Numerical simulation of CO_2 storage and CO_2 leakage along faults during CO_2 geo-sequestration in saline aquifer by THMC software

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Abstract

The immediacy of climate change is obviously highlighted by the global carbon issue, which has spotlighted CO_2 geo-sequestration within saline aquifers as a key strategy for carbon capture and storage (CCS) sites. However, many studies have still not clearly considered the densities of CO_2 and brine, along with the basic concept of CO_2 density and caprock permeability alteration during CO_2 storage. Furthermore, leakage risk is one of the highest risks, so it is necessary to predict the leakage. This study employs a tool notably developed by CAMRDA at NCU, the THMC 7.1 model for the simulation of the complex interplay of underground T-H-M-C processes, especially observing the movement and stabilization of CO_2 under different CO_2 density, caprock permeability conditions, and assessing the potential for CO_2 leakage along faults in caprock layers. The main results focus on CO_2 movement with different CO_2 densities of the supercritical phase; lower density causes the CO_2 to rise towards the top of the aquifer, yet higher density will stabilize CO_2 distribution. Simultaneously, the results also indicate that THMC 7.1 successfully simulates CO_2 storage in the deep saline aquifer. Afterward, in a deep-going study of leakage potentials along faults in caprock layers, fault simulations aim to pinpoint leakage pathways to ensure safety and stability during injection and post-injection.

Keywords: CO_2 geo-sequestration, CO_2 movement, CO_2 leakage, Fault, THMC 7.1.