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Characteristic Load Parameters for flexible Debris Flow Barriers investigated through Laboratory Experiments

A. Gubler, A. Volkwein and C. Wendeler
WSL Swiss Federal Research Institute (volkwein@wsl.ch)

In order to safely design flexible debris flow barriers physical modelling helps to investigate relevant load characteristics. The study includes a series of 70 laboratory experiments analysing the interaction between a debris flow and a net barrier using original debris flow material taken from four different sites. The presentation will give detailed information on the results summarized below

The chute experiments with start volumes between 50 and 150 l were performed at different slope inclinations ranging 25 to $50\,\%$. The experiments are scaled to reality based on Froude similarity and other significant dimensionless numbers. Assuming a Froude similarity with a length scale factor between 10 and 30 the velocities obtained in the experiments were too large, however the volumes too small. The front shapes obtained were modelled realistically, whereas their tails were too short.
The friction losses during the flow can be quantified based on the changing rate of the potential energy. The losses reduce in size for larger flow heights but increase for steeper slope angles. Therefore, friction influences the flow but the flow characteristics also influence the friction. The results obtained with natural debris flow material are transferable to full-scale debris flows.

The modelled barriers had different mesh sizes and basal openings between barrier and river bed. The barriers filled up at mesh opening sizes of the characteristic grain size $d_{90} = 3cm$ and 4 cm basal openings. 6 cm openings (about twice the grain size) did not fill the barriers up.
The maximum impact loads measured at the barrier supports behave directly propor-

tional to the kinetic energy of the debris flow, the static loads of the filled barriers are proportional to the impact velocity squared as well as the ratio between maximum and static loads, the latter also depending on the used debris flow material. To dimension flexible debris flow barriers the estimation of the maximum forces depending on the kinetic energy of the debris flow seems to be more plausible than the up to now normally used approaches based on the hydrostatic pressure combined with dynamic factors.