Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SCG62-01 Room:103 Time:May 20 09:00-09:15

Activity style of nonvolcanic tremor in southwest Japan

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In some subduction zones like as Nankai and Cascadia, slow earthquakes composed of slow slip event and non-volcanic tremor occur between the transition zone between the locked zone and downdip stable sliding zone. This slow earthquake source region ranges with a length of 600 km in southwest Japan or 1200 km in Cascadia; however, the region is divided into some segments based on their activity style. In each segment, the tremor episode recur at a certain interval with clear migration. Sometimes, the migration is observed across the different neighbor segments. Such activity style of tremor is very similar to that of megathrust earthquake because the tremor episode frequently occur. Therefore resolving the key factor that controls the activity style of tremor episode may contribute to understanding the occurrence mechanism of megathrust earthquake. Therefore, we investigate the detail activity style of tremor based on the clustering catalog (Maeda and Obara, 2009, Obara et al., 2010) because the tremor is well-detected and determined compared to other slow earthquakes.

The epicentral distribution of tremor is not uniform within the narrow belt-like zone. The tremor belt-like zone includes some aseismic portions. Some large aseismic portions in Ise Bay and Kii Channel is considered as the segment boundary because many tremor episodes stop at or start from the edge of the aseismic portion. However, the tremor activity in the central and eastern Shikoku clusters occurs continuously in space and time on both sides of a small aseismic portion. This indicates that the slow slip might propagate through the aseismic portion without tremor activity (Obara et al., 2011). The segment is defined as the rupture area of recurrent tremor episodes with a certain recurrence interval. However, sometimes the segment is divided into some small episodes with short time interval. These small episodes are not overlapped and finally cover the whole region of the segment. Therefore, the rupture area of the coming small episode is predicted in advance based on the occurrence style of previous small episodes. The rupture initiation point of the tremor episode is frequently away from the stop point of the previous tremor episode. This suggests that the effect of the stress concentration caused by the rupture propagation of the slow slip event is not so significant, but anyplace in the segment is ready to rupture and the rupture starts from the most weak point. These small episodes sometimes occur at the same portion within the segment. This might be defined as a sub-segment. The sub-segment boundary usually corresponds to the continuous tremor active spot. This spot also coincides to the rupture initiation discussed above. Therefore, the inhomogeneous spot on the plate interface may control rupture initiation and termination of slow slip event.

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