Interseismic slip of the Shanchiao fault in northern Taiwan from GPS and leveling measurements

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The Shanchiao fault is a major late-Pleistoene active structure responsible for accommodating the extension across the Taipei metropolitan area in northern Taiwan, and its left-lateral normal faulting together with clockwise block rotation have been revealed from regional structural geology, paleomagnetism, and GPS measurements. This study presents Global Positioning System (GPS) measurements for the period 2006–2015 at 106 sites in northern Taiwan and uses horizontal GPS observations and elastic half-space dislocation models to evaluate the interseismic slip of the Shanchiao fault. We first performed model resolution tests for fault slip distribution based on scenarios of subsurface fault geometry that were proposed by previous geologic and geophysical researches. With a dimension of 3×3 km^2 for each fault patch, the results show that our GPS measurements can resolve slips no deeper than 9 km. The method of Tikhonov regularization was then performed to stabilize nonnegative linear inversion for left-lateral normal slip distribution. Our best model suggests two fault planes dipping 75º to SE at depths of 3-6 km, with the north segment having normal slip rates of 1.43±0.71 cm/yr and the south segment having left-lateral normal rates of 0.82±0.75 cm/yr. Moreover, a shallow-dip (25ºSE) plane at depths of 6-15 km with mainly left-lateral slips of ~2.5 cm/yr may correspond to the observed regional clockwise rotation. The residuals of GPS vertical and precise leveling measurements from the best predicted vertical motion reveal uplift at the Linko tableland and the Tatun volcano area and subsidence in the Taipei basin and the northeast coastline in the period of 2006–2015. For future work we will try to include volcanic source model to better resolve the interseismic fault slip from the surface deformation field.

Keywords: Shanchiao Fault, Active fault, Resolution, GPS and Leveling

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