S153-P003 Room: Poster Session Hall Time: May 16

Crust and uppermost mantle discontinuities beneath the Japanese Islands inferred from receiver functions

Toshihiro Igarashi[1]; Takashi Iidaka[2]

[1] ERI, Univ. Tokyo; [2] ERI, Univ. of Tokyo

Information on seismic velocity discontinuities is important to clarify the characteristics of the seismogenic zone. However, most of previous analyses were limited on area and depth ranges. We applied receiver function (RF) analysis to estimate seismic velocity discontinuities in the crust and the uppermost mantle beneath the Japanese islands.

We used seismic stations operated by NIED, JMA and ERI in the period from August 2002 to October 2007. Deep borehole stations over 300 m deep and ocean bottom stations were not used. The earthquakes are selected from the PDE and QED catalogues by the USGS with M5.5 or greater and epicentral distances of 30-90 degrees. The total number of events is 1139.

First, we estimate simple velocity structures by searching the best-correlated model between observed RF and synthetic RF for 10 seconds from direct P arrival. Synthetic RFs were calculated and stocked from a lot of 1-D horizontal layered structures which consist of a sediment layer, two or three crustal layers and a mantle layer. We considered only positive velocity step. Observed RFs after low-pass filtering by squared cosine-taper with a cut-off frequency (fc) at 1 Hz were stacked without considering back-azimuth or epicentral distance.

We investigated the effect of sediment layer beneath stations from average Vs from the ground surface to 5 km deep. A thick low velocity layer was covered in several areas. Particularly, it was distinct around the Konsen plateau, Ishikari plain, Mid-Niigata area, and Boso peninsula. These characteristics are consistent with other seismic structure models. We think that any of estimated crustal discontinuities represent information on the Moho discontinuity. However, it was difficult to determine the depth of the Moho, because some seismic discontinuities are overlapping in space.

Next, we constructed vertical cross-sections of depth-converted RF images with JMA2001 velocity model to identify discontinuities of the crust and the uppermost mantle. RF amplitudes after low-pass filtering with fc=3 Hz within the range of 20 km width and to 100 km deep were projected and stacked at each cross-section. We applied station corrections to compensate for the station altitude and the effects of the low-velocity sediment layer. The totals of 884 profile lines in east-west or north-south direction with 0.1 degree intervals were investigated.

As a result, we can detect many discontinuities in the crust and the uppermost mantle from these cross-sections. First, distinct overlying negative and underlying positive signals that dipped toward northwest to north are shown from the Kanto district to the Nansei Islands. Similarly, parallel negative and positive signals that dipped toward west to northwest are shown from Hokkaido to Kanto district. We interpret that these signals are the upper boundary and the oceanic Moho of the subducting Philippine Sea plate and the subducting Pacific plate. The configurations of the subducting plate boundary are consistent with models proposed by previous studies.

We also estimated the Moho in the overriding plate. It is indicated from positive amplitudes on RF images referring to the rough estimation of the Moho with a simple layered structure. The discontinuity is continuous but undulating locally. The depth is estimated in a range from 24 to 43 km deep. It is deep beneath the mountain district of the land area and becomes shallow toward the surrounding seas in most part of the Japanese Islands. This result is consistent to previous results, but there are some differences in Hokkaido and Kyushu districts.

There are distinct velocity discontinuities in the lower limit of the crustal earthquakes or around the low-frequency events. Furthermore, we can see dipping positive and negative stripes above the subducting plates. Further studies of the velocity transitions will provide the physical constraint on the formation process of the Island lithosphere.