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3D seismic velocity structure around Philippine Sea slab subducting beneath Kii Peninsula (3)

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1. Introduction

Kii Peninsula is a part of the source area of Nankai Trough megaquakes and the region through which the strong seismic waves propagate to the big cities in Kansai. Moreover, the rupture starting point is thought to be possibly at off the peninsula. After the 2011 Tohoku Earthquake the assumed source area of the Nankai Trough earthquake was readjusted and extended to a land side deeper portion. The extended portion corresponds to 30 - 40 km depth in the plate boundary, where hydrous minerals in the oceanic crust are dehydrated. The discharged fluids will influence the frictional condition of the plate boundary. Therefore, it is important to estimate accurately seismic velocity structure at these depths.

2. Current results

We carried out linear array seismic observations in Kii Peninsula since 2004 in order to estimate the structure of the Philippine Sea slab and the surrounding area. We have performed receiver function analyses for 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 Moho, the upper surface of the oceanic crust and the oceanic Moho (Fukui et al., 2012). In addition, we performed seismic tomography with a velocity model embedded the discontinuities and observed travel times at stations in the linear arrays (Shibutani et al., 2012). The results show the following features of the Philippine Sea slab. At the depth of 40 km the oceanic crust shows low velocity anomaly. As we go up to shallower depths, the low velocity anomaly seems to continue to the mantle wedge and to the lower crust. It becomes a large low velocity region at the depth of 16 km under the northwestern part of the Kii Peninsula. It is known that seismic activity is very high in the upper crust above the low velocity region. These features show that hydrous minerals in the oceanic crust are broken down by dehydration at the zone of deep low frequency events, then the discharged fluids flow into the mantle wedge and the lower crust, and reduce the velocity in the regions.

3. Updating the results

In the receiver function analysis, we update the image of S wave velocity discontinuities along Kameyama - Gobo profile line by adding new receiver functions. We make up eight new profile lines by selecting permanent stations and temporary stations in the linear arrays and draw up the receiver function images. We try to estimate more detailed 3D shapes of the discontinuities by interpreting the new images together with those for the above mentioned six profile lines. In the seismic tomography, we add more travel time data. We try to utilize events in wider areas as well as deep focused events in order to improve the resolutions in depths more than 40 km.

We used waveform data from permanent stations of NIED; JMA; ERI, Univ. of Tokyo; Nagoya Univ. and DPRI, Kyoto Univ.

Keywords: tomography, receiver function, Philippine Sea slab, Kii Peninsula, Nankai Trough megaquake