Comparison between present-day and Holocene deformation in SW Taiwan based on a full coverage of the Taiwan Island by InSAR.

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Abstract

Taiwan Island, resulting from oblique collision between Philippine Sea plate and Eurasian plate converging at a rate of about 8 cm per year, is one of the most active tectonic region in the world. Due to a complex geodynamical context and high strain rate, the pattern of deformation is not well solved by GPS, despite the dense network. In complement, INSAR shows its contribution with respect to GPS, with a dramatic increase of the spatial information. Processing of the full archive of ALOS-1 PALSAR images through a small-baseline time-series approach (NSBAS), combined with GPS, allows us to obtain a complete deformation map of all Taiwan over the period 2007-2011. NSBAS interferometric chain (Doin et al., 2015) includes several corrections applied before unwrapping, in particular correction of atmospheric delays predicted from the global atmospheric re-analysis ERA-Interim model, and local DEM error correction. These corrections are of particular importance as they reduce the variance of the phase across regions with high topographic gradients, hence facilitating unwrapping step. Our InSAR result offers an unprecedented continuous view of deformation field of the entire Island. For instance, in the Central Range the LOS velocity map shows a clear pattern of deformation, consistent with a rapid uplift (cm/y) of the Central Range South of the island. This uplift, already partially documented by GPS and leveling, is clearly mapped here and seems to show an overall continuity. Here we focus on rapid deformation in southwestern Taiwan where the INSAR LOS velocity map of velocity provides a good coverage in the foothills area, revealing several localized areas of interseismic deformation that can be correlated with tectonic structures. Among them, is the 15km-long Lungchuan anticline, showing relative surface displacement toward satellite by several cm/year. Those observations, combined with a geological study and field survey (Le Beon et al., 2017), suggest the existence of a back-thrust fault that reaches the surface on western side of Lungchuan ridge and roots on the _˜4 km deep Tainan detachment. This structure has also been activated during 2010 Mw 6.3 Jia-Shian Earthquake and the Meinong earthquake (02/05/2016, Mw6.4). Interestingly the interseismic deformation pattern in spatially consistent with Holocene uplift derived from fluvial terraces analysis suggesting that anelastic penetrative deformation may coexists with elastic deformation.

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