Geophysical Research Abstracts
Vol. 18, EGU2016-13316-1, 2016
EGU General Assembly 2016

The 2015 Gorkha earthquake investigated from radar satellites: slip and stress modeling along the MHT

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The active collision at the Himalayas combines crustal shortening and thickening, associated with the development of hazardous seismogenic faults. The 2015 Gorkha earthquake largely affected Kathmandu city and partially ruptured a previously identified seismic gap. With a magnitude of Mw 7.8 as determined by the GEOFON seismic network, the 25 April 2015 earthquake displays uplift of the Kathmandu basin constrained by interferometrically processed ALOS-2, RADARSAT-2, and Sentinel-1 satellite radar data. An area of about 7000 km2 in the basin showed ground uplift locally exceeding 2 m, and a similarly large area (∼9000 km2) showed subsidence in the north, both of which could be simulated with a fault that is localized beneath the Kathmandu basin at a shallow depth of 5–15 km. Coulomb stress calculations reveal that those areas that are laterally extending the active fault zone experienced stress increase, exactly at the location where the largest aftershock occurred (Mw 7.3 on 12. May, 2015). The subparallel faults of the thin-skinned system, in turn, experienced clear stress decrease at locations above (or below) the active fault. Therefore, this study provides insights into the shortening and uplift tectonics of the Himalayas and shows the stress redistribution associated with the earthquake.