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Modelling of climate change impacts on river flow regime and discharge of the Danube River considering water management effects

Judith Stagl, Fred F. Hattermann, and Hagen Koch
Potsdam Institute for Climate Impact Research, Climate Impacts & Vulnerabilities - Research Domain II, Potsdam, Germany (stagl@pik-potsdam.de)

The Danube River basin (∼ 800,000 km2) is the second largest river basin in Europe. As a highly regulated river (80% of the length of the Danube are affected) the Danube is strongly influenced by water management. Large dams, for instance, might not only interrupt the river and habitat continuity, but have an important impact on the natural flow regime. The Iron Gates I and II (reservoirs) alone have a total volume of 3.2 billion m3 with a total length of 270 km. Besides hydropower generation they are also used for the flow regulation of the Danube River.

In the framework of the HABIT-CHANGE project (INTERREG IV B CENTRAL EUROPE programme) knowledge about potential changes due to climate change on a regional level is required for the adaption of management plans and strategies of protected areas. To gain scenario information about the actual river flows in the future, the natural discharge as well as reservoir management in the Danube basin needs to be considered when simulating potential impacts of climate change.

For this study the eco-hydrological watershed model SWIM was applied for the Danube basin using a special reservoir management module which accounts for the major reservoirs in the basin, thus allowing for a better representation of the actual river. The SWIM model (Soil and Water Integrated Model) is a continuous-time semi-distributed watershed model, which combines hydrological processes, vegetation, erosion and nutrient dynamics at the meso- to macroscale. After calibration and validation of the model, we used a set of 14 high-resolution climate change projections as meteorological drivers for the SWIM model to simulate the future development of river runoff under scenario conditions. They were performed by several state-of-art GCMs and RCMs within the ENSEMBLES project (EU FP6) and are all based on the IPCC-SRES-A1B emission scenario. The results are used to quantify the range of predictive scenario uncertainty and to allocate robust trends as input for adaptive regional management.