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Physical experiments on driftwood retention at the torrent Kleine Schliere, Alpnach

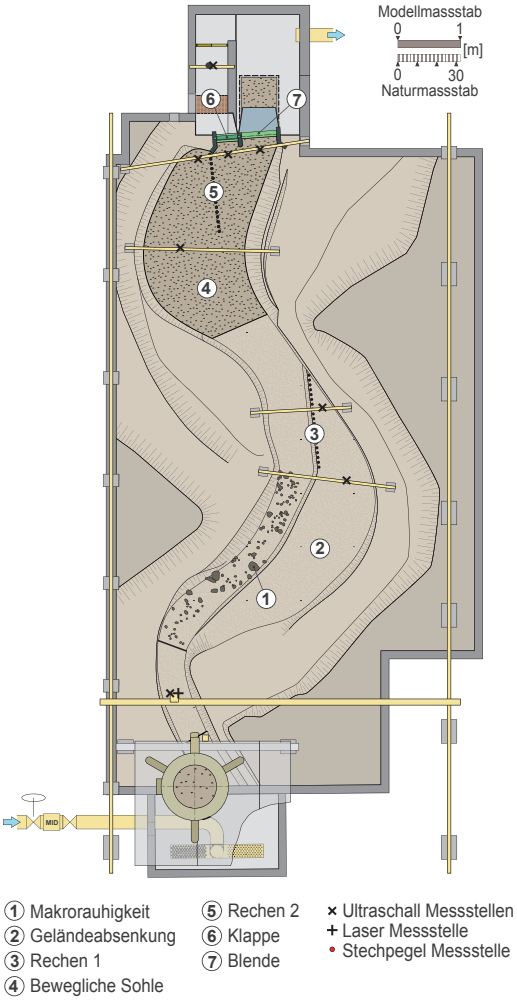

Fig. 1: Hydraulic model of the driftwood retention at a scale of 1:32

Fig. 2: Driftwood accumulation at the rack after a short 300-year flood

The floods of the torrent Kleine Schliere always threatened the village Alpnach. The flood event in August 2005 has shown the problems and limits of the existing flood protection. This flood, with a peak discharge of 80 m^3/s was the largest event in the 33 years long history of the water level Alpnach. Especially the huge amount of driftwood increases the risk of an inundation of the densely populated area. The trunks can block several bridges in the village. Furthermore the discharge capacity of the bed-load transport channel is limited to 100 m^3/s. In the case of big events the torrent overflows the banks and the water cannot flow back in the channel. The surrounding village centre would be heavily affected. Additionally the channel, which is established as a sequence of step structures can easily be eroded in case of insufficient bed-load transport during a flood event.

Because of the recognized risk, a flood protection project for the Kleine Schliere was created. Besides some measures in the downstream channel, an overflow corridor and the corresponding flow-dividing structure was developed. Discharges higher than 100 m^3/s are restrained by a blind. The rest is channelled through a bypass. This construction is located at the end of a river widening. Additionally a system of two driftwood racks were planned to avoid the blocking of the construction. The driftwood retention happens with two racks in outer bends. To optimize the driftwood retention an artificial flood plain is situated next to the upper rack. The river widening next to the second rack is increased to create enough space for the driftwood.

The physical model is built at a 1:32 scale (Fig. 1). The aims of the model are the survey the functionality of the driftwood rack as well as the behaviour of the bed-load transport for the most important flood scenarios. The water level is measured with point gauges and ultrasonic sensors. Bed level changes are detected with a laser distance meter mounted on a 3D traversing system. The driftwood is downscaled geometrically and prepared from smaller wood branches. It is added manually during the model tests. Driftwood and sediment balances are determined after each experiment. Four different scenarios depending on the duration and intensity of the precipitation are tested. The peak discharge ranges between 70 m^3/s and 135 m^3/s. The maximum bed-load is 20’000 m^3. In the worst case the racks should hold back nearly 5’000 m^3 driftwood (Fig. 2).

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