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Modeling of climate change impact on hydrological regime in the headwater catchment of the Vistucky Creek

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Assessment of the impacts of climate change on hydrological regime is important for sustainable water resources management. The objective of this study is to assess the impacts of future climate changes on the hydrological regime of the headwater catchment of the Vistucky Creek (area 9.8 km2) in south-western Slovakia. Changes in climatic characteristics (i.e. precipitation and air temperature) for periods 2022-2060 and 2062-2100 were prepared by two regional climate models KNMI and MPI using the A1B emission scenario (average related to fossil carbon production). Both climatic scenarios assume increase in the air temperature and precipitation (higher in winter than in summer). A lumped conceptual rainfall-runoff model (the HBV-based TUW model) was used to simulate the catchment hydrological behaviour. The TUW model was calibrated for the reference period of 1982 – 2008. The calibration of the model was performed 50 times with a differential evolution algorithm. After obtaining the collection of the 50 parameter sets, the best set (in terms of Nash-Sutcliffe efficiency and the volume error) was chosen. This set of model parameters was used for the simulation of long-term mean monthly runoff for the three periods (i.e. 1982-2008, 2022-2060, and 2062-2100).
The results show that changes in the long-term runoff seasonality and extremality of hydrological cycle could be expected in the future if the climate changes as the scenarios assume. The runoff should increase in autumn and winter months (i.e. from September to February) and decrease in spring and summer months (i.e, from April to August) compared to the reference period. Peakflows should increase in period 2062-2100 while discharge minima should slightly decrease (only for the climatic data from the KNMI model). It indicates possible increase in flow extremality. Catchment water storage as expressed by the soil moisture index and baseflow should decrease in period 2062-2100, especially according to climatic data from the KNMI model. Our contribution will discuss these changes in hydrological regime in the climate change context.

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