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Snow cover retrieval under Climate Change conditions (present and future) using the PREVAH hydrological model. Application to Austrian Alps and validation by Remote Sensing.

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Snow cover is an important parameter for the natural environment in alpine regions. Precipitation decreasing, earlier snow melting and elongation of the snow-free period – correlated to increasing summer temperatures observed since the 90's – can impact strongly on the water resource management in calcareous areas.

The methodology used is the rainfall-runoff hydrological model *PREVAH* from Gurtz and Zappa (WSL, Switzerland). This spatially semi-distributed model is based on Hydrological Response Units (HRUs), clusters of similar hydrological behaviour over the river basins of the study area.

The objective is here to generate a set of key-parameters for snow (statistics, cover maps) under present and future (XXI century) climate conditions, and tested for actual conditions using optical satellite images comparison.

The study area is located in the North-eastern Calcareous Alps (NCA) of Austria (47˚30' to 47˚50 N and 15˚ to 16˚ E) comprising four different mountain ranges (Mt. Hochschwab, Mt. Rax,, Mt. Schneealpe, Mt. Schneeberg) with an overall area of 150 km^2. This area provides drinking water supply for the city of Vienna.

Inputs: (i) meteorological data from the Austrian Meteorological Service (ZAMG) and from the Technical University of Vienna (snowpits) provide daily means values for the 1981-2000 reference time period: air temperature, precipitation, relative humidity, wind speed and solar radiation. The spatial discretization of PREVAH relies on the aggregation of gridded geophysical information: land cover and soils maps, DEM at 20m grid. (ii) A runoff gauges network is used for calibration of the snow model.

Outputs: retrieval of cumulative snow duration (CSD), final snow accumulation day (FSAD) and frost risk days (FRD) are given in a spatially explicit way for each cell of the grid (20 m).

Validation: a set of snow maps derived from orthorectified SPOT satellite images are used to estimate the accuracy of the snow cover modelling results.

The PREVAH model is then used in a second step for the 2081-2100 time period, to future simulation of the same snow outputs. Two climate models are compared: HadCM3 (global) and HirHam4 (regional), using climate regional units (CRU) shifting of air temperature (increasing) and precipitation (decreasing) between the two 20 year periods. The focus is set on the temporal and spatial extent of snow-free areas.