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HYPE model performance and calibration strategy for hydrological components: a case study in Latvia

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Model of Hydrological Predictions for the Environment (HYPE) (Arheimer et al. 2012) and its application for modelling of runoff for the Berze River in Latvia is a subject of the current study. Pre-calibrated model is analysed to track the further calibration strategy for a better model performance. Average Nash-Sutcliffe model efficiency coefficient (NSE) (Moriasi et al. 2007) is 0.84 and percent bias (PBIAS) (Moriasi et al. 2007) is -6.9% according to simulated and observed runoff values at the outlet of the Berze River for the simulation period of 2005 to 2014. Even though the model performance can be described as satisfactory, detailed analysis of simulated runoff values indicates an unrealistic contribution of main hydrologic components. The model predicts the groundwater contribution of 95.5% to total runoff at the outlet of the Berze River basin, while the contribution from the 3rd (deepest) soil layer is 87.1% of total groundwater contribution. Simulated daily average groundwater level reached its maximum at 1.1 m of depth below ground surface, which is 0.1 m above the depth of drainage pipes (1.2 m). Therefore, simulated subsurface drainage flow is limited as saturated soil conditions occur rarely above the depth of drainage pipes. In addition, the long-term average baseflow of 55.2% from total runoff is estimated by the Base flow separation index tool (Wahl and Wahl 1995) showing less pronounced contribution from the groundwater component. Overall, it can be concluded that simulated groundwater flow contribution is overestimated, while the runoff through subsurface drainage pipes is underestimated.
Further calibration strategy could include stepwise adjustments of main parameters such as: 1) effective porosity and groundwater flow recession; 2) subsurface drainage flow recession; 3) recession of surface runoff under saturated conditions and infiltration capacity of surface runoff caused by intensive precipitation and snowmelt; 4) evapotranspiration as soil water content is expected to change due to the adjustments of parameters previously stated.

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