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Comparing the results of bed load transport equations to field measurements in an Alpine river

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Transport processes play a decisive role in fluvial systems when sediment is carried from source to sink. In a mountain river reach the morphologic development is basically determined by the bed load transport. Attempts to observe bed load entrainment and movement directly in the field are often complicated through difficulties in spatial and temporal variability and a necessary field effort. For this reason the development of sediment transport equations has a long history. A variety of such formulae has appeared since the first "modern" equation of DU BOYS (1879) was presented. Each of them is based on one of the following approaches: shear stress, stream discharge, stochastic function for sediment movement or stream power. Many of these equations have been developed on the basis of flume data or field data sets from specific river reaches. Therefore a critical consideration of their application to other natural streams is essential. A lack of available field data is undoubtedly the cause for a deficiency of such testing. (GOMEZ & CHURCH 1989; HABERSACK & LARONNE 2002; MARTIN 2003)
In this study a selection of sediment transport equations is tested against data sets of 50 field observations from the Partnach River, in the Reintal Valley, Germany, in the years 2008-2011. At the outlet of this alpine catchment the channel bed is characterized by a gradient of 2 % and a median grain size of 24 mm. Bed load samples were taken using the Helley-Smith sampler at flow rates ranging from 1.0 – 5.9 m3/s.
According to these data evaluations performance and feasibility of transport equations for field applications are checked. Up to now the results between observed and calculated transport rates show a large scatter of more than several orders of magnitude. This underlines the statements from GOMEZ AND CHURCH (1989) that most equations under/over predict transport rates if the basic requirements (steady flow, equilibrium load), which are usually assumed, are not fulfilled.

References

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