Geophysical Research Abstracts
Vol. 16, EGU2014-5850, 2014
EGU General Assembly 2014

Detecting and locating teleseismic events with using USArray as a big antenna

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We design an earthquake detection and location algorithm that explores coherence and characteristic behavior of teleseismic waves recorded by a large-scale seismic network. The procedure consists of three steps. First, for every tested source location we construct a time-distance gather by computing great-circle distances to all stations of the network and aligning the signals respectively. Second, we use the constructed gather to compute a Tau-P transform. For waves emitted by teleseismic sources, the amplitude of this transform has a very characteristic behavior with maxima corresponding to different seismic phases. Relative location of these maxima on the time-slowness plane strongly depends on the distance to the earthquake. To explore this dependence, in a third step, we convolve the Tau-P amplitude with a time slowness-filter filter whose maxima are computed based on prediction of global travel-time calculator (Buland and Chapman, 1983). As a result of this three-step procedure, we obtain a function that characterizes a likelihood of occurrence of a seismic event in a given position in space and time. We test the developed algorithm by applying it to vertical-component records of USArray to locate a set of earthquakes distributed around the Globe with magnitudes between 6 and 8.