Seasonal prediction of mountain snow resources: an application in the Alps

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The development of seasonal projections of the state of snow resources in the Alps is of particular interest for the management of water resources and tourism. We present the progress in the development of a modelling chain based on the seasonal forecast variables produced by seasonal prediction systems of the Copernicus Climate Change Service (C3S).

Seasonal forecast variables of precipitation, near-surface air temperature, radiative fluxes, wind and humidity are downscaled at three selected instrumented sites, close to five Alpine glaciers, in the North-Western Italian Alps, eventually bias-corrected and finally used as input for a physically-based multi-layer snowpack model (Snowpack; Lehning et al. 2012). A stochastic downscaling procedure is used for precipitation data in order to allow an estimate of uncertainties linked to small-scale variability in the forcing.

We evaluate uncertainties affecting the skill of the modelling chain in predicting the evolution of the winter snowpack in hindcast simulations, comparing against historical data of snow depth and snow water equivalent by automatic stations in the study areas.

The chain is tested considering seasonal forecast starting dates of November 1st, which are relevant for the snowpack processes. The sensitivity of the snow model to the accuracy of the input variables is discussed.