The Analysis of Receiver Function around The Rupture Area of Western Tottori Prefecture

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A large inland earthquake (Mj 7.3) occurred in the western part of Tottori Prefecture on October 6, 2000. Seismologists have tried to reveal the processes in which large inland earthquakes occur. Recently, Iio and Kobayashi (2002) suggested that aseismic slips occur precedently on the downward extensions of the seismic fault of large earthquakes. Ito (1999) suggested that large inland earthquakes tend to occur in areas where large lateral changes exist in the lower cutoff depth of the seismicity in the crust. This might be due to the stress concentration caused by high pressure and high temperature fluid upwelling from the lower crust. Therefore, in order to reveal the preparatory process of large inland earthquakes, we need to investigate structure of not only the rupture area but also the area below it.

Receiver function (RF) analysis can reveal deeper structure under seismic stations. Shiomi (2003) and Yamauchi et al. (2003) successfully obtained high resolution images of the Moho discontinuities and the subducting Philippine Sea Plate beneath the Kinki, Chugoku, and Shikoku districts by using the RF method.

We investigated the seismic structure of the crust and the uppermost mantle beneath the source area of the 2000 Western Tottori Earthquake by the RF method. We used teleseismic waveform data, which are observed by high density aftershock observations (Group of the dens aftershock observations of the 2000 Western Tottori Earthquake).

We calculated the RF by deconvolving the vertical component from the radial component of the teleseismic P wave. We also applied the Gaussian high-cut filter with the cutoff frequency of ~1 Hz to reduce higher frequency noises. This method can emphasize P-to-S converted waves and their reverberations (Langston, 1979). We then apply NMO (Normal move-out) correction to the P-to-S converted phases so that they can be treated as a vertical incidence. Next we converted the time axis of the RF to the depth axis with a velocity structure model obtained for the source region (Shibutani, 2003). Lastly we projected the RF onto the seismic fault plane of the 2000 Western Tottori Earthquake.

The main features of the resulting RF image show a clear Moho discontinuity and another deeper discontinuity below the Moho. The depth of the Moho discontinuity changes smoothly from 30 to 35 km with the shallowest point beneath the epicenter of the 2000 Western Tottori Earthquake. The deeper discontinuity is located at 50-70 km in depth and is dipping toward the north. This discontinuity corresponds to reflectors obtained by a seismic reflection survey (Nishida et al., 2003) and might be an aseismic Philippine Sea slab, although the depth is shallower than expected from the slope of the plate boundary in the Shikoku district.

We will discuss the features of the discontinuities in detail and make comparisons with other geophysical results in this area such as the distribution of aftershocks, 3-D velocity structures obtained by tomography.