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A simple tool for the computation of the stream-aquifer coefficient.

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Most groundwater models consider a river network in interaction with aquifers, where the stream-aquifer boundary is usually modeled with a Cauchy-type boundary condition. This condition is parameterized with the so-called "river coefficient", which is a lumped parameter representing the effects of numerous geometric and hydrodynamic controlling factors.
The value of the river coefficient is essential for the quantification of stream-aquifer flow but is challenging to determine. In recent years, many formulations for the river coefficient have been proposed from analytical and numerical approaches. However, these methods are either too simple to be realistic or too complex to be easily implemented by groundwater modelers.
We propose a simple tool to infer the value of the river coefficient from a fine-grid numerical model. This tool allows the simple and fast computation of the river coefficient with various stream geometries and hydraulic parameters. A Python-based pre- and post-processor has been developed, which reduces the contribution of the operator to the definition of the model parameters: river geometry and aquifer properties. The numerical model is implemented with the USGS SUTRA finite element model and considers an aquifer in interaction with a stream in a 2D vertical cross-section. A Dirichlet-type boundary condition is imposed at the stream-aquifer interface.
The linearity between the stream-aquifer flow and the head difference between river and the aquifer has been verified. For a given parameter set, the value of river coefficient is estimated by linear regression for different values of head difference between the river and the aquifer. The innovation is that the mesh size of the regional model is also considered for the computation of the river coefficient. This tool has been used to highlight the importance of parameters that were usually neglected for the computation of the river coefficient. The results of this work will be made available to the scientific community with a web-interface.