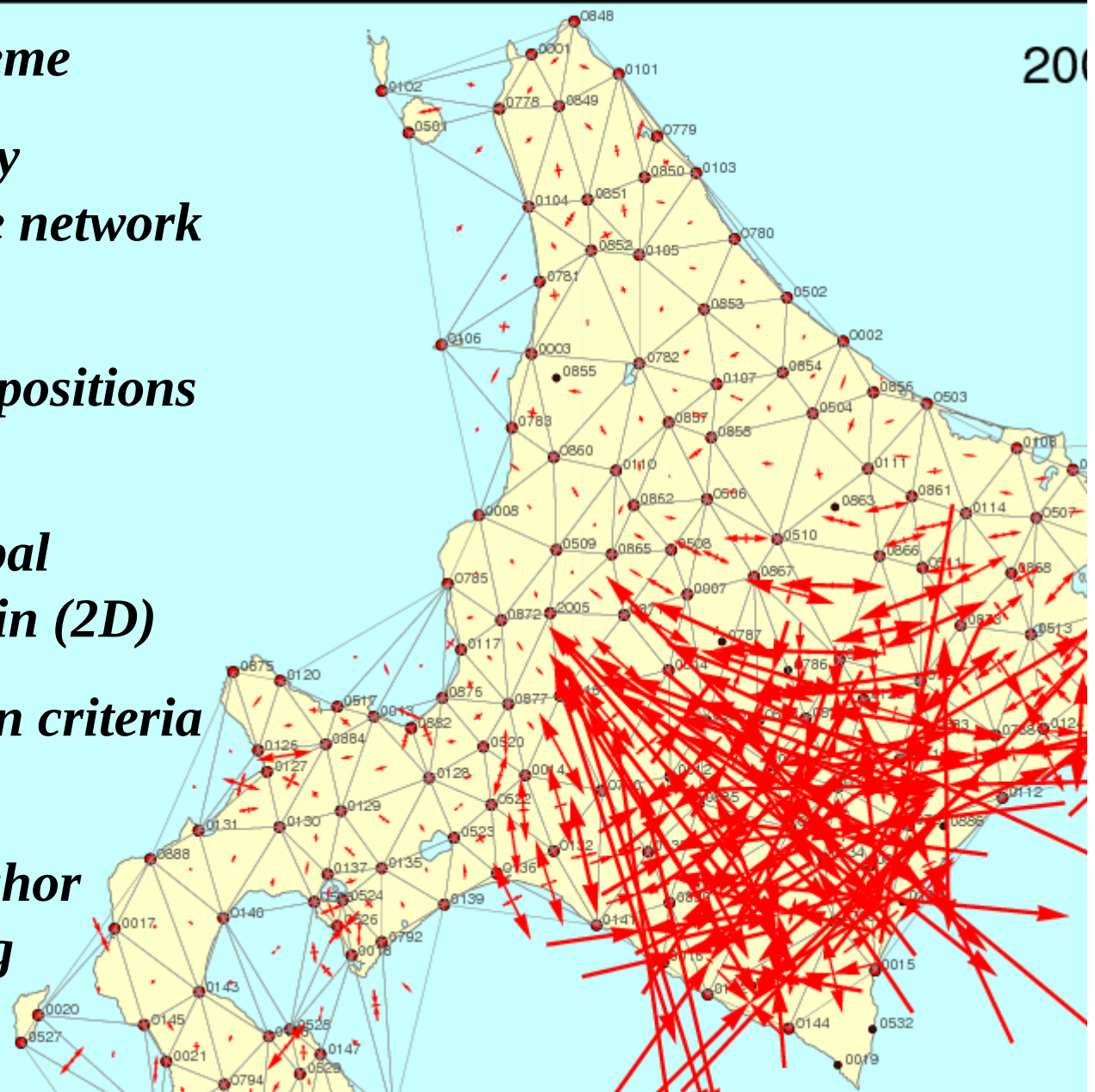


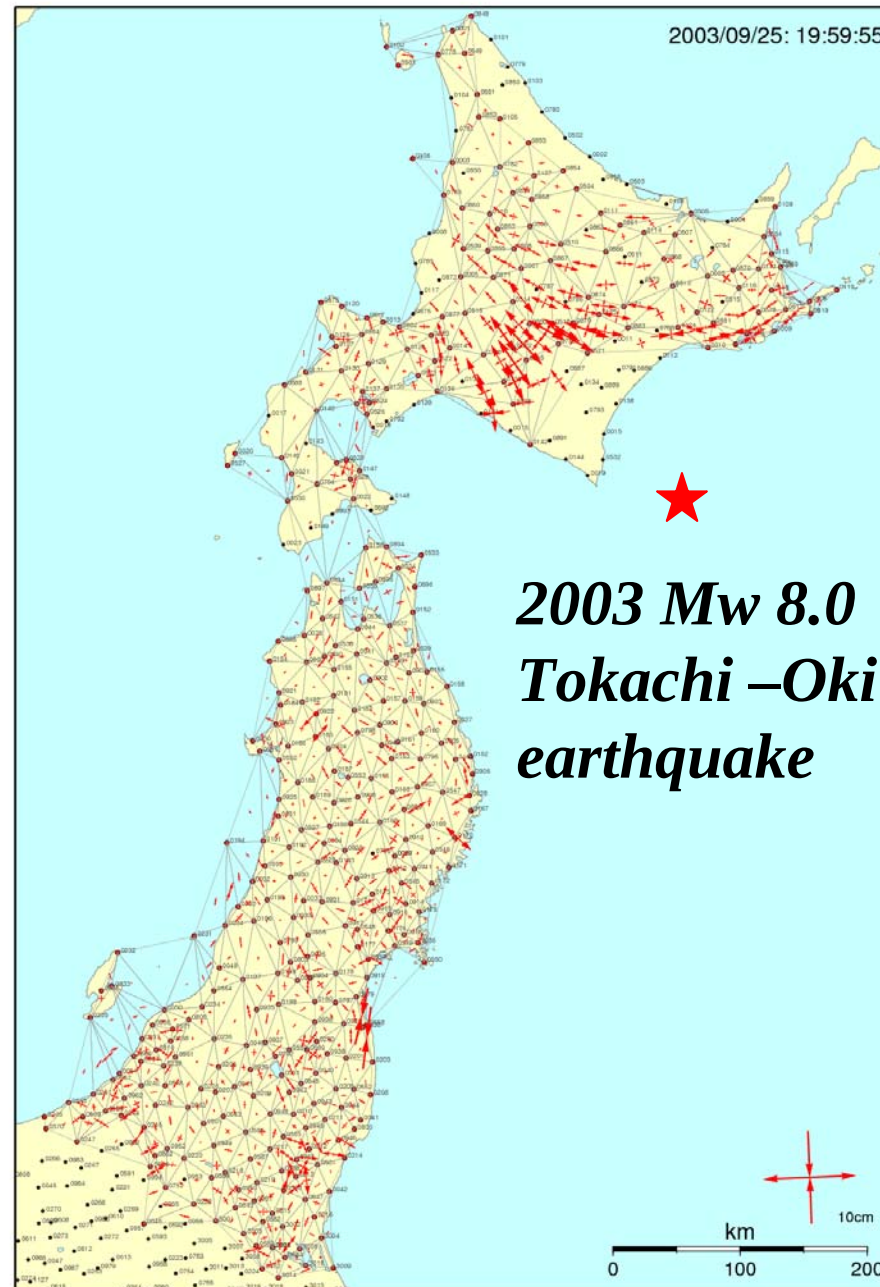


Japan's Geophysical Survey Institute (GSI) operates nationwide 1200-station continuous GPS network (GEONET), with ~ 20 km spacing. Of these, 1156 stations are streaming @ 1 Hz to a central facility in Tsukuba City.

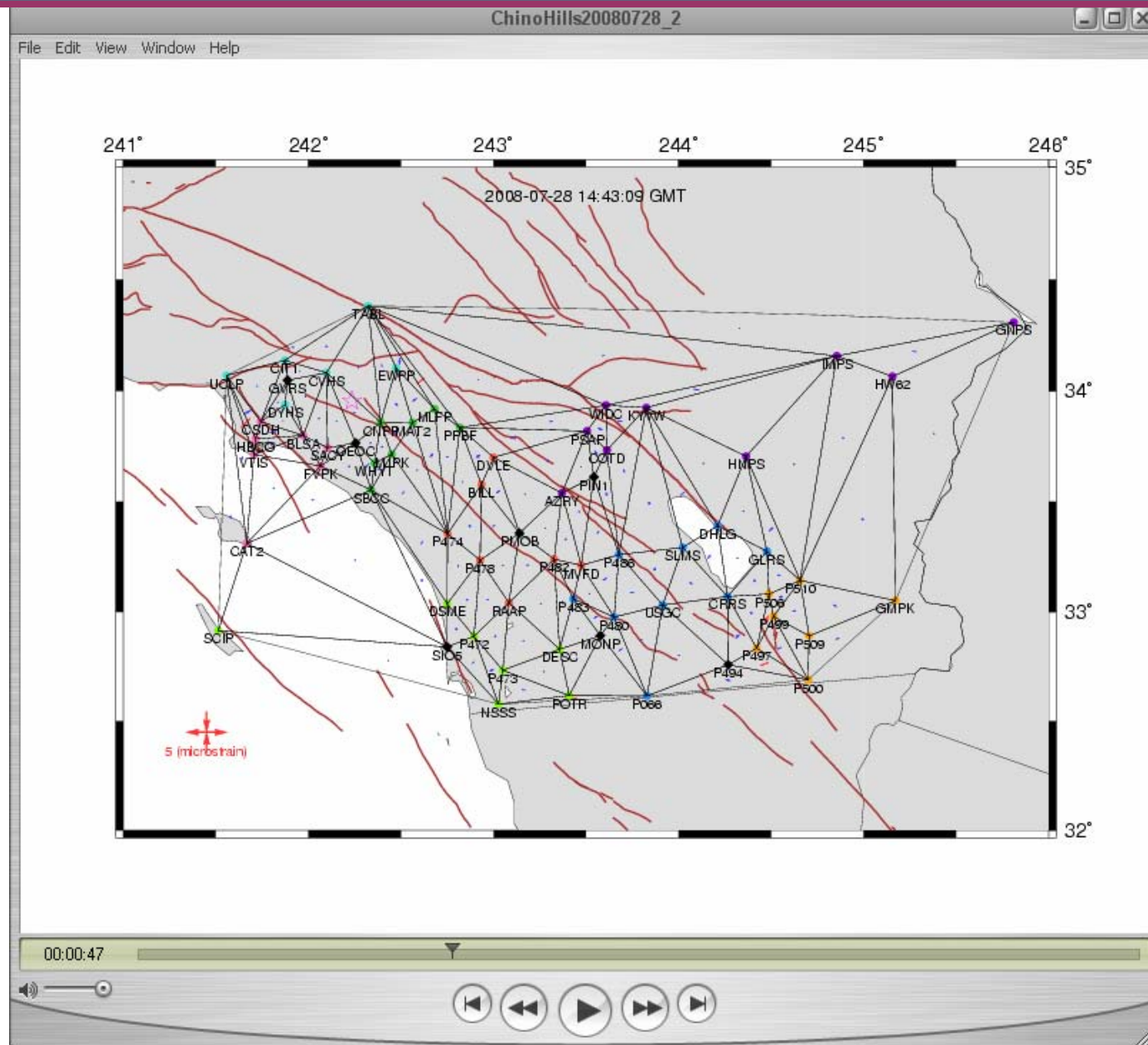
Triangulation Scheme

- *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*



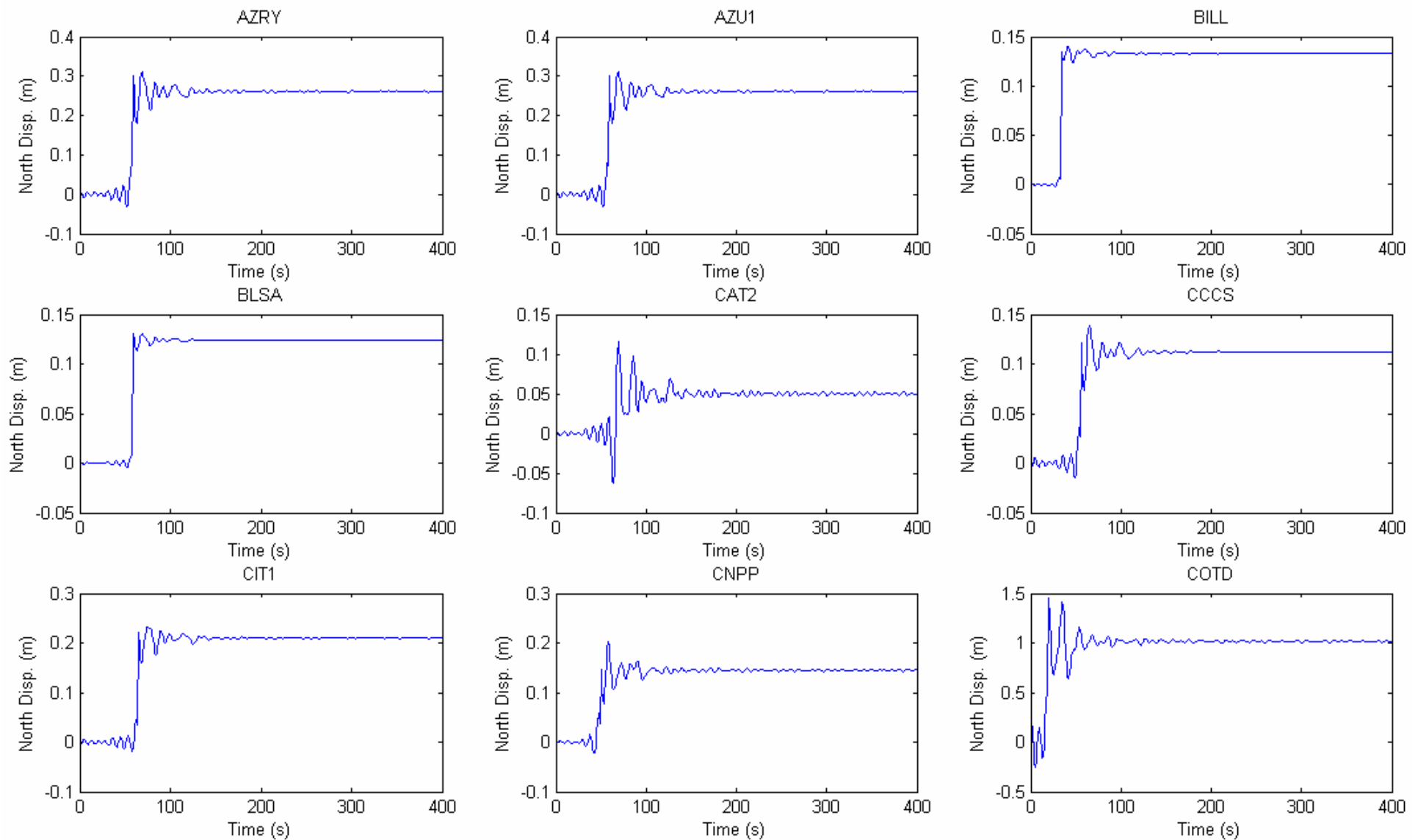


ShakeOut

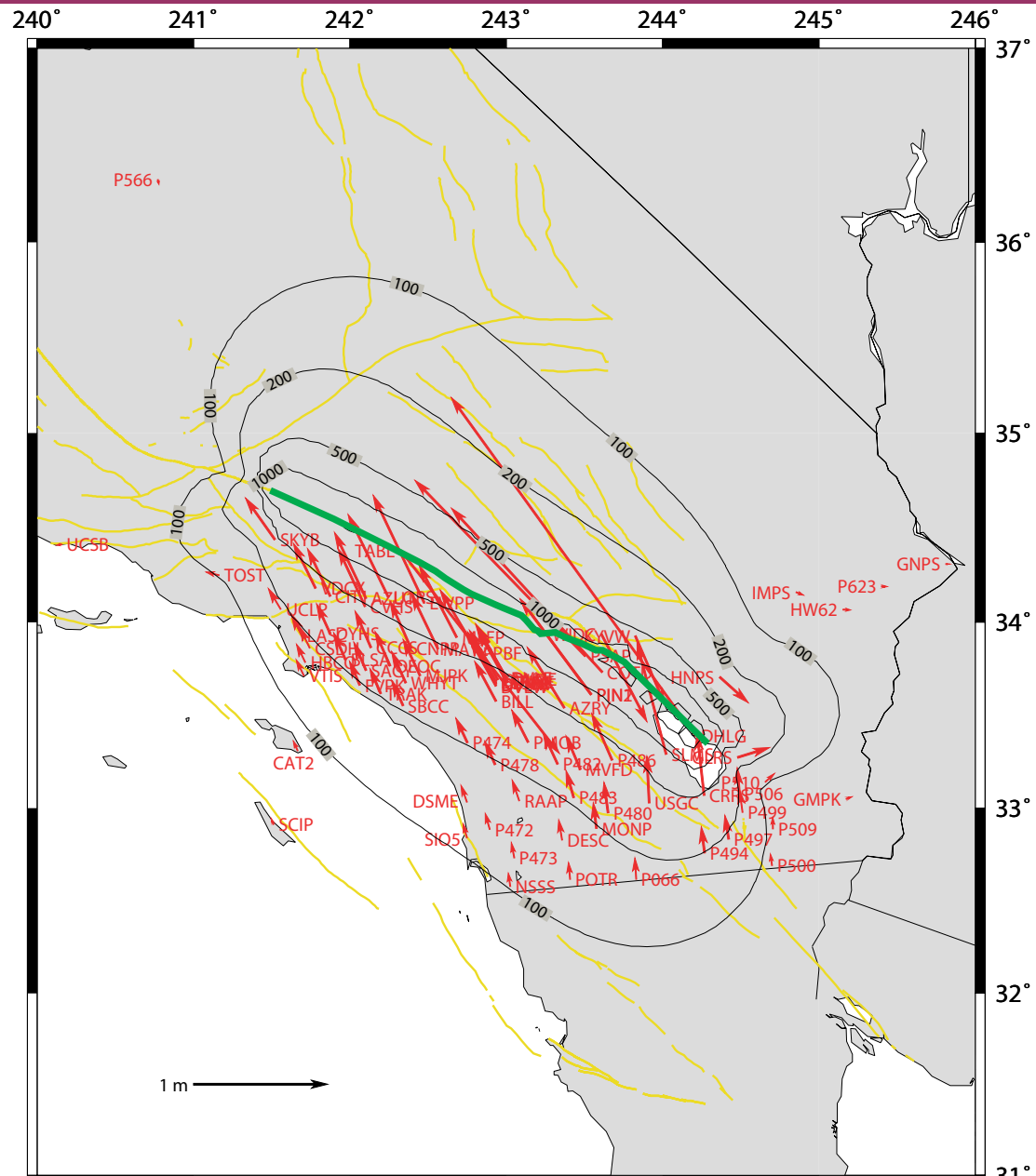


Demo

Total Displacement Waveforms



Coseismic Displacement Model



California Spatial Reference Center (CSRC) Proposal for a Statewide California Real Time Network

Multipurpose:

- Positioning Service
- EWS Test Bed
- GPS Meteorology

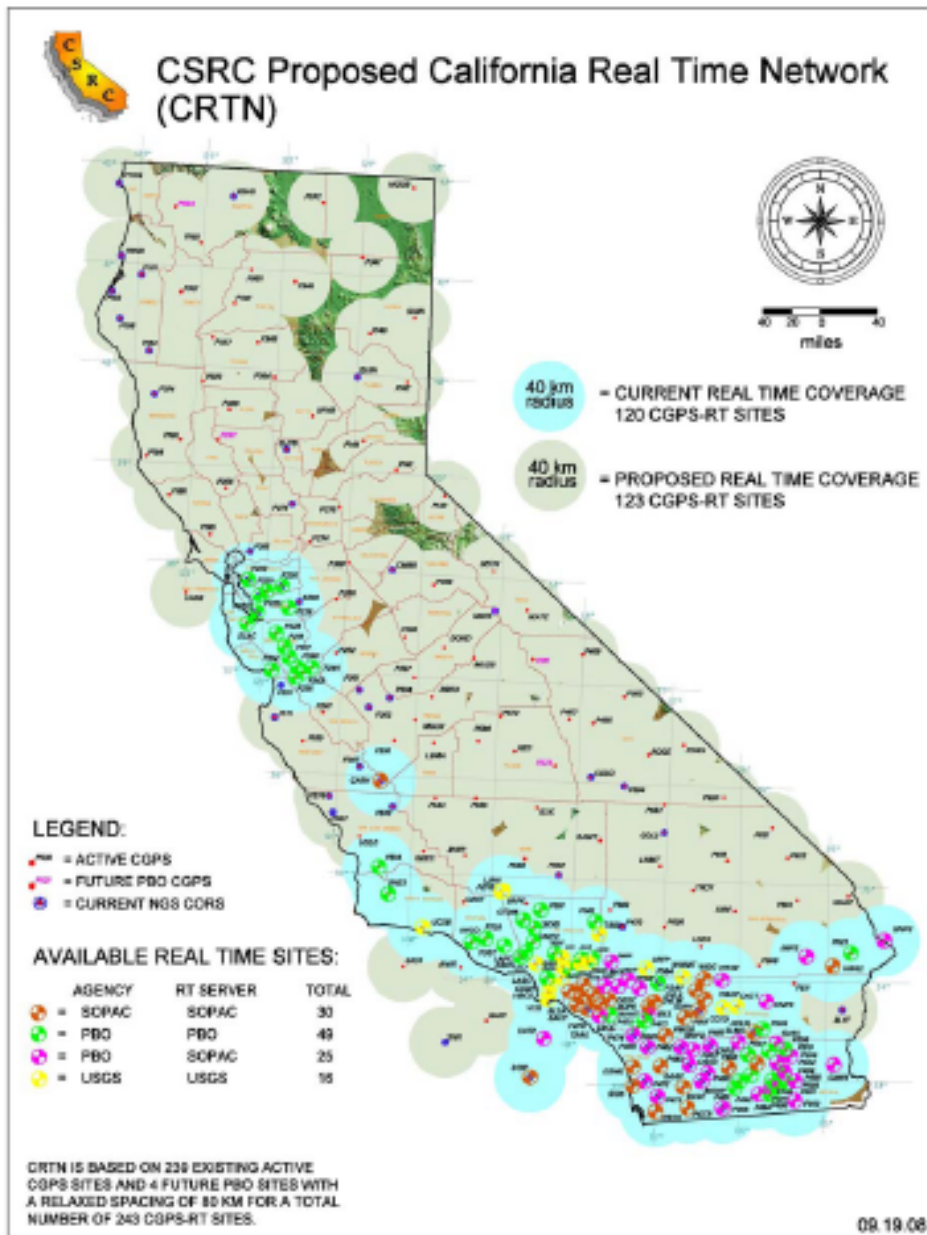


Figure 1. Map of proposed statewide CRTN with a nominal spacing of 80 km

http://csrc.ucsd.edu/input/csrc/proposals/CRTNProposal_version5.0.pdf