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Time evolution of non-volcanic tremor episode

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Non-volcanic tremor in subduction zones like as Nankai is one of slow earthquake phenomena in the transition zone between the seismogenic zone and the stable sliding zone on the subducting plate interface (Obara, 2002). Major tremor episodes with duration longer than several days are always accompanied by short-term slow slip events (SSEs). The space-time correlation of tremor and SSE suggests that the time evolution of tremor episode reflects the rupture process of SSE. Based on the similarity, studying the mechanism of slow earthquakes is important to understand the activity style of megathrust earthquake. Therefore, we investigate the time evolution of tremor episode based on the clustering catalog (Maeda and Obara, 2009, Obara et al., 2010) because the tremor is well-detected compared to other slow earthquakes.

Tremor belt-like zone is divided into some segments based on their spatial extent and recurrence interval (Obara, 2010). Each segment includes some sub-segment as units of tremor activity (Obara et al., 2013). Tremor episode usually initiates from the deeper part of the tremor belt-like zone. If the episode reaches to the updip part of the tremor zone, it becomes a major episode associated with detectable SSE (Obara et al., 2011). We sometimes observe major episodes initiated from the shallower part. The time evolution of tremor energy at the beginning stage of the tremor episode depends on the location of initiation point. If the episode starts from the deeper part, the evolution velocity is small for a while then increases rapidly after the tremor migration front reaches to the updip edge. On the other hand, the evolution velocity is high if the episode starts from the shallower part. This suggests that the tremor patches radiating high energy concentrate at the updip side. The time evolution of tremor energy at the beginning stage of each episode is not related to the final size of the episode. The size of episode may be controlled by the strain energy accumulation at each portion on the way of migration. This is the same for along-strike evolution of tremor episode. The propagation of tremor episode depends on the slip deficit in each sub-segment ahead of the rupturing sub-segment. We observed temporal deceleration of migration speed in front of the small gap as the sub-segment boundary. On the other hand, we detect acceleration of the migration speed at a common spot during passage of the major tremor episode several times. This spot is considered as a sweet spot where tiny tremor activity continuously occurs in the shallower part of the tremor zone. This spot frequently generates tremor episodes and is considered to be strongly inhomogeneous. Such variation on the plate interface may control the rupture process of SSE.

Keywords: non-volcanic tremor, slow earthquake, source migration, segmentation