Subduction geometry and seismicity around northern Ryukyu subduction zone

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At the Ryukyu subduction zone, located forearc region of Japan’ s Southwest Islands, the Philippine Sea plate is subducting beneath the Eurasian plate toward northwest direction. Due to the subduction, not only active seismicity but also short-term slow slip event (SSE) (Nishimura, 2014) and low frequency tremor (LFT) activity (Yamashita et al., 2015) were observed in the forearc region of Ryukyu arc. However, the subduction geometry is still unclear since seismic and geodetic stations are limited to the sparsely distributed islands. To know the seismicity, lithospheric structures and subduction geometry, Japan Agency for Marine-Earth Science and Technology (JAMSTEC) launched a series of seismic observations and active-source seismic surveys at the Ryukyu arc from 2013, as a part of research project funded by Ministry of Education, Culture, Sports, Science and Technology, Japan. In FY2016, we have conducted a passive source observation in the northern Ryukyu forearc region. We have deployed 47 seismic stations including 43 ocean bottom seismographs (OBS) and 4 onshore stations at Tanegashima (two stations), Nakano-shima, and Akuseki-jima. The observation period of OBS is about 4 months, from September to December 2016.
In this study, we conduct double-difference seismic tomography (Zhang and Thurber, 2006) to obtain both precious hypocenter location and structural information around plate boundary. We combine 1,303 events detect from our observation data with 454 events from Japan Meteorological Agency (JMA) with our data set. To improve the spatial resolution and ray coverage, we also used the arrival time data at 33 permanent stations from JMA seismic catalogue and dataset of a part of previous OBS observation in Hyuga-nada (Yamamoto et al., 2013; 161 events and 27 OBSs). After the tomographic inversion, we estimate the focal mechanisms by using P-wave first arrival polarity data. Then, we establish the subduction geometry model with reference to the velocity model, distribution of low-angle thrust type earthquakes, previous geometry model based on active source surveys (Nishizawa et al., 2009, 2017; Nakanishi et al., 2018).
Estimated subduction geometry indicates that there is no obvious roughness in this study area. Interplate earthquake, defined as earthquakes within 5 km from plate boundary of this study, is active at depth between 15 and 30 km especially in the southern part. The down-dip limit of interplate earthquakes is corresponding to the high Vp/Vs just above the plate boundary, suggesting that the existence of serpentinized mantle wedge. In addition, LFT, SSE, and interplate earthquake seem to be separately occurred along the plate boundary. Intraslab earthquake is also active. Some of them occurred in the seaward of trench axis. The separation between intraslab earthquakes and plate boundary is larger (25 ~ 30 km) in northern part than that in southern part (15 ~ 20 km). This regionality might be relate to the subduction of Amami Plateau.

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