Seismic discontinuities and anisotropy in the uppermost of the Pacific Plate east of the Japan Trench

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Seafloor Observation Network for Earthquakes and Tsunamis along the Japan Trench (S-net) has been deployed east of Japan since September 2016. This network contains 17 cabled seismometers east of Japan Trench, which is located on the incoming Pacific Plate. The stations include velocity sensors (15 Hz), but seismic signals up to 10 s can be observed (Takagi et al. 2021). Therefore, *P* waves and their conversions from teleseismic events can also be observed by S-net stations, which allow us to calculate receiver functions at each S-net station (Kim et al. 2021). However, such studies focusing on the incoming Pacific Plate have not been performed. In this study, using the receiver functions, we investigate the shallow structure of the Pacific Plate east of the Japan Trench, especially seismic discontinuities and anisotropy within the sediment and oceanic igneous crust.
Receiver functions are calculated by the deconvolution of the vertical component from the radial and transverse components of motions. To avoid the contamination of water reverberations from the sea surface, the time windows of the vertical and two horizontal components are set to be 6 s and 20 s from the *P* arrival times, respectively, in which the *P* arrival times are manually picked. The bandpass filters of 1–3 Hz and 0.5–1.5 Hz are examined. We performed the following approaches using the obtained receiver functions. (1) The thickness and *Vp/Vs* were estimated by *H-κ* stacking method (Zhu and Kanamori, 2000) at each station. (2) The anisotropic structure within the sediment and igneous crust by a splitting analysis of Ps converted phases, with a stripping analysis of Oda (2011).
The receiver functions at 0.5–1.5 Hz show positive amplitudes at lag times of 1 s and 2 s, which correspond to Ps conversions from the bottom of the sediment and the oceanic Moho, respectively. However, those at 1–3 Hz at some of S-net stations show another positive amplitudes between 1 s and 2 s. It seems that those amplitudes correspond to *Ps*phases converted at the top of chert layer above the igneous crust.
The obtained sediment thicknesses ranged in 0.1–0.5 km. It appears that the spatial pattern of the thickness is consistent with that of two-way travel times of *P* waves reflected from the bottom of the sediment (Nishizawa et al. 2022). The values of Vp/Vs are 5–12. Such large values are caused by soft marine sediments, and are in consistent with those from previous studies (e.g., Tonegawa et al. 2013).
The fast polarization directions within the sediment in the southern part of the examined array are oriented to the direction parallel to the trench axis, while those in the northern part are slightly oblique to the axis. This indicates that the fast axes in the southern part are affected by fractures and faults due to the bending of the Pacific Plate, but those in the northern part may be affected by topographic lineation at the seafloor or other factors. On the other hand, the fast axes within the igneous crust in the northern part are parallel to the trench axis, whereas those in the southern part are scattered. The fast axes in the northern part are formed by fractures and faults due to the bending. However, it is necessary to consider reasons for the scattered results in the southern part in future studies.

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