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Two models for the automatic susceptibility mapping of snow avalanches over very large regions

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Several governmental and regional agencies, in Europe and South America, are interested in having a rough assessment of areas that can be affected by snow avalanches over wide regions (thousands of km2). In order to make such assessment technically feasible, only few input data should be required and the computation time should be kept relatively short. For this purpose, we have developed two models requiring only a digital elevation model (a 25 m grid cell in our case) as input data. For both models release areas were selected according to the slope angle (30 to 55 degree).
The first model (RAS) is an extension of the alpha/beta method (Lied & Bakkehoi 1980) that is originally designed to work on predefined profiles. In this model, from each release point a profile is automatically defined using a flow path algorithm. Then the angle beta is measured on the digital elevation model and the angle alpha is calculated using a statistical alpha/beta relationship adapted to the region. Finally, from each release point the propagation is estimated by the cone method (Jaboyedoff 2003) using the angle alpha.
The second model (DF_IGAR) couples a multiple flows algorithm (Holmgren 1994) with a two parameters friction model (Voellmy). The multiple flow part defines the possible paths of the snow, taking into account the topography and an inertia factor, but it does not specify where the avalanche will stop. The friction part of the model defines how far the avalanche can flow.
Both models have been proved to be efficient on large regions, with of course their respective limitations, advantages and drawbacks. They do not intend to compete with site specific physically based models, calculating for instance dynamic pressures, but they provide a practical solution for regional assessment and hotspots detection.