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Discrepancy between fluvial incision and erosion rates in Pamir

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Understanding mountain evolution relies on quantitative estimates of surface processes. Variations in magnitude allow to decipher the control of tectonic and climatic factors. However, significant discrepancies exist between fluvial incision and erosion rates in Pamir.
Optically stimulated luminescence (OSL)-based terrace incision along the Panj at the western Pamir margin outpaces cosmogenic nuclide (CN)-based erosion of marginal basins by up to 10 times.
Differences in the captured time interval of both methods are not convincing to explain the contrast. The millennial erosion rates are highest (1.0 – 1.5 mm/yr) where long-term (104 years) fluvial incision is moderate (2 – 5 mm/yr). In contrast, erosion is lower ($\sim$0.8 mm/yr) where incision is highest (7 – 10 mm/yr), although the millennial scale of rates suggests to represent the most recent stage of adjustment to base level lowering.
Analyses of fluvial incision and erosion patterns in Pamir reveal differing control factors. The longitudinal profile and valley profiles of the Panj highlight links between fluvial incision and tectonic structures. Several river captures across Pamir domes correspond to intense incision, while southern dome boundaries coincide with base levels of successive river segments. The interpretation of river captures implies sudden base level drops for basins at the Pamir margins. The generally high erosion at the Pamir margins (0.5 – 1.5 mm/yr) correlate with the resulting steep slopes (0.75 quartiles of values within a basin) with an R2 of $\sim$0.8. The coincidence of the highest erosion rates with increased moisture supply from the Westerlies indicates an additional role of precipitation that becomes evident in multiple linear regression of erosion with the 0.75 quartiles of steep slopes and precipitation (R2 of 0.93). Hence, steep slopes are the primary precondition for high erosion, but sufficient winter precipitation (snow) and the related concentrated discharge during the melting season are needed for an efficient sediment transport out of basins. Accordingly, the discrepancy between erosion in marginal basins and fluvial incision along the Panj is lowest ($\sim$2 - 3 times) where a minimum of precipitation facilitates the sediment transport from hillslopes into the river channels and out of basins.
We propose that river captures are responsible for the strong base level drop driving the incision along the Panj and consequently, initiate steep hillslopes that will contribute to high erosion at the Pamir margins. Precipitation may act as limiting factor to hillslope adjustment and consequently to erosion processes.