Geophysical Research Abstracts,
Vol. 11, EGU2009-3962, 2009
EGU General Assembly 2009

Bias correction of temperature and precipitation data for regional climate model application to the Rhine basin

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The Hydrology and Quantitative Water Management group of Wageningen University is involved in the EU research project NeWater. The objective of this project is to develop tools which provide medium range hydrological predictions by coupling catchment-scale water balance models and ensembles from mesoscale climate models. The catchment-scale distributed hydrological model used in this study is the Variable In[U+FB01]ltration Capacity (VIC) model. This hydrological model in combination with an ensemble from the climate model ECHAM5 (developed by Max Plank Institute für Meteorologie (MPI-M), Hamburg) is being used to evaluate the effects of climate change on the hydrological regime of the Rhine basin and to assess the uncertainties involved in the ensembles from the climate model used in this study. Three future scenarios (2001-2100) are used in this study, which are downscaled ECHAM5 runs which were forced by the IPCC carbon emission scenarios B1, A1B and A2. A downscaled ECHAM5 "Climate of the 20th Century" run (1951-2000) is used as the reference climate. Downscaled ERA15 data is used to calibrate the VIC model. Downscaling of both the ECHAM5 and ERA15 model was carried out with the regional climate model REMO at MPI-M to a resolution of 0.088 degrees. The assessment of uncertainties involved in the climate model ensembles is performed by comparing the model (ECHAM5-REMO and ERA15-REMO) ensemble precipitation and temperature data with observations. This resulted in the detection of a bias in both the downscaled reference climate data and downscaled ERA15 data. A bias-correction has been applied to both the downscaled ERA15 data and the reference climate data. This bias-correction corrects for the mean and coefficient of variation for precipitation and the mean and standard deviation for temperature. The results of the applied bias-correction are analyzed spatially and temporally. Despite the fact that the bias-correction only uses two parameters, the coefficient of variation, standard deviation and mean of the bias-corrected data sets showed significant improvements for both precipitation and temperature. Even statistics that were not taken into account in the bias-correction, such as the fraction of wet days, the lag-one autocorrelation and the exceedance probabilities have improved as well.