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ニュージーランド北島におけるテクトニックな微動活動と温度構造
Tectonic tremors and its thermal condition in the Hikurangi Subduction Zone, North Island, New Zealand

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Tectonic tremors are widely detected in the subduction zone around the Pacific since its discovery. The oceanic plates, which are subducting beneath such subduction zone, are usually young (~30Myr). The subduction zone with younger oceanic plate is supposed to have a proper condition for tremor generation, such as a shallower slip transition and a active dehydration reaction from oceanic slab, both of which is considered to be important for tremor generation. However, in North Island, New Zealand, where much older oceanic plate (~80Myr) is subducting, tectonic tremor activities were reported by Kim et al., 2011, Fry et al., 2011 and Ide 2012. In North Island, slow slip events (SSEs) are also well known. Tremor activity and SSEs in such cooler subduction seems to be strange. Therefore, in this study, we aim to understand the physical conditions, especially temperature of tremor source areas in North Island. To find out the physical conditions of tremor source areas in cooler subduction zone would be an important clue for clarifying tremor mechanism.

To detect and locate tremors, we use the envelope correlation method of Ide 2010, 2012. The Data is continuous horizontal velocity seismographs from January 2004 to March 2010 downloaded from GeoNet. The 100 Hz sampling original data is 2~8 Hz band-passed and take envelope, then down sampling to 2 Hz in 300 s time windows. In each time window, if more than 40 pairs of cross correlations of envelope between different stations exceed threshold value, we detect seismic signals and try to locate. We also apply same method to 10~20 Hz band-passed data. We rejected detected signals if more than 10 pairs of correlation exceed threshold in 10~20 Hz data as applied in Kim et al., 2011. We also use duration thresholds and simple clustering method to get clearer image of tremor activity. Our analysis detects and locates short belt-like distributed tremor activities. It is just at the transition zone from deeper SSEs to shallower SSEs and at down dip area of deeper SSEs. We also estimated the absolute depth of tremors using S-P time of tremors obtained from cross correlation between vertical and horizontal components of the same station. The estimated depth of tremors suggests its occurrence on the plate interface though the estimation error is not so small due to low signal-to-noise ratio.

McCaffrey et al., 2008 and Fagereng and Ellis, 2009 already estimate the thermal state of Hikurangi Subduction, North Island. However, the estimation error is not clear in these studies. We are interested in the thermal profile along plate interface, especially possible thermal range around the tremor source areas. Therefore, to assess estimation error is important for us. To estimate the temperature profile on the plate interface, we use the subduction thermal model based on Yoshioka and Sanshadokoro, 2002 using finite difference method. In this model, we consider the viscous dissipation, frictional heating and advection. To assess the estimation error of temperature along plate interface, we try some parameter sets, and then the possible temperature range of tremors source areas in North Island is evaluated.

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