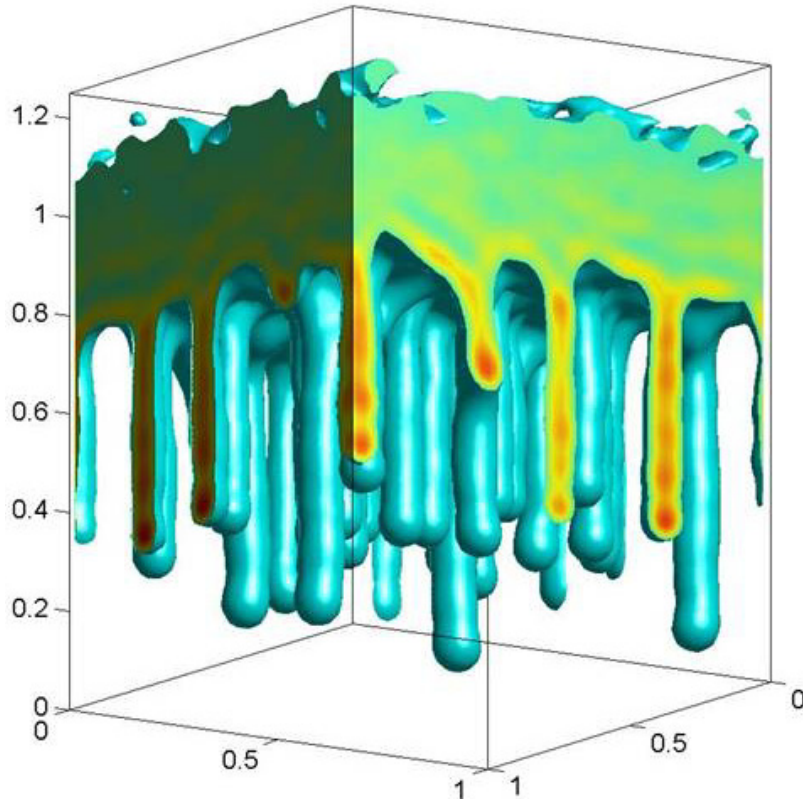


Earth System Initiative Young Faculty Seminars:

Non-equilibrium physics of multiphase flow in porous media: Origin of gravity fingers



4:00 pm Tuesday, February 9th
MIT Building 54-915
Reception to Follow

Ruben Juanes

ARCO Assistant Professor in Energy Studies
Civil and Environmental Engineering

Simultaneous flow of multiphase fluids through porous media is a pervasive natural phenomenon—such as when water infiltrates soil, and during the formation of methane hydrates in ocean sediments and permafrost. It also is central to critical energy technologies, like production of oil and gas reservoirs and CO₂ injection into geologic formations. Yet our ability to model multiphase flow at the macroscopic scale is still in a stage of infancy.

I present a new approach to modeling multiphase flow that incorporates one basic feature—a system out of thermodynamic equilibrium. To demonstrate this approach, I examine the infiltration of water into soil to solve a long-standing mystery in soil physics: why do the infiltration fronts lead to preferential flow paths—aka gravity fingers? The answer has direct implications for predicting contaminant travel times through the vadose zone, recharge rates in shallow aquifers, and the susceptibility of soils to desertification.



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