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# Numerical modelling of velocity structure estimation method for earthquake's hypocenters zones

Dmitry Likhodeev, Artem Numalov, Dmitriy Presnov, and Lidiya Slavina
Schmidt Institute of Physics of the Earth of the Russian Academy of Sciences, Moscow, Russian Federation (dmitry@ifz.ru)

Velocity properties of the heterogeneous crust are required for solving a wide range of geophysical problems, including earthquakes hypocenters location and deep structure investigation for delineating geological anomalies of different nature. In this work, we considered an unusual approach of subsurface characterization on the basis of P- and S- waves travel times – so-called "reverse wave" method for areas of dense seismicity. Considered method is based on the principle of wave reversibility with is that the travel time of the seismic wave propagating from the source to the receiver is equal to the travel time of wave propagating from the receiver to the source. This principle allows us to consider quite a bit of travel times of seismic waves running from sufficiently weak local earthquakes to some seismic station as the reversal waves travel times, propagating from this seismic station to the hypocenters of the corresponding earthquakes. Thus, the initial parameters for velocity distribution reconstruction includes coordinates of the earthquake hypocenters and seismic wave travel times corresponding to the particular seismic station. The novel algorithm to find the solution of the inverse problem is developed which incorporates the iteration procedure to improve the reconstruction results and imposes additional smoothness conditions on the reconstructed values. Several numerical experiments based on forward problem solution were performed. Waves travel times in 3D heterogeneous medium have been calculated in the ray approximation. It made it possible to estimate the effect of various parameters including earthquakes density, size and shape of the velocity anomalies on the residual of the reconstructed velocity distribution. Obtained results allow us to choose optimal parameters for calculation of the velocity distribution depending on the set of initial data and make a comparison with tomographic methods.
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