California Real Time (GPS) Network: Earthquake Early Warning and Detection of Strain Transients

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There are now more than 1200 continuous GPS stations in the Western U.S. for crustal deformation monitoring. Of these, about 200 stations have been upgraded to real-time operations, including ~130 stations in southern California which we refer to as the California Real Time Network (CRTN). We have developed and implemented a prototype earthquake early warning system, which relies on a dense network of real-time GPS stations with average spacing in the 20-40 km range (possibly with a subset of stations co-located with seismic instruments). Japan's GEONET, the Western Canada Deformation Array (WCDA), the Bay Area Regional Deformation Network (BARD), parts of the Plate Boundary Observatory (PBO) and the California Real-Time Network (CRTN) are examples of networks that fulfill these requirements. For CRTN, total (dynamic + static) displacement waveforms are computed once per second for all available network stations. In addition, CRTN provides a mechanism to allow field GPS surveys to be performed in real-time with high-accuracy allowing us to further densify regions of active faulting. I discuss two examples of monitoring strain transients using real-time regional GPS networks. The first is measuring total displacement waveforms during the 2003 Tokachi-Oki earthquake off Hokkaido Island and the 2008 ShakeOut simulation in southern California, in the context of earthquake early warning. The second is an interseismic strain transient, based on three rapid-static GPS surveys of 115 geodetic monuments stretching from the United States-Mexico border into the Coachella Valley using the method of instantaneous positioning with respect to CRTN, and conducted from February, 2008 to March, 2009. We compare our computed strain field to that computed using the Southern California Earthquake Center Crustal Motion Map 3.0, which extends through 2003 and includes 840 measurements. We describe an interseismic strain transient that corresponds to an increase in the maximum shear strain rate along a fault near Obsidian Buttes since 2003.