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A numerical study of real-time source mechanism inversion (GRiD-MT) considering 3D heterogeneous subsurface structure

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Abstract

One of the main objectives in this study is upgrading the GRiD-MT system (Tsuruoka et al., 2009), which performs a moment tensor inversion in real time basis by using both observed waveforms and correlation coefficients of Green's function. To achieve the goal, we firstly simulated seismic wave propagation using the finite difference method (FDM) which takes into account the heterogeneous underground structure, frequency dependence and so on.

GRiD-MT, considering 3D horizontally stratified structure model, is good for rather long period seismic waves (20-50s) and can determine MT solutions of Mw4 class earthquakes. We would like to apply GRiD-MT much smaller magnitude and more accurate determination for MT solution, we have to take into account using more shorter period seismic waves (less than 20s). We initially investigated effects of number of observation stations and frequency ranges for MT inversion. We used 2D model to know the features of MT inversion under the heterogeneous structure. Because, in the future, we would like to use Green's function under 3D heterogeneous structure model for the calculation.

We performed 2D simulation of seismic wave propagation and estimated hypocenter locations using the FDM method. We beforehand set 96 virtual sources in the model and computed 96 Green's functions for each observation point at the surface. So, we determine real hypocenter by comparing actual waveforms and Green's functions and using cross correlation coefficients. We adopt the highest point of cross correlation coefficient as a real hypocenter. In this study, we used maximum 5 stations to compare them.

In the future, we would like to compute 3D Green's function for 3D heterogeneous subsurface structure. Furthermore, we have a plan to use reciprocal theorem in the GRiD-MT.

Keywords: GRiD-MT, hypocenter location, correlation coefficient