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Monitoring of the Longitudinal Valley Fault (Eastern Taiwan) using PS-InSAR method with ALOS data

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The Longitudinal Valley, located in the eastern part of Taiwan, corresponds to the suture zone between the Eurasian and Philippine Sea plates, where an active collision occurs associated to an important seismicity. A series of historical large earthquakes occurred on the Longitudinal Valley, especially in autumn 1951 with four earthquakes Ms > 7 and more recently, with the Ms∼6.5 Chengkung earthquake (10th December 2003). This tectonic activity is principally due to the reactivation of the Longitudinal Valley Fault (LVF), which is one of the most active structures in Taiwan. It has been monitored by regional GPS network that revealed that in addition to earthquake deformation, surface creep occurs in a narrow zone on the eastern part of the Valley. This has been confirmed in few places by ground geodetic measurements, notably at Chihshang where two creepmeters installed since 1998 show 30mm/year of localized creep, mainly thrust with left-lateral component [1]. A previous InSAR study, using ERS C-band data [2], also confirmed on few local profiles, the existence of surface creep along the LVF. However, all these geodetic measurements are too sparse to extensively map and monitor the creeping sections of the fault.

This study presents new results about creeping on the southern part of the Longitudinal Valley from interferometric synthetic aperture radar (InSAR) using data acquired by ALOS satellite and provided by JAXA. We use 10 SAR images acquired from January 2007 to February 2010 by the PALSAR sensor, an L-band radar (wavelength = 23cm) which provides a much better coherence than in C-band (5.6 cm) over the Longitudinal Valley (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) [3].

To analyze the PS results, a series of 51 close profiles is performed perpendicularly to the fault, and rates of displacement are converted into dip-parallel slip rates assuming a 45° dip angle. Across the discontinuity, the relative change of LOS velocity is about 2cm/year but shows significant variations along the fault. All these data are compared to GPS (before and during the same period), leveling, creepmeters, and preliminary ERS InSAR data [2].

In order to validate the new map of the Fault, two missions were realized on the field to find signatures of tectonic deformations. There is a very good agreement between the location of the discontinuity and the field evidences of fault activity. Agreement with fault traces mapped based on geologic and geomorphologic studies is globally good; however there are locally significant differences.

L-band ALOS data and PS-InSAR analysis are shown to be a promising geodetic approach to characterize, quantify and monitor the Longitudinal Valley Fault activity and to better understand the earthquake cycle in the area.

[1] Lee, J.-C., J. Angelier, H.-T. Chu, J.-C. Hu, F.-S. Jeng, and R.-J. Rau (2003), Active fault creep variations at Chihshang, Taiwan, revealed by creep meter monitoring, 1998-2001, J. Geophys. Res., 108(B11), 2528, doi:10.1029/2003JB002394.
[2] Hsu, L., and R. Bürgmann (2006), Surface creep along the Longitudinal Valley fault, Taiwan from InSAR measurements, Geophys Res. Lett., 33, L06312, doi:10.1029/2005GL024624.
[3] Hooper, A. J., Persistent scatterer radar interferometry for crustal deformation studies and modeling of volcanic deformation, Ph.D. thesis, Stanford University, 2006.