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Application of a sediment transport model for steep slopes and comparison with LiDAR data in an ungauged catchment

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Modelling bedload transport in steep headwater channels/torrents is very challenging. For the calibration of a hydraulic model generally flow data are necessary, but in ungauged catchments these data are mostly not available. The input hydrographs, necessary for the simulation model, need to be generated with a rainfall runoff model and calibrated with reconstructed hydrographs. Cross-sections without morphological change have to be used for the recalculation of the peak discharge. For the purpose of a model calibration airborne LiDAR data were used to determine the morphologic changes during the extreme flood event that occurred in August 2005 in the Swiss Alps. Two high resolution elevation models for the Chirel stream watershed were available. The first was from the year 2001 and the second was generated shortly after the extreme event. Areas of erosion and deposition were verified with aerial photos. For torrents it is generally assumed that major morphologic changes occur only during flood events. During the considered time period no other major floods occurred in the catchment. It is estimated that about 150 000 m^3 of bedload were mobilized during the flood event of August 2005. A one dimensional sediment routing model for steep torrent channel networks called SETRAC has been developed at University of Natural Resources and Applied Life Sciences, Vienna. SETRAC is the acronym for Sediment Transport Model in Alpine Catchments. In SETRAC the water runoff is given as input hydrographs at discrete points. A kinematic flow routing of the flood hydrograph is performed in the channel network. Different sediment transport formulae and flow resistance approaches can be selected in SETRAC. The sediment is transferred through

the channel network considering a sediment budget in sections. Initial sediment stock can be assigned for each channel reach. The model has been applied to calculate the bedload volumes that were mobilized during the extreme event and compared with the sediment volumes calculated from the comparison of the LiDAR based elevation models. This case study of an extreme event in the Swiss Alps demonstrates the models capability and limits to compute sediment transfer in a mountain stream.