Geophysical Research Abstracts
Vol. 14, EGU2012-11793, 2012
EGU General Assembly 2012

Analysis of the atmosphere-snow energy balance during wet-snow instabilities

C. Mitterer and J. Schweizer
WSL Institute for Snow and Avalanche Research SLF, Switzerland (mitterer@slf.ch)

Air temperature is commonly used among practitioners for predicting high wet-snow avalanche danger. The predictive power of this meteorological variable is, however, unclear and a reliable forecast based on this proxy is not often possible. As melt water is the major driver of wet-snow instability and snow melt depends on the energy input into to the snow cover, we computed the energy balance and studied whether it is a better proxy than meteorological parameters such as air temperature for predicting periods with high wet-snow avalanche activity. The energy balance was partly measured and modeled for virtual slopes at different elevations for the aspects south and north using the 1-D snow cover model SNOWPACK. We used measured meteorological variables and computed the energy balance and its components to compare wet-snow avalanche days to non-avalanche days for four consecutive winter seasons in the surroundings of Davos, Switzerland. Air temperature, the net shortwave radiation and the energy input integrated over 3 or 5 days showed best results in discriminating event from non-event days. Multivariate statistics, however, revealed that for better predicting avalanche days, information on the cold content of the snowpack (i.e. snow temperature) or the snow surface temperature is needed. This additional information indicates whether the energy input was used for warming the snowpack or directly for melting (water production). Prediction accuracy with measured meteorological variables was as good as with computed energy balance parameters, but simulated energy balance variables accounted better for different aspects, slopes and elevations than meteorological data. Consequently, we performed model runs with the distributed energy and snow cover model ALPINE3D. First results were promising in determining zones with high potential of wet-snow avalanche release. Days and areas with high daily maximum energy input and snow temperatures close to a 0°C isothermal agreed fairly well with the release zones of recorded avalanche events. Wet-snow avalanche cycles due to rain-on-snow events were not detected by both models. For the one recorded rain-on-snow event, precipitation was simulated as snow.