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Trade off between topographic complexity and weather and climate forecasting skills at a ski resort level

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The H2020 PROSNOW project will develop a seamless snow prediction system allowing for improved ski resort management and optimization, covering time scales from few days to several months ahead. Snowpack simulations driven by numerical weather prediction data, initialized with local snow height measurements and accounting for snowmaking and grooming practices will be carried out over several ski resorts.

In order for the snow cover modelling outputs to cross the spatial representation of ski areas, an original methodology has been developed, seeking for the best trade off between the topographic complexity and the spatial representativity of climate forecasting skills. Indeed, a too coarse spatial resolution will not allow to capture the local topographic characteristics of the ski slopes, while a too detailed representation will not reflect the spatial resolution of the meteorological forcing, generating redundant information that will only increase the computational time. Therefore, an intermediate spatial scale has to be defined.

To reach this goal, we have combined 3 sources of information: the Digital Elevation Model (DEM) of the ski resort area, the Global Information System (GIS) of the ski resort (in particular the location and surface area of each slope) and the geometry used to spatialize the meteorological data. Our methodology starts from the DEM to identify pixels of 25m x 25m, each one characterized by its altitude, slope and aspect. Then, we extract the pixels located within the slopes and we merge them following the spatial discretization of the meteorological data. The areas defined by this pixel aggregation are compared to those already used by the ski resort managers for their snowmaking and grooming daily practices, and refined if need be. Finally, snow-guns are assigned to each area, allowing us to account explicitly for the amount of machine-made snow produced.

Snow height simulations, performed on different areas in 2 French ski resorts using the detailed snowpack model SURFEX/ISBA-Crocus, will be presented. A special focus is put on the representation of the snow management practices, whose variation from one area to another can be taken into account in our spatial modelling framework.