

Small-scale along-dip variations of deep low frequency tremor activity detected in western Shikoku, southwest Japan

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It is reported that deep low frequency tremor occurs more episodically at the updip part of the tremor region compared to the downdip part in Shikoku in southwest Japan (Obara et al., 2010, 2011) and Cascadia (Wech and Creager, 2011). In this study, we focused on the updip cluster in western Shikoku analyzed in Obara et al. (2010) in order to investigate tremor activity in a finer scale along the dip direction.

We detected tremor activity by using the matched filter technique (Shelly et al., 2007) in western Shikoku. The continuous waveform data from 2013 to 2015 at 12 Hi-net stations operated by National Research Institute for Earth Science and Disaster Resilience are used after applying band-pass filter of 2 to 8 Hz. As template events, we selected several low frequency earthquakes located within a streak-like tremor cluster along the dip direction of the subducting plate from the catalog of Japan Meteorological Agency (JMA). We used the time window of four seconds from one second before the arrival time of S-wave detected by JMA at each station. We applied two thresholds for detection: 8 and 8.5 times of median absolute deviation for the distribution of correlation sums.

We found stepwise tremor activities at all spots corresponding to episodic tremor and slip (ETS), which recurs at intervals of about half a year in western Shikoku. At the northern (deeper) part, the number of detected events during ETS was smaller, and small tremor bursts were more frequently detected during inter-ETS compared to the southern (shallower) part. This result is consistent with the general trend of tremor activity in wider scale in southwest Japan and Cascadia. For both thresholds, the characteristics of the results are almost the same.

Some tremor episodes were detected only at the up-dip part of the tremor cluster, although individual ETSs are mainly initiated at the deeper part and migrate upwards in western Shikoku (Obara et al., 2011) and Cascadia (Wech and Creager, 2011). This may suggest that some ETSs initiate at the updip part.

Keywords: deep low frequency tremor, slow earthquake, ETS