Imaging the reflection structure beneath the Japan Islands using cross-correlation analysis of teleseismic records

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Seismic correlation analysis or interferometry reconstructs a Green's function (a shot record) from one receiver (seismic station) as a source to another receiver using the cross-correlation of the seismic records observed at two receivers. The correlation analysis, has a possibility to obtain subsurface images equivalent to those obtained by seismic reflection method using natural earthquakes, for example, swarms, aftershocks, teleseismics and noises.

We have been applied the cross-correlation analysis and prestack depth migration to the teleseismic records obtained by Hi-net in order to detect seismic reflection structures such as the Moho and the plate boundary beneath the Japan Islands. Kashiwagi et al. (2007) showed a possibility of imaging a plate boundary. However, the S/N ratio was insufficient. this study addresses the improvement in the S/N ratio via selection of the data and removal of the source wavelet.

The UD components of 58 teleseismic events observed by Hi-net stations from April 2003 to August 2004 were used. Seismic records up to 200s after arrival were bandpass filtered (0.4 - 1.2 Hz). Seismic records of low S/N ratio were carefully removed by hand. The source wavelet of each teleseismic event was estimated by stacking the records aligned at their arrival time. The effect of the source wavelet was removed from the seismogram using Wiener filter deconvolution. Any pair of seismograms was cross-correlated and formed a shot record equivalent. After the prestack 3-D Kirchhoff depth migration, a 3-D reflector image was obtained.

A 3-D reflector image in Northern Kanto and Chubu area show some dipping structures that may correspond to the boundary of the Pacific plate and the Philipine Sea plate. However, the images are obscure and has insufficient resolution and accuracy.

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