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Comparison of spatial and temporal future changes of hydrological regime in selected river basins of Slovakia

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Changes in the hydrological cycle are increasingly influenced by climate change. Every year, droughts and floods increase and strongly threaten the landscape, buildings, human settlements and lives. Climate data from climate scenarios are used to predict extreme events in the future. Many methods can process the climate data and evaluate the hydrological characteristics, according to which it is possible to determine the changes in the hydrological regime in the landscape.

The paper aims to characterize future changes in the hydrological regime for eight selected basins of Slovakia, which were divided into four groups according to location, i.e., eastern Slovakia, northern Slovakia, central Slovakia, and western Slovakia. The input data include mean daily discharges and are divided into four groups. The first group consists of observed daily discharges provided by the Slovak Hydrometeorological Institute and represents the reference period from 1981 to 2010. The second group generates mean daily discharges using the HBV type TUW rainfall-runoff model in 1981-2010. The third and fourth groups simulate mean daily discharges using the meteorological inputs from the KNMI and MPI climate scenarios, containing data from 1981 to 2100. The available data were inputs to The Indicators of Hydrologic Alteration program, and subsequent analyses are focused on mean monthly discharges, M-day minimum and maximum discharges, the occurrence of maximum and minimum discharge, and baseflow index. For assessing the future changes in hydrological regime characteristics, the reference and future period 2070-2100 were compared.

The results indicated that the spring's most significant decrease in mean monthly discharges occurred in eastern Slovakia. Summer is characterized by a decrease in mean monthly discharges throughout Slovakia, especially in eastern Slovakia. In eastern Slovakia, a decrease in selected M-day minimum discharges is also expected. Minor changes are expected in the characteristics of the 90-day minimum discharge Q_{90d} in the Topľa – Hanušovce and Topľou gauging station. The most significant changes can be expected in the Laborec - Humenné gauging station, where the 90-day minimum discharge Q_{90d} can decrease by up to 38% compared to the reference period. The results show a rise of M-day maximum discharges of up to 50% in the gauging stations in the eastern part of Slovakia. The minimum discharge is shifted from November/January to October and the maximum from March to February/March.

According to the increasing base flow index, the Váh River basin will have the best conditions for

maintaining minimum discharges in drier periods. In the other basins, the values of the baseflow index decrease.

An increase in mean monthly discharges may indicate future, increasing precipitation in given basins, predominantly in liquid form, or, on the other hand, increasing temperatures that can eliminate snow cover.

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