

Difference in location of the neutral plane of stress in the Pacific slab between Hokkaido and Tohoku

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We determined hypocenters and focal mechanisms of many intermediate-depth intraslab earthquakes within the Pacific slab beneath NE Japan by using data obtained by the nationwide dense seismic network recently constructed. The results show that, in addition to the upper and lower planes of the double seismic zone, intraslab earthquakes also occur between the two planes. This interplane earthquake activity is not homogeneously distributed in space, and is high beneath east Hokkaido and the fore-arc regions of southeast and central Tohoku. Focal mechanisms of the interplane earthquakes tend to have down-dip compressional type (DC) for Tohoku and the Hokkaido corner, while they tend to be down-dip extensional type (DE) for east Hokkaido. Upper plane earthquakes are characterized by DC and lower plane by DE both for Tohoku and east Hokkaido. Existence of the interplane earthquakes enables us to estimate location of the neutral plane between the DC stress in the upper plane and the DE stress in the lower plane. We estimated it by applying stress tensor inversions to focal mechanism data obtained by the present study and those determined by JMA. The results show that the neutral plane is located about 22 km away from the upper plate interface beneath Tohoku, whereas it is only about 10 km from the upper surface beneath east Hokkaido. This difference in the location of the neutral plane between Tohoku and Hokkaido is perhaps due to the difference in buoyancy force by the less dense metastable olivine wedge resulting from the oblique plate subduction beneath Hokkaido. Comparison with large intraslab earthquakes beneath the two regions shows that their aftershock areas are limited by the neutral plane, suggesting that large earthquake ruptures are confined to one stress regime and do not exceed the neutral plane.

Keywords: The double seismic planes, Interplane events, The stress regime in the slab, The stress tensor inversion method, Oblique descending of the Pacific plate, The metastable olivine