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Climatic vs tectonic forcing: the case of Pamir

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Surface processes in Pamir are temporally and spatially extremely variables. Our collaborative research demonstrated that, (1) the controlling forces such as climate and tectonic deformation have evolved during the Quaternary, (2) Westerlies and Monsoon have varying domains of influence and (3) the rates of deformation, erosion and incision are locally extremely high. The determination of the localization and intensity of active tectonic structures was allowed by the production of remote sensing based geomorphometric maps combined with published GPS and seismological data. Incision rates were measured by OSL and cosmogenic dating of river terraces. Modern erosion rates were calculated using AMS 10Be concentrations in river sediments. Tectonic deformation principally occurs along the borders of the Pamir domes, probably along propagating strike-slip faults reactivating older structures such as sutures and dome bounding faults. Most rivers are in imbalance and witness a strong reorganization of the drainage system during the Late Quaternary. The Panj itself is built by the concatenation of rivers by successive captures, the last one probably younger than MIS2. The average incision rate of the Panj, the main river draining Pamir and its main tributaries is about 4 mm/yr. Peak incisions reach 10 mm/yr where river captures induced high offsets with respect to base levels. Erosion rates are high at the Pamir periphery (ca 0.7 mm/yr) and very low on the plateau (ca 0.005 mm/yr). The Pamir can be subdivided in zones in which specific controlling forces are dominating. The Pamir plateau is dominated by diffusive hillslope processes contributing to further flattening. The main rivers are located in or nearby active faults. High erosion rates are probably sustained by steep hillslopes generated by high incision rates. Highest erosion rates are found were both Monsoon and Westerlies occur.