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Suspended sediment load, climate and relief in the central Pamirs

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Relief and climate affect the generation of sediment transport. While relief and climate also affect each other, their influence on sediment transport can be investigated separately to determine their direct impact on this matter. Taking into account the complex topography of the central Pamirs and the fact that this region marks the transition zone of the Westerlies and the northward Indian Summer Monsoon, this region provides an excellent basis to investigate the interrelationship between sediment transport, climate and relief.

The Panj River and its tributaries are representative for the hydrological setting of the central Pamirs as they drain most of the region. We first present suspended sediment characteristics from historical archive data for the whole river catchment and for the sub-catchments. We show the dynamics of the relationship between suspended sediment concentration and discharge on an annual basis for the different catchment sizes. The uppermost catchments are characterized by a transport-limited situation, showing a simple power-law relationship between discharge and sediment concentration for the entire year. The lowermost catchments show a strong hysteresis effect, especially in spring, which is related to the onset of snowmelt. The result is a differentiated power-law relationship within a year.
As snow and glacier melt control the discharge in the central Pamirs, we investigate the climatological conditions derived from remote sensing data. We do this with respect to the different sub-catchments and with a special focus on the temporal variability.
Results from the previous steps are finally interrelated with calculated geomorphological features at different catchment scales to characterize the suspended sediment load in the context of both relief and climatic conditions.

Our results suggest climate to play the first-order determinant for the generation of suspended sediment load. This is in particular due to the Westerlies that provide the bulk of precipitation as snow in winter. Eventually temperature triggers snowmelt and causes high sediment loads. Still, relief causes the sediment load indirectly by forcing the climatic setting and providing the potential energy for stream flow.