

Small repeating earthquake activity and plate dynamics in Tokyo

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The Philippine Sea plate (PHS) and the Pacific plate (PAC) are subducting below Tokyo and seismicity is very complex due to mutual plate subduction and their interaction. Large earthquakes in Tokyo are likely to have close relation with plate dynamics. Repeating earthquakes are events which repeat on an isolated fault patch distributed on the plate boundary and provide information about location and history of interplate shearing. Numerous small repeating earthquakes have been found in Tokyo. These repeating earthquakes are important to understand and monitor plate dynamics.

An automatic detection system of the small repeating earthquake started on May 2007. Earthquakes automatically determined by Hi-net were compared with repeating earthquakes obtained by Kimura et al. (2003) and Kimura et al. (2006). The analyzing method is the same as Kimura et al. (2006). From Oct 2008, the monitoring area was expanded to central Japan and off Iwate, northeastern Japan by incorporating results of Matsubara et al. (2006).

Numerous small repeating earthquakes have been found near the upper boundary of plates and are used to determine a configuration of plate as a boundary of interplate shearing (Kimura et al., 2006, 2008). High-precision distributions of repeating earthquakes in significant seismic clusters of PHS and PAC were determined by Double Difference method with waveform correlation. Most M3-class repeating earthquakes are located within 40 m and 140 m, at largest, for the PHS and the PAC, respectively (Kimura et al., 2008). Larger distances for the PAC would be caused by location of the target region at the edge of the seismographic network. Considering fault size of used events, they are likely to occur at the same location.

Averaged cumulative slip histories were estimated to reveal spatio-temporal distribution of interplate shearing. Most repeating earthquake clusters show almost constant slip rate indicating steady plate motion. On the other hand, significant temporal changes were found for areas off the Boso Peninsula, southeastern Kanto, and near eastern Kanto. Slow slip event (SSE) repeats with a time interval of about 6 years off the Boso Peninsula, accompanying repeating earthquake swarms (Kimura et al., 2004). Numerous repeating earthquakes associated with the August 2007 SSE were detected automatically. Quiescence of repeating earthquakes preceding M-6 class interplate earthquakes was observed at eastern Kanto (Kimura et al., 2007).