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2011 年東北沖地震最大すべり域周辺での人工地震波構造調査（序報）
Seismic survey around the largest slip area of the 2011 Tohoku-oki earthquake

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The slip amount during the 2011 Tohoku-oki earthquake exceeded tens meters at the near-trench region off Miyagi, though few meters caused at off Sanriku (e.g., Iinuma et al., 2012). Such the spatial variation of the coseismic slip seems to reflect the variation of the physical property on the interplate fault, which can be correlated with a seismic velocity structure. In this study, to understand the mechanism of enormous coseismic slip of this megathrust event, we investigate the heterogeneity of the seismic velocity structure around the fault.

Many seismic refraction surveys were carried out at off Miyagi and Sanriku regions. Azuma et al. (2013) found the high-Vp anomaly in the overriding plate, corresponding the backstop block (Tsuru et al., 2002), at the area of 38?38.5N and 20 km from the trench axis (Figure 1). This Vp anomaly overlapped the large slip area during the 2011 earthquake, and they suggested that the heterogeneous structure in the overriding plate controlled the extent and amount of the coseismic slip near the trench based on the 2-D structure model along a seismic profile. It is expected that similar correlation between the seismic velocity and the amount of coseismic slip is broadly observed in the trench slope area, if the coseismic slip was actually controlled by the material heterogeneity, e.g. the distribution of backstop brock.

To confirm broad consistency of the previously identified structural variation, we conducted a seismic survey on October 2014 in the gap area where no seismic surveys have been conducted (Figure 1). We set two survey lines, with a length of 180 km, which run slightly oblique against the Japan Trench axis. Along the profiles, 17 and 20 ocean bottom seismometers (OBSs) were deployed. The spacings of the OBSs were 10 and 8 km, along the land-ward and trench-ward profiles, respectively, taking into account the difference in depths to the plate interface. We used an airgun array composed of four guns with a total volume of 100 liters as a controlled source. During the shooting operation, we also collected near-vertical reflection data by a 48-channel hydrophone streamer with a length of 1.2 km.

The obtained wide-angle data showed clear first arrivals within the offset range of 60 km, and later phases interpreted as the wide-angle reflections from the plate interface. Further analyses of the obtained data set will provide a velocity structural model to clarify more detailed distribution of the backstop block and to reinforce the interpretation based on the spatial correlation between the high-Vp block and large coseismic slip area of the 2011 Tohoku-oki earthquake.

Figure 1. Map view of surveyed area. Red lines and yellow plots indicate survey lines and deployed OBSs′ positions of this study. Black line indicates the profile of Azuma et al. (2013). Blue arrow represents the high Vp area detected by Azuma et al. (2013). Gray lines were surveyed by Ishihara et al. (2015). Black blocks shows the distribution of sedimentary prism obtained by reflection surveys (after Tsuru et al., 2002). Color-filled contour represents the coseismic slip distribution of the 2011 Tohoku-oki earthquake (Iinuma et al., 2012).

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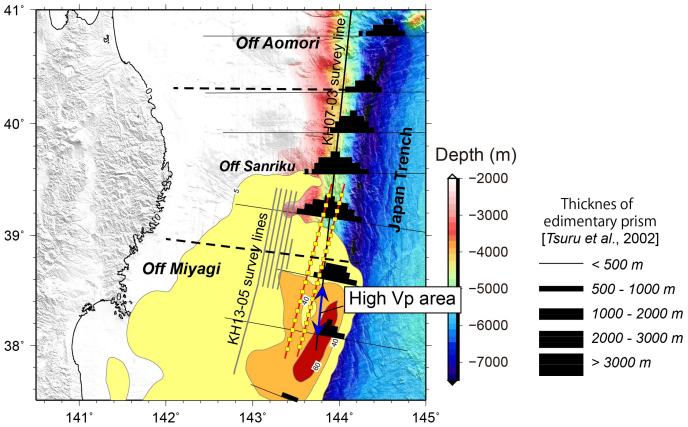

Figure 1