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Assessment of the frictional effect of forests on debris flow runout in numerical models

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Geomorphic processes like debris flows constitute a major risk in alpine regions. It is therefore of prime importance to delineate areas of high hazard potential to reduce the loss of life and severe damages to settlements and infrastructure. The two dimensional dynamic model RAMMS DF (RApid Mass MovementS Debris Flow) is an engineering prediction tool designed for predicting the flow intensity and runout behavior of debris flows. It is based on a numerical solution to the shallow water equations for granular flow including the well known Voellmy friction relation. In this contribution we use RAMMS to simulate recent debris flow deposition on forested fans reconstructed by dendrogeomorphic analyses for two study sites located in the Austrian Alps. Trees obviously influenced by past debris flow activity were sampled and further used to determine the spatial extent of past depositions on the fan. An average deposition height assessed from field investigations was used to derive an estimate of past event volumes as input for RAMMS. Simulation results were improved using separate friction parameter sets for forested areas and as a consequence the replications of the mapped deposition pattern were derived. Our goal is to derive a physically based algorithm which depends partially on the properties of the trees (e.g. spacing and diameter) and on the granulometry of the flow. This study contributes to the evaluation of realistic model parameters for simulation of debris flow deposition outside of the channel on alpine fans.