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CONTRIBUTION OF 1D RIVER FLOW MODELING TO THE QUANTIFICATION OF STREAM-AQUIFER INTERACTIONS IN A REGIONAL HYDROLOGICAL MODEL

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Summary. The main objective is to provide a realistic simulation of river stage in regional scale river networks in order to improve stream-aquifer interactions and better assess stream discharge and hydraulic head in aquifers at this scale. The general framework is the distributed model Eau-dyssée, which couples existing specialized models to address water resources and quality in regional scale river basins. In particular, it simulates aquifer flow with a finite difference pseudo 3D model and river flow with a simple Muskingum model that only simulates river discharge.

We focus on the Oise river basin (a 16 670 km^2 sub-basin of the Seine River basin, in Northern France), where the resolution of the Muskingum model is 1 km. We propose here an upscaling method to benefit from high resolution hydraulic modeling in order to improve the representation of river stage profiles in the regional scale model. The methodology is based on 1D Saint-Venant simulations of the main rivers, from which functional stage-discharge relationships, or rating curves, are defined for each cell of the modeled area. These rating curves are then projected onto the cells of the regional basin model as boundary conditions and allow for calculating river stage, which is then used to calculate the exchanges between aquifer units and river.

We used HEC-RAS for 1D hydraulic modeling in a 188 km of the Oise stream network. Manning's roughness coefficient (n) in the main channel and floodplains were calibrated against time series of discharge and water stages measured at 5 hydrometric stations. The efficiency of the model was evaluated using Nash, RMSE and Bias criteria.

This work outlines the efficiency of the approach to better simulate water pathways and stream-aquifer interactions at regional scale with low computing cost. Apart from hydrology, it offers interesting perspectives to simulate nitrate elimination in wetlands which are often located at the contact zone between groundwater and in-stream waters.