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# Eulerian simulations to assess dispersion for transport through 2D correlated porous media

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Transport through 2D correlated porous media has been shown to induce mixing through deformation of material elements owing to the heterogeneity in the flow fields [1]. The stretching of line elements brings about an increase in the area for reaction and increases the diffusive flux through the thinning of the direction transverse to stretching and is thought to be an important mechanism to determine hotspots of mixing in various flow conditions [2]. These mechanisms are useful to quantify the extent of reaction for fast reactive fluids wherein the local reactivity may be obtained through the information gained from the gradient maps of a conservative tracer. Unlike earlier works which have primarily focussed on a Lagrangian approach for quantifying dispersion, we attempt to establish the dispersion rates in the transport through a porous media by means of fully resolved Eulerian simulations for the typical Peclet numbers (ratio of the diffusion time to the advection time) encountered in transport through porous media. The observations do indicate that the dispersion has a strong dependence on the Peclet number and correlation length for lognormal conductivity fields. This approach will helps us alleviate the problems of binning and coarse graining that the Lagrangian methods suffer from.

[1] Borgne, Tanguy Le, Timothy R. Ginn, and Marco Dentz. "Impact of fluid deformation on mixing-induced chemical reactions in heterogeneous flows." Geophysical Research Letters 41.22 (2014): 7898-7906
[2] Bandopadhyay, Aditya, Philippe Davy, and Tanguy Le Borgne. "Shear flows accelerate mixing dynamics in hyporheic zones and hillslopes." Geophysical Research Letters 45.21 (2018): 11-659.