EGU21-5757
https://doi.org/10.5194/egusphere-egu21-5757
EGU General Assembly 2021

Effects of climate change and human interactions on water balance dynamics in the River Vistula basin

Renata Romanowicz, Emilia Karamuz, Jaroslaw Napiorkowski, and Tesfaye Senbeta
Institute of Geophysics, Polish Academy of Sciences, Hydrology and Hydrodynamics, Warszawa, Poland
(romanowicz@igf.edu.pl)

Water balance modelling is often applied in studies of climate and human impacts on water resources. Annual water balance is usually derived based on precipitation, discharge and temperature observations under an assumption of negligible changes in annual water storage in a catchment. However, that assumption might be violated during very dry or very wet years. In this study we apply groundwater level measurements to improve water balance modelling in nine sub-catchments of the River Vistula basin starting from the river sources downstream. Annual and inter-annual water balance is studied using a Budyko framework to assess actual evapotranspiration and total water supply. We apply the concept of effective precipitation to account for possible losses due to water interception by vegetation. Generalised Likelihood Uncertainty Estimation GLUE is used to account for parameter and structural model uncertainty, together with the application of eight Budyko-type equations. Seasonal water balance models show large errors for winter seasons while summer and annual water balance models follow the Budyko framework. The dryness index is much smaller in winter than in summer for all sub-catchments. The spatial variability of water balance modelling errors indicate an increasing uncertainty of model predictions with an increase in catchment size. The results show that the added information on storage changes in the catchments provided by groundwater level observations largely improves model accuracy. The results also indicate the need to model groundwater level variability depending on external factors such as precipitation and evapotranspiration and human interventions. The modelling tools developed will be used to assess future water balance in the River Vistula basin under different water management scenarios and climate variability.