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Refinement and Testing of the Probabilistic Event Detection, Association, and Location Algorithm

We present results of testing the latest version of our Probabilistic Event Detection, Association, and Location (PEDAL) algorithm. PEDAL uses an Earth model discretized into a dense 3D grid of 427,265 nodes, extended to 4D by the addition of a time dimension. Given a set of seismic observations (arrival time, horizontal slowness, azimuth and associated uncertainties), a 'fitness' value is calculated at each grid node, assuming that each observation was generated by a refracted P wave. The node with peak fitness value is accepted as a hypothetical seismic event location. We then solve for the corresponding origin time and associate individual arrivals with the event, considering many different phases. Improvements include: 1) incorporating prior probability of signal detection for each station; 2) association in two stages, P first, then later phases; 3) calculation of mb and association based on magnitude, depth, and distance from event to station; and 4) integration with waveform correlation. We tested the new version on a 2-week period of time processed by the IDC and carefully examined by an analyst to identify all legitimate events. A sophisticated bulletin review algorithm shows PEDAL performance superior to the Global Associator (GA).

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