Geophysical Research Abstracts
Vol. 14, EGU2012-6831, 2012
EGU General Assembly 2012

A Seismic Event Detection and Signal Association Algorithm

T. J. Draelos (1), S. Ballard (1), C. J. Young (1), M. Gonzales (1), and R. Brogan (2)

(1) Sandia National Laboratories, Albuquerque, New Mexico, USA (sballar@sandia.gov), (2) Ensco Inc., Melbourne, Florida, USA (brogan.ronald@ensco.com)

We present results of extensive testing of the latest version of our Probabilistic Event Detection, Association and Location algorithm (PEDAL). The Earth is discretized into a dense 3D grid of 383,753 nodes, extended to 4D by the addition of a time dimension. Given a set of seismic observations (arrival time, horizontal slowness, and azimuth), a 'fitness' value is calculated at each grid node, assuming that each observation was generated by a refracted P wave. The node with the highest fitness value is accepted as a hypothetical seismic event location, subject to some minimal fitness value. Once we have identified the peak, we solve for the corresponding origin time and then associate individual arrivals with the event, considering many different phases.

In the new method, we have made several improvements: 1) we incorporate a priori probability of a seismic event happening at a grid node; 2) we incorporate a priori probability of signal detection for each station; 3) we do association in two phases, P first, then later phases; 4) after the P phase association, we calculate an mb magnitude and use this to define the list of secondary phases to consider for association; 5) we use the SNL-LANL SALSA3D model to predict travel times for grid nodes that do not have sufficient data to define predictions empirically. We tested the new version on a 2-week period of time that has been processed by the IDC and that have also been carefully examined by an analyst to identify all legitimate events. A sophisticated bulletin review algorithm is used to compare PEDAL results to both the automatically-generated IDC SEL3 event list, a product of the Global Associator (GA), and the analyst-reviewed LEB. We show that our latest version of PEDAL significantly improves our processing results.