Trial estimation of eclogitization depths within subducting oceanic crust of the Philippine Sea slab inferred from head wave propagating along the oceanic Moho

*Shunsuke Takemura[1], Takashi Tonegawa[2], Junichi Nakajima[3], Katsuhiko Shiomi[1]

1. National Research Institute for Earth Science and Disaster Resilience, 2. Japan Agency for Marine-Earth Science and Technology , 3. Tokyo Institute of Technology

To investigate structural properties within the subducting oceanic crust of the Philippine Sea slab, we analyzed head wave propagating along the oceanic Moho (P_{PHS}). In the case of offshore earthquakes occurred at depths shallower than oceanic Moho, P_{PHS} is first arrival at onshore seismic stations (e.g., Takemura et al., 2016 EPS). During southeast off Mie earthquake, observed Hi-net seismograms illustrated first arrivals with an apparent velocity of 7.2 km/s, which correspond to apparent velocity of P_{PHS}, at epicentral distances of 70-200 km. At distances greater than approximately 200 km, apparent velocity of first arrivals was increased. Such distance change of apparent velocities is related with velocity structure at depths below the continental Moho.

We conducted two-dimensional (2D) finite-difference method (FDM) simulations of seismic wave propagation using the realistic slab model (Hirose et al., 2008 JGR). Thickness of subducting oceanic crust was assumed to be 7 km. Crust and mantle structures were referred from the F-net 1D model (Kubo et al., 2002 Tectonophys.). Although P_{PHS} was clearly found in simulated seismograms, the simulation result with oceanic crust at deeper (> 70 km) depths did not reproduced observed first arrivals at greater (>200 km) distances. By replacing structural properties of the oceanic crust with ones of the oceanic mantle at depths of 40-60 km, simulated first arrivals were changed depending on structural change depth. A structural change depth of 52 km is the optimal model for explaining observed first arrivals. This depth well corresponds to an eclogitization depth of the subducting oceanic crust beneath the Kii Peninsula (Kato et al., 2014 EPS).

We consider that estimated structural change depth within the oceanic crust is linked with transformation to anhydrous eclogitic oceanic crust (Fukao et al., 1983 Nature; Abers et al., 2003 GRL; Hacker et al., 2003 JGR). Our analysis using head wave propagating along the oceanic Moho may provide depth of eclogitization within the oceanic crust.

Acknowledgement
NIED F-net MT catalog and Hi-net velocity seismograms were used. Finite-different method simulations were conducted on the Earth Simulator at the JAMSTEC.

Keywords: Nankai Trough, Philippine Sea Slab, Oceanic crust, Eclogitization, Head wave

