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Seismic structure of the northeastern Tokyo Metropolitan area by dense seismic array observations

Eiji Kurashimo^{1*}, Hiroshi Sato¹, Susumu Abe², Shigeharu Mizohata², Naoshi Hirata¹

¹ERI, Univ. Tokyo, ²JGI, Inc.

In central Japan, the Philippine Sea Plate (PHP) subducts beneath the Tokyo Metropolitan area, Kanto region. The bottom of the PHP is in contact with the upper surface of the Pacific Plate (PAP) beneath eastern Kanto. Detailed structure of the PHP-PAP contact zone is important to constrain the process of earthquake occurrence beneath the Tokyo Metropolitan area. Active and passive seismic experiments were conducted to obtain a structural image beneath northeastern Kanto (Sato et al., 2010). The geometry of upper surface of the PHP has been revealed by seismic reflection profiling (Sato et al., 2010). Natural earthquake data set is useful to obtain a deep structural image. Two passive seismic array observations were conducted to obtain a detailed structure image of the PHP-PAP contact zone beneath northeastern Kanto. One was carried out along a 50-km-long seismic line between Kujukuri and Kasumigaura. (K-K line) and the other was carried out along a 65-km-long seismic line between Tsukuba and Mito (T-M line). Sixty-five 3-component portable seismographs were deployed on K-K line with 500 to 700 m interval and waveforms were continuously recorded during a four-month period from June, 2010. Forty-five 3-component portable seismographs were deployed on T-M line with about 1-2 km spacing and waveforms were continuously recorded during the seven-month period from June, 2010. The continuously recorded data were divided into event files, starting from an origin time determined by the Japan Meteorological Agency (JMA). In order to obtain a high-resolution velocity model, a well-controlled hypocenter is essential. Due to this, we combined the seismic array data with permanent seismic station data. We used 95 telemetered seismic stations in the present study. During the seismic array observation, the JMA located 581 earthquakes ($M_j > 1.0$) in a latitude range of 35.8-36.5 N and a longitude range of 140.0-140.6 E. We selected 135 earthquakes, all of which occurred near the survey lines. The arrival times for the first P- and S- waves obtained from 135 local earthquakes were used in a joint inversion for earthquake locations and three-dimensional velocity structure, using the iterative damped least-squares algorithm, simul2000 (Thurber and Eberhart-Phillips, 1999). The depth section of V_p/V_s structure along the T-M line shows the lateral variation of the V_p/V_s values along the top of the PAP. Clustered earthquakes are located in and around the high V_p/V_s zone.

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Keywords: dense seismic array observation, Philippine Sea Plate, Pacific Plate, seismic tomography