

Shallow low-frequency tremor triggered by nearby moderate earthquakes off Sanriku

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In the region off Sanriku, we have observed shallow low-frequency tremor, which occurs between the 12 km and 20 km depth contours of the plate interface, applying an envelope correlation method (Obara, 2002) to the records from the Seafloor observation network for earthquakes and tsunamis along the Japan Trench (S-net) (Tanaka et al., 2018). Several episodes of tremor, each of which lasted for half a day to six days, were detected in 2017, with intervals of one to three months. In the present study, we found tremor triggered by nearby moderate earthquakes. On July 24, 2017, an Mw 5.6 earthquake, showing reverse faulting consistent with the slip on the plate interface, occurred at the downdip end of the tremor zone off Sanriku, which was the largest event within 100 km of that tremor zone in the year. Immediately after the Mw 5.6 earthquake, coherent tremor signals were identified at surrounding stations. These signals continued for 20 hours, and the locations of their sources spanned 40 km along strike and 50 km along dip. Similar triggered tremor was observed following an Mw 5.1 earthquake on July 22, two days before the Mw 5.6 earthquake. This tremor activity was smaller and shorter than that triggered by the Mw 5.6 earthquake; tremor was localized to an area of 20 km by 15 km, and lasted for twelve hours. After a quiescence of nearly one day, the Mw 5.6 earthquake occurred at an adjacent area and triggered tremor was detected again. Triggering of tremor by moderate interplate earthquakes in or very close to the tremor zone we observed may imply small-scale (~ a few kilometers) heterogeneities in frictional properties on the plate interface in the area.

Keywords: shallow low-frequency tremor, triggered tremor, Japan Trench