

Analysis of River Profiles in northwestern Bhutan

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With large alluvial plains, narrow gorges, prominent knick points, and chains of terraces or cut-off ridges, the deeply-incised valleys in Bhutan reflect an environment of diverse erosional activity. Topography ranges from 97 m to 7570 m, with characteristic postglacial landscapes typically located above ca 4200 m. The lower latitudes below ca 3000 m show high relief and terraced or linear hillslopes indicative of a fluvial origin. Although full channel analyses in the region suggest significant local tectonic contributions to longitudinal river profiles (Adams et al., 2016), we develop a method to isolate rivers in an apparently homogeneous tectonic block in the mid- to upper- elevations. Profiles of rivers in this region show a consistent pattern with a marked topographic step covering 2000 m of elevation change within 10 km. Field observations of knick points, terraces and cut-off ridges associated with the step suggest a regionally consistent signal resulting from changes in relative uplift or erosion rate. Chi plots correlate well for all channels when the base level is chosen to isolate rivers below the main alluvial plain, suggesting similar fluvial erosion histories in upstream regions. Employing third order topographic derivatives (Minár et al., 2013), we identify low angle slope sections/plateaus corresponding to terraces and/or extrapolated ridges that project onto former valley floor levels. Employing similar methods as those used to correlate fluvial knickpoints, these will be used to test for regionally consistent changes in fluvial and hillslope activity that may be tied to major tectonic or climatic changes.

REFERENCES

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