Geophysical Research Abstracts
Vol. 14, EGU2012-8909, 2012
EGU General Assembly 2012

Application of a statistical-dynamical downscaling approach to simulate present and future regional precipitation regimes in Central-Asia

M. Reyers, K. Born, and J.G. Pinto
IGMK, University of Cologne, Cologne, Germany (mreyers@meteo.uni-koeln.de)

A statistical-dynamical downscaling approach is used to analyse the effect of climate change on the precipitation regimes within a river catchment in the Tienshan Mountains in Central Asia. Since this region is characterised by extraordinary topographic heterogeneity, with a large desert basin in the south and high ridge mountains in the north, highly resolved regional climate simulations are performed to capture the orographic effects on rainfall climatology. In the statistical part of the downscaling a Circulation Weather Type (CWT) analysis is applied to daily 700hPa geopotential height datasets of the ERA40 Reanalyis, where the lower tropospheric flow for each day is subdivided into one of eight directional flows and/or into cyclonic or anti-cyclonic flow. In the dynamical part of the downscaling a sample of representatives for each cluster of the CWTs is simulated with the COSMO-CLM model with a horizontal resolution of up to approximately 7 km. By weighting the simulated representatives with their climatological frequencies, a climatology of the precipitation can be determined on the regional scale. For the analysis of the impact of climate change on the regional precipitation in the Tienshan Mountains different scenarios of the ECHAM5 model are used. For this purpose, changes of the CWT frequencies of the ECHAM5 scenarios related to the respective control period are added to the climatological ERA40 frequencies. The simulated representatives are then weighted by these new frequencies to estimate the precipitation change signal in the catchment.
First results of the statistical-dynamical downscaling suggest that the general orographic effects are well captured by the downscaling procedure. A precipitation climatology computed from simulations with a horizontal resolution of approximately 20 km shows the expected horizontal rainfall distribution, with less than 100 mm per year in the desert basin and at the southern slope of the Tienshan Mountains and with more than 200 mm per year at the northern windward slope. The downscaling approach is currently applied to the 7 km simulations and the resulting horizontal rainfall distribution is compared to observations from meteorological stations and to a gridded observational dataset. The downscaling approach is employed to changed CWT frequencies of different ECHAM5 scenarios, so that climate conditions for future precipitation regimes can be determined.