

Toward Earthquake Early Warning in Northern California

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The implementation of Earthquake Alarm Systems (ElarmS) in Northern California has presented significant challenges, including the need to integrate both broadband velocity and strong-motion accelerometer data over two networks: the Berkeley Digital Seismic Network (BDSN) and the Northern California Seismic Network (NCSN). This has necessitated several improvements over the implementation of ElarmS in Southern California. A major improvement has been the incorporation of p-wave peak amplitude data in the rapid magnitude determination, which has helped to improve significantly magnitude estimates in smaller events. Another improvement has been the incorporation of attenuation relationships from CISEN ShakeMap for prediction of shaking hazard during earthquakes. Efforts are currently underway to establish an Earthquake Early Warning (EEW) system in Northern California using ElarmS. Since February of 2006, every event in Northern California, greater than $M \sim 3.0$ has been processed using the ElarmS methodology. This processing has been performed automatically after each event with a delay of 10 minutes. This delay is to allow sufficient data to arrive at the network data center before processing. Periodically, a major change to the ElarmS code will prompt a reprocessing of these events, but this reprocessing is performed on the original data acquired 10 minutes after the event, and without any human interaction or oversight. We refer to this procedure as "non-interactive processing." We present the results of ten months of non-interactive processing, with a focus on events which represent possible hazardous earthquake scenarios in the Bay Area. These events highlight the capabilities and weaknesses of ElarmS in conjunction with the present disposition of BDSN and NCSN stations in and around the Bay Area. We discuss the performance of ElarmS in the non-interactive setting, as compared to expectations derived from its performance on calibration data. We also discuss possible improvements to ElarmS and to the NCSN and BDSN networks.