Deciphering debris-flow erosion

Experimental assessment of the relation between flow composition and bed erosion

Department: Physical Geography
Research group: Landscape functioning and natural hazards
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Project description

Debris flows are masses of soil, rock and water that rush down mountainsides and spill onto valley floors, where they can devastate people and property. The number of casualties and the amount of damage caused by a debris flow depends on its volume. Unfortunately, prediction of debris-flow volume, and thus hazard mitigation, is currently hampered by our limited understanding of the processes of debris-flow erosion.

To minimize debris-flow hazards, the mechanisms of debris-flow erosion thus urgently need to be unraveled. But which processes and mechanisms control debris-flow erosion? Limited field and experimental data suggest that debris flows may entrain bed material by 1) basal-shear forces, by material sliding along the bed surface; and 2) impact forces, by rocks hitting the bed. Yet, how these forces vary between flows and affect bed erosion is poorly understood.

The student will perform experiments in a large novel debris-flow flume in the Earth Science Simulation Lab (ESL), equipped with state-of-the art measurement devices such as load cells, geophones, and laser scanners. The student will build up a dataset on the effects of debris-flow composition (e.g., amounts of coarse particles, clay, and water) on bed erosion over dry and wet bed sediment. With this dataset the student will then assess the relative importance of basal-shear and impact forces on the erosion process. The experiments and resulting insights in the processes and mechanisms of debris-flow erosion will be published in a scientific publication that will be prepared together with the student. The experiments are part of the NWO-VENI project of Dr Tjalling de Haas.

Job requirements

Interest in experimental lab work, understanding of earth surface processes, and basic programming skills (e.g., Matlab, Python) are recommended.