



Himalayan Main Boundary Thrust reactivation as a normal fault: constraints and implications for the seismic cycle in western Nepal

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The largest (M8+) known earthquakes in the Himalaya have ruptured the upper locked segment of the Main Himalayan Thrust zone, producing slip at the surface along the Main Frontal Thrust at the range front. However, out-of-sequence active structures have received less attention. Here, we focus on an active fault that generally follows the surface trace of the Main Boundary Thrust (MBT), which has generated a clear geomorphological signature of recent deformation in eastern, western Nepal and eastern India. In western Nepal, between the towns of Surkhet and Gorahi this fault is well expressed. A preliminary fluvial terrace analysis has suggested that it slipped during the great 1505 earthquake that occurred in western Nepal. Across most of its length, this fault appears geomorphologically as a normal fault, raising questions about why the crust would be extending in the hanging wall of the MHT and whether slip events relate to larger earthquakes that also rupture the MFT. Here, we study the reactivation of the MBT on the Surkhet-Gorahi 120km-long surface fault trace. We first use a high-resolution Digital Elevation Model generated from triplets of very high-resolution Pleiades images in order to map the fault scarp and its geomorphological lateral variation. We then present evidences of normal faulting in a trench located in the village of Sukhetal. For this site we provide chronological constraints on the timing of the last event rupturing the MBT using radiocarbon dating analysis. We discuss these results and their implications on the frontal Himalayan thrust system co-seismic behavior.