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Sensitivity of snow models to the spatial and temporal resolution of meteorological forcing

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The simulation of snowpack dynamics in high elevation environments is facing the problem of the uncertainty and the spatial representativeness of the input data, owing to a high spatial variability of meteorological parameters in complex topography.

In this study we evaluate the land-surface model UTOPIA (University of TOrino land Process Interaction in Atmosphere) single-layer snow scheme in order to assess its capability in reproducing the snow dynamics, i.e. the accumulation/melting processes and the snow depth temporal variability, and we compare it to the snow module of the Hydrology-Tiled ECMWF Scheme for Surface Exchange over Land (HTESSEL) of the European Centre for Medium-range Weather Forecasts (ECMWF).

The validation is performed using high-quality datasets provided by the two experimental snow-meteorological observation sites in Torgnon (2150 m a.s.l.) and Col de Porte (1325 m a.s.l.), located in the Italian and French Alps respectively.

We assess the sensitivity of the models to the spatial and temporal resolution of the input data, comparing the case in which high-quality and high-frequency data are provided by individual stations at specific observation sites, as those employed in this study for validation, to the case in which data are provided by gridded datasets based on the spatial-temporal interpolation of surface station measurements. Interpolation, in its various forms, represents a source of uncertainty in the final gridded product, thus we evaluate the quality of the models estimates in case of increasing uncertainty in the input data.