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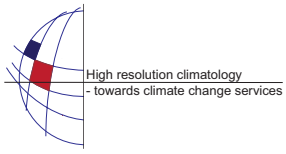

Elevation Gradients of 21st Century European Climate Change

S. Kotlarski, D. Lüthi, P. Pall, and C. Schär

ETH Zurich, Institute for Atmospheric and Climate Science, Zürich, Switzerland (sven.kotlarski@env.ethz.ch)

Given the importance of mountain regions for large-scale water supply and a high vulnerability of alpine ecosystems, elevation gradients of future climate change and possible modifications of large-scale climate change signals in mountain regions are of high interest for climate impact assessment. In this study, a transient climate scenario of the CLM regional climate model is evaluated with respect to the elevation dependency of surface climate change (near-surface air temperature, precipitation, snow cover) in Europe. The RCM experiment was carried out for the period 1950-2099 at a spatial resolution of 25 km and using a HadCM3 simulation as lateral driving data.

For near-surface air temperature, the analysis reveals that in many regions climate change signals are subject to an elevation dependency. High altitudes typically experience a stronger warming which can in many cases be related to a decrease in snow cover and a corresponding decrease of surface albedo. Often, differences in the warming signal become more pronounced towards the end of the 21st century. Despite larger warming rates at high altitudes, we cannot identify a clear potential of high-altitude warming as an early detection tool for larger-scale warming. Also precipitation changes vary with altitude, especially during the summer season. Over most parts of Europe the relative change in summer precipitation is larger at low elevations.

The reasons for the simulated elevation gradients of surface climate change are manifold and vary from region to region, in particular for precipitation. Our analysis will put a special focus on the Alps, where elevation gradients are most pronounced and where high altitudes cover a considerable fraction of the total surface area.