Receiver Function Imaging of Crust and Uppermost Mantle Structure beneath the Japan Islands

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--- Introduction ---

We are examining a large number of teleseismic waveforms observed at stations closely distributed over the Japan Islands to construct body-wave waveform tomography data for determining 3-D crust and upper mantle structure including velocity discontinuities. As one of preparatory studies toward this final goal, we are executing array analyses of Receiver Functions (RFs), now especially from Hi-net (dense distribution of stations and high sampling) by NIED. High resolution of Hi-net data up to for 3 Hz high-cut filtering provides us more detailed imaging.

--- S wave reflective layer (1) mapping over the whole Japan Islands ---

It is said that the lower crust condition makes an important role in the occurrence of large inland earthquakes (ex. Iio(1996), Umeda and Ito(1998), Iio(2001)). A fundamental idea common to their researches is as below. The concentration of stress on the S wave reflective layer in the lower crust under the region near an active fault or a volcano makes slow slip, which urges the main shock. Therefore detailed imaging of the lower crust must contribute to resolving the mechanism of occurrence of large inland earthquakes. We made RFs of 51 teleseismic events (2000/10-2001/11, larger than M5.5, more distant than 30 degrees) to map the regions where reflective lower crust may be detected over the whole Japan Islands. Our present result shows that there can be seen such stations mainly over the Tohoku district and southeast Japan except for the Kyushu region. We report the spatial relation to the distribution of active faults and volcanoes.

--- S wave reflective layer (2) focusing on Arima-Takatsuki tectonic line ---

Katao(1994) suggests the existence of the S wave reflective layer only in northern part bounded by Arima-Takatsuki tectonic line, analyzing later phases of S wave data from micro earthquakes. And then Iio(1996) applies the hypothesis of detachment to the tectonic line, and estimates the configuration of S wave reflective layer to construct the model for the occurrence of 1995 Kobe earthquake. But the western boundary of the configuration is not determined from actual data. Hence it is important to investigate the lower crust structure under this part. On the other hand, Ito(1994) presents the earthquake generation model that the lateral depth distribution of S wave reflective layers in the lower crust predicts the location of hypocenter of a large inland earthquake. We've already got the rough result that the Conrad and the Moho under the Lake Biwa region are deeper than those under the surrounding part. The more detailed examination is needed to relate our results to his model. Therefore, we carefully investigate the existence of S wave reflective layers mainly under Arima-Takatsuki tectonic line using RFs data of Hi-net to map the distribution. The reflective layers are detected over plural stations not only under the northern area from the line but also under other areas, which may suggest the lower crust is reflective over larger areas.

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