

P and S wave tomography of the NE Japan forearc region using S-net data

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The great 2011 Tohoku-oki earthquake (Mw 9.0) occurred off the Pacific coast of Northeast Japan, where the Pacific plate is subducting beneath the Okhotsk plate. The S-net (the Seafloor observation network for earthquakes and tsunamis along the Japan Trench) that initiated in 2016 is a large-scale, permanent, ocean-floor seismograph network with cabled 150 stations, which covers a wide oceanic region off Northeast Japan (Kanazawa, 2013). In this work, we study the 3-D seismic velocity structure beneath the NE Japan forearc region covered by the S-net.

We have newly collected two sets of arrival-time data. The first set contains arrivals picked by our technical staff, which include 36,002 P and 13,326 S arrivals of 241 local earthquakes recorded at the S-net and other inland Hi-net stations. The second data set contains arrivals picked by the first author (G.T.), which include 3,754 P-wave arrivals of 63 local earthquakes recorded by the S-net. Then the newly picked data are integrated with the existing arrival-time data from 747 teleseismic events for P-wave and 643 teleseismic events for S-wave, as well as 2,528 local earthquakes recorded at 1,852 Hi-net stations on the Japanese land areas (Liu & Zhao, 2016). These combined data are inverted to obtain new 3-D P- and S-wave velocity models (V_p , V_s) beneath the entire NE Japan arc by using the tomographic method of Zhao et al. (2012).

In this work we focus on the obtained 3-D images at depths < 80 km below the region covered by the S-net. The major results are summarized as follows.

- (1) The spatial resolution of the V_p and V_s images at depths of 5~60 km beneath the S-net is greatly improved.
- (2) Prominent low- V_p and low- V_s anomalies are revealed in the off-Iwate and off-Fukushima areas. These features are consistent with those revealed by previous works (e.g., Zhao et al., 2011; Huang & Zhao, 2013; Liu and Zhao, 2018), suggesting that our hand-picked arrival-time data are quite accurate and robust.
- (3) A significant high- V_p anomaly is revealed along the Japan Trench especially beneath the off-Miyagi region where the rupture of the 2011 Tohoku-oki earthquake (Mw 9.0) initiated, which may reflect that the sedimentary layer is very thin there above the subducting Pacific plate.

References

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