Geophysical Research Abstracts
Vol. 17, EGU2015-8680, 2015
EGU General Assembly 2015

Co-seismic deformation of the 16 May 2007 Laos earthquake based on SAR interferometry analysis

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Large earthquakes are often accompanied by noticeable surface deformations and damages. In cases where surface ruptures are visible and field investigations are feasible, detailed information about the co-seismic deformations can generally be obtained in the field. However, in cases where field evidence for surface deformations are difficult to delineate either due to smaller magnitude of the events, deeper hypocenters, or inaccessibility of the earthquake area, remote sensing observations may provide information about the co-seismic deformations. In this study, we analyzed the 16 May 2007 Mw 6.3 earthquake that occurred in northeastern Laos. In the study area, information from GPS networks or seismic stations is scarce. The event also occurred in an area which is nearly inaccessible. Therefore, we chose to utilize SAR interferometry in an attempt to understand the co-seismic deformation pattern of the event. We used Phased Array type L-band Synthetic Aperture Radar 1.0 (PALSAR 1.0) images of Advanced Land Observing Satellite (ALOS) and the Differential Synthetic Aperture Radar interferometry (D-InSAR) method on the GMTSAR software. We analyzed two co-seismic pairs, 2007/2/17-7/5 and 2007/2/17-8/20, in order to obtain better constraint for the co-seismic deformation patterns. We also attempted to build a model for the subsurface fault slip from the InSAR results. We suggest that the earthquake occurred on the Mae Chang fault, one of a series of left-lateral faults in the region. The length of the slip patch is $\sim$18 km, with a width of $\sim$8 km and the rupture top at $\sim$4 km deep. The attitude of the fault is approximately (N33E, 89N). The co-seismic deformation signal is quite apparent on both interferograms. However, the signal is $\sim$15-20 km away from the epicenter locations of most global earthquake catalogues, and the depth of the epicenter is also different by $\sim$10 km. This implies the global catalogues may have large errors in this region due to poor local constraints. Despite such uncertainties, our results are consistent with tectonic geomorphological observations of the area and the focal mechanism from the Global CMT catalogue.