Imaging crust, mantle and slab structure beneath Chugoku and Shikoku districts by Double-Difference Tomography

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Obara [2002] detected nonvolcanic deep tremors occurring along the strike of the subducting Philippine Sea plate over a length of 600 km. Their occurrence is associated with fluids generated by dehydration reactions of minerals in the slab [Obara, 2002]. However, the relationship between the location of the tremors and heterogeneous structure of the seismic velocity is poorly known. In this study, detailed P- and S-wave velocity structures in the Chugoku and Shikoku districts were estimated by Double-Difference Tomography [Zhang and Thurber, 2003]. Travel time data from 3,977 earthquakes that occurred in the period from August 2000 to December 2003 were used in the inversion. The total number of stations is 80. As an initial model, one-dimensional velocity model is adopted, in which no seismic velocity discontinuities are taken into account. Grid nodes with horizontal and vertical separations of 20-25 km and 5-20 km, respectively, were set in the model space.

Obtained results show that clear high-velocity zones are distributed along the deep seismic zone beneath the western part of Shikoku and the Kii Channel, which probably correspond to the Philippine Sea slab. On the other hand, low velocity zones are imaged above these high-velocity zones in the western part of Shikoku, where Vp/Vs ratios are generally higher than 1.8. Deep-low frequency earthquakes appear to occur in and around these low-velocity and high Vp/Vs regions. A low-velocity anomaly connecting the subducting slab and the shallow part of the Awaji Island are found beneath the Kii Channel.