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Reflection from the subducting Pacific plate detected by MeSO-net

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The subducting plate interface generates various secondary seismic waves by conversion, reflection, and scattering. These seismic waves are useful to resolve the configuration and impedance contrast of the plate interface.

Twenty years ago, Obara and Sato (1988) and Obara (1989) found the reflected wave from the top boundary of the subducting Pacific plate beneath the Kanto region within the later coda part of shallow earthquakes. Based on the high-sensitivity seismograph network operated by the National Research Institute for Earth Science and Disaster Prevention, the reflector was located at depth ranging from 70 to 120 km just beneath the Tokyo metropolitan area. The reflection coefficient was very high, suggesting the existence of the fluid.

The Earthquake Research Institute, the University of Tokyo has been constructing the Metropolitan Seismic Observation network (MeSO-net) as a part of "Special Project for Earthquake Disaster Mitigation in the Tokyo Metropolitan Area" promoted by the Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan. The spacing of MeSO-net stations is from 2 to 5 km, therefore, the waveform pattern is quite coherent between neighbor stations even though high noisy area. By using the MeSO-net data, we investigated the reflected wave from the top boundary of the Pacific plate.

According to the previous studies, we selected earthquakes with depth shallower than 40 km and magnitude greater than 3 in the Kanto and Tokai area. The reflected wave is most predominant in the frequency range from 4 to 16 Hz. Therefore, we applied the band pass filter to the MeSO-net accelerometer waveform data and plotted pasted-up seismograms recorded at some linear station arrays. In order to find the reflected wave easily, the theoretical arrival time is also plotted on the paste-up seismograms.

The reflected wave is clearly observed for earthquakes that occurred west of Tokyo. The arrival of the reflected wave is very unclear and the amplitude gradually increased. The duration of the reflected wave is sometimes longer than 10 seconds. The reflection points having very clear reflected waves are distributed beneath from Tokyo Bay to eastern Kanagawa area. The arrival of the reflected wave is generally coincident with the theoretical arrival time; however, there are some fluctuations. This may indicate that the reflector has some topographic change. The long duration of the reflected wave may be explained by the back scattering with a strong reflector or thick reflective layer at the top of the slab.

Keywords: Pacific plate, Reflection, MeSO-net