



Testing new roughness approaches for calculating bedload transport rates in steep mountain streams

M. Nitsche, A. Badoux, J. M. Turowski, and D. Rickenmann

WSL Swiss Federal Institute for Forest, Snow and Landscape Research, Birmensdorf, Switzerland

Currently used methods for predicting bedload transport do not appropriately represent typical roughness elements of small, steep mountain streams, like step-pool sequences, large boulders or woody debris. Besides sediment supply, flow resistance due to such form roughness elements appears to be an important control on bedload transport rates in small, steep mountain streams.

Recently, new approaches based on laboratory experiments were proposed to assess flow resistance due to form roughness. They quantify the effects of generalized models of roughness elements to flow resistance. Furthermore, several empirically derived formulae to calculate bedload transport rates including a respective roughness parameter have been published. None of these approaches has been systematically tested with field observations.

We review these approaches and analyze their applicability for natural streams. For this purpose, we measured the required roughness parameters for seven Swiss mountain streams, with local channel gradients ranging from 1.5 to 16.5 %, and catchment areas from 12 to 43 km². We calculated flow resistance and bedload transport for sediment transport events in 2000 and 2005, for which information on discharge and transported bedload volumes are available. By comparing calculated and observed data of bedload transport we identified whether and in which range the examined approaches are suitable for application in natural stream conditions.