A coupled modeling approach to incorporate vadose-zone flow and solute transport in ground water models

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Incorporation of variably saturated water flow and solute transport in to ground water models has posed many challenges for ground water modelers in the past. Simplified representation of vadose zone processes in ground water models is a very attractive approach but leads to poor modeling efficiency. A balance between modeling efficiency and computational demand of the adopted approach is thus needed to reasonably represent the effects of vadose zone processes. Recently, the HYDRUS package for MODFLOW has been developed that has been shown to represent vadose zone flow processes in ground water models at different spatial and temporal scales. Here, we extend the capabilities of the HYDRUS package to additionally represent the solute transport in vadose zone. Along with modeling water flow, the new HYDRUS package simulates solute transport such that the MODFLOW-HYDRUS code produces concentrations as well as their fluxes as a function of time that can be incorporated into the source function for MT3D. We test the ability of our models to simulate coupled vadose zone- ground water solute transport processes using laboratory-based experimental data.