TRANSVERSE MIXING ENHANCEMENT IN HETEROGENEOUS ANISOTROPIC POROUS MEDIA

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Transverse mixing is a process of pivotal importance in order to understand and model reactive solute transport in porous media, especially if the analysis is focused on s teady state plumes developing from continuous sources. Processes occurring at different scales influence transverse mixing: incomplete dilution at the pore scale leads to a compound specific parameterization of the local (Darcy scale) transverse dispersion coefficient which depends non-linearly on the flow velocity, while flow heterogeneities at the field scale significantly enhance local mixing due to the squeezing of the streamlines in high permeability inclusions. For heterogeneous porous media generated using an isotropic exponential covariance function it has been recently derived an analytical expression to quantify mixing enhancement and effective transverse dispersion coefficients. In this work we investigate the influence in the efficiency of mixing enhancement of an
anisotropic Gaussian and exponential covariance function. We consider conservative as well as reactive solute transport in heterogeneous anisotropic porous media. We identify scenarios for which a compound specific description of transverse mixing is particularly important and we show that a correct quantification of the anisotropy can be as important as the quantification of the variance of the hydraulic conductivity field. Moreover, the results of Monte Carlo simulations,
allow us to derive effective transverse dispersion coefficients using the flux-related dilution index and the flux-related second central moments, and these values are used to estimate the length of contaminant plumes undergoing mixing-controlled degradation reactions.