Impact of climate change on snow cover in the mountainous regions of France using high resolutions climate simulations

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Mountain areas are among those regions where the most significant impacts of climate change are expected. Indeed, mountain regions have already experienced a steeper temperature rise than the global average in the 20th century.

The project SCAMPEI addresses some aspects of vulnerability of French mountain areas with respect to possible climate changes in the 21st century due to increasing greenhouse gas concentration. The scientific approach is based on very high resolution (12 km) numerical modeling of the atmosphere/soil system over France under several IPCC hypotheses as well as on meso-scale statistical downscaling (8 km) of the surface atmospheric fields. Both dynamical and statistical downscaling are developed to derive estimates of snow amount over mountain areas (Alps, Pyrenees, Massif Central, Vosges, Jura and Corsica) including surface elevation effects within each 8 km box. Dynamical downscaling are obtained with 3 limited area models (ALADIN, LMDZ, MAR), while the statistical downscaling is based on the IPCC AR4 and Météo-France ARPEGE climate scenarios.

The 3 limited area models are run using a 12 km grid. Then the surface meteorological variables are unbiased and projected over the 8 km grid. Large scale IPCC scenarios are downscaled on the 8 km grid using the DSCLIM statistical method, the local information being provided by the SAFRAN meteorological analyses over the 8 km grid.

The snow cover is calculated using the SURFEX land surface model on the 8 km grid over France, and also on different elevations in mountainous areas in order to better take into account orography variations. The impacts of the A1B, A2 and B1 GES emission scenarios on the French snow cover are assessed over both the 2020-2050 and 2070-2100 time periods.