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Subsurface image inferred from receiver functions using a dense linear array in Niigata region: Preliminary results

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NIED installed a dense linear seismic array in Niigata and western Fukushima in 2008 and will continue its operation until fall of 2012. This linear array, which has about 165 km length, is composed of 31 velocity type three-component seismometers with eigenfrequency of 1Hz. This temporal observation is done as a part of the MEXT research project for high-strain rate zone. We can include two NIED Hi-net stations (N.TWAH / N.TSTH) to the linear array. In order to reveal subsurface structure around the high-strain rate zone, we apply the receiver function analysis to the data obtained by this linear array. As a reference, we also estimate the receiver functions at the F-net station N. ADMF in Sado Island.

For temporal stations, we select teleseismic waveforms with high signal-to-noise ratio observed from November 2008 to September 2011. For Hi-net and F-net stations, we choose earthquakes from October 2000 to November 2011. Magnitudes of the target teleseismic events are 5.5 or greater for all stations. Two kinds of low-pass filters (fc = 1 Hz / 2 Hz) are applied to estimate receiver function.

We got pretty good teleseismic records at the stations in the mountain area. In the radial receiver functions, we can find clear positive phase arrivals at 4 to 4.5 s in delay time at these stations. Since this time delay corresponds to 35 km-depth velocity discontinuity existence, these phases may be the converted phases generated at the Moho discontinuity. Seeing the backazimuth paste-ups of the transverse receiver functions, we can find polarity changes of later phases at 4 to 4.5 s in delay time. This polarity change occurs for direction of N0E (north), N180E (south), and N270E (west). Although we have no events in N90E (east) direction, this feature implies that anisotropic rocks may exist around the Moho and that its fast-axis (or slow-axis) directs to N-S or E-W direction. This characteristic is consistent with the fast-axis direction estimated by the S-wave splitting analysis [e.g., Sakakibara, 2004]. At the stations in the edge of Niigata plain, the first pulse, which corresponds to the direct P-wave arrival, delays from zero and its pulse width becomes broad. This feature is caused by the existence of thick sediments. In these cases, Shiomi & Obara (2005) pointed out that arrival time of the Moho converted phase may be contaminated by the multi-reflection phases by sediment layer. Thus, it is hard to discuss the structural feature using receiver function itself.

We will construct a crustal anisotropy model based on the receiver functions and compare it with the results of S-wave splitting analysis as the next step. We also try to construct the geometry of the Moho discontinuity.

Keywords: Receiver function, High strain rate zone, Moho discontinuity, Anisotropy