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Estimation of the Particle Image Velocimetry (PIV) technique to measurement the near-fault surface displacement, eastern Taiwan

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Measuring earthquake surface deformation provides information of both general kinematics of earthquake faulting and secondary deformation features, which usually reflect fault behaviors and surface geological heterogeneity. Recently, technology provided increasing variety of methods to measure surface deformation of earthquakes. Especially, photogrammetic analysis with sub-pixel correlation of remote sensing imagery, which we focused on in this study, is useful to reconstruct the co-seismic surface displacement field. The 2003 (M=6.5) Chengkung earthquake resulted from rupture of the Chihshang fault, a plate suture fault between the Eurasian plate and the Philippine Sea plate in eastern Taiwan. GPS and geodetic measurements indicated that the Chengkung earthquake induced horizontal displacement of about 30 cm across the surface trace of the Chihshang Fault, mostly during post-seismic creep for more than 6 months following the earthquake. The surface trace of the Chihshang fault is generally well mapped based on both the strikingly geomorphic fault scarps and abundant surface breaks along the fault. The occurrence of the 2003 Chengkung earthquake on the Chihshang fault provides a good opportunity to test the application of the PIV photogrammetric analysis tool and to determine surface displacement field in a dense vegetation area during a moderate earthquake event. The particle image velocimetry (PIV) method is an application of an optical image correlation technique, in which the horizontal displacement field is measured by comparison of images acquired at two different times. This method is based on a sub-pixel correlation of orthorectified images, using sliding windows. Our preliminary result shows that geometrical disparities between aerial photographs acquired before and after the Chengkung earthquake

provide constraints on the geometry of the Chihshang fault zone, with a velocity discontinuity near the surface rupture.