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Robustness of the climate change signal over Europe simulated by the MPI-M global and regional climate models

S. Hagemann, H. Göttel, D. Jacob, P. Lorenz and E. Roeckner

Max Planck Institute for Meteorology, Bundesstr.53, 20146 Hamburg, Germany (stefan.hagemann@zmaw.de)

Recently, the new version of the coupled atmosphere/ocean general circulation model of the Max Planck Institute for Meteorology has been used to conduct an ensemble of climate simulations for the 4th assessment report of the Intergovernmental Panel on Climate Change (IPCC). These simulations comprise three control simulations for the past century covering the period 1860-2000, and nine simulations for the future climate (2001-2100). The coupled model was run without flux correction at T63 (about 1.9° or 200 km grid size) horizontal resolution and 31 vertical levels in the atmosphere, and about 1.5° horizontal resolution and 40 vertical layers in the ocean. For the past climate (1860-2000), observed concentrations of CO2, CH4, N2O, CFCs, O3 (tropospheric and stratospheric), and sulphate aerosols (direct and first indirect effect) were prescribed. For the future climate (2001-2100) these concentrations were prescribed according to the three IPCC scenarios B1, A1B and A2. Here, for each scenario three simulations were performed. Within the EU project ENSEMBLES these global simulations were dynamically downscaled over Europe using the regional climate model REMO at 0.44° horizontal resolution (about 50 km). The regional simulations comprise the 3 control simulations (1900-2000), the 3 A1B simulations and one simulation for B1 as well as for A2 (2001-2100).

In our study we will focus on the 2m temperature and the hydrological cycle in a control period representing current climate from 1961-1990, and in a future period representing a possible climate in the end of the 21st century from 2071-2100. First the simulated hydrological cycle of the control period will be considered to get an idea of the internal variability of the modelsąÇ climate over large European catchments.

Then the robustness of the climate change signal will be analysed by comparing the projected changes in the hydrological cycle for the three simulations within each scenario and between the different scenario simulations. Ideally regions and seasons will be identified where the climate change signal in the hydrological cycle is robust, and where this signal has a larger uncertainty. Finally it will be analysed whether significant differences in the robustness of the climate change signal occur between the global and the regional climate simulations.