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Instability onset and mixing by diffusive Rayleigh-Benard Convection in a Hele-Shaw Cell DANA EHYAEI, KEN KIGER, University of Maryland — The injection and eventual dissolution of carbon dioxide in deep saline aquifers has suggested as an effective means of carbon sequestration. Typical injection conditions produce a buoyantly stable source of CO2 layered on top of the brine, whose dissolution is greatly accelerated by the onset of dissolution-driven, negatively buoyant, convective plumes that develop at the interface. The current work is a study conducted within a Hele-shaw cell, as an analogue for porous media, using working fluids that are mixtures of methanol and ethylene glycol diffusing in water, imitating the convective behavior of CO2 in the brine. The underlying physics of the flow are examined by measuring the velocity field directly via PIV, using appropriate methods to allow quantitative measurement in this thin-gap flow. This technique allows for detailed measurement of the entire evolution of the velocity and vorticity field during onset, growth and saturation of the instabilities. Features of the flow, the mechanisms that govern it and accurate time scales form onset time to later time mixings would be discussed for different Rayleigh numbers ranging from 2000 to 15000.

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