

Continental Moho slanting upwards to the southeast beneath Kii Peninsula and middle layer earthquakes

SHIBUTANI, Takuo^{1*} ; IMAI, Motohiro¹ ; HIRAHARA, Kazuro² ; NAKAO, Setsuro¹

¹DPRI, Kyoto Univ, ²Science, Kyoto Univ

We carried out linear array seismic observations in Kii Peninsula from 2004 to 2013 in order to estimate the structure of the Philippine Sea slab and the surrounding area. We performed receiver function analyses for 14 cross-sections including four profile lines in the dipping direction of the slab and two lines in the perpendicular direction so far. We estimated three dimensional shapes of seismic velocity discontinuities such as the continental and oceanic Mohos and the upper surface of the oceanic crust. The results clearly showed that the slab top and the oceanic Moho are dipping northwestwards and that they correspond to the upper surfaces of the low and high velocity layers, respectively. Beneath northern to central Kinki the continental Moho spreads subhorizontally at 35 - 37 km deep, while beneath the Kii Peninsula it shallows southeastwards above the slab, reaching 20 km at the central part and 15 km at the southern shore.

Mizoue et al. (1983) analyzed data from permanent seismic stations which were being developed in the Kii Peninsula at that time, found that the travel time differences between the direct P waves and the Moho reflections or the Moho refractions propagating in the east - west direction became smaller from the northern part to the southern part of the peninsula, and suggested that the continental Moho slanted upwards to the south. They also found out earthquakes in the middle depth which were distinguished from both events in the upper crust and in the Philippine Sea slab, and called them as middle layer events. They pointed out that the middle layer events occurred around the slant continental Moho.

As mentioned above our receiver function analyses successfully estimated the three dimensional configuration of the continental Moho with a high accuracy. The results clearly showed that the middle layer events are located beneath the continental Moho shallowing southeastwards. Usually no earthquake occurs in the depth range equivalent to the lower crust. This is because crustal materials deform plastically at the depth and the strength of plastic flow becomes lower than that of brittle fracture. However, if the continental Moho shallows to the depth, the strength of plastic flow for mantle materials becomes larger than that of brittle fracture. This can be a cause of the middle layer events in the shallow mantle.

Keywords: continental Moho, middle layer earthquakes, Kii Peninsula, receiver function