



Regionalisation of parameters of a large-scale water quality model in Lithuania using PAIC-SWAT

Nina Zarrineh (1), Ann van Griensven (1,2), Juris Sennikovs (3), Liga Bekere (3), and Svajunas Plunge (4)

(1) Vrije Universiteit Brussel, Department of Hydrology and Hydraulic Engineering, Brussels, Belgium, (2) UNESCO-IHE, Chair group of Hydrology and Hydraulic Engineering, Delft, Netherlands, (3) University of Latvia, Faculty of Physics and Mathematics, Riga, Latvia, (4) Environmental Protection Agency of Lithuania, Vilnius, Lithuania

To comply with the EU Water Framework Directive, all water bodies need to achieve good ecological status. To reach these goals, the Environmental Protection Agency (AAA) has to elaborate river basin districts management plans and programmes of measures for all catchments in Lithuania. For this purpose, a Soil and Water Assessment Tool (SWAT) model was set up for all Lithuanian catchments using the most recent version of SWAT2012 rev627 implemented and imbedded in a Python workflow by the Center of Processes Analysis and Research (PAIC). The model was calibrated and evaluated using all monitoring data of river discharge, nitrogen and phosphorous concentrations and load. A regionalisation strategy has been set up by identifying 13 hydrological regions according to the runoff formation and hydrological conditions. In each region, a representative catchment was selected and calibrated using a combination of manual and automated calibration techniques.

After final parameterization and fulfilling of calibrating and validating evaluation criteria, the same parameters sets have been extrapolated to other catchments within the same hydrological region. Multi variable cal/val strategy was implemented for the following variables: river flow and in-stream NO_3 , Total Nitrogen, PO_4 and Total Phosphorous concentrations. The criteria used for calibration, validation and extrapolation are: Nash-Sutcliffe Efficiency (NSE) for flow and R-squared for water quality variables and PBIAS (percentage bias) for all variables. For the hydrological calibration, NSE values greater than 0.5 should be achieved, while for validation and extrapolation the threshold is respectively 0.4 and 0.3. PBIAS errors have to be less than 20% for calibration and for validation and extrapolation less than 25% and 30%, respectively. In water quality calibration, R-squared should be achieved to 0.5 for calibration and for validation and extrapolation to 0.4 and 0.3 respectively for nitrogen variables. Besides PBIAS error should be less than 40% for calibration, and less than 70% for validation and extrapolation for all mentioned water quality variables. For the flow calibration, daily discharge data for 62 stations were provided for the period 1997-2012. For more than 500 stations, water quality data was provided and 135 data-rich stations was pre-processed in a database containing all observations from 1997-2012.

Finally by implementing this regionalisation strategy, the model could satisfactorily predict the selected variables so that in the hydrological part more than 90% of stations fulfilled the criteria and in the water quality part more than 95% of stations fulfilled the criteria.

Keywords:

Water Quality Modelling, Regionalisation, Parameterization, Nitrogen and Phosphorus Prediction, Calibration, PAIC-SWAT.