Geophysical Research Abstracts
Vol. 14, EGU2012-4356, 2012
EGU General Assembly 2012

The dependence of 21st century European climate change on surface elevation – An RCM ensemble analysis

S. Kotlarski, D. Lüthi, and C. Schär
ETH Zurich, Institute for Atmospheric and Climate Science, Zurich, Switzerland (sven.kotlarski@env.ethz.ch)

An ensemble of 15 regional climate model (RCM) scenarios carried out within the ENSEMBLES project is analyzed to assess the dependence of 21st century European climate change on surface elevation. A focus is put on near-surface air temperature and precipitation, and model results are analyzed separately for the European Alps, Eastern Europe, the Iberian Peninsula and Scandinavia. The RCM experiments mostly cover the period 1951-2099, are driven by 6 different GCMs and assume the SRES A1B greenhouse gas emission scenario. Model validation for the period 1961-2000 reveals that all RCMs are able to approximately reproduce the observed elevation dependence of near-surface air temperature in all regions, including the mean annual cycle of the lapse rate. In case of precipitation, most models overestimate the elevation gradient and show a wet bias at high elevations in all domains.

The analysis of climate change signals for the period 2070-2099 relative to 1961-1990 suggests that 21st century climate change might considerably depend on surface elevation. Despite differences in mean seasonal temperature and precipitation changes in the 15 experiments, there is high model agreement on the elevation dependence of these changes, irrespective of the driving GCM. In all domains, the summer temperature increase is typically strongest at high elevations. A similar result is obtained for springtime except for the European Alps, where all models show the strongest warming at medium elevations between 1500 and 2500 m. Typically, elevations that experience the strongest warming are also subject to important snow cover reductions and accompanying decreases of the surface albedo. This indicates an important role of the snow-albedo feedback for the warming pattern. In case of precipitation the model agreement is less pronounced. Still a number of robust features valid for most models can be found which, however, strongly depend on the season and the region under consideration.