小笠原諸島下における660 km地震波速度不連続面のレシーバ関数イメージング
A receiver function imaging of the 660-km discontinuity beneath the Ogasawara Islands

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A magnitude-8.1 earthquake occurred on 30 May 2015 at a depth of 681.71 km (determined from Japan Meteorological Agency (JMA)) beneath the Ogasawara Islands. The relative location of the deep earthquake to the 660 km seismic velocity discontinuity (the 660) is an interesting issue, because the 660 is the transition between the upper and lower mantle, and the hypocenter is located at a depth of the lower mantle. Indeed, the undulation of the 660 in the Izu-Bonin subduction zone has been investigated using S-to-P phases converted at the discontinuity (Collier and Helffrich, 1997; Castle and Creager, 1998). Castle and Creager (1998) showed a large depression of the 660, down to 745 km depth, at a distance scale of 2 degrees around the Ogasawara Islands, which is associated with the cold material of the subducting Pacific slab. In the map view, the epicenter of the deep earthquake is located inside the region of the depressed 660, which may imply that the earthquake occurs in the upper mantle. However, to determine a relative spatial location, the depth estimation of the deep earthquake and the 660 using the same velocity model would be necessary. In this study, we convert from the time-domain to depth-domain receiver function (RF) using a 1D JMA velocity model, which was used by JMA to determine hypocenter location of the deep earthquake, and compare their relative depths.
We calculate RFs using teleseismic records observed at two broadband stations, a station OGS in Ocean Hemisphere network Project (OHP) and another station OSW in F-net operated by National Research Institute for Earth and Disaster Prevention (NIED), deployed at the Chichijma Island in the Ogasawara Islands. The separation distance of the two stations is 4.6 km. The teleseismic events that occurred during 2006–2014 and 2005–2014 were used for OGS and OSW, respectively. The total number of the collected RFs is 267 (188 at OGS and 79 at OSW). We applied 0.16 Hz low-pass filter to the time-domain RFs, and converted them to depth-domain RFs using the 1D JMA velocity model.
We could image the depth-variation of the 660 from 660 km to 750 km. Most importantly, we found a RF that shows a peak of P660s, and the Ps converted point at a depth of 660 km of the RF is only ~20–30 km in horizontal distance away from the hypocenter of the deep earthquake, which allows us to compare the relative depths of the deep earthquake and the 660. As a result, is seems that the 660 is deeper than the focal depth at least by 50 km, and this fact indicated that the deep earthquake occurred in the upper mantle, but presumably deeper than the surrounding 660 km discontinuity.
We used seismic records observed by F-net operated by NIED, and thank K. Shiomi for kindly providing us teleseismic event data.

キーワード：レシーバ関数、小笠原、660 km地震波速度不連続面
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