Paper Number: 3146

A method to determine hypocentral parameters of shallow earthquakes including explosions.

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Assuming that the true velocity structure is not well known, it is generally difficult to determine accurate hypocentral parameters of a shallow earthquake (focal depth < 5 km) compared to those of an intermediate or deep one. This is due to the fact that the most first arrival phases of shallow earthquakes are converted waves such as head waves or turning waves, while those of intermediate or deep ones are direct waves. Therefore, the hypocentral parameters of a shallow earthquake are more sensitive to the used background velocity structure than those of an intermediate or deep one. The conventional methods (e.g., HYPO71, HYPOINVERSE, VELEST, HYPOSAT, hypo-DD, etc.) using the fixed background velocity model are highly influenced by the accuracy of the implemented velocity model. The hypocentral parameters of shallow earthquakes are determined using a hypocentral parameter inversion method based on an adaptive-velocity-model-updating scheme (VELHYPO) which searches the average of the used velocities between a source and receivers closest to the average of the true velocities. Using the layered models consisting of constant velocities and linear velocities, the accuracies of hypocentral parameters of shallow earthquakes determined by VELHYPO are compared with those done by the conventional methods for various cases such as different velocities, numbers of layers, and focal depths. VELHYPO yields more accurate hypocentral parameters than the conventional methods do.