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A methodology for determining the optimal position and dimensions of snow fences in alpine terrain

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Snow fences are used to accumulate snow in defined areas as permanent protection measures. However, the snow cover distribution in alpine terrain is known to be highly influenced by the local wind field. Therefore positioning and dimensioning of snow fences is -contrary to level terrain- a difficult matter. In this study we present a new methodology to achieve this goal and we provide an example of a potential avalanche release zone.
The methodology contains the following steps: 1) Statistical analyses of wind data from permanent meteorological measurement stations in close distance to the investigation area. 2) Additional automatic wind measurements within the investigation area. 3) Generation of snow depth maps using terrestrial laser scanning (TLS) technology and picture analyses. In this respect the TLS device, RIEGL LPM-321, was applied. The following technical features were provided by the used device: a) Measuring range: up to more than 4000 m, b) beam divergence: 0.8 mRad, c) scanning speed: 1000 Hz d) wavelength of 0.9 μm (near infrared). The spatial distribution of snow depth was measured and showed an accuracy of +/- 8 cm and a high resolution of 24 cm (at a distance of 800 m). This measuring system is able to capture the major snow drift zones.
4) Three-dimensional wind field modeling applying the atmospheric model ARPS (Advanced Regional Prediction System). Very high resolution wind fields (5 m horizontal resolution) were simulated initialized by measured wind data and data gained from a lower resolution atmospheric model (INCA) as input. 5) Computation of potential snow fence locations using the Tabler equation for classified snow drift events.
Results of the example are presented and their reliability for positioning and dimensioning of snow fences in alpine terrain is discussed.