

## **Modelling of water flow and solute transport in saturated–unsaturated media using a self adapting mesh**

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**Abstract** In this work, a mathematical modelling tool was developed to simulate the water and solute transfers in unsaturated–saturated porous medium. We used a mathematical formulation which consists in considering as a single continuum the saturated and the unsaturated zones. The model is based on the finite elements method using the Freefem++ code. This code was adapted to the equations used in this study, namely: Richards equation to study the water flow in the unsaturated zone, the diffusivity equation for the groundwater flow and the transport equation of advection–dispersion type to study the solute transfer. The advantage of the Freefem++ is that it generates self-adapting grids. The modelling tool was validated using experimental data measured on the small-scale physical model. A comparative study with the ADI method was carried out and showed that the use of the finite elements Freefem++ code presents an advantage and provides more accurate results.

**Key words** modelling; unsaturated–saturated; flow; solute; finite elements; self-adapting grids