

Moment tensor inversion for repeating earthquakes with stacks of seismograms of tiltmeter

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1. Introduction

Repeating earthquakes have been identified along plate boundary in northeast of Japan, which are recognized as a group of earthquakes that occur with a fixed region and same source mechanism (Igarashi et al., 2003; Uchida et al., 2003; Matsubara et al., 2005; Kimura et al., 2006). It was difficult to perform of moment tensor inversion of these earthquakes since the most of their magnitudes are between 2 and 4. To obtain a stable long-period component of repeating earthquakes for the moment tensor inversion, we stacked the waveforms of them. In general, the random noise is reduced by the square root of the number of records. National Research Institute for Earth Science and Disaster Prevention (NIED) operated the broadband seismograph network (F-net) and high-sensitivity seismograph network of Japan (Hi-net) [Okada et al., 2004; Obara et al., 2005]. Yagi and Matsubara (2006) analyzed the focal mechanism of repeating earthquakes by stacking the waveforms obtained by the NIED F-net. A two-component tiltmeter is equipped in each NIED Hi-net station besides a three-component velocity-type seismometer. The interval of seismic station of NIED F-net is approximately 100 km, however, that of the NIED Hi-net is approximately 20 km. We stack the waveforms obtained by the tiltmeter of Hi-net rather than F-net and apply to the moment tensor inversion.

2. Data and method

We used the waveforms of repeating earthquakes around the 2003 Off Tokachi earthquake detected by Matsubara et al. (2005). The method of stacking and moment tensor inversion is the same as Yagi and Matsubara (2006). We stacked the seismograms of tiltmeter, band-passed between 0.05 and 0.1 Hz, and converted into ground displacement with a sampling time of 0.5 sec. We varied the centroid depth from 10 to 80 km in moment tensor inversion procedure with fixed epicenter since the hypocentral depth is not adequately constrained by the local seismic observation network in the Japan land.

3. Results

Beneath the land or coastal area, such as the areas beneath the Hidaka Mountains or off Nemuro peninsula, we obtained the focal mechanism of repeating earthquakes with the magnitudes larger than 2.8. Those centroid depth are consistent with the location of the plate boundary between the Eurasian and Pacific plates and e depth and those low-angle thrust focal mechanisms are consistent with the inter-plate type earthquake.