



The Role of Dispersion in Steady State Heat Transport in 3D Heterogeneous Porous Media

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Heat is transported in aquifers by advection and conduction. Spatial variability of hydraulic conductivity causes fluctuations in small scale advection, whose effect can be represented by a dispersion term. However, the use of this term is still subject to controversy among modelers. We examine the effect of heterogeneity on the dispersion of a steady state 3D heat plume generated by a groundwater heat exchanger (GHE) in an aquifer. Transverse dispersion is estimated using a stochastic approach. We distinguish between effective and ensemble dispersion. Ensemble transverse dispersion is high near the heat source and decreases with distance from the GHE, while effective transverse dispersion is essentially constant. Both are significantly larger than thermal conductivity. No relevant effects are found regarding the energy dissipated by the GHE.