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Calculation of Probabilistic Climate Change Scenarios for Switzerland

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Global warming and corresponding climatic changes are expected to continue well into the 21st century leaving major impacts on society and ecosystems. The assessment of different future climate pathways, however, is a highly challenging task due to the cascade of uncertainties which are still inherent to any projection of future climate, ranging from emission uncertainties over model uncertainties down to uncertainties arising from natural fluctuations. Moreover, to be of use for the development of potential adaptation measures over complex terrains such as the Alps, model projections of the future climate using regional climate models (RCMs) with a detailed topography are essential. To date, our knowledge about climatic change in the Alpine region mainly stems from RCM projections at 50 km horizontal resolution, as obtained from the international PRUDENCE project. Yet, from an impact modeler's perspective it would be desirable to acquire climate change information at spatial scales which are higher resolved.

Here, we calculate climate change scenarios of temperature and precipitation over Switzerland from a new generation of RCM simulations (driven by general circulation models, GCMs) provided by the European project FP6-ENSEMBLES. The RCMs (at 25 km horizontal resolution) were run in transient mode over the period 1950 to 2050 based on the A1B emission scenario. Climate change over Switzerland is assessed for the period 2021-50 as seasonal means over four different regions including an Alpine area. The scenarios are derived in a probabilistic multi-model approach quantifying model uncertainties. The different model chains are combined in a Bayesian model framework. The underlying assumptions of this Bayesian approach will be discussed, and the role of internal climate variability will be quantified.

With respect to the reference period 1961-90, the majority of RCMs indicate an increase in temperature over Switzerland within the range of plus 0.5 – 3.0 °C. For precipitation, the ENSEMBLES models do not show a significant decrease in the summer and autumn season. This is quite remarkable, given that previous estimates of climate scenarios over Switzerland indicated such a decrease. Yet, the majority of models simulate enhanced precipitation during winter as was also found in earlier model studies. The inter-model spread in the climate change signals of temperature and precipitation is to a large degree determined by the choice of the GCM which also largely explains the range of the systematic biases.