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Effects of heterogeneity on density-driven convection in porous media SAIKIRAN RAPAKA, Johns Hopkins University, RAJESH PAWAR, PHILIP STAUFFER, GEORGE ZYVOLOSKI, Los Alamos National Laboratory, DONGXIAO ZHANG, University of Oklahoma, SHIYI CHEN, Johns Hopkins University & Peking University — In the context of geological sequestration of carbon dioxide, it is well known that convective transport is expected to play a crucial role in accelerating the rate of carbon dioxide dissolution into the brine present in the aquifer. Most previous studies of this convective process have considered a homogeneous porous medium. However, the properties of the aquifer are known to be extremely heterogeneous over all length scales. Previous research on convection in heterogeneous media has suggested that global quantities like Rayleigh number etc. may be inadequate for describing convective transport in such systems. In this work, we consider the process of density-driven convection in heterogeneous porous media using detailed numerical simulations with a Monte-Carlo approach. We present results using an averaged global Rayleigh number and show that it can be extremely useful in predicting convective transport in heterogeneous media. We also discuss the role played by the properties of the medium heterogeneity, and analyze the uncertainty in the predictions as the variance of the permeability field is increased.

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