The Active Longitudinal Valley Fault zone (E. Taiwan): New insights from UAS high resolution Digital Terrain Model, GPS and PSInSAR

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Abstract

Taiwan is among the activest neotectonic place in the World as it is the result of the rapid collision of both Eurasian and Philippine Sea Plates, with an annual average convergence rate of about 9cm.y-1. This active tectonic shortening generates the Taiwan relief which is characterized by two major mountain ranges: (1) the metamorphic Central Range from Eurasian continental origin, and (2) the eastern Coastal Range characterized by a volcanic Philippine Sea Plate affinity. In between both runs the crustal suture so-called the Longitudinal Valley Fault (LVF), 150km long and N020◦E trending, which presents both inter-seismic (Champenois et al., 2013) and earthquake seismic activities. Effectively it has been affected by several earthquakes (EQ) of magnitude larger than 5 during the last 70 years (e.g., Oct.22, 1951 in Hualien M7.1-7.3, Nov.25, 1951 in Chihshang M6.1 and in Yuli M7.3, Dec.5, 1951 in Taitung M5.8, see Central Weather Bureau, 1952, or May20 1986 M6.2 in Hualien, 2003 Mw6.8 in Chengkung, 2006 Mw5.9 in Taitung, 2013 Ruisui EQ, Feb.6 2018 Mw 6.4 Hualien EQ). Consequently, the detailed study of this major active seismic plate suture zone is a major concern for any Taiwan citizens. We herein settle an UAS survey above the Longitudinal Valley Fault zone and acquired 17483 high resolution photographs (Sony QX-1 camera with 20 megapixel resolution) through 2 drones flying at 350 meters above ground level height, by total 23 flight missions, covering a total area of 195km2. After classical photogrammetric

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processing, we calculate the high resolution Digital Terrain Model (HR-DTM) of the LVF zone, (with a 11cm planimetric resolution and a 40cm vertical accuracy) and its immediate surroundings along a "buffer" zone of 2.5km. This UAS HR-DTM enables us through classical morphostructural interpretation to map into much details the active tectonics structures of the Longitudinal Valley Fault that lead us to up-date pre-existing published works (*e.g.* CGS geological maps, Lin et al., 2009 ; Shyu et al., 2005, 2006, 2007, 2008). Moreover, we use and combine this morphostructural interpretation with levelings, GPS and PSInSAR datasets (Champenois et al., 2013) in order (1) to locate the active tectonic structures; (2) to characterize those using also field studies; and (3) to quantify them with various geodetic measurements (*e.g.* Yu et al., 1997; Lee et al., 2008; Hsu et al., 2009; Huang et al., 2010). Then finally, we propose a new simple Longitudinal Valley Fault active tectonic model which has geodynamic implications.