Title: An Earthquake Detection Algorithm with Pseudo Probabilities of Multiple Indicators

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Abstract

We develop an automatic earthquake detection algorithm combining information from numerous indicator variables in a non-parametric framework. The method is shown to perform well with multiple ratios of moving short- and long-time averages having ranges of time intervals and frequency bands. The results from each indicator are transformed to a pseudo-probability time series (PPTS) in the range [0, 1]. The various PPTS of the different indicators are multiplied to form a single joint PPTS that is used for detections. Since all information is combined, redundancy among the different indicators produces robust peaks in the output. This allows the trigger threshold applied to the joint PPTS to be significantly lower than for any one detector, leading to substantially more detected earthquakes. Application of the algorithm to a small data set recorded during a 7 day window by 13 stations near the San Jacinto fault zone detects 3.13 times as many earthquakes as listed in the Southern California Seismic Network catalog. The method provides a convenient statistical platform for including other indicators, and may utilize different sets of indicators to detect other information such as specific seismic phases or tremor.