Lithosphere structure of the Yamato Basin from receiver function analysis

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Large earthquakes have occurred around the Japan Sea, including the 2007 Chuetsu-oki Earthquake. To estimate the risk of potential earthquakes and tsunami, better understanding of the lithosphere structure beneath the Japan Sea is an issue of importance. Revealing the lithosphere structure would also help constrain the formation process of the Japan Sea, which has been considered due to back-arc opening. In this study, we conducted receiver function analysis using broad-band ocean-bottom seismometers (BBOBS) installed at the Yamato Basin from 2013 to 2016. The final goal of this study is to detect a lithosphere-asthenosphere boundary (LAB), which provides fundamental information of the oceanic plate i.e., thickness of the lithosphere. Teleseismic P waveforms recorded by horizontal sensors at offshore sites are significantly affected by multiple reflections and conversions within the sediment layer beneath the seafloor. These multiple phases have potential to overprint signals from the LAB. We, therefore, first estimated shallow (< 20 km) crustal velocity structure from receiver function waveform inversion. Then we searched for the depth and contrast of the LAB which can better explain observed waveforms than any structure models without the LAB. As a result, we acquired good waveform fitting with only the shallow crustal structure. We also found that the LAB located at 70 km depth can improve the waveform fitting. Unfortunately, we could not identify LAB-related signals visually due to dominating sediment reverberations. Statistical approach is left for future studies to confirm whether this improvement in the waveform fitting truly represents the existence of the LAB or not.

Keywords: Lithosphere structure, Ocean-bottom seismometer, Receiver function analysis

