# Characteristic activities style of slow earthquakes: 1.Tremor migration beyond gaps

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Episodic tremor and slip (ETS) occurs periodically at the downdip side of the megathrust seismogenic zone on the subducting plate interface in Cascadia and southwest Japan. Tremor episode usually migrates at a speed of about 10 km/day along the strike of the subducting plate geometry. This is interpreted as propagation of the rupture front of short-term slow slip event (SSE). In general, tremor migration is easily recognized as a sequence of spatiotemporally continuous distribution. However, we sometimes observe tremor clusters which are distributed discretely but seem to be connected including some gaps. In this presentation, we focus on the tremor migration phenomena beyond gaps.

Between central and western Shikoku, there exists tremor clusters separated by a small gap. Tremor activities on both sides frequently occur coincidently. Obara et al. (2011) showed that these tremor clusters seem to follow a single line for spatiotemporal evolution. They interpreted that the silent gap is a rheological inhomogeneous patch on the plate boundary and SSE rupture front propagates aseismically. Similar tremor migration with gap is observed in Kii and Tokai area. On either sides of Ise Bay, tremor episode occurs at recurrence intervals of about six months independently. However, we sometimes observe tremor migration from Kii to Tokai continuously including aseismic gap at Ise Bay. The first significant migration episode occurred in January 2006. It started from the middle part of Kii then jumped over Ise Bay, finally traveled through Tokai (Obara and Sekine, 2009). In November 2017, similar big migration episode occurred again. During the migration episodes, tremor activity is always silent although the SSE source faults are estimated at Ide Bay area. Therefore, rheological property on the plate boundary is expected to be different from other tremorgenic regions.

In the above cases, silent region in tremor activity is spatially fixed; however, we rarely observe a sequence of tremor clusters distributed discretely in the tremorgenic region. From September to December 2007, six tremor episodes distributed discretely occurred successively in Tokai and Kii. These isolated tremor clusters are separated by silent portion where tremor has occurred previously. Their spatiotemporal plot roughly follow a single regression line with a migration speed of about 4 km/day from northeast to southwest. Interestingly, some of isolated clusters includes small-scale migration within each cluster and the migration seems to fill in the gap. Similar tremor migration is also observed in Cascadia (Wech and Bartlow, 2014). In this case, small slip event spatiotemporally associated with tremor gap was detected. Therefore, this phenomena is interpreted as tremorless slip due to low-speed of slip velocity and low pre-existing stress level. Similar tremorless slip might have occurred in southwest Japan. Another possibility is aseismic slip propagation at the deeper or shallower part from the tremorgenic region. Takagi et al. (2016) detected minor long-term SSE at the updip side from the tremor zone in central and western Shikoku. This long-term SSE affected to the temporal variation of the tremor activity. Similar outside phenomena might occur and affect to the tremor activity.

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