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Mixing under convective flow in heterogeneus porous media

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Mixing in the presence of convective flow in porous media is governed by the behaviour of stagnation points where the fluid interface is stretched and compressed. We use a interface compression model combined with a stochastic approach to analyse the impact of the conductivity field structure on the fluid interface compression and on fluid mixing behaviour. We consider a Rayleigh-Bénard instability in which the stagnation points are at a fixed interface and Rayleigh-Taylor instability in which the interface is mobile. Using a stochastic approach we perform a series of numerical simulations using randomly generated conductivity fields realizations with varying statistical properties. We analyse the impact of variance and spatial correlation of conductivity fields on the way the fluid interface is compressed and on the mixing behaviour of the system. The flow structures are visualized by the strain rate and characterized by their correlation length.