Geophysical Research Abstracts, Vol. 8, 04430, 2006
SRef-ID: 1607-7962/gra/EGU06-A-04430

The impact of climate change on low-flow conditions in the Upper Danube watershed - a scenario case study using the DANUBIA decision support system

W. Mauser (1), U. Strasser (1), R. Ludwig (2), W. Willems (3), R. Barthel (4) and B. Frueh (5)

(1) Faculty for Geosciences, Ludwig-Maximilians University (LMU), Luisenstr. 37, D-80333 (w.mauser@iggf.geo.uni-muenchen.de, 49-89-21806674), (2) Institute for Geography, University of Kiel, Germany, (3) Institute for Applied Water Resources Management and Geoinformatics, IAWG - Ottobrunn, Germany, (4) Institute of Hydraulic Engineering, Universitaet Stuttgart, Germany, (5) Institute for Atmospheric Physics, University of Mainz, Germany

To understand and predict the potential effects of climatic change on the water resources and stream flows it is necessary to be aware of the nonlinearity and complexity of the interactions between the climate and the land surface, and to consider the dependence on the scale on which these interactions are investigated. In mountainous watersheds and their forelands the hydrological situation is particularly complex because of lateral flows being of considerable importance. To be able to realistically treat the impact of different scenarios of future climate change on the water cycle of mountainous watersheds and their forelands physically based hydrologic models with high predictive ability are necessary. Within the GLOWA-Danube project we have developed the physically based Global Change decision support system DANUBIA with the aim to minimize external calibration and thereby maximize predictive capabilities. Among other modules DANUBIA couples a physically based hydrological model with a stochastic procedure to derive long time series of synthetic future climate data from measured historical records. The stochastic procedure is used to create more likely realizations of future climate scenarios than regional climate models can provide for mountainous regions at reasonable CPU costs. To compile a future meteorological data set spanning over the next 100 years, the procedure considers measured relations between temperature and rainfall, applies a random variation of temperature,

overlays the trend, and selects the appropriate time slice from the given basic population of measurements (30 years of DWD (German Weather Service) recordings). In our case study, the IPCC B2 scenario predicts a temperature increase of 2.7 K for the Upper Danube watershed until 2100. The stochastic climate generator was applied to the 77.000 km^2 Upper Danube catchment (gauge Passau). DANUBIA calculates the energy- and water balances as well as discharges with a temporal resolution of 1 h and a spatial resolution of 1 km. Results show that the increase of temperature and decrease of precipitation is accompanied by an increase of global radiation and evapotranspiration and a corresponding decrease of groundwater recharge and streamflow. The lowest average discharge within a 7 day interval (NM7Q) was statistically analyzed for its change in return period during the 100 years for selected tributaries. The analysis shows that serious decreases in discharge lead to a vast change in return period for given minimum discharges.