Using kilometric-resolution meteorological forecasts and satellite-derived incoming radiations for snowpack modelling in complex terrain

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Simulations are carried out in the Pyrenees during four consecutive winters with the detailed snowpack model Crocus, driven by forecasts from the numerical weather prediction system AROME at 2.5 km grid spacing. The evaluation is performed by comparisons to ground-based measurements, satellite data and reference simulations driven by the meteorological analysis system SAFRAN. Studying daily snow depth variations allows to separate different physical processes affecting the results of snowpack simulations. We show the added value of AROME kilometric resolution and dynamical behavior in terms of snowpack spatial variability within a mountain range, and in terms of daily snow depth variations despite a global overestimation. The problematic assimilation of precipitation gauge measurements is also emphasized, which raises the issue of a need for a dedicated analysis to complement the benefits of AROME in mountains.
The use of satellite-derived products to improve incoming longwave and solar radiations simulated in mountainous terrain is also tackled. LandSAF products, derived from MSG/SEVIRI cloudiness and cloud type observations, are evaluated against AROME forecasts at 15 altitude stations. They are finally combined with AROME forecasts to generate better estimations of incoming radiations in complex terrain. The aim is to assess their impact on snowpack simulations.