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Interseismic crustal deformation of Taiwan: an aspect of block tectonics

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The island of Taiwan has been undertaking the convergence between the Eurasian and Philippine Sea plates, and formed the Longitudinal Valley, which has long been regarded as one of the major collisional suture zones, to the east and a fault-and-thrust belt to the west across the island. Based on recent published geological map and relevant studies, several major active faults are currently acting in Taiwan and dividing the crust into several blocks. In eastern Taiwan, the Longitudinal Valley fault, the most dominant fault within the suture zone, is locked along the northern segment and is creeping at shallow depth but locked at deeper depth in the southern segment. In western Taiwan, lots of active faults, which are seismogenic, imbricate and propagate to the west above a proposed major Taiwan detachment. In order to quantitatively characterize present-day kinematics and interseismic crustal deformation around the island of Taiwan, we constructed a 3-D block model constrained by GPS data and detailed mapping results. The model combined elastic half-space and block motions based on the backslip model to describe the GPS velocities and locking faults. The GPS data we used were measured from 1990-1999 before the largest earthquake in the past decade, the Chi-Chi earthquake to avoid the coseismic and following postseismic effects of the shock. The interseismic fault-slip rates on individual faults, which separate crustal blocks of the Taiwan region, can be calculated by the model. The results show that major convergence takes place along the two megathrusts and longitudinal Valley fault. The northeastern tip of the Central Range illustrates block bending and results in model misfits. The southwestern block represents extrusive motion as mentioned in

previous studies with much stronger slip rates. The locking of the subduction zones along the Ryukyu and Manila Trenches as well as the locking and creeping of the active faults around Taiwan constrain the interseismic deformation across the Taiwan region and accumulate strain which may be released during future large earthquakes. The GPS constrained block model provides estimates of present-day fault slip rates and seismic potential within the entire Taiwan region.