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21st century snowfall changes over the French Alps : the role of temperature

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Mountainous areas are among the regions where particularly severe climate changes are expected to occur within the next century. Snowfall changes in those regions could have widespread hydrological, ecological and economic impacts. Fine topography influence on the local climate in those regions has to be taken into account to produce realistic climate projections, especially for precipitations. Within the recent SCAMPEI (Climate Scenarios for Mountain Areas : Extreme Events, Snow Cover and Uncertainties) project, dedicated to climate change over French mountainous areas, a very large ensemble of high-resolution regional climate projections has been analyzed. They were obtained either through statistical or dynamical downscaling. The statistical downscaling method is based on weather typing and is applied to 14 models from the Coupled Model Intercomparison Project 3 and to a set of projections from the atmospheric global circulation model of Météo-France, to reach a horizontal resolution of 8km over France. High resolution regional climate projections come from three specific models at 12km used in SCAMPEI and also from 16 models from the ENSEMBLES European project (at a 25km horizontal resolution over Europe). An evaluation of the robustness of snowfall changes over the French Alps simulated during the 21st century and the associated uncertainties will be presented. In particular, the role of temperature changes on snowfall changes will be discussed. At the beginning and at the end of the cold season, temperature change is found to be an important source of spread in snowfall changes. However, no link is found between temperature and snowfall changes in January and February. For early and late winter, the relative change in snowfall per degree Kelvin is a robust quantity in the sense that its sensitivity to the bias correction step, the projection period or the greenhouse gas emission scenario is low.