Monitoring of active deformation along the collisional plate boundary in eastern Taiwan by PS-InSAR and continuous GPS measurements

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The InSAR and PS-InSAR techniques have proven to be capable of measuring active crustal deformation and anthropogenic land subsidence at fine space resolution of tens of meters over wide coverage in Taiwan (e.g., Huang et al., 2006; Tung and Hu, 2012; Wu et al., 2012). In this study, we presents new results about creeping and fault segmentation along the Longitudinal Valley (LVF) from continuous GPS and interferometric synthetic aperture radar (InSAR) using data acquired by ALOS satellite and provided by JAXA (Champenois et al., 2012). The LVF is an active suture between the Luzon arc of the Philippine Sea plate (PSP) and the Chinese continental margin of the Eurasian plate in eastern Taiwan. With respect to Paisha station located at stable continental margin, the stations of Coastal Range in PSP show the velocities of 40.5-72.3 mm/yr towards azimuth 307°-309°. The stations in the Longitudinal Valley and Central Range revealed velocities in the range 19.0-49.3 mm/yr towards azimuths 285°-318° (Lin et al., 2010). This study presents the results about vertical velocity on the Coastal Range and Longitudinal Valley (LV) in eastern Taiwan from Continuous GPS using data acquired from 1999 to 2010. In the vertical velocity pattern, the significant subsidence appears in northern Coastal Range about -15.7 ±0.3 mm/yr, but the uplift in southern Coastal Range about 20.6±0.2 mm/yr respectively. Furthermore, the vertical variation presents a discontinuity across the Chihshang Fault nearly 28.9 ±1.2mm/yr. We use 10 SAR images acquired from January 2007 to February 2010 by the PALSAR sensor, an L-band radar (wavelength = 23 cm) which provides a much better coherence than in C-band (5.6 cm) over the LV (a rural area surrounded by mountainous tropical areas with a dense vegetal cover). Data are processed with the Stanford Method for Persistent Scatterers (StaMPS) that can perform time series analysis on a dense set of selected points called Persistent Scatterers (PS). Interferograms from L-Band data show a dramatic improvement of coherence in comparison to previous studies using C-Band ERS data. The density of measurement resulting from StaMPS processing is the highest achieved so far in the area (about 40-55 points per km^2) which allowing a continuous view of the deformation along the Valley and also giving information on its borders (Central Range and Coastal Range). The most striking feature of the resulting mean velocity map is a clear velocity discontinuity localized in a narrow band (0.1 to 1 km) along the LVF and responsible for up to 3 cm/year offset rate along the radar line of sight, which is attributed to interseismic creep. InSAR results are in good agreement with continuous GPS measurements over the same period (0.3 cm/year rms). The density of measurement allows us to improve fault trace map along the creeping section of the LVF (with accuracy about 100 m) and to find new field evidences of the fault activity.

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