Determining hypocentral parameters and 1-D velocity structure simultaneously using the GA-MHYPO algorithm

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The genetic algorithms in the earthquake location and velocity optimization program, GA-MHYPO (Kim et al., 2006, GJI), search for a global solution of the 1-D velocity structure, within prescribed velocity ranges, that provides the minimum travel-time difference between observed (true) and calculated travel times for P- and S-wave arrivals. Having obtained the optimum average 1-D velocity structure, GA-MHYPO is thus able to determine hypocentral parameters more accurately than methods which rely on *a priori* (and possibly incorrect) 1-D models. The velocity structure estimated by GA-MHYPO for one event represents the average velocity between the hypocenter and receivers. Kim et al. (2006) showed that for synthetic tests this average velocity is nearly the same as the average of the true velocity, if the data used have no error. The overall 1-D velocity structure for a specified region can be determined by GA-MHYPO when the region has many earthquakes. This study shows that the computational results and/or degree of resolution depend on the number of sources and their distributions, the differences (e.g., the number of layers and their thickness) between true and assumed model, and the effects of noisy data using both synthetic data and real earthquake data from two very different source regions.