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Reconstruction of erosional stages in the Bhutan Himalaya through a combination of hillslope extracted morphological markers and knickpoint analysis

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Recently, advances in the evaluation of river channels have shown that transient erosional signals can preserve detailed information on the formation of topography and morphology of mountain ranges (e.g., Perron and Royden, 2012). Records of temporal variations in erosional activity within a landscape have also been demonstrated to be retained in the morphology of affected hillslopes (e.g., Colman and Watson, 1983). Here, we present a new method bringing together both the record of erosional activity stored in the hillslopes and the transient erosional signals stored along the river channel.

The limit equilibrium relationship between topography and erosional processes has been described in the work of both Selby (1982) and Blöthe et al. (2015), the former showing a direct dependence of stable slope angle to rock mass strength, while the latter study discusses the erosional potential of slopes exceeding the critical angle of the material (excess topography) through landsliding. We use these mechanical concepts in addition to geometrical criteria to identify hillslope surfaces related to former erosional stages in two large (∼5000 km2) catchments in the Bhutan Himalaya. These can then be tied to knickpoints extracted along the river profiles, thus allowing for a side by side analysis of hillslope and fluvial processes related to the recent tectonic and erosional activity of the region within and across catchments.

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