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Analysis of crustal deformation and the earthquake potential in Taiwan by block modeling and geodetic observations

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Taiwan locates on the boundary between the Philippline Sea plate and the passive continental margin of the Eurasian plate, where is one of the active seismogenic region in the world. We characterize the kinematics of modern crustal deformation in Taiwan and evaluate the earthquake potential for large earthquakes by computing tectonic block motions and fault slip rates of the active faults from GPS observations and geologic slip rate constraints. Our model slip rates are reconciled with the geologic rates constrained by geologic slip rates. Attempt to discuss the regional characters, we separate Taiwan into five sub-regions exhibit distinct tectonic behavior, which are southwestern, central, northern, eastern Taiwan and the Central Range. In southwestern Taiwan with an obvious southwestward extrusion, we can separate this area into two major domains from our distribution of principal strain rates of each block. One is the deforming domain with larger strain rates about 1.1 to 1.2 μstrain/yr and majorly clockwise rotation rates, another is the quasi-rigid block domain with opposite effect. This is coincided with previous geodetic analysis study. Central Taiwan is characterized by the clockwise block rotation and slip deficit estimated about 3 mm/yr. The higher slip rates estimated by 10 to 20 mm/yr are located in the foothills region of central and southwestern Taiwan. In northern Taiwan, the fault slip rates are relatively lower because of the gradually weak plate motion. Because of the full collision of plate motion, the long-term slip rates of Longitudinal Valley region are as high as 50 mm/yr. The postseismic relaxation of the 1999 M_w 7.6 Chi-Chi earthquake and of the 2010 M_w 6.4 Jiashian earthquake may be responsible for these faults with high slip rates. In the southern part of the Central Range, there is a significant extension besides the plate convergence. The principal strain rates of the blocks within this region are estimated about 0.4 to 0.7 μstrain/yr.