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# Past and future of the Austrian snow cover – results from the CC-Snow project

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This study has the goal to simulate the evolution of the Austrian snow cover from 1971 to 2050 by means of a coupled modelling scheme, and to estimate the effect of climate change on the evolution of the natural snow cover. The model outcomes are interepreted with focus on both the future natural snow conditions, and the effects on winter skiing tourism. Therefore the regional temperature-index snow model SNOWREG is applied, providing snow maps with a spatial resolution of 250 m. The model is trained by means of assimilating local measurements and observed natural snow cover patterns. Meteorological forcing consists of the output of four realizations of the ENSEMBLES project for the A1B emission scenario. The meteorological variables are downscaled and error corrected with a quantile based empirical-statistical method on a daily time basis. The control simulation is 1971–2000, and the scenario simulation 2021–2050. Spatial interpolation is performed on the basis of parameter-elevation relations.

We compare the four different global/regional climate model combinations and their effect on the snow modelling, and we explain the patterns of the resulting snow cover by means of regional climatological characteristics. The provinces Tirol and Styria serve as test regions, being typical examples for the two climatic subregions of Austria. To support the interpretation of the simulation results we apply indicators which enable to define meaningful measures for the comparison of the different periods and regions. Results show that the mean duration of the snow cover will decrease by 15 to 30 days per winter season, mostly in elevations between 2000 and 2500 m. Above 3000 m the higher winter precipitation can compensate this effect, and mean snow cover duration may even slightly increase.

We also investigate the local scale by application of the physically based mountain snow model AMUNDSEN. This model is capable of producing 50 m resolution output maps for indicators relevant for technical snow production. Using an empirical snow production strategy as applied by practitioners, AMUNDSEN is used to estimate the costs of compensating the effect of climate change on the natural snow cover by tracking the consumption of water and energy to maintain good skiing conditions all over the winter seasen.

At both scales we make an attempt to validate the simulations with observed recordings of the snow height and snow coverage. The presented outcomes represent the final results of the CC-Snow project which was funded by ACRP (Austrian Climate Research Programme). These results are used to support the investigation of the effects of the future snow conditions on tourism and economy in the two regions in the follow-up project CC-Snow II.