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Evaluation of bedload transport predictions using different flow resistance equations for large scale roughness in steep mountain streams

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Steep mountain streams typically feature large scale roughness elements like rarely mobile boulders, step-pool sequences, and a varying bed width. Flow resistance due to such roughness elements appears to be an important control on bedload transport rates. Many bedload transport equations overestimate the transport in steep streams by up to three orders of magnitude. Only few approaches exist that take into account the typical large scale rough-ness elements, and systematic tests with field observations are lacking. Here, several approaches are considered that explicitly include a measure of large scale roughness to calcu-late flow resistance. These approaches are combined with bedload transport equations and the predictions are compare with field measurements of transported bedload volumes. The basis for the evaluation are data on discharge, transported sediments and channel characteristics in 13 Swiss mountain streams. The streams have channel slopes ranging from 2 to 19 %, and catchment areas of 0.5 to 170 km2. For six streams there are series of mostly yearly sediment yields and for the other seven streams sediment volume estimates are available for large flood events in 2000 and 2005. The data is used to evaluate the performance of the approaches for bedload prediction and their feasibility for field applications.