Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

CO_2 migration in saline aquifers: a gravity current model with capillary and solubility trapping[1] RUBEN JUANES, CHRISTOPHER MACMINN, MICHAEL SZULCZEWSKI, MIT — Injection of carbon dioxide into geological formations is widely regarded as a promising tool for reducing global atmospheric CO_2 emissions. While an accurate understanding of the post-injection spreading and migration of the plume of mobile CO_2 is essential, many aspects of the fundamental physics of CO_2 migration are poorly understood. Here, we develop a sharp-interface mathematical model for the post-injection migration of a CO_2 plume driven by groundwater flow in a sloping aquifer, subject to both residual trapping and CO_2 dissolution. We show that the interplay between dissolution and migration leads to three regimes, depending on how quickly the water beneath the plume saturates with dissolved CO_2. We develop some semi-analytical solutions to the migration equation when the water beneath the plume saturates very slowly or very quickly relative to plume motion, and we solve the migration equation numerically in general. We use these solutions to study the relative importance of capillary and solubility trapping, and the impacts of these physical mechanisms on the storage capacity of an aquifer.

[1]Funded by the U.S. D.O.E. under Grant DE-FE0002041

Ruben Juanes
MIT

Date submitted: 06 Aug 2010 Electronic form version 1.4