Seismic structure of interplate seismogenic zone in the southern Japan Trench from SP converted phases

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Evident later phases often appear about 1-3 second after the P first arrivals on seismograms of the interplate earthquakes occurring in the southern part of the Japan Trench subduction zone recorded by the land seismic network in the NE Japan arc. If these arrivals (X-phase) are converted or reflected waves at an interface in the deeper part of the interplate seismogenic zone, it is important to locate the conversion or reflection points to clarify the seismic structure. The results of preliminary analyses on the particle motions and arrival time differences, X-P times, versus offsets indicate that X-phase is possibly a SP converted wave at an interface located near the hypocenter. For accurate estimation of the point of conversion, it is very important to determine the hypocenters of the earthquakes with the SP arrivals. In this study, we relocate the hypocenters of the offshore interplate earthquakes by using ocean bottom seismographic data. Our data set consists of two groups: 1) nine events occurred in 1997 when a dense OBS array was deployed and 2) earthquakes taking places since 1995 when a permanent offshore seismic station was put into operation.

The OBS array in 1997 observation was in operation for over three weeks and detected about 900 microearthquakes. 94 of them were recorded also by the land stations and nine were observed with the evident SP phase. Detailed inspection of the OBS waveform records, the SP phase was also recorded at OBSs. Using a seismic velocity structure model determined by an airgun-OBS seismic experiment (Nishino et al., 1999), we relocated both the hypocenters and the point of SP conversion simultaneously, from P and SP arrival times at the land and OBS stations. The estimated SP conversion points are located just above the cloud of the microseismicity defining the location of the subduction interface. Therefore, the nine earthquakes are not actually the interplate events and the observed X-phase was interpreted as the S to P conversion at the plate interface. We are now analyzing the data set 2) and the conversion points also seem to be located along the plate boundary. If our interpretation that X-phase is the plate boundary SP from the intraplate events is true, X-phase can be a good marker to identify intraplate events. Since it is difficult to distinguish whether an earthquake actually occurs along the plate boundary only from its hypocenter location, our X-phase analyses is important not only to clarify the geometry of the plate boundary but also to understand the 'thickness' of the interplate seismogenic zone.