

Applied and Computational seminar

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3:00

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Multiscale modelling of fluid migration in subsurface aquifers

Abstract:

The threat of global warming has motivated for the disposal of greenhouse gases, e.g., CO₂, into aquifers. An understanding of how CO₂ migrates in a subsurface aquifer has thus been an active research area in the field of geoscience and reservoir engineering. When a volume of injected CO₂ accumulates beneath an impermeable cap-rock due to gravity forces, the density of brine increases just below the cap-rock, which results into downward fingers of the binary fluid, showing a fully multiscale nature of the flow.

In this talk, I will discuss the development of a multiscale model for simulating CO₂ migration in an aquifer, and will present a multiscale eddy simulation~(MES) methodology. Starting with first principle conservation laws, I will show how the method of volume averaging technique~(VAT) incorporates multiscale fluctuations of momentum fluxes to a overly simplified Darcy's model so that the density stratification due to the dissolution of CO₂ can be resolved with the MES model. A detailed understanding of the multiscale nature and the effect of stratification on the vertical migration of CO₂ may provide further insight into the solution

trapping strategy, as well as, to the time scale of possible CO2 leakages. If time permits, I will try to put some hint on how the MES model would benefit the enhanced oil recovery process and other related areas, where CO2 is injected to displace a resident fluid.