A Rapid Earthquake Detection Algorithm for Earthquake Early Warning: A Bayesian Approach using Single Station Waveforms and Seismicity Forecast

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The utility of Earthquake Early Warning (EEW) relies on the robust and rapid classification of near-site earthquake source signals from noise and teleseismic arrivals. We propose a new method to achieve this, which uses the three-component acceleration and velocity waveform data and Epidemic-Type Aftershock Sequence (ETAS) seismicity forecast information in parallel, producing the posterior prediction by combining the predictions from the heterogeneous sources using a Bayesian probabilistic approach. We collected 2,446 three-component strong-motion records for training and testing. The rapid prediction is available as quickly as 0.5 s after the trigger at a single station, achieving a precision of 98% at the first prediction with the classification accuracy increasing with time. The leave-one-out validation method also demonstrates confidence of robust performance for future earthquake signal detections. Our new strategy has shown promising results and the implementation of this methodology could provide significantly faster and more reliable EEW warnings to regions near the earthquake’ s epicenter where the strongest shaking is observed.

