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Seismogenic stress field of the double seismic zone within the Philippine Sea plate beneath Ise Bay to the Kii Peninsula

Takayuki Miyoshi[1*], Kazushige Obara[1]

[1]NIED

The intra-slab seismicity within the Philippine Sea (PHS) plate, which occurs in the southwestern part of Japan beneath Ise Bay to the Kii Peninsula, defines a clear double-planed seismic zone (DSZ) [e.g. Seno et al. (2001, EPS), Miyoshi and Ishibashi (2007, JPGU)]. It is important to know the features of the seismogenic stress field of the DSZ to clarify why intra-slab earthquakes occur. The seismogenic stress field of the DSZ has been discussed so far only beneath Ise Bay (Miyoshi and Obara, 2009, SSJ). In this study, we discuss the seismogenic stress field of the DSZ, from Ise Bay to the Kii Peninsula, based on hypocenter and focal mechanism distributions.
We have located the hypocenters and determined the focal mechanism solutions of intra-slab events, selected from the earthquake catalog of NIED, Hi-net. The HYPOMH program (Hirata and Matsu'ura, 1987) was used to locate the earthquakes. The double-difference relocation method was applied to some earthquake clusters to obtain relative locations of hypocenters with high accuracy. Focal mechanisms were determined from initial P-waves polarities, using the HASH ver. 1.1 program (Hardebeck and Shearer, 2002).
Based on the hypocenter and focal mechanism distributions, we have clarified the features of intra-slab earthquakes as follows. Beneath Ise Bay, the upper plane earthquakes were normal or strike-slip type, with the T-axis in an E-W direction. However, the lower plane events were strike-slip type, with the T-axis in an E-W direction, and reverse or strike-slip type, with the P-axis in an E-W direction, beneath the southern and northern part of Ise Bay, respectively. These events occurred within the ridge-shaped slab with NW-SE trend beneath Ise Bay to Lake Biwa. To the northeastward of this slab, an M0.8 event occurred at a depth of about 80 km beneath Gifu prefecture on August 14, 2009. This was the deepest event in this area, except for the deep intra-Pacific-slab events. If this event occurred within the upper part of the PHS slab, the slab is inferred to dip steeply.
From the northeastern to the middle part of the Kii Peninsula most of the upper plane events show strike-slip focal mechanisms, with E-W tension and N-S compression, while most of the lower plane events are normal or strike-slip type with N-S compression. This feature is clear beneath the middle part of the Kii Peninsula where Miyoshi and Ishibashi (2004) suggested tearing or strong distortion of the slab. On the other hand, beneath the southwestern part of the Kii Peninsula, the T-axes changes continuously between N-S and E-W directions from northeast to southwest. This feature is common for the events of both the upper and lower seismic zones and it indicates that the seismogenic stress field is almost the same between the upper and the lower zone. However, as the seismic activity is inhomogeneous, more data is needed to reveal the seismogenic stress field in the areas of low seismicity.
By comparing the slab geometry and the seismogenic stress field we inferred the origin of the later. The difference in the seismogenic stress field between the upper and lower seismic plane is distinct beneath the northern part of Ise Bay (upper, tension; lower, compression) and the middle part of the Kii Peninsula (upper, compression; lower, tension). These features are explained by the bending of the slab in the direction along the trough axis. In short, ridge-shaped slabs generate tension and compression fields in the upper and the lower part of the slab, respectively. Valley-

shaped slabs generate compression and tension field in the upper part of the slab and in the lower part of the slab, respectively. The occurrence of intra-slab earthquakes could be related to the geometry of the subducting slab.

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