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Physical scale experiments on torrential filter structures

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In the framework of the INTERREG Project "SedAlp" physical scale model experiments are carried out in the hydraulic laboratory of the Institute of Mountain Risk Engineering at the University of Life Sciences in Vienna in order to optimize torrent protection structures. Two different types of check dams are investigated. A screen-dam with inclined vertical beams is compared with a beam-dam with horizontal beams. The experiments evaluate the variation of sediment transport of these structures including the influence of coarse woody debris. Therefore the distance between the steel elements can be adjusted to show their ability to filter sediment. The physical scale of the experiments is 1:30. All experimental runs are Froude scaled. Both dams are tested in elongated and pear-shaped sediment retention basins in order to investigate the shape effect of the deposition area. For a systematic comparison of the two check dams experiments with fluvial bedload transport are made. First a typical hydrograph for an extreme flood with unlimited sediment supply is modelled. A typical torrential sediment mixture with a wide grain-size distribution is fed by a conveyor belt according the transport capacity of the upstream reach. Then the deposition is scanned with a laser-scan device in order to analyse the deposition pattern and the deposited volume. Afterwards a flood with a lower reoccurrence period without sediment transport from upstream is modelled to investigate the ability of the protection structure for self-emptying. To investigate the influence of driftwood on the deposition behaviour experiments with logs are made. Different log diameters and lengths are added upstream the basin.
The results show, that the deposition during the experiments was not controlled by sorting-effects at the location of the dam. The deposition always started from upstream, where the transport capacity was reduced due to the milder slope and the widening of the basin. No grain sorting effects could be identified. The deposition volume can be controlled by the beam distance if there is no driftwood and the pear shaped basin resulted in higher deposition than the elongated basin. Driftwood often causes log jams at the filter structure and therefore increases the trapping efficiency for bedload material. Beam dams with horizontal beams produce worse log jams than screen dams with inclined vertical beams. Even if the log-jams are removed, the self-emptying efficiency is limited.