Geophysical Research Abstracts
Vol. 14, EGU2012-601, 2012
EGU General Assembly 2012

Numerical evaluation of apparent transport parameters from forced-gradient tracer tests in statistically anisotropic heterogeneous formations

D. Pedretti (1), D. Fernandez-Garcia (1), D. Bolster (2), X. Sanchez-Vila (1), and D. Benson (3)

(1) Universitat Politecnica de Catalunya UPC-BarcelonaTech, Barcelona, Spain (daniele.pedretti@upc.edu), (2) University of Notre Dame, Notre Dame, IN, USA, (3) Colorado School of Mines, Golden, CO, USA

For risk assessment and adequate decision making regarding remediation strategies in contaminated aquifers, solute fate in the subsurface must be modeled correctly. In practical situations, hydrodynamic transport parameters are obtained by fitting procedures, that aim to mathematically reproduce solute breakthrough (BTC) observed in the field during tracer tests. In recent years, several methods have been proposed (curve-types, moments, nonlocal formulations) but none of them combine the two main characteristic effects of convergent flow tracer tests (which are the most used tests in the practice): the intrinsic non-stationarity of the convergent flow to a well and the ubiquitous multiscale hydraulic heterogeneity of geological formations. These two effects separately have been accounted for by a lot of methods that appear to work well. Here, we investigate both effects at the same time via numerical analysis. We focus on the influence that measurable statistical properties of the aquifers (such as the variance and the statistical geometry of correlation scales) have on the shape of BTCs measured at the pumping well during convergent flow tracer tests. We built synthetic multigaussian 3D fields of heterogeneous hydraulic conductivity fields with variable statistics. A well is located in the center of the domain to reproduce a forced gradient towards it. Constant-head values are imposed on the boundaries of the domains, which have 251x251x100 cells. Injections of solutes take place by releasing particles at different distances from the well and using a random walk particle tracking scheme with constant local coefficient of dispersivity. The results show that BTCs partially display the typical anomalous behavior that has been commonly referred to as the effect of heterogeneity and connectivity (early and late arrival times of solute differ from the one predicted by local formulations). Among the most salient features, the behaviors of BTCs after the peak (the slope of the BTCs in log-log scales, which is the diagnostic plot to infer power-law type nonlocal distribution parameters due to hydraulic heterogeneity) indicate that anisotropy generates apparent higher capacity coefficients in certain directions. At very late times, however, the slopes display similar values, indicating that at these spatial scales (injection distances comparable with the integral scales), particles are stacked in low K areas for much longer than the advection times in higher K zones.