Continuous shear wave signals following 2014 Mw 6.8 SSE in the Hikurangi subduction margin offshore New Zealand

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The Hikurangi Plateau having anomalously thick oceanic crust subducts under the Australian plate along the Hikurangi subduction zone offshore the North Island of New Zealand. The plate interface is shallow and some characteristics on the plate interface such as seamounts and seismic high reflectivity zones were identified by seismic surveys (Bell et al., 2010). At the Hikurangi subduction margin, slow slip events (SSEs) occur at intervals of 18 to 24 months with durations of 1 to 2 weeks. From May, 2014, to June, 2016, the Hikurangi Ocean Bottom Investigation of Tremor and Slow Slip (HOBITSS) observation was conducted in the northern Hikurangi margin. During this observation, Mw 6.8 SSE occurred in September through October, 2014, directly beneath the ocean bottom seismometer (OBS) network.
In this study, we used continuous waveform data recorded by these OBSs, and applied a shear wave splitting analysis (Ando et al., 1983) and a polarization analysis for monitoring shear wave signals. These methods have been successfully applied to waveform data from onshore seismic networks in Cascadia subduction zone by Bostock and Christensen (2012) and in Shikoku Island, Japan, by Ishise and Nishida (2015).
As a result, we detected continuous arrival of shear wave signals that appeared to have started in the later half of the SSE duration reported by Wallace et al. (2016). Parts of the continuous signals were identified as tremors and their source locations have been determined by the envelope cross-correlation method (Todd et al., 2016). Our result, however, suggests that the transmission of the signals were rather continuous than sporadic as individual events, and they appeared to last for more than two weeks. Polarization direction became stable in synchronous with the continuous signals and its orientation is different from that in the other times. Arrivals of such continuous long-duration signals with a stable polarization direction are only seen during this period through the year-long OBS records. Our analysis requires less OBSs than envelope cross-correlation methods for monitoring such shear wave signals, which may enable us to detect as yet to be unidentified continuous signals in the Hikurangi margin where seismic attenuation has been known to be large.
Distribution of the OBS stations detecting such continuous signals infers that they were generated only around the subducted seamount adjacent to the slow slip area. A previous study on distribution of this SSE obtained by inversion of seafloor vertical displacement data from ocean bottom absolute pressure gauges (Wallace et al., 2016) showed that the fault slip along the plate interface circumvented the subducted seamount. By combining these results about slip distribution and the origin of continuous shear wave signals, we can put more constraints on relationship between frictional properties along the plate interface and its topographic features.

Keywords: Seismicity, Slow Slip, Hikurangi subduction zone, Subducted Seamount

