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Erosion model assessment using a high-resolution bedload-erosion dataset

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Morphological evolution of terrestrial and planetary landscapes is of increasing interest in the geosciences. In mountainous regions bedrock stream sections are prevalent. They are conduits for water and sediments and provide a base level for hillslope evolution. Their shape and development is a consequence of the interaction of uplift and erosion driving surface formation. Hence, the correct description of bedrock channel erosion is fundamental for landscape evolution modelling. Especially the understanding of how erosion rates depend on input factors like discharge, sediment transport and present topography is essential for scaling purposes.

Current bedrock erosion models comprise to different degrees bedload transport thresholds, actual bedload transport rates, and the associated tools and cover effects to reflect the underlying mechanistic processes and represent them with non-specific calibration factors (overview by Sklar & Dietrich, 2006). However, so far only few low resolution datasets exist that can be used to evaluate model validity for natural situations.

Based on a new discharge-bedload-transport-erosion field dataset with high temporal and spatial resolution (minutes and sub-millimetre respectively), we assess here in how far existing erosion models can reproduce the measured temporal evolution of erosion rate during a flood event. This evaluation illuminates the importance of incorporation of bedload transport in erosion modelling and advance mechanistic process understanding to serve as a basis for model choice for e.g. scaling purposes in landscape modelling.