Moment tensor inversion for repeating earthquakes using stacks of the broadband seismograms

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Recent studies identified the repeating earthquakes in subduction zone of northeastern Japan, which were recognized as a group of earthquakes that occur with a fixed location and fixed source mechanism along a plate boundary. Since magnitude of repeating earthquake is small (M2-4), it had been difficult to estimate the depth and the focal mechanism using the moment tensor inversion of the long period component. To obtain a stable long period component of repeating earthquakes, we constructed a stack of available broadband seismograms. In general, random noise is reduced by the square root of the number of records stacked. Using stacking seismograms, we performed moment tensor inversion, and obtained the depth and the moment tensor components for each group of repeating earthquakes.

For analysis, we used broadband seismograms observed by F-net (NIED), and a list of repeating earthquakes obtained by Matsubara et al., (2005). We stacked broadband seismograms, band-passed between 0.05 and 0.1 Hz, and then converted into ground displacement with a sampling time of 0.5 sec. Since the hypocentral depth is not adequately constrained by the local seismological network, we varied the centroid depth from 10 to 70 km in the moment tensor inversion procedure with epicenter fixed.

We obtained results of 83 groups of repeating earthquakes, and found that almost repeating earthquakes are classified into the inter-plate type earthquake.

Matsubara, Yagi and Obara (2005) Geophys. Res. Lett., doi:10.1029/2004GL022310