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Estimate of Interplate Coupling Along the Nankai Through by Using a New Plate Model

TOMOKAZU KOBAYASHI[1], MANABU HASHIMOTO[1]

[1]*Kyoto University*

Introduction: At the Nankai Trough in southwest Japan where the Philippine Sea Plate subducts beneath the Eurasian Plate, large thrust earthquakes such as the Nankai/Tonankai earthquakes have occurred periodically. In order to understand the process of strain accumulation along the Nankai Trough, the spatial distribution of the interplate coupling has been evaluated from geodetic data in previous studies. In recent years, seismic experiments at Shikoku and the Kii Peninsula give us a clear image of the plate interface, that is, we can find a clear boundary about 10 km shallower than the top face of the hypocenter distribution of slab earthquakes, and it is thought that the boundary is the top of the Philippine Sea Plate. In previous studies concerning the interplate coupling, however, the coupling ratio between the two plates has been estimated by using plate interfaces based on the depth of the slab earthquakes. Therefore, in this study, we set a new plate interface model based on the seismic profiling, and evaluate the spatial distribution of interplate coupling along the Nankai Trough by using continuous GPS data(GEONET data) in southwest Japan. Method: We estimated the slip deficit on the plate interfaces by conducting an inversion procedure with a priori information. Based on the boundary deduced by seismic experiments(e.g. Kurashimo et al., 2002; Ito et al., 2005), we set 38 fault planes from the west of Shikoku to the Tokai region. In the regions where the seismic experiments were not conducted, we set the fault planes at 10 km shallower than the top of slab earthquakes presented by Miyoshi and Ishibashi(2004). For the inversion procedure, we used horizontal velocities at GEONET stations referring to the Amurian Plate, located from 131.0 to 138.5 degrees of east longitude and from 32.8 to 35.8 degrees of north latitude, from 1998 to 2000. For a priori data, we used the velocity of the Philippine Sea Plate relative to the Amurian Plate, 6.5 cm/yr(Miyazaki and Heki, 2001). In this study we assumed full coupling for the fault segments with depth to 25 km, 50 % for 25 to 35 km, and no coupling for deeper than 35 km. Result: The slip deficit rates in the offshore Shikoku where the Nankai earthquake is anticipated are estimated as 4.8 to 6.2 cm/yr. The coupling ratios are 75 to 95 %, so the strong coupling is suggested in the region. The slip deficit rates beneath Shikoku are estimated as 1.3 to 2.6 cm/yr. The coupling ratios are 20 to 40 %, so the coupling is weaker compared with the offshore Shikoku. On the other hand, the slip deficit rates in the offshore the Kii peninsula where the Tonankai earthquake is anticipated are estimated as 3.3 to 4.5 cm/yr, and the rate beneath the peninsula is 1 cm/yr more or less. It suggests that the coupling is weaker than that around Shikoku. Furthermore, it is noted that the slip deficit rate is estimated smaller at a segment off Shiono Cape which is the boundary region between the anticipated Nankai and Tonankai earthquakes and includes the rupture starting point of the 1944 Tonankai and the 1946 Nankai earthquakes. The slip deficit rates are estimated as 3.3 to 6.2 cm/yr off Shikoku and the Kii peninsula, while the rate at the segment off the cape is 2.2 cm/yr. The coupling ratio is 35 %, so it suggests that the coupling is weaker at the boundary between the two source areas of the anticipated large earthquakes. Acknowledgement: We used GPS data observed by GEONET(GPS Earth Observation Network), which has been operated by the Geographical Survey Institute(GSI), Japan.