



## **Shallow Creep Along the Southern Longitudinal Valley Fault in Eastern Taiwan Constrained by Multiple Geodetic Approaches**

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We integrate the near-fault data from 10 campaign-mode GPS stations and the data from 25 continuous GPS stations and from PSInSAR, total station measurement and Photogrammetry method for recognizing the spatiotemporal variation of the kinematics at shallow part of the Chihshang fault in SE Taiwan, which has been considered to show interseismic creep near the surface. The GPS coordinate daily solutions were calculated using the software Bernese v.5.0 under the ITRF2008. The horizontal velocities estimated from coordinate time series by least squares method is relative to the station S01R in the stable continental margin of the Penghu Island in the Taiwan strait. The far-field continuous GPS horizontal velocities during January 2012 - October 2016 decrease, from east to west, from 84.4 mm/yr at the eastern coastline, 62.5 mm/yr at the hanging wall close to the fault, 45.3 mm/yr at the footwall of the fault, to 24.8 mm/yr at the Central Range. This velocity pattern reflects the fault kinematics at deep part of the fault is stably moving over time. The PSInSAR mean velocities from January 2007 to December 2010 show a localized shortening rate of up to  $\sim 10$  mm/yr in the line-of-sight component across the Chihshang fault, consistent with the shallow creep reaching to the surface. However, no significant velocity discontinuity is observed across the southern segments of the Chihshang fault based on the near-fault campaign-mode GPS results ( $\sim 30$ -meter station spacing) and from both total station measurement and Photogrammetry between January 2012 and October 2016, which implies the shallow part of the fault is locked. Because this locked behavior is continued over four years and is not a seasonal signal, we therefore propose this phenomenon as a transient locked event at the creeping segment of the fault. In addition, a slow-down creeping rate has been ever detected at the northern Chihshang fault in Chihshang area before the 2003 Mw 6.8 Cheng Kung earthquake. This transient locked event that we observed might also be a precursor of the future large earthquake at the southern Chihshang fault in Taiwan.