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EFFECTIVE SOLUTE TRANSPORT WITH LINEAR SORPTION IN LATTICE FRACTURE NETWORKS

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Summary. We study transport in a lattice fracture network with uncorrelated velocity fields using a stochastic modeling approach. We consider a two-dimensional regular fracture network model characterized by a constant fracture length and fracture angle. The transport velocity in the fractures is a random variable. Here, we present an exact derivation of effective equations for the average particle density and concentration variance from the microscopic disorder model. Within a Lagrangian transport framework, we derive effective equations for particle transport by coarse graining, noise averaging and ensemble averaging of the local scale Langevin equations. We rigorously show that average particle density describes effectively an uncoupled continuous time random walk (CTRW) and the concentration variance is quantified by a two particle CTRW. The obtained mean behavior and concentration variance are compared to direct numerical simulations of particle transport in single medium realizations and the corresponding ensemble averages.