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The influence of sediment thickness on energy delivery to the bed by bedload impacts

Jens Turowski (1) and Jean-Pierre Bloem (2)

(1) GFZ German Research Centre for Geosciences, 5.1 Geomorphology, Potsdam, Germany (turowski@gfz-potsdam.de), (2) Swiss Federal Research Institute WSL, Zürcherstrasse 111, CH-8903 Birmensdorf

Fluvial bedrock erosion rates due to impacting sediment particles are thought to be proportional to the energy delivered to the bedrock. When sediment particles cover the bed, they reduce the energy transmitted to the bed by an impacting particle. We measured the decline of energy transferred through sediment covers of increasing thickness. The energy arriving at the bed is a function both of the cover thickness and the grain size of the covering sediment. Using a simple stochastic model of cover distribution, we show that the partial energy delivery is important when many particles already reside on the bed. However, in these situations an erosion threshold could become important. On grounds of the presented data we expect that the areal distribution of sediment in a bedrock channel dominates total energy delivery, and that partial energy delivery to the bed through a sediment layer can be neglected for most modelling purposes.