Seafloor sediment thickness around the Japan and Kurile trenches obtained by traveltime analysis for PS converted wave recoded by ocean bottom seismograms

*Ryosuke Azuma[1], Genti Toyokuni[1], Ryota Takagi[1], Syuichi Suzuki[1], Makiko Sato[1], Takashi NAKAYAMA[1], Naoki Uchida[1], Ryota Hino[1]

1. Recearch Center for Prediction of Earthquake and Volcanic Eruption, Graduate School of Science, Tohoku University

seafloor observation network for earthquake and tsunamis has been working in the Japan and Kurile trench subduction zones since 2016 (S-net, installed by National Research Institute for Earth Science and Disaster Resilience). The seismograms recorded by such the ocean bottom observatories are very useful for a precise hypocenter estimation. On the other hand, to obtain precise location results, it is also necessary to take suitable correction for traveltime delay due to the presence of the thick low-velocity sediments below sites, because the thickness of sediments differs with sites.

This study aims to estimate thickness of the sedimentary layer below the sites of the S-net and pop-up-type ocean bottom seismometers (OBSs). We then focused on traveltime difference between direct P-waves and PS waves converted at the sedimentary basement.

In the analysis, we first estimated a sensor direction based on gravitational acceleration and particle motions of teleseismic surface waves on accelerograms and then transformed components of velocity waveforms from XYZ to UD, NS and EW (Takagi et al., this meeting). Next, we picked PS arrivals on horizontal components of velocity records, for thirty of intraslab earthquakes observed at twenty of the S-net sites located on the outer slope of the Kurile and Japan trenches and the landward slope of the Kurile trench (off Nemuro). As a result, we obtained PS-P traveltime difference of ~1.4 s at the most of sites, ~1.6 s near the Japan and Kurile trenches junction, and 1.8 and 2.7 s on the lower and upper portions of the landward slope of the Kurile trench. Considering the standard deviation of PS-P of ~0.15 s at each site, our result suggests that PS-P traveltimes at the junction and other trench-outer region differs significantly while that variation between neighbor sites seems to be small.

The obtained PS-P traveltime differences for the outer-trench sites is consistent with those by seismic surveys (1.0–1.5 s, Kodaira et al., 2014; Fujie et al., 2016) and OBS observations (0.9–1.2 s, Hino et al., 2009) at the outer rise of the Japan trench. Therefore, picked PS arrivals on the S-net records in this study coincide with those by the previous studies. Assuming a Vp/Vs ratio of 8.0 and an average Vp of 2.0 km/s in the sediments estimated by the wide-angle seismic surveys (Kodaira et al., 2014; Fujie et al., 2016) at the Japan and Kurile trench-outer rise regions, sediments thickness below the S-net sites would be 350~400 m, which is also consistent with results of the seismic reflection section (Kodaira et al., 2014; Fujie et al., 2016). By further analysis for PS converted wave at the inner-trench sites of OBSs and S-net besides off Nemuro, we will investigate the distribution of thickness of the sedimentary layer in the forearc region of the east Japan.

Acknowledgements: We used waveform data from S-net by NIED.

Keywords: PS converted-wave traveltime analysis, Sedimentary-layer thickness, Ocean bottom seismograph (S-net and pop-up type OBS)

