稠密地震観測網を用いた地下構造推定

Seismological structure beneath dense-array seismic network

京都大学大学院理学研究科地球惑星科学専攻　佐脇 泰典

研究成果概要

At Hyuga-nada in the western Nankai, vigorous high activity of shallow tectonic tremors and very-low-frequency earthquakes has been noted in the vicinity of the subducted Kyushu–Palau Ridge (KPR) (e.g., Tonegawa et al., 2020; Yamashita et al., 2015, 2021). Akuhara et al. (preprint) found a striking LVZ of shear waves at ~3–4 km beneath the seafloor over the KPR through transdimensional inversion of teleseismic GFs (Akuhara et al., 2019) and surface wave dispersion curve from a dense OBS array observation. The LVZ structure implies that dehydrated fluid originating from either the subducted KPR, hydrous sediment, or oceanic crust may then ascend to become stagnant in the hanging wall due to recurrent shallow slow earthquakes, however, the spatial distribution of LVZ was not constrained by their dense array of ~2 km radius. Aiming to constrain the lateral and depth distribution of the LVZ around the KPR, we compute GFs from teleseismic and regional deep-focus events using widely distributed campaign networks with broadband and short-period OBSs starting from 2014 at Hyuga-nada.

We detect successive GF phases of negative and positive amplitudes around 2-s lapse time, characterized as the LVZ and are in keeping with the presence of the LVZ above the KPR from the dense-array observation (Akuhara et al., preprint). High-frequency GF images show the lateral and depth variation of the LVZ. Around the subducted KPR with active shallow tectonic tremor (Yamashita et al., 2021), the negative GF phases for the top of LVZ are distributed ~3 km above the plate interface model, without any significant negative impedance contrasts along the plate interface. Also, the along-strike image corroborates the wide presence of LVZ over 100 km width around the source region of shallow slow earthquakes. In contrast, the GF phases with negative impedance likely deepen towards the plate interface at the northeastern Hyuga-nada, where there are fewer tectonic tremor activities (Yamashita et al., 2021). Our results might reflect the lateral variation of physical properties such as frictional property, thermal structure, and upper plate permeability, together with shallow slow earthquake activities.

Using the SCL supercomputing system, we were trying to test the transdimensional Bayesian inversion for estimating one-dimensional shear-wave velocity structure (e.g., Akuhara et al., 2020). However, we failed to obtain the final outputs due to several complicated problems.