



Hydrodynamic modelling at the stream-aquifer interface constrained by multi-method and time-lapse geophysical measurements

Marine Dangeard (1), Agnès Rivière (2), Ludovic Bodet (1), and Roger Guérin (1)

(1) Sorbonne Université, UMR METIS, Paris, France, (2) MINES ParisTech, Département de Géosciences, Fontainebleau, France

The spatio-temporal evolution of flows at the interface between surface water and groundwater is one of the key questions of the Critical Zone (CZ) study. These flows are mainly controlled by the near-surface properties, the geometry of the stream-aquifer interface and the hydraulic gradient. Various investigation methods make it possible to estimate exchanges and interactions at this interface, sometimes with the help of numerical models. But the definition of boundary conditions is generally based on poorly constrained assumptions. The shape of the water table is controlled by the hydraulic gradient and the hydrofacies heterogeneities, coming from sparse logs information. Close to a river, the flows are not horizontal but, in the absence of information on the spatial variations of the saturated/unsaturated zone interface depth, the models are usually involving a Dirichlet condition of hydrostatic head inferred from a few piezometers. We suggest here to constrain these assumptions by using a multi-method approach combining geotechnical characterizations, geophysical imaging and time-lapse measurements. We show how high resolution electrical resistivity tomographies coupled with auger soundings and dynamic penetrometer tests, help: 1) describing the spatial heterogeneities of the studied section; 2) providing a distribution of associated facies and hydrodynamic properties; and, 3) expanding the modelling domain. Thanks to time-lapse seismic acquisitions with a 2-month time step, we are able to catch the dynamics of the saturated/unsaturated zone continuum and define the initial and boundary conditions of the cross-section. A finite volume hydrogeological model coupled with a parameter sampling script is used to calibrate the hydraulic parameters. The results give plausible ranges of parameters to reproduce the piezometric surfaces and an estimation of the stream-aquifer exchanges.