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Analysis of influence of the uncertainty of the rating curve in Warsaw on the flow conditions in the Middle River Vistula

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ABSTRACT

The flow forecasting system for the middle reach of the River Vistula consists of a distributed flow routing model and rainfall-runoff modules. The MIKE 11 flow routing model, applied in the study requires specification of a number of input variables, including roughness coefficients, initial conditions, river geometry and boundary conditions. All listed variables introduce errors into the system that have an impact on the uncertainty of flow predictions. This work focuses on the estimation of uncertainty of flow predictions resulting from inaccuracy of boundary conditions and parametric uncertainty. In particular we are interested in the influence of a stage-discharge relationship (rating curve) uncertainty applied as the downstream boundary condition. The influence of parameter and rating curve uncertainty on model predictions is studied using the Generalised Likelihood Uncertainty Estimation GLUE framework. We parameterised downstream rating curve using a power law. The rating curve parameters were optimised together with the model roughness coefficients. The optimal parameter values were subsequently used as mean values of a priori distribution within the GLUE approach to derive the flow routing model prediction uncertainty. The results were superior to those without rating curve uncertainty taken into account. The proposed methodology was applied to the Middle Vistula reach between Zawichost and Warsaw Port Praski gauging stations. Model performance was estimated using both water level and flow observations at gauging stations situated along the river reach.