Array analysis of elastic wave from ACROSS source in mid-term continuous observation using seismic array

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ACROSS (Accurately Controlled and Routinely Operated Signal System) is effective in monitoring temporary changes of Earth's interior. Toward Tokai monitoring plan to detect the reflected phases from the top of Philippine Sea Plate and to monitor its temporal changes, a mid-term continuous experiment was conducted using ACROSS source and a seismic array. We deployed a seismic array in Aichi Prefectural Forest Park in Shinshiro City, Aichi Prefecture and observed the ACROSS signal of Tono Geoscience center. In this region, a strong reflected phase from the plate boundary was found by the seismic observation using explosive sources (Iidaka et al., 2003).

The ACROSS source continuously transmits precisely-controlled frequency modulated signals whose frequency band ranges from 10 to 20 Hz with a period 50 seconds. We deployed a short-span seismic array at the distance of 57 km from the ACROSS source. The cross-shaped seismic array spanning 2 km consists of 12 seismometers equipped with an offline data logger, an amplifier and a solar panel. The data were observed from Dec. 2004 to Sep. 2005. We stacked the received signal for a month with an interval of 200 seconds in order to improve signal to noise ratio. We extracted a series of line spectrum of ACROSS signal. Transfer function can be obtained by dividing spectrum by the source. Applying inverse Fourier transform, we can obtain the transfer function in time-domain. Direct P and S wave and after phases appear in this record.

To identify the coherent phases that appeared in the transfer function, we applied the semblance analysis, and estimated the slowness, the incident angle and the velocity. The Hzr component of the transfer function among six components was used for the analysis. We searched the direction angle, the incident angle and the P wave velocity beneath the array which gives highest semblance value. It was estimated that P wave velocity was 2.8 km/s, the direction angle was 45 degrees from North to West, and the incident angle was 25 degrees in the result of this analysis. Then, using the fixed P wave velocity of 2.8 km/s and direction angle of 45 degrees, we calculated semblance value for the later phases. In this result, the later phases has higher incident angle than the primary phase. The continuous observation record also contains natural earthquakes. We can estimate the P wave velocity beneath the array using the semblance analysis.