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

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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 in a multi-agency collaboration. 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. A trigger and an epicenter may be provided through operational global seismic network detections. The GPS data, that is, static displacements and long-period waveforms, would then be used especially to characterize very long-period aspects of the earthquake source that are not as well determined by the relatively short-period seismic data data. This effort includes the building of a data base for all known tsunamigenic faults, and the pre-calculation of "fingerprints" for all fault elements.
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 plans for system enhancement and transition to operations, as well as current and potential collaboration work with related natural hazard assessment and alert systems.

http://www.gdgps.net/products/great-alert.html

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