Geophysical Research Abstracts
Vol. 16, EGU2014-2753, 2014
EGU General Assembly 2014
© Author(s) 2014. CC Attribution 3.0 License.

Field and laboratory analysis of hillslope debris flows in Switzerland

Marcel Hürlimann (1), Brian W. McArdell (2), and Christian Rickli (2)

(1) Department of Geotechnical Engineering and Geosciences,Technical University of Catalonia (UPC), Barcelona, Spain, (2) Swiss Federal Institute for Forest, Snow and Landscape Research WSL, Birmensdorf, Switzerland

Hillslope or open-slope debris flows are unconfined flows that originate by shallow failures in colluvium or other unconsolidated material. The most common triggering factor is rainfall, sometimes combined with snowmelt. Hillslope debris flows can reach high velocity and runout distances up to several hundreds of meters. Although these facts confirm the important hazard of hillslope debris flows, little research has been performed on this type of mass movement. Thus, the present study intends to improve the knowledge on the characteristics of the initial failure as well as on the runout mechanisms. Two major tasks were carried out to achieve this major goal. First, detailed inventories of hill-slope debris flows in Switzerland during the last two decades were analysed. The datasets include field observations and measurements on morphometrics, hydrology and geology of more than 500 events. Second, laboratory tests were carried out to study the effect of the water content, the clay amount and the volume on the post-failure behaviour of the flow.

The investigation of the inventories show that hill-slope debris flows mostly starts as translational slides of up to 400 - 500 m3 at a terrain slope angle between 25 to 45º. The initial failure has normally a mean thickness from 0.2 to 1.5m, a width between a few meters and 30 m and a length of 5 to 50 m. The maximum runout distance of the event is mostly less than 200 m, but there are also some events with distances of up to 500 m. These data were used to dimension the experimental set-up, with a scale factor of 20 and represented by a 7.5m long and 30º inclined laboratory slope. Flow velocity and flow depth were measured using point lasers installed at different positions along the slope and a high-speed camera, while the final deposit was documented using laser scanning techniques. First results with mixtures of 4 and 10 dm3, using clay amounts between 5 and 20% and water contents ranging from 22 to 32% show that even small changes of the clay amount and the water content strongly alters the behaviour of the flow and directly influence the maximum runout. The relationship between total runout distance and water content is best fit by a power law, which is consistent with previous studies.

The results of this on-going study improve the understanding of the initiation and kinematics of hill-slope debris flows and provides useful inputs for a correct hazard assessment of this type of mass movements.