

Evaluation of large-scale CO₂ storage on fresh-water sections of aquifers: an example from the Texas Gulf Coast Basin

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Abstract:

Large-scale injections of CO₂ into subsurface saline aquifers have been proposed to remediate climate change related to buildup of green house gases in the atmosphere. The pressure buildup caused by such injections may impact a volume of the basin significantly larger than the CO₂ plume itself. In areas with hydrological settings similar to the Gulf Coast Basin, the perturbation of the flow-field in deep parts of the basin could result in brines or brackish water being pushed up-dip into unconfined sections of the same formations or into the capture zone of fresh-water wells. The premise of the current study is that the details of multiple-phase flow processes necessary to model the near field evolution of the CO₂ plume are not necessary to describe the impact of the pressure anomaly on up-dip aquifers. This paper quantitatively explores conditions under which shallow groundwater would be impacted by up-dip displacement of brines, utilizing an existing carefully calibrated flow model. Modeling an injection of water, arguably equivalent to 50 million tons of CO₂/year for 50 years resulted in an average water-table rise of ~1 m, with minor increase in stream baseflow and larger increase in ground water evapotranspiration, but no significant change in salinity.

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