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Influence of permeability anisotropy on mixing controlled reactive transport simulations in porous media

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Several studies have demonstrated how plume deformation induced by flow heterogeneity in porous media can enhance mixing of reactants. This enhancement can have important impact on mixing controlled reactions such a biodegradation of plumes of organic compounds. On the other hand, recent studies have indicated the possibility of observing complex flow topology on groundwater flow that occurs in anisotropic yet homogenous porous media. Moreover, it has been demonstrated that those complex flow topologies can also enhance solute mixing.

We study the effect of medium anisotropy on reactive solute transport for the case of a chemical reactor composed of two homogeneous anisotropic layers. We simulate different injection strategies for different chemical reactions that involve two reactants. We demonstrate the effect of the medium anisotropy by analyzing the results of the simulations and identify best strategies for the operation and design of the system to maximize reaction rates. These findings could have potential application in the design of new remediation systems for contaminated groundwater, chemical reactors and other engineering problems that involve flow through porous media.