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Basin scale hypsometry of the Himalayan fold-and-thrust belt and its tectonic implications

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The style of deformation of the Himalaya has been proposed to be localized along the Main Himalayan Thrust (MHT), underlying the entire range and becoming emergent at the Main Frontal Thrust (MFT). An alternative model focuses on the significance of a physiographic boundary known as PT_2 , south of the Main Central Thrust (MCT), and proposes out-of-sequence deformation. It is interesting to test these models using variations in drainage basin scale hypsometry of the Himalayan range, and to understand the relation between these variations and the main tectonic structures of the Himalaya. This study utilises SRTM 30 m datasets to extract Hypsometric Index (HI) values for the 3rd order river basins of the Himalayan range and southern Tibetan Plateau.

A major change in HI values is coincident with the trace of the Main Frontal Thrust (MFT), with higher values north of this structure than in the foreland to the south. There is smaller magnitude increase in HI across PT_2 . Results also show a pronounced drop in HI on the northern side of the Himalaya, which is roughly coincident with the location of the South Tibetan Detachment Fault (STDF). The sharp rise in HI values across the MFT is consistent with slip along the MHT raising the entire crustal wedge above it, but the limited rise across PT_2 offers no strong support for the out-of-sequence model. The drop in HI across the STDF could represent geomorphic control by the STDF, but this fault has been inactive for millions of years. An alternative explanation is that the decrease in HI values is controlled by underlying changes on the MHT, and the transition from locked to creeping behaviour on this structure.

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