Geophysical Research Abstracts
Vol. 20, EGU2018-6254, 2018
EGU General Assembly 2018

Decadal predictions for the Wupper River Basin, Germany – Hydrological impacts

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Under the framework of the EU-Horizon 2020 project BINGO (Bringing INnovation to onGOing water management), climate change impacts on the water cycle in the Wupper catchment area are being studied. For this purpose, two hydrological models (NASIM and SWAT) have been set up, calibrated, validated and then applied with climate data from decadal predictions. Decadal predictions have been selected instead of IPCC-RCP scenarios, as they provide a more realistic assumption of climate variability for the next ten years. This is especially important for local stakeholders in order to be prepared for managing hydrological extremes in the near future.
Ten decadal members based on the MiKlip framework have been prepared for the time span of 2015 to 2024 in daily time steps and pre-processed for both hydrological models. The sub-catchment “Große Dhünn” of the Wupper basin has been selected for this study, as it generates the inflow to a large reservoir, which is used as drinking water source for about 0.5 million people and as flood protection system for downstream areas.
First results show that climate variability is increasing in the next decade, whereas seasonal median precipitation sums are also increasing. Concerning the hydrological impacts, both models predict higher median discharge, which do not occur in all ten member model runs. However, there are also differences between both models, as NASIM and SWAT were designed for different purposes. For example, SWAT features a more complex description of runoff generation processes with respect to soil water and vegetation.
For further analysis of the model results and differences, several statistical methods have been applied. For example, Standardized Precipitation Index (SPI) and Standardized Precipitation-Evapotranspiration Index (SPEI) have been calculated for different time scales to analyse drought periods and relate them to soil moisture conditions and groundwater recharge. Furthermore, flood events have been ranked and compared to earlier decades.