Statistical Assessment of regional Avalanche Danger using SNOWPACK parameters

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SNOWPACK is a one-dimensional finite element model for heat and mass balance, snow metamorphosis and surface energy exchange. The model describes snow stratigraphy and its development. Whereas a few physically-based stability estimations are already implemented in the model, a reliable link between modelled output and regional avalanche danger has not yet been established. On the other hand, numerical avalanche forecasting which only relies on meteorological variables has shown insufficient results, mainly since snow cover information is lacking. Therefore, we used for our statistical approach the output of a physically based snow cover model combined with meteorological variables to achieve better predictions of the regional avalanche danger. Snow stratigraphy was simulated for the location of two automated weather stations in a test region in Switzerland. The simulation included virtual slopes of the four main aspects. Only dry snow situations were considered. Statistical methods, including classification trees, artificial neural networks, support vector machines and nearest neighbor, were trained on the forecasted regional avalanche danger (European avalanche danger scale), which was issued daily by the Swiss avalanche warning service. Depending on the method, a misclassification rate of less than 15% applied on a test data set is achieved. Since this misclassification error is not always the best criterion for a useful model, other criteria are discussed. These findings suggest that SNOWPACK is a helpful tool to support regional avalanche danger forecasting, especially since SNOWPACK can be used to create prognostic output.