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Local simulations of snow redistribution by wind with an intermediate-complexity snow cover model driven by different wind downscaling methods

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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. In an operational modelling 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 are run and evaluated over a small mountain range in the Swiss Alps at 25 to 100 m resolution. Being implemented in the model framework of the SLF operational snow hydrology service (OSHD), simulations further benefit from snow data assimilation techniques to provide improved estimates of solid precipitation fields. As complex wind patterns in mountains are the key processes driving snow transport, we tested statistical and dynamical methods to downscale 1 km resolution COSMO winds to better reflect topographically-induced flow patterns. 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.