

Activities of low frequency tremors in Sanriku-Oki before the 2011 Tohoku-Oki earthquake

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Recently, slow earthquakes have been discovered in Tohoku-oki by using the Seafloor Observation Network for Earthquakes and Tsunamis along the Japan Trench (S-net) (Tanaka et al., 2019). These activities differ from those in Nankai Trough (Obara and Kato, 2016), where sources of slow earthquakes and megathrust are clearly separated, and slow earthquakes are continuously distributed along the deeper and shallower side of the seismogenic zone, whereas those show complex spatial distribution along the Japan Trench (Nishikawa et al., 2019).

In northern Sanriku-Oki region between 39°N and 40.7°N, low frequency tremors (LFTs) frequently occur as well as very low frequency earthquakes (VLFs) (Matsuzawa et al., 2015), but their activities are significantly lower in the southern Sanriku-Oki regions (~39°N). Since the southern LFT cluster is located within the coseismic slip zone of the 2011 Tohoku-Oki earthquake (Iinuma et al., 2012), it is probable that the occurrence of the massive coseismic slip affects the LFT activities after the Tohoku-oki earthquake.

Here, we report the activities of LFTs in Sanriku-Oki before the 2011 Tohoku-Oki earthquake. We used 46 short-period ocean bottom seismograms (OBSs) deployed from Oct. 2007 to May 2008. The envelope correlation method (e.g. Obara, 2002, Ohta et al., 2019) is applied to the OBS seismograms, with almost the same parameter settings as the study by Nishikawa et al. (2019) using the S-net data. As a result, we detected 448 and 168 tremors in northern and southern Sanriku-Oki regions, respectively. In the northern region, LFTs show evident along-strike migration during multiple episodes, each of which has ~1 week duration. The migration speed is ~20 km/day, which is comparable to that observed in the deep LFTs in the western Shikoku of Nankai (Obara, 2002).

The S-net observation for two years after the 2011 Tohoku-Oki earthquake detected 2894 events in the northern region, while only 17 in the southern region. Our result using the OBS data in 2007 and 2008 suggests that the LFTs in the southern Sanriku-Oki was much more active before the Tohoku-Oki earthquake and the change in the LFT activity reflects the change of the behavior of the plate boundary caused by the massive interplate earthquake.

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