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Erosion and deposition in a debris flow torrent channel: Influence of event type and rainfall

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Progressive entrainment or deposition of sediment during a debris flow is related to the delivery of sediment from upstream as well as the properties of the flow and the sediment on the channel bed. Herein we investigate these processes at the Illgraben catchment in the southwest Swiss Alps. The Illgraben catchment, which has been monitored for debris flows since 2000, is characterized by steep slopes, abundant sediment, and frequent debris flow activity. The objective of this study was to analyse the changes of the channel bed elevation related to the record of debris flow activity and the high-resolution precipitation records. Herein we focus on bed elevation changes along one reach of the torrent channel close to the downslope end of the debris fan, where extensive photographic and video records are available.

Between 2001 and 2006, the bed level elevation varied by a maximum difference of 8 m, generally progressively increasing from 2001 to the middle of 2005, followed by a generally progressively decreasing level to the end of 2006, followed again by a tendency to increase in elevation in 2007. A similar cyclic behaviour is apparent in the monthly and annual precipitation data: the transition to high bed elevations was generally associated with smaller total precipitation amounts. Annual bed level changes were negative (erosion) when more large storms with debris flows occurred than large storms without debris flows, and conversely. Therefore, debris flows tended to be erosive and large floods without debris flow were depositional. Additional bed erosion sensors are being installed that will permit a correlation of bed erosion with debris flow properties such as normal and shear forces generated by the flows, and will

further allow us to determine the timing of erosion within individual debris flows.