Configuration of the Pacific Ocean and Philippine Sea plate and seismicity around off eastern Kanto

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A configuration of the Pacific Ocean (PAC) slab has been obtained by the precise determination of earthquakes beneath the Kanto region (deeper than approximately 60km), or by the seismic reflection survey around Japan Trench convergent margin (up to 20km deep). However, the slab configuration of the depth of 20-60km has not been obtained clearly beneath east of Kanto. This is because that the subducting Philippine Sea (PHS) plate complicates the hypocenter distribution, and a hypocenter determination has large error in a long way from seismic networks. And then it is hard to detect reflective waves from deeper reflectors.

In east of Kanto (off-Ibaraki prefecture), large earthquakes (M6.7-7.3) have occurred with a recurrence interval of approximately 20-30 years (off-Ibaraki earthquake). In 1982, the earthquake occurred at the depth of 20 km, whose fault area was 50 x 70 km^2 and the dip was 14 degrees. The fault type of the earthquake was a thrust fault (Murotani et al., 2003). Also, there is a possible that the depth of the PHS slab reaches to 20-30 km and the northern end of it exists. Therefore, it is important to obtain the configuration of the PAC slab deeper than 20km to investigate the relationship between the configuration and occurrence of the large earthquake or the PHS slab. In this study, we estimated the configuration of the PAC slab up to 30km deep by comparing the seismic reflection with cut off depth section of the earthquakes whose magnitude was greater than 3.5.

We analyzed seismic reflection data recorded by Japan Agency for Marine-Earth Science and Technology. The earthquakes compared with the seismic reflection section, which is provided by NIED, were relocated with initial locations calculated by moment tensor inversion method. Since the profiles of seismic reflection survey were lying from the off-Choshi to far eastern off-Kanto, we termed our study area off eastern Kanto.

The clear reflectors interpreted as an upper surface of the PAC slab was obtained at each profile, where seismic activity is relatively low. On the other hand some reflectors showed weak continuity, where seismic activity is relatively high. There were these clear and weak reflectors at the depth of ˜30km. We obtained the depth contour map of the PAC slab by using the reflector depth. As the result, we found that the seduction angle is approximately 7 degrees at 65km landward from the Japan Trench axis and increases up to approximately 10 degrees far from it. For the south region, a slope of the PAC slab became 15 degrees at 50km landward from the trench axis. In addition, there were strong reflectors at the depth of 10-20 km in the southwestern region of our study area.

The source region of the 1982 off-Ibaraki earthquake located at the northwestern region of our study area. The continuity of reflectors was disappeared in this region. It means that there is the low reflection strength area over the asperity area calculated by Murotani et al. (2003) and might indicate that other asperities exist, though the reflection profiles did not completely lie on the entire asperity area. Out of source region, there is high reflection strength area. A slope of the PAC slab in the source area is approximately 10 degrees.

In a part of near Choshi city and Kujukuri coast boso peninsula which are located at south of our study area, Kimura et al. (2007) found the strong reflectors at the depth of 10-20 km, which is interpreted as the underplating of the PHS plate. Since the reflectors obtained our study also located at the depth of 10-20 km beneath southwestern part of off eastern Kanto, it is quite likely that the reflectors have been formed by a similar mechanism to the underplating. These reflectors seem to be disappeared in the vicinity of the PAC slab. The reflectors may indicate that the PHS plate have remained as the northern edge, where it had been strongly transformed by subducting the PAC plate.