

Possible shallow episodic slowslip in the Nankai Trough seismogenic zone detected by seafloor borehole observatory.

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Occurrence of very low frequency events (VLFE) have been known in the shallow part of seismogenic zones of oceanic plate subduction. In the Tonankai region of the Nankai Trough, where large earthquakes repeatedly occurred in the history, several observation of VLFE has been reported (Ito et. al, Sugioka et. al, To et. al) in the shallower part of the subducting plate interface or in the shallower accretionary prism. These VLFE were detected by surface waves in 0.01-0.1 Hz on land observation, but seafloor displacement due to the VLFE were observed in the seafloor as well as relatively high frequency P and S waves. On the other hand, no detectable motion in lower frequencies was reported that accompanies with these VLFE in the Nankai Trough.

We report two case of possible episodic slow slip in Tonankai region of the Nankai Trough, which were observed by pore-fluid pressure measurement of seafloor borehole observatory in IODP borehole C0002G. The first case was observed after the Tohoku earthquake of March 11, 2011, where borehole pore-fluid pressure showed gradual decrease of 1.8 kPa for two days, while VLFE swarms were observed locally. The second case was in October, 2015. The borehole pore-fluid pressure again gradually decreased by 1.6 kPa over two weeks. In the later period of the two weeks, local VLFE were also observed for a week period.

The pore-fluid pressure measurement in the borehole was taken at approximately 1 km below the seafloor. The pore-fluid pressure measurement can be regarded as a proxy of strain change in periods shorter than a few months. Observed pore-fluid pressure decrease is accounted by an extension of the crust at the observatory at very slow rate (two days, two weeks in these cases). Simultaneous occurrence of VLFE suggests the slow change were caused by slower fault slip probably in the offshore of the observatory where VLFE were observed. After started observation at C0002G, there have been no observation of local VLFE without slower pore-fluid pressure change. Therefore we also consider that, in the Nankai Trough, such slower fault slip exists and the VLFE is passively excited by the slower fault slip.

Keywords: Nankai Trough, slow slip, borehole observatory