Submitted Abstract

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Abstract

In mountainous terrain, wind-driven transport of deposited snow affects the overall distribution of snow, and can have a significant effect on snowmelt patterns even at coarser resolution. It remains unclear at what degree the representation of this process could improve a nation-wide operational snow hydrology modelling. In this perspective, a compromise must be found to represent this complex small-scale process with enough accuracy while mitigating the computational costs of snow cover simulations over large domains.

To achieve this compromise, we implemented the SNOWTRAN-3D snow transport module within the FSM intermediate complexity snow cover model. We included a new layering scheme and a historical variable of past snow wetting, but without resolving the snow microstructure.

Simulations were run over a mountain range in the Swiss Alps at 25, 50 and 100 m resolution, over a 37 x 32 km domain. Being implemented in the model framework of the SLF operational snow hydrology service (OSHD), simulations further benefited from snow data assimilation techniques to provide improved estimates of solid precipitation fields. 1 km resolution COSMO meteorological fields were downscaled down to 25 m resolution, and in particular, wind fields were dynamically downscaled with the WindNinja model, to better reflect topographically-induced flow patterns. The modelled snow cover was assessed using snow depths from LIDAR measurements.

An upscaling to 250 m resolution is necessary for operational implementation. These simulations are a first step working towards the integration of wind transport processes over large domains in an intermediate-complexity and -resolution operational modelling framework.