

Geometry of the subducted Pacific slab beneath Japan estimated from ScSp phases observed by high density seismic network

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Upper surface of the subducted Pacific slab beneath NE Japan was estimated from ScSp - ScS times observed at Tohoku University seismic network from 1975 M7.7 deep earthquake ($h=600$ km), and was located right above the upper plane of the double-planed deep seismic zone in the depth range from 50 to 250 km with a dip angle of ~ 30 degree (Hasegawa et al., 1978). The location of the upper surface of the slab was confirmed by our further research on ScSp-ScS times observed by the seismic networks of Tohoku University and Japan Meteorological Agency from 1994 M7.3 and 1999 M7.1 earthquakes ($h=471$ km and $h=565$ km, respectively).

After the establishment of a high density seismic network (Hi-net) in Japan, a large deep earthquake (M7.3, $h=566$ km) took place beneath Vladivostok, Russia, on June 29, 2002. ScSp phases were detected from this event at many seismic stations not only in northeastern Japan but also in southwestern Japan. However, observed amplitudes of ScSp phases at stations in southwestern Japan are much smaller than those in northeastern Japan. Arrival times of those slightly obscure ScSp phases were measured on bandpass filtered envelope seismograms of short-period vertical component. Arrival time differences between ScSp and ScS phases depend on station locations and decrease with increasing longitudes. They are up to ~ 70 sec at the westernmost stations in Kyushu island, Japan.

By applying 3-D seismic ray tracing method (Cerveny et al., 1988) based on IASPEI91 velocity model, we tried to estimate locations of ScS-ScSp conversion points on the upper surface of the Pacific slab. One of the appropriate slab model shows that the Pacific slab must be subducted beneath southwestern Japan with its dip angle smaller than a critical angle of S-P conversion (~ 35 degree). In the depth range from ~ 300 km to ~ 600 km beneath southwestern Japan, these conversion points are located right above the hypocenters of deep earthquakes relocated by Engdahl et al. (1998) using regional and teleseismic P and S phases, teleseismic depth phases, and some core phases. We infer that the Pacific slab subducts beneath southwestern Japan down to ~ 600 km depth with a dip angle less than ~ 35 degree, where deep seismicity is not seen any more.

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