Opportunities and challenges for hectometric scale simulations of alpine snow cover: wind-induced snow transport and precipitation uncertainties

Ange Haddjeri et al.

Accurate snowpack predictions are decisive for anticipating natural hazards related to snow and improving hydrological forecasts. In mountainous terrain, resolving the high and complex snow spatial variability is hardly feasible without a hectometric or higher resolution simulation. At this scale, there is the need to account for new simulated processes such as wind-blown snow transport. SnowPappus is a new hectometric wind-blown snow transport model coupled to the state-of-the-art multilayer Crocus snowpack model. In this study snow cover simulations are computed with this new modeling system using different atmospheric forcing and different simulation resolutions. These simulations show changes in snow cover caused by the snow transport module mainly localized around mountain crests. Evaluations are made by comparing results to on-site measurement stations and satellite imagery: Sentinel 2 snow cover Presence (SCP), C-Snow snow height product derived from Sentinel 1 backscattered radar imagery and Pleiades stereo imagery snow height retrieval. The first evaluation of simulated snow depth reveals the recurrent dominance of precipitation uncertainty over simulation errors at the hectometric scale. Thus these evaluations underline the need for alpine hectometric snow forecasting models of assimilating snow-related observations.