The estimation for the interplate coupling around souhtwest Japan with consideration for the rigid motion of forearc region

Sou Nishimura[1], Masataka Ando[2], Manabu Hashimoto[3], Shin'ichi Miyazaki[4]

[1] RCEP, DPRI, Kyoto Univ., [2] RCSV, Science, Nagoya Univ., [3] RCEP., DPRI., Kyoto Univ, [4] Research Center, GSI

We estimate the spatial distribution of the interplate coupling around southwest Japan, using GSI's GPS data. From the GPS velocity field in Ryukyu and southern Kyushu, we obtain the rigid motion. We subtract this rigid motion from original GPS velocity field in forearc region and we obtain improved GPS velocity field which is just a result of the interplate coupling. In order to estimate the distribution of backslip rate along the subduction boundary, we invert the improved GPS velocity field using a geodetic inversion method which minimize an ABIC. Large backslip in the south of Shikoku and relatively small backslip in Hyuga-nada are obtained. Interplate coupling is strong (nearly equal 1) in the south of Shikoku, and intermediate (0.7 to 0.3) in northern Hyuga-nada.

The interplate coupling is one of the important factors of seismic cycle, which represents the contribution of relative plate motion to strain accumulation along the subduction boundary. Interplate coupling is deffined by a relation of (backslip rate) / (relative plate motion rate) [Yoshioka et al., 1993]. Backslip indicates the drag by subducting slab [Savage, 1983;

Sato and Matsu'ura; Yoshioka et al., 1993]. The region of large backslip (strong coupling) must effectively accumulate seismogenic strain. On the other hand, the region of small backslip (weak coupling) must slowly accumulate seismogenic strain.

In this study, we estimate the spatial distribution of the interplate coupling around southwest Japan, using GSI (Geographycal Survey Institute)'s continuous GPS data [Abe and Tsuji, 1994; Tsuji et al., 1995]. A linear trend of GPS time series of each GPS site might be regarded as a GPS velocity (original velocity). We think the original velocity field in southwest Japan consists of two parts. The one is the deformation (strain accumulation) by the interplate coupling. The other is a rigid motion of forearc region

{ Ryukyu, southern Kyushu (south of Beppu-Shimabara Graven), and Shikoku (south of Median Tectonic Line) }. From the original velocity field in Ryukyu and southern Kyushu, we obtain the rigid motion. The euler pole is at (30.4 N, 134.3 E) and the angular velocity is 0.0283 rad/m.y. In Ryukyu and southern Kyushu, the original GPS velocities can be well explained by the obtained rigid motion of forearc region. We subtract this rigid motion from original GPS velocity field in forearc region and we obtainthe improved GPS velocity field which is just a result of the interplate coupling.

In order to estimate the spatial distribution of backslip rate along the subduction boundary, we invert the improved GPS velocity field using a geodetic inversion method which minimize an ABIC [Yabuki and Matsu'ura, 1992]. The estimated interplate coupling is strong (nearly equal 1) in the south of Shikoku, and intermediate (0.7 to 0.3) in northern Hyuga-nada. In central Hyuga-nada, the interplate coupling is weak (around 0.2). We cannot estimate backslip rate and interplate coupling properly in southern Hyuga-nada, because the eastward residuals (about 1 cm/yr) in southernmost part of Kyushu remain in the improved velocity field.

We conclude that (1) interseismic GPS velocity field in southwest Japan can be well explained by the superposition of the interplate coupling along the subduction zone and the rigid motion of forearc region, (2) The interplate coupling is strong (almost full coupling) in the south of Shikoku, and weak or intermediate in Hyuga-nada, (3) We cannot explain the GPS velocity

around southernmost part of Kyushu only by the interplate coupling, therefore, other source of crustal deformation is required for this region.