Evaluation of large-scale CO_2 storage on fresh-water sections of aquifers: an example from the Texas Gulf Coast Basin

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Abstract:

Large-scale injections of CO_2 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 CO_2 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 CO_2 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 CO_2/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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