Snow modeling using SURFEX with the CROCUS snow scheme for Norway

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In 2010 a research project was initiated with the aim to investigate methods to establish a regional snow avalanche forecasting system for Norway. A part of this project concerns snow models that simulate snow stratigraphy and physical parameters in the snow pack. For this purpose we have used the CROCUS snow scheme within the land surface model SURFEX for the location of 18 weather stations in Norway. We have carried out a sensitivity study of available meteorological data. Few weather stations have measurements of all the parameters used by the model on an hourly basis. Therefore it is interesting to investigate if certain parameters can be replaced by short-term prognoses from the operational weather prediction models (Unified Model-4 km, HARMONIE-4 km and postprocessed prognoses of temperature and precipitation).

This study indicates that short-term prognoses of radiation, air humidity, wind and air pressure may replace observations without loosing the quality of the snow simulations. For all stations the modeled snow depth is validated with the observed snow depth for the last 2-3 winter seasons. Our results show that the modeled snow depth is most sensitive to precipitation and air temperature. Overall, very good estimates of the snow depth are obtained using the CROCUS snow scheme, except for very wind exposed stations.

Temperatures within the snowpack were compared with observations of snow temperature at the Filefjell station, showing promising results. A cold bias was observed, but daily variations were reasonably modeled. During the winter 2011/2012 a series of snow stratigraphy observations from the Filefjell station is carried out for validation purposes of other intra-snowpack physical properties (density, liquid water content, temperature, grain type).