CCG39

Use of 3-Dimensional Dynamic Modeling of CO_2 Injection for Comparison to Regional Static Capacity Assessments of Miocene Sandstone Reservoirs in the Texas State Waters, Gulf of Mexico

Wallace, K.[1]**, Meckel, T.** [1]**, Carr, D.** [1]**, and Trevino, R.** [1]
kerstanwallace@utexas.edu
1. Gulf Coast Carbon Center, Bureau of Economic Geology, Austin, TX

A 14,467 sq. mi area of the coastal and offshore Texas Miocene interval was evaluated for CO_2 storage capacity using 3,008 wireline logs with paleontological and USGS overpressure data. Capacity was estimated using the static (volumetric) NETL approach. Input parameters of porosity and sand thickness were determined from logs and CO_2 density was determined by applying a regional pressure and temperature based depth-to-density transform to the midpoint depth of the interval of interest. Capacity was calculated for the entire Miocene interval above overpressure and below non-supercritical CO_2 conditions using an efficiency factor of 0.03 and interpolated over the area with a grid cell size of 1 sq. mi. Total capacity was found to be 86 Gt of CO_2, (range: .02-14.5 Mt/sq. mi.; average: 6.4 Mt/sq. mi). In order to determine the effectiveness of the regional assessment, we examine dynamic aspects of capacity using both simple analytical and complex reservoir injection simulations.

Initially, injection is simulated into an idealized reservoir using an analytical solver for pressure and fluid front evolution through time. Key assumptions include boundary conditions, sweep efficiency and relative permeability, especially end point water saturation. This calculation focuses on the time that it takes to access the available storage space. Results are presented for large-scale blocks within the regional static calculation.

Subsequently, a 3D dynamic model has been generated for a Miocene reservoir near San Luis Pass, offshore Galveston Island and compared with the regional static and analytical dynamic capacity assessment values over the same area. The dynamic model was created using a 3D seismic volume tied to well logs in order assign rock properties as continuous fields over the reservoir. Seismic imaging from RMS, semblance, coherency, and sweetness attributes are used to help determine distribution of depositional environments.

We examine how realistic distributions of CO_2 within a reservoir from injection modeling compare to idealized distributions from static calculations with no structural/fluid flow considerations. We observe revisions in total capacity estimation with increasingly refined geologic data and scale. We hypothesize that with increased effort (data, time, costs, etc.) estimates of storage capacity will evolve asymptotically, reaching a value that becomes relatively insensitive to additional inputs compared to the uncertainty related to those inputs.

Keywords: carbon capture and storage, capacity, Miocene, Offshore Texas