A trial for active monitoring of interplate coupling in Tokai area (Long-based array observation -Preliminary Report-)

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We report a recent experiment of a long-based ACROSS array observation in Tokai area as a trial for active monitoring of subtle changes of geophysical properties in the Earth's structure such as an interplate boundary. We have been transmitting seismic signals continuously by the ACROSS source at Toki, Gifu since 2002 (Kunitomo et al., 2004). On the other hand, beneath the western Shizuoka Prefecture, the strong reflection of seismic waves from the depth of 30 - 40 km around the upper boundary of the Philippine Sea Plate were found (Matsu'ura et al., 1991; Iidaka et al., 2003; Kodaira et al., 2004) and it was supposed a pre-slip happened just before the Tonankai earthquake in 1944 around the area (Linde and Sacks, 1997). We therefore conducted two type array (i.e., a long-based-array and a dense-array) experiments in the eastern Aichi to the western Shizuoka Prefectures.

Here we describe about the long-based array observation with 10 seismic stations aligned along 40 - 75 km from the source and the preliminary results. We recorded the data with a sampling rate of 200 Hz and a length of 200 seconds for a stacking-time length of 3400 sec, using three-component velocity-type seismometers (MarkRand V4.5-3D and Mark Product L22) and portable six-channel A/D recorders (DATAMARK LS-7000). We analyze the data in the frequency range of 10 - 20 Hz to obtain the transfer functions described as six elements of second-order tensor by the following steps: 1) Remove large amplitude noises in time series, 2) stack the data in the nighttime, 3) obtain the spectral data by Fourier transform, 4) perform weighted-stacking on the data in the frequency domain, 5) obtain the complex spectra corresponding to signal frequencies and their observation errors estimated from the noise levels around the signals and 6) derive 6-component transfer functions through dividing 3-component displacement by 2-component source spectra. Finally 7) we obtain 6-component transfer functions (i.e., Hrr, Htr, Hzr, Hrt, Htt and Hzt; Subscripts, r, t and z represent the radial, transverse and vertical directions, respectively). We analyzed the stacked data for about 204 hours in the nighttime (19:00 - following 7:00) on December 25, 2004 to January 12, 2005 because the noise level of the data were low and stable in time. Several wave groups with larger amplitude (a few times of a noise level) are found around 11 - 14 and 17 - 23 seconds in the seismic records which was obtained by an inverse Fourier transform of Hrr, Hzr, Htt, Hrt and Htr at the receivers located at 61 - 64 km distance from the source. These wave groups also appear both on the records of a Hi-net station, Horai (Yoshida et al., 2004) (about 57.4km) and those of our dense-array observation sites located around 56 ? 58 km (Ikuta et al., in this meeting). Assuming a velocity structure referring to the model by Kodaira et al. (2004), we calculated the travel times by the ray tracing method (Fujie et al., 2000). It is found the above-mentioned arrival times are close to the travel time of the refracted waves through the upper crust and the reflected waves from the Moho (i.e., PmP and SmS) and/or from an upper boundary of the subducting Philippine Sea plate at the depth of 20 - 40 km. Moreover, the wave groups with considerable amplitude appear in the non-diagonal components, Htr and Hrt, are suggested the 3-D heterogeneous underground structure.

In conclusion, from these preliminary results we have the following subjects: 1) to investigate several technological problems on the recording system for the high-quality data acquisition, 2) to accumulate the data for identification of the arrival times of the wave groups, 3) to gather the information about the travel times and amplitudes by numerical computation, and 4) to determine the travel time precisely by Sompi event analysis (Hasada et al., 2001) and so on.