Illuminating deep tremors along the Nankai subduction zone, Japan, by matched filter technique

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Deep no-volcanic tremors along the Nanakai subduction zone, SW Japan, can be explained as a swarm of sequential ruptures of low-frequency earthquakes (LFEs) [e.g., Shelly et al., 2007]. Therefore, it is very important to investigate spatio-temporal evolution of each LFE. A matched filter technique is a one of the most powerful tool to detect earthquakes buried in intensive seismic sequence [e.g., Shelly et al., 2007; Kato et al., 2012]. However, there is little constraint on long-term behavior and regional scale properties of LFEs along Nankai Trough throughout the MFT analysis.
To more precisely characterize the evolution of tremors, here, we applied the matched filter technique to continuous seismograms during around 11 years, using template LFEs determined by JMA along the tremor belt from the western Shikoku to Tokai regions, SW Japan. We used continuous three-component velocity seismograms obtained by Hi-net seismic stations located near the tremor belt, which has been operated and archived by NIED. Both continuous data and template waveforms were bandpass filtered from 1 to 6 Hz and decimated to 20 Hz. We divided the tremor belt-like zone over a length of 600 km into ten regions which overlap each other. We selected ~4000 LFEs from the JMA catalog as template waveforms based on the signal-to-noise ratio. We newly detected about 20 times the number of LFE events determined by JMA, which is larger than ones obtained by conventional envelope cross correlation method.
Based on the newly constructed catalog, we find out clear down-dip variations along the tremor belt-like zone. From deep to shallow depths, tremor activity is getting to be more episodic than continuous manner, which well matches with previous studies [e.g., Obara et al., 2010; Wech and Creager, 2011]. But, the transition along-dip direction is more continuous than previously thought. In addition, b-value, which regulate a slope between frequency vs magnitude distribution, gradually decreases with an increasing depth. These depth dependences might be explained by localization of tremor patches and expansion of slow slip area toward shallow depths.

