Geophysical Research Abstracts
Vol. 17, EGU2015-6166, 2015
EGU General Assembly 2015

Physical modelling of sediment transport in mountain torrents upstream of open check dams

Sebastian Schwindt, Mario J. Franca, and Anton J. Schleiss

Laboratory of Hydraulic Constructions, Ecole Polytechnique fédérale de Lausanne, Lausanne, Switzerland (sebastian.schwindt@epfl.ch)

Dynamic morphological processes in mountain torrents do not only attract the attention of many contemporary researchers, but are also a relevant issue for the design of flood protection measures in the downstream sections where dwellers may be threatened by the important potential of flows with high concentration of sediments. Events which have a morphodynamic effect are simulated at the Laboratory of Hydraulic Constructions (LCH) in order to optimize the design of a flood protection measure, notably open check dams. Different scenarios with a fix bed consisting of boulders as well as mobile beds are studied and the influence of flow constrictions, i.e. distinct geometric configurations of open check dams are analysed. Three varying water pumped discharges in the order of 5 to 20 l/s are tested with progressively increasing solid discharges of 1, 3 and 6 $\%$ of the liquid discharge according to the transport capacity. The moistened sediments are introduced via a system of conveyor belts and are then mixed with the liquid discharge in an about 3 m long rough trapezoidal channel with a base width of 24 cm. The mean diameter D_m of the injected sediments is 0.86 cm and the dimensionless grain size distribution is in line with a normalized shape derived from over 60 streams in the Alps. A wide range of frequent floods in morphologically diverging types of mountain torrents is covered, in particular regarding the sediment availability in the catchment area and along the river. A basic assumption here is considering that the frequent floods are floods with return periods between 1 to 5 years and are the most important process in terms of amounts of sediment transport. This may be arguable for some mountain torrents and landscape effective processes which are driven by floods with return periods of more than several decades. In order to identify benchmarks for hydraulic parameters which lead to the obstruction of flow restrictions at mountain torrents, the water depth is evaluated using ultrasonic probes, the flow velocity is derived by particle image velocimetry (PIV) and the occurrence of sediment depositions as well as the sediment outflow are observed. The results are in particular analysed in the moment when the flow constriction causes rising back water effects.