Studying solute transport using parsimonious groundwater modelling

Evangelos Rozos and Demetris Koutsoyiannis

National Technical University of Athens, Department of Water Resources and Environmental Engineering, Athens, Greece (vrozos@yahoo.gr)

Groundwater modelling is plagued by the increased uncertainty concerning the properties (hydraulic conductivity, porosity, geometry) and the conditions (boundary conditions, initial conditions, stresses) of aquifers. Some studies suggest that the magnitude of this uncertainty does not justify the detailed level of representation and simulation employed by groundwater models that numerically solve differential equations. Rozos and Koutsoyiannis (2010) suggest that multi-cell models should be considered as an alternative option in cases of increased uncertainty. This study extends that work by including solute balance in a multi-cell model. To simplify the calculation of the solute balance instant and complete mixing are assumed. The flow domain is discretized using a low number of cells of flexible geometry. The water volumes exchanged between cells are simulated at each time step using 3dkflow with an additional module to estimate the concentrations at the beginning of the next time step. This method was tested in a case study that has analytical solution, the release of a pollutant in an infinite column (Bear, 1979). The accuracy of the multi-cell modelling (concerning concentrations and hydraulic heads) and its dependence on the parameters of this problem (water flux, injected amount, dispersion coefficient) were studied to identify the applicability of this method.