Determination of focal mechanisms for aftershocks of the 2000 M7.3 Tottori Earthquake using the empirical Green tensor method

Yoshihiro Ito[1], Tomomi Okada[2], Akira Hasegawa[2], Kazushige Obara[3]

[1] RCPEV, Tohoku Univ., [2] RCPEV, Graduate School of Sci., Tohoku Univ., [3] NIED

Information on stress field in seismogenic zone will be extracted from focal mechanism solutions of many earthquakes occurring there. There are mainly two ways to estimate focal mechanisms. One is using distribution of P-wave first motions and the other is moment tensor inversion method. The former needs many stations near the hypocentral area. Usually it is impossible to accurately estimate focal mechanisms of events with magnitudes less than 2, even if using a recent high-density seismic network such as Hi-net. In the waveform inversion method, Green tensors play a key role. Various numerical methods, proposed to date, to calculate them need to assume the earth structure a priori. Waveforms of small earthquakes are dominated by high frequency components. It isn't realistic to assume a detailed velocity structure sufficient for these small earthquakes, because such a structure has rarely been obtained. Plicka and Zahradnik(1998) developed a new method, in which empirical green tensors, EGT, are estimated from seismograms of plural earthquakes whose focal mechanisms are known. In the present paper, we show spatial distribution of focal mechanisms for aftershock observed right after the 2000 M7.3 Tottori Earthquake, western Japan, using the moment tensor inversions with EGT. First, we calculated EGT at each station using seismograms of events whose focal mechanisms are accurately estimated by P-wave first motions. We assumed in the calculation of the EGTs that all these events occurred at the same location. In the case that stations are not located so far from the hypocenter, this assumption may not be appropriate. We corrected the difference of source locations by rotating focal mechanisms, under the assumption that wavelength used is larger than the characteristic scale of heterogeneity between station and hypocenter. Then, we applied the moment tensor inversion method using EGTs to other aftershocks whose focal mechanisms were not known. Obtained focal mechanisms from the present inversion are consistent with those from P-wave first motion data. Synthetic waveforms by EGTs are also consistent with observed ones. We obtained about 300 focal mechanisms of aftershocks by using the moment tensor inversion with EGT method. Their distribution is consistent with that already obtained by P-wave first motions [Shibutani and Katao(2001)].