Configuration and structure of the Philippine Sea plate off Boso, Japan

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1. Introduction

In the off Boso area, the Philippine Sea plate (PHS) had been subducted northward from 15 Ma beneath the Sagami trough, and changed its direction to northeastward at 1–3Ma (e.g. Yamaji 2000; Kamata 2003; Takahashi 2006). The northeastern limit of the PHS is defined by Uchida et al. (2009), however, the geometry and the presence of the PHS to the east of 141.5˚E has not been well constrained. Associated with subduction of the PHS, slow slip events (SSEs) occur off Boso (e.g. Hirose et al. 2014; Ozawa 2014). So far, the relation of SSEs, regular earthquakes, and subduction zone structure are not clear in the offshore area. Main subjects in the presentation are: (1) the shape of upper boundary and the eastern edge of the PHS (2) the relation between an area of SSEs and velocity structure, and the segregation of SSEs and regular earthquakes in the offshore area.

2. Data and Method

We analyzed seismic data from 74 temporary OBS observations (Shinohara et al. 2011, Ito et al. 2017) and 48 land-based stations operated by the National Research Institute for Earth Science and Disaster Resilience (NIED) (Okada et al. 2004). For examination of seismic activity and velocity structure, we analyzed local earthquakes that occurred from October 2011 to March 2013. For the receiver function (RF) analysis, teleseismic *P* waves were collected from seismic records observed at the OBSs. We used events with criteria of epicentral distance of 30º–90º and magnitudes >5.5.
We applied tomographic inversion to seismic data from ocean-bottom seismometers and land-based stations. We determined the focal mechanisms from *P*-wave polarity data. RFs were calculated through spectral division of radial components by vertical ones with a water level of 0.001(e.g. Langston, 1977, 1979). To convert a time-domain RF to a depth-domain one, a common-conversion-point stacking technique (e.g. Yamauchi et al. 2003; Tonegawa et al. 2005) was used.

3. Results and Discussion

Tomographic results showed the mantle part of the Pacific plate, the North American plate, and PHS. We observed several low-angle thrust-faulting earthquakes associated with the PHS subduction. The upper boundary of the PHS around 141.5˚E was imaged as the seismic velocity discontinuities by the RF analysis.
We delineated the upper boundary of the PHS based on both the velocity structure and the locations of low-angle thrust-faulting earthquakes (Fig. 1). The upper boundary of the PHS is distorted upward by a few kilometers between 140.5˚E and 141.0˚E. We also elucidated the eastern edge of the PHS based on the upper boundary and results of RF. The eastern edge has northwest-southeast trend between triple junction and 141.6˚E, while the trend changes to north-south direction to the north of 34.7˚N. The change in subduction direction at 1–3Ma might have resulted in the inflection of the eastern edge of the subducted PHS.
We compared the subduction zone structure and hypocenter locations, and the area of the SSEs. Most of the low-angle thrust-faulting earthquakes occurred outside the areas of recurrent the SSE, which indicates that the slow slip area and regular low-angle thrust earthquakes are spatially separated in the offshore

area. In addition, the slow slip areas are located only at the contact zone between the crust parts of the NA and the PHS. The localization of SSEs at the crust-crust contact zone off Boso is first clarified in this study.

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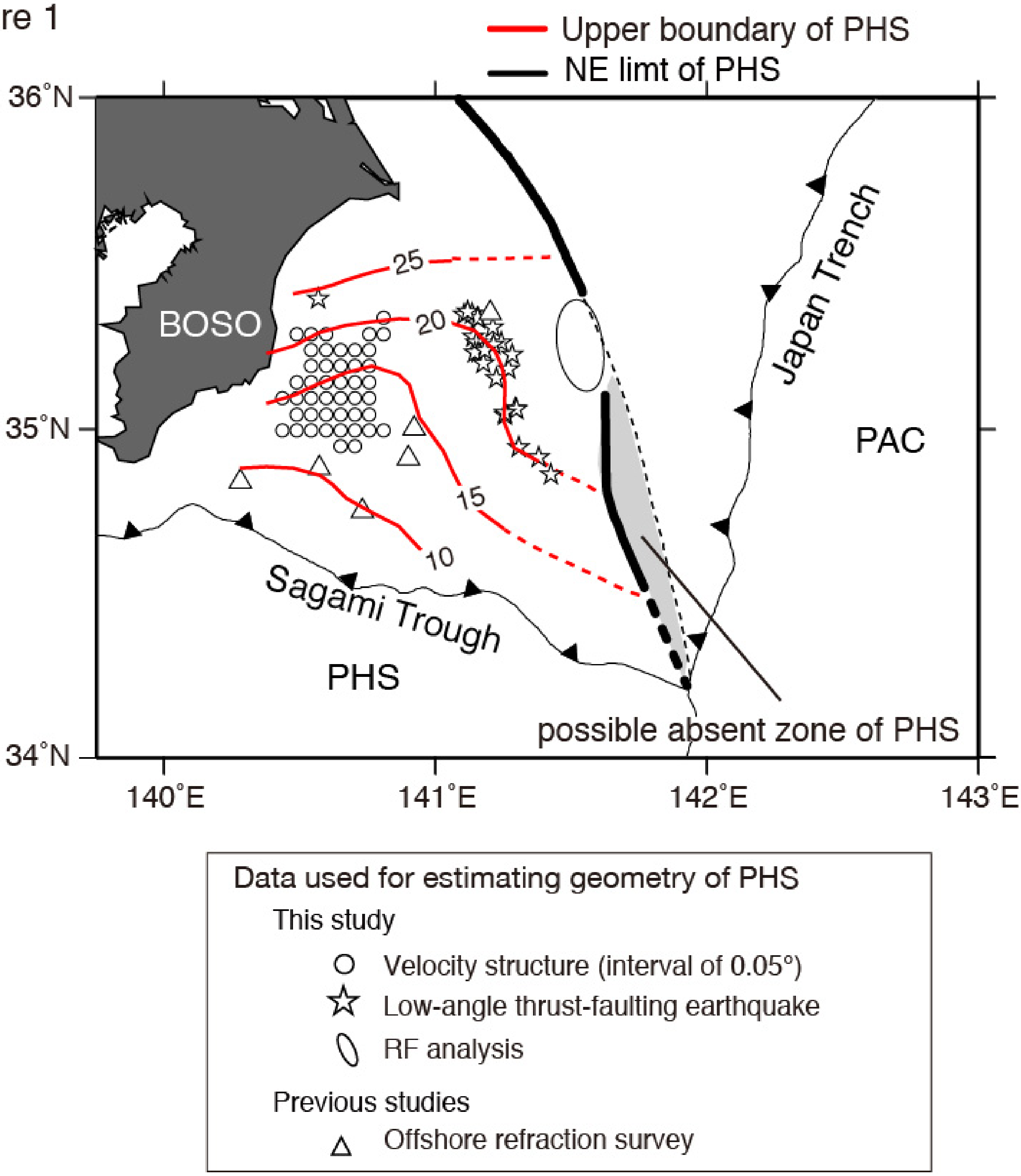
Figure 1


Upper boundary of PHS
NE limt of PHS
36°N
35°N
34°N
140°E
141°E
142°E
143°E
BOSO
25
20
15
10
Japan Trench
PAC
Sagami Trough
PHS
possible absent zone of PHS
Data used for estimating geometry of PHS
This study
Velocity structure (interval of 0.05°)
Low-angle thrust-faulting earthquake
RF analysis
Previous studies
Offshore refraction survey