



Sediment transport simulations in a distributed hydrological catchment model

Markus Konz (1), Michael Chiari (2), Jens Turowski (3), Peter Molnar (1), Stefan Rimkus (1), Dieter Rickenmann (3), and Paolo Burlando (1)

(1) ETH Zürich, Hydrology and Water Resources Management, Zürich, Switzerland (markus.konz@ifu.baug.ethz.ch, 0041 44 633 10 61), (2) Institute of Mountain Risk Engineering, University of Natural Resources and Applied Life Sciences, Peter Jordan-Strasse 82, 1190 Vienna, Austria, (3) Swiss Federal Research Institute WSL, Mountain Hydrology and Torrents, Zürcherstrasse 111, 8903 Birmensdorf, Switzerland

Sediment transport and erosion processes in channels are important components of natural hazards related to flood events in alpine environments. Therefore, prediction methods used for flood risk mitigation require a reliable simulation of sediment transport rates, deposition and channel erosion. A distributed hydrological model has been further developed to support transient simulations of river bed erosion and deposition processes. The hydrological model simulates all relevant components of the water cycle and non-linear reservoir methods are applied for water fluxes in the soil and on the surface. For the solution of hydrodynamics in the channel the kinematic wave approach is used. The original hydraulic simulations have been modified in a way that flow resistance due to form roughness can be considered optionally in the simulation of sediment transport processes as well as the effects of armour layers on the transport threshold discharge. Several transport equations are implemented and the modeler has the possibility to apply the model in the most adequate way in order to meet the specific catchment conditions. Slope erosion processes are also simulated and coupled to the channel sediment balance, in order to simulate the sediment supply to the channels and the long-term dynamics. The advantage of the investigated approach is the integrated simulation of the entire water balance and flood modeling combined with soil-channel coupled erosion and transport simulation. This is expected to allow the simulation of complex hydrological hazards that frequently occur in mountainous catchments. Back-calculations of the 2005 flood events in the Bernese Alps of Switzerland are encouraging and the comparison with well established modeling tools shows the reliability of the modeling concept.