Geophysical Research Abstracts
Vol. 14, EGU2012-4434-2, 2012
EGU General Assembly 2012

Influence of snow-cover properties on avalanche dynamics

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Snow avalanches with the potential of reaching traffic routes and settlements are a permanent winter threat for many mountain communities. Snow safety officers have to take the decision whether to close a road, a railway line or a ski slope. Those decisions are often very difficult as they demand the ability to interpret weather forecasts, to establish their implication for the stability and the structure of the snow cover and to evaluate the influence of the snow cover on avalanche run-out distances.

In the operational programme 'Italy-Switzerland, project STRADA' we focus on the effects of snow cover on avalanche dynamics, and thus run-out distance, with the aim to provide a better understanding of this influence and to ultimately develop tools to support snow safety officers in their decision process.

We selected five avalanches, measured at the Vallée de la Sionne field site, with similar initial mass and topography but different flow dynamics and run-out distances. Significant differences amongst the individual avalanches could be observed for front and internal velocities, impact pressures, flow regimes, deposition volumes and run-out distances. For each of these avalanches, the prevailing snow conditions at release were reconstructed using field data from local snowpits or were modeled with SNOWPACK.

Combining flow dynamical data with snow cover properties shows that erodible snow depth, snow density and snow temperature in the snow pack along the avalanche track are among the decisive variables that appear to explain the observed differences. It is further discussed, how these influencing factors can be quantified and used for improved predictions of site and time specific avalanche hazard.