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# Assessing the debris flow run-out frequency of a catchment in the French Alps using a parameterization analysis with the RAMMS numerical run-out model

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Debris flows occurring in the European Alps frequently cause significant damage to settlements, power-lines and transportation infrastructure which has led to traffic disruptions, economic loss and even death. Estimating the debris flow run-out extent and the parameter uncertainty related to run-out modeling are some of the difficulties found in the Quantitative Risk Assessment (QRA) of debris flows. Also, the process of the entrainment of material into a debris flow is until now not completely understood. Debris flows observed in the French Alps entrain 5 – 50 times the amount of volume compared to the initially mobilized source volume. In this study we analyze a debris flow that occurred in 2003 at the Faucon catchment in the Barcelonnette Basin (Southern French Alps). The analysis was carried out using the Voellmy rheology and an entrainment model imbedded in the RAMMS 2D numerical modeling software. The historic event was back calibrated based on source, entrainment and deposit volumes, including the run-out distance, velocities and deposit heights of the debris flow. This was then followed by a sensitivity analysis of the rheological and entrainment parameters to produce 120 debris flow scenarios leading to a frequency assessment of the run-out distance and deposit height at the debris fan. The study shows that the Voellmy frictional parameters mainly influence the run-out distance and velocity of the flow, while the entrainment parameter has a major impact on the debris flow height. The frequency assessment of the 120 simulated scenarios further gives an indication on the most likely debris flow run-out extents and heights for this catchment. Such an assessment can be an important link between the rheological model parameters and the spatial probability of the run-out for the Quantitative Risk Assessment (QRA) of debris flows.