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Evolution of the Toma hills and transport of flood deposits in a propagating Flims rock avalanche (Grisons, Switzerland)

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Rock avalanches are amongst the most destructive natural hazards in mountaineous regions. Understanding the processes of disintegration and entrainment is required to assess the complex flow behavior and predict the runout path and length in future models. The character of the entrained material and the terrain significantly contribute to the frictional resistance, the velocity and runout length of the rock avalanche. Far reaching rock avalanches are hypothesized to be linked to the entrainment of water and/or fine grained sediments.
The Flims rock avalanche (∼8900 yrs) is the largest known rock-slope failure in the European Alps and has fascinated researchers with its complexity and diversity of features ever since. This study focuses on the hypothesized impact of the Flims rock avalanche on (Paleo-) Lake Bonaduz. This massive impact probably created a high flood wave – our models show heights of up to 200 m – and highly fluidized rock material. The Bonaduz gravel and similar flood deposits were investigated in terms of thickness and distribution. We found possibly event-related land marks and flood deposits more than 30 km far down the Rhine valley. By detailed sedimentological mapping and ERT measurements with penetration of up to 120 m depth, we deciphered the stratigraphic relation between the Bonaduz gravel and the Tamins rock avalanche deposits, as well as between the Bonaduz gravel deposits and the Cresta hills. Geophysical insights into the Cresta/Toma hills provide new information on their genesis. The results imply blocky cores with an agglomeration of smaller boulders/gravel which drift and override the Toma core, building the smoothly shaped top. We consider a simultaneous but at the front slower movement related to the main rock-avalanche flow.
This study contributes to an improved understanding of motion dynamics in rock avalanches, the genesis and transport of outburst-flood deposits and the characteristics of Toma hills resp. hummocks in rock-avalanche deposits.