Crustal and uppermost mantle structure inferred from auto-correlation analysis of teleseismic S coda

Takashi Tonegawa[1]; Kiwamu Nishida[1]; Katsuhiko Shiomi[2]

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

Passive seismic imaging has recently been employed to detect seismic velocity discontinuities using relations between reflection and transmission responses. Indeed, Claebout (1968) showed that the reflection response can be obtained by auto-correlating the transmission response for a 1D acoustic medium, and Wapenaar (2003; 2004) extended that the Claebout's idea is applicable for a 3D inhomogeneous medium by cross-correlating noise traces recorded at two stations. In this study, we applied the auto-correlation analysis to teleseismic S-coda observed at Hi-net tiltmeters, deployed by NIED, to investigate crustal and uppermost mantle structure underneath Japan, especially Tokai region.

We used 125 teleseismic events with magnitudes 5.5 or larger for a period from April 2003 to May 2005, and applied band-pass filter of 0.03-0.3 Hz to S-coda on radial component. The time-window used in this study is 20 sec before and 200 sec after the S arrival time. Specific features of our analysis are the following three. First, we enhanced signals by subtracting an auto-correlated waveform, which is calculated using the noise portion before P arrival, from S-coda auto-correlated waveform. Second, we depressed the portion of source-time function by applying taper in order to effectively use S-coda portion, which is expected to produce multiple scattered phases with various incident angles to the station. Third, we used a 3D S-wave velocity model (Nishida et al, 2007) to convert time-domain functions to depth-domain ones. After these processing, we stacked the auto-correlated waveforms with good S/N ratios among all teleseismic events, and made cross-sections by aligning the recordings.

In the presentation, we show that our analyses are useful to enhance signals by comparing some transects for each step, and our resultant cross-section in Tokai region presents remarkable phases corresponding to the Philippine Sea slab.

Claebout, J. F., Synthesis of a layered medium from its acoustic transmission response, Geophysics, 33, 264-269, 1968.

Wapenaar, K., Synthesis of an inhomogeneous medium from its acoustic transmission medium, Geophysics, 68, 5, 1756-1759, 2003.

Wapenaar, K., J. Thorbecke, and D. Draganov, Relations between reflection and transmission responses of three-dimensional inhomogeneous media, Geophys. J. Int., 156, 179-194, 2004.

Nishida, K., H. Kawakatsu, and K. Obara, Three-dimensional crustal S-wave velocity structure in Japan using microseismic data recorded by Hi-net tiltmeters, submitted to J. Geophys. Res, 2007.