Seismic Moments of Inland Small Earthquakes in Japan: Spectral Analyses Using the Hi-net

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Seismic moments and moment magnitudes are one of the most important quantities in characterizing earthquakes. NIED reports moment magnitudes for moderate and large earthquakes (M_W > ~3.5) using the F-net or the KiK-net/K-NET. However, the moment magnitudes of small earthquakes (M_W < 3.5) aren't well determined because of sparse station distributions of the F-net and low sensitivity sensors of the KiK-net/K-NET. These earthquakes' magnitudes are determined using maximum amplitudes of the seismograms of the Hi-net, a dense seismic observations with high-sensitivity sensors. Such high sensitivity seismometers are also used to estimate seismic moments (e.g., Uchide and Imanishi, 2018). This study estimated seismic moments and moment magnitudes for inland earthquakes in Japan using the Hi-net.

We calculated seismic moment for inland earthquakes shallower than 20 km deep with magnitudes from 3 to 4 occurred in 2013 to 2017. Firstly, we calculated a source spectrum from waveform data during 1s before to 9s after the S-wave arrival time. Then, correcting path, site, and the instrumental response, we estimated source spectra. Comparing the observed source spectra with a theoretical one supposing the ω^2 model, we obtained the seismic moment.

The Hi-net detected 455 inland earthquakes with the magnitude from 3 to 4 in 2017. We successfully estimated the seismic moments more than 90 % of those earthquakes. We could estimate the moment magnitudes more than 90 % except 2016. Because the aftershocks of the Kumamoto earthquakes contaminated Hi-net records, we calculated the seismic moments only for 70 % of the 1730 earthquakes in 2016. We compared the moment magnitudes determined by the Hi-net with those by a moment tensor inversion of the F-net. The moment magnitude of Hi-net was smaller than those of the F-net by 0.13±0.11. On the other hand, the magnitude using the maximum amplitude of the Hi-net was larger than the F-net by 0.06±0.21.

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