Geophysical Research Abstracts
Vol. 12, EGU2010-10669, 2010
EGU General Assembly 2010

Effects of Climate Change on Water Resource and Hydrological Extremes in Germany

Shaochun Huang, Valentina Krysanova, and Fred F. Hattermann
Potsdam Institute for Climate Impact Research, Potsdam, Germany (huang@pik-potsdam.de)

Different studies show that the expected climate change has already influenced the hydrological cycle and the runoff behavior of catchments in Germany, and the more frequent extreme events rose to be a particular concern during the recent years. In Germany, where hydrological and climatic patterns differ in various regions, it is an important task to assess both the extent and the spatial distribution of these impacts, as it helps an overall decision making for the country scale.

The process-based ecohydrological model SWIM (Soil and Water Integrated Model) was applied for the whole of Germany, and the simulated results were calibrated (from 1981 to 1990) and validated (from 1961 to 1980) at several selected gauges in the five largest river basins (lower Rhine, upper Danube, Elbe, Weser and Ems). The potential effects of climate change on the hydrology and water resources are assessed by simulating with the scenarios derived from statistic downscaled climate model STAR (scenario period: 2009-2060) and the dynamic downscaled model CCLM (scenario period: 2001-2010). Different indicators were applied to compare the simulation results for the reference period (1961-1990) and scenario periods (2051-2060 for STAR with 100 realizations and 2011-2040, 2041-2070 and 2071-2100 for CCLM with 1 realization). The indicators, such as average seasonal river discharge, average annual water components (i.e., water runoff, groundwater flow and actual evapotranspiration) assess the impacts on hydrological cycle and the runoff pattern for the whole Germany, while the annual maximum daily discharge, the annual minimum 7-day average of discharge and the river discharge values exceeded between 0.1% and 99.9% of the time were used especially for extreme analysis.

The results simulated with the realizations from model STAR show that in summer time, all the five rivers will have less river flows and the decline is substantially strong in river Elbe and Danube. Higher actual evapotranspiration is expected in most part of Germany mainly due to the increased temperature. The East Germany may face severe water stresses in the future while in northwest, it may become wetter especially in winters. The scenarios taken from the dynamic climate model CCLM lead to a moderate impact on the hydrological components. Floods may become higher and more frequently in the scenario periods in most rivers while the decreasing annual minimum low flow indicates that even in northwest wet regions, the summer low flow condition can be a serious problem and the river management should be adapted.