Estimated seismic tremor energy for small amplitude tremors

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Various types of slow earthquakes, such as tectonic tremor [Obara, 2002] and slow slip events [e.g. Rogers and Dragert, 2003] have been recently observed at both the updip and downdip edges of the coseismic slip areas [Obara, 2002; Yamashita et al., 2015]. The frequent occurrence of slow earthquakes may help us to reveal the physics underlying megathrust events as useful analogs [Kato and Obara, 2016]. Maeda and Obara. [2009] estimated spatiotemporal distribution of seismic energy radiation from low-frequency tremors. They applied their method to only the tremors, whose hypocenters had been decided with multiple station method. However, a lot of tremors with small amplitude could be prone to underestimate on their detection. The events with small amplitude should not ignored to reveal slow earthquake activity and to understand strain condition around a plate boundary in subduction zones.
Here, we apply the modified frequency scanning method (mFSM) at a single station to NIED Hi-net data in the southwestern Japan. The original frequency scanning method [Sit et al., 2012] proposed a tremor detection method of calculating envelope waveform ratios through different bandpass filters of broadband data in the Cascadia margin. We modified this analysis for short period seismic Hi-net data recorded in the Southwest Japan. Three bandpass filters of 2–8 Hz, 10–40 Hz, and 0.25–1.0 Hz, corresponding to the dominant frequency band of tremors, local earthquakes, and seasonal noise, respectively. In addition, we removed the regular earthquake events by considering these envelope waveform shapes are similar to exponential curve in 2–8Hz band. We do not use three minutes continuous seismic data when correlation coefficient value is greater than 0.8 between envelope waveform and given simple exponential function.
Our results with mFSM is corresponded to those with multiple method in Southwest Japan. On the other hand, our results include small amplitude tremors which can not be detected with multiple methods. We also estimated their seismic tremor energy including small amplitude tremors which were detected by mFSM at each sites. Amplitudes observed at each site was corrected using the site amplification factors estimated with the coda normalization method and the Euclidean distance between the tremor source and the station, The estimated energy in this analysis may indicates more realistic strain release rate around the plate boundary.

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