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Influence of rainfall on the initiation of debris flows at the Illgraben catchment, canton of Valais, Switzerland

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Debris-flow triggering is controlled by factors which are difficult to measure or monitor. Here we describe interpretation of rainfall measurements from the Illgraben, an active debris-flow catchment in the Swiss Alps that is characterized by steep slopes and very abundant sediments. Using high-resolution rainfall data from within the catchment from 2001-2006, we investigate thresholds for debris flow activity considering parameters such as duration, intensity, total rainfall amount, and antecedent rainfall for 54 rainfall events, 23 of which produced debris flows.

Because in the investigation area debris flows or similar events occur with almost every convective rain storm, an individual storm was defined as an event that exceeded quite low intensities (1.1mm/10 minutes and 4.1 mm/hour) and accumulated rainfall amounts (13 mm). Traditional duration-intensity curves for the Illgraben, which are very low in comparison with typical published curves, result in a false-prediction more than half of the time, and thereby promoting a closer look at the data. One interpretation is that this catchment is much more limited in the availability of rainfall than sediment for producing debris flows.

Similar to other Alpine studies, we find that debris flows are triggered by high-intensity, short-duration storms and typically are associated with the maximum 10-minute intensity, even following relatively dry periods. Moreover and also in agreement with other studies, we observe no correlation with antecedent rainfall. However, antecedent moisture may play a role because there is a difference in the triggering storms in the summer (very strongly correlated with rainfall intensity) compared with spring snow-melt periods (May-June, weaker correlation with intensity).

In future work, we will investigate the role of soil moisture more thoroughly through

a combination of field, monitoring, and modelling work.