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

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In central Japan, the Philippine Sea Plate (PSP) subducts beneath the Tokyo Metropolitan area, the Kanto region. In western Kanto region, the Izu-Bonin arc (IBA) within the PSP has been colliding from the south with the Honshu arc, forming a complex structure called the Izu-Collision zone (ICZ). The geometry of the subducting PSP and the overlying crustal structure of the ICZ are important to constrain the process of earthquake occurrence and the crustal evolution process associated with arc-arc collision. Recent seismic experiments reveal the geometry of the subducting PSP beneath the Kanto region (e.g., Sato et al., 2005). Two dense seismic array observations were conducted to obtain a structural image beneath the ICZ. One is a 40-km-long line (EW-line) located in the northern part of the ICZ and the other is a 55-km-long line (NS-line) located in the central part of the ICZ. 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. In and around the ICZ, deep seismic reflection and refraction/wide-angle reflection profilings were conducted using explosive sources (Oikawa et al., 2007; Sato et al., 200 5, 2006). In 2009, a seismic profiling using explosive source was conducted under the Special Project for Earthquake Disaster Mitigation in Tokyo Metropolitan Area (Sato et al., 2010). Permanent seismic stations observed the controlled seismic signals as well as natural earthquakes. We added the arrival time data of these controlled sources into the dataset to improve the shallow velocity structure. The arrival times for the first P- and S waves obtained from local earthquakes and explosive shots were used in a joint inversion for earthquake locations and three-dimensional Vp and Vp/Vs structures, using the iterative damped least-squares algorithm, simul2000 (Thurber and Eberhart-Phillips, 1999). The seismic velocity structure shows that high Vp and low Vp/Vs zones exist beneath the Tanzawa Mountains and Misaka Mountains, which considered as fragments of the IBA. A low Vp and low Vp/Vs zone exists along the estimated deeper extension of the Sone fault.
We have started a dense seismic array observation under the Special Project for Earthquake Disaster Mitigation in Tokyo Metropolitan Area. Seventy-five portable seismographs were deployed on a 55-km-long survey line between Chichibu-Tanzawa. Analyzing this new seismic data set, we will obtain the detailed image of the ICZ.

Keywords: dense seismic array observation, Philippine Sea Plate, Izu-Collision zone, seismic tomography