GPS Velocity Field and Tectonics From the Ryukyu Arc to Taiwan

Kohei Segawa[1]; Manabu Hashimoto[2]; Tomokazu Kobayashi[3]

[1] Earth and Planetary Sci,Kyoto Univ; [2] DPRI, Kyoto Univ; [3] DPRI, Kyoto Univ.

Convergence between the Philippine Sea and Eurasian plates is complicated around Taiwan. The Philippine Sea plate is subducting beneath the Eurasian plate on the Ryukyu trench side, while the Eurasian plate is subducting beneath the Philippine Sea plate on the Manila trench side. Furthermore, the Ryukyu islands and the northern part of Taiwan move toward southeast, but the southern part of Taiwan moves toward northwest. In this study, I try to model the plate kinematics of such a complicated convergence zone from the Ryukyu arc to the Taiwan using the GPS velocity field. I adopt the model of Matsu'ura et al.(1986) and Hashimoto and Jackson (1993) in which crustal deformation is represented as the sum of rigid block motions and deformation due to slip deficits along the fault of block boundary. In this study, I use the GPS data of the Ryukyu Arc from 30 stations of the GEONET, operated by the Geographical Survey Institute, that provide good measurements of the crustal deformation. I estimate the secular velocities of GEONET stations. I also use the GPS data from 140 stations in Taiwan (Yu et al., 1997). All GPS velocities are converted to those relative to the Shanghai station of the International GPS Service (IGS). I assume 7 blocks and 34 faults in this study field based on the distribution of active faults and large earthquakes and according to the model proposed by Shyu et al. (2005). Moreover I improved the model in which the location of block boundary near Longitudinal Valley Fault (LVF) is changed. Thus, I estimate the block motions and slip rate of faults. The model predicts that the Philippine Sea block moves northwestward at about 68mm/yr relative to the Eurasian block. The south Ryukyu block and the east Taiwan block move in the southeast direction at about 38mm/yr and in the west-northwest direction at about 26mm/yr, respectively, relative to the Eurasian block. The calculated velocities which are predicted by the model match the observation in the Ryukyu Arc and north of Philippine Sea block well. However, the calculated velocities in the west and south Taiwan blocks tend to have more northerly and southerly directions, respectively, than the observation. I estimate a slip deficit rate of about 70mm/yr between the Ryukyu Arc and Taiwan. These large slip deficit rates indicate that strain accumulation due to relative block motion is fast in these areas.