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IMPROVEMENT OF THE INTERACTIONS BETWEEN THE UNSATURATED AND THE SATURATED ZONES: IMPACT ON POLLUTANT TRANSFER

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Summary. In order to predict the evolution of a contamination in the hydrosystems and test the impact of remediation policies, it is required to have a good estimation of the solute transfer in the unsaturated zone (UZ). Indeed, transfer through this interface is rather low (0.5 m/year) and is therefore responsible for a long delay for solute transfer to reach the aquifer. We proposed an improvement of a simple UZ scheme that was used by Ledoux et al. (2007) to study the nitrate transfer in the Seine basin (Northern France, encompassing Paris). The modifications are based on a comparison with a mechanistic model which solves the Richards equation using a finite elements method. The simple scheme assimilates the UZ to a Nash cascade. The main improvement is to consider a saturation profile within the UZ according to the Van Genuchten equation. The transfer of solute is therefore faster at the top of the UZ than close to the water table. This modification introduces a relationship between the UZ scheme and the depth of the water table that is varying in time. Fluctuations can reach 10 meters per year in some part of the Seine basin, and are therefore supposed to have an important impact on the solute transfer. The interactive coupling between the UZ and the saturated zone is simulated by considering that i) hydrostatic equilibrium of humidity profile is instantaneously reached in the UZ at each time step and ii) water fluxes from the water table are used to reach the equilibrium. In spite of keeping simple and computationally efficient, the new UZ scheme allows now to better take into account some physical phenomena having a direct impact on the dynamic of groundwater contamination. An application on the simulation of nitrate transfer in the Seine is presented, and the impact of the water table fluctuations on the nitrate transfer is quantified.