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Rapid denudation at the Dhauladhar range front, Himachal Pradesh, India

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ABSTRACT: Assessing along-strike variability in deformation patterns along the Himalayan arc is of primary importance to decipher the relative contribution of the main tectonic structures in accommodating the India-Eurasia convergence. In active mountain ranges a dynamic coupling exists between tectonic and denudation, with high rates of rock uplift along thrust faults usually coincident with high denudation and exhumation rates (e.g. Kirby and Whipple 2012). From that perspective, surface processes provide a way to investigate the spatial distribution of tectonic uplift and test different possibilities for the geometry and slip rates of the associated structures, even though simultaneous variations in the climatic boundary condition can interfere in the interaction between tectonic and erosion. Significant along-strike variability has been reported along the Himalayan arc, in terms of geometry of the structures and intensity for both external and internal forcings. One of the most peculiar long-wavelength feature of the range is the Kangra reentrant (Himachal Pradesh, India) in the western part of the arc. This area displays (1) a wide sub-Himalayan zone, (2) noticeable changes in the orientation of the structures and (3) very high topographic gradients at the Dhauladhar front range. Recent studies have highlighted the occurrence of significant out-of-sequence deformation at various times scales in the Kangra reentrant (Mukherjee 2015; Dey et al. 2016; Thiede et al. 2017), suggesting that this area could significantly depart from deformation regimes determined in other well documented regions (e.g. Avouac 2003). We present 25 new 10Be-derived denudation rates from the Chamba region in Himachal Pradesh and in particular the southern front the Dhauladhar range, where the Main Boundary Thrust has been identified as an active structure from the analysis of thermochronological data, as well as from the Ravi and Beas rivers. Calculated denudation rates range from 0.2 to 3 mm/yr, with the highest rates localized along the front of the Dhauladhar range (1-3 mm/yr range). The data also display significant along-strike variability and

denudation rates appear to taper down below 1 mm/yr at the NW and SE tips of the range. Our data provide further support for sustained uplift of the Dhauladhar range at millennial time-scales and the existence of significant out-of-sequence deformation in this part of the Himalayan arc.

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