



A GPS Real Time Earthquake and Tsunami (GREAT) Alert System

Yoaz Bar-Sever and the GREAT Alert Team

JPL, Mail Stop 238-600, Pasadena, United States (Yoaz.Bar-Sever@jpl.nasa.gov, +1 818 393-4965)

The GREAT Alert is a NASA-sponsored, real-time prototype system designed to enhance natural hazard warning capability and damage assessment. The system takes advantage of the increasingly available global and regional real-time GPS data, as well as advanced fault and ocean dynamics models to enable more accurate and timely assessment of the magnitude and mechanism of large earthquakes, and the magnitude and direction of resulting tsunamis.

We will describe the prototype operational system being developed, highlighting the underlying GNSS technology. The key system components are:

1. The operational real-time estimation of site coordinates from hundreds of GPS sites using a precise point positioning (PPP) algorithm. This is accomplished by the NASA Global Differential GPS (GDGPS) System which, unlike other GPS algorithms such as real-time kinematic (RTK), is insensitive to motions of any ground-based reference stations in the vicinity of an event.
2. The application of data filtering and quality control techniques to the real-time site position time series in order to enhance the accurate retrieval of co-seismic site motions.
3. Usage of a Fingerprint inversion model (and potentially other models) for the rapid determination of the earthquake displacement field from the GPS-based records of ground motion at each station.
4. Detected and modeled seafloor displacements are then used within a special ocean dynamics model to determine tsunami source energy and scales, and estimate the tsunami propagation.
5. The resulting near-real-time information about earthquake source properties magnitude, type, and when relevant, magnitude and direction of the resulting tsunami, is then available to the responsible agencies to help in their decision-making processes.

We will discuss the preliminary performance of the system, and analyze the aspects of GNSS infrastructure and technology that require further investments in order to realize the full potential of the GREAT Alert system and similar approaches for natural hazard monitoring.