

INFLUENCE OF UNCERTAINTY ON THE ESTIMATES OF WATER BALANCE DYNAMICS AND DROUGHT INDICES IN THE RIVER VISTULA BASIN

Tesfaye Belay Senbeta (Institute of Geophysics Polish Academy of Sciences)

Renata Romanowicz (Institute of Geophysics Polish Academy of Sciences)

Topic: Quantifying uncertainty in hydrological predictions

Abstract. Water balance modelling is often used in studies of climate and human impact on water resources. Annual water balance is usually derived based on observations of precipitation, runoff, and temperature, assuming negligible changes in annual water storage in a river basin. However, this assumption might be violated in very dry or very wet years. Annual and seasonal water balance is examined using a Budyko framework to assess actual evapotranspiration and total water supply in nine sub-basins of the Vistula River basin. 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. A number of drought indices, including the Standardised Precipitation Index, the Standardised Precipitation-Evaporation Index, and the Standardised Runoff Index, are evaluated and their uncertainty is assessed. The seasonal water balance models show large errors for the winter season, while the summer and annual water balance models follow the Budyko framework. The dryness index is much smaller in winter than in summer for all sub-basins. The spatial variability of the water balance modelling errors indicates increasing uncertainty in the model predictions as the size of the catchment increases. The developed modelling tools will be used to evaluate the future water balance in the River Vistula basin under different water management scenarios and climate variability.

Keywords: Water balance dynamics, drought indices, uncertainty, Budyko framework