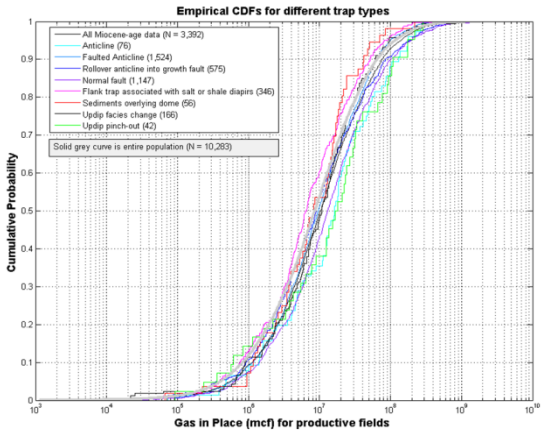
Reliable Capacity Estimation: Natural Analogs, Data, and Models

Project Description

The petroleum system of the Gulf of Mexico (GoM) was considered a natural analog for future engineered, anthropogenic CO_2 storage developments. The Miocene-age section of Texas State waters was selected as a most promising subset.



Cumulative Distribution Function for Gulf of Mexico Miocene trap type

Methods

- Compilation and analysis of data from GoM Miocene petroleum fields, i.e., field size, fluid type, trap type, porosity, permeability, pressure, etc. Datasets were subsequently used as inputs for various models to predict CO_2 flow during and after injection in specific reservoirs.
- A simple dynamic algorithm proposed by Jain and Bryant (2011) was applied to an offshore Texas Miocene reservoir.
- Development of a 3D dynamic flow model for a reservoir site in the offshore Texas Miocene interval. A base case, along with 8 variation cases was simulated using three model scenarios: homogeneous, statistically heterogeneous, and seismic-based heterogeneous (27 total model cases).

Impacts

Key results from work on analogs include

- Treating faults as no-flow boundaries (fill-to-spill modeling) is not accurate and fault rock properties must be used in modeling long term CO_2 sequestration capacity (Nicholson, 2012).
- Membrane fault seal and fault slip stability workflows established for the Lower Miocene in Texas State Waters can be used to quantify column heights and storage capacities for both site specific and regional capacity estimations. (Nicholson, 2012).
- In regional capacity assessments, incorporating measured sand thickness vs. gross sand interval thickness increases accuracy and may reduce estimated regional capacity by around 25% (Wallace et al., 2014).
- Use of regional assessments to determine feasibility for long term CCS planning may lead to an extremely optimistic understanding of actual storage potential (Wallace, 2013).

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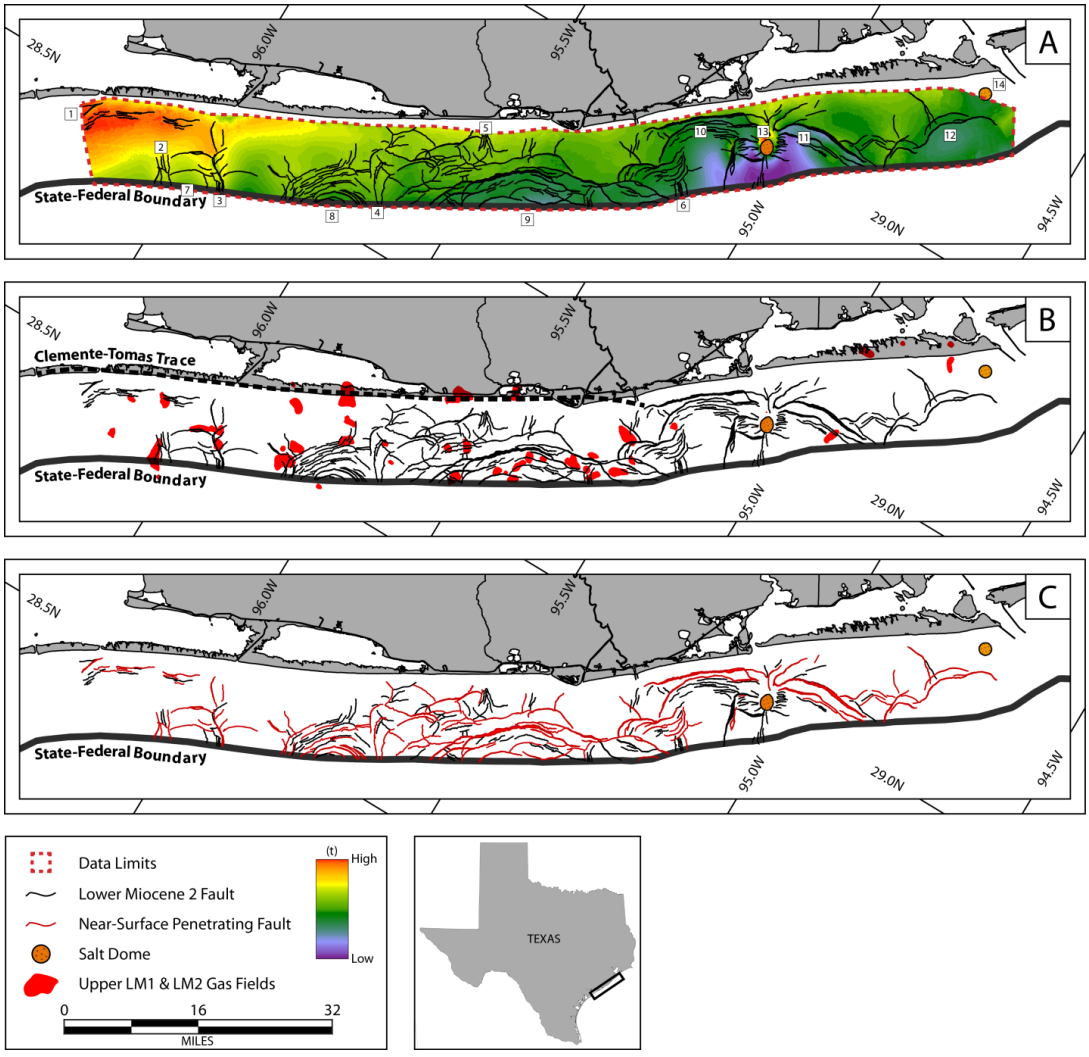

Structure, faulting, and natural gas accumulations of the Lower Miocene, upper Texas coast.

Selected Citations

Miller, E. N., 2012, A question of capacity assessing CO_2 sequestration potential in Texas offshore lands: The University of Texas at Austin, Master's thesis, 119 p.

Nicholson, A. J., 2012, Empirical analysis of fault seal capacity for CO_2 sequestration, Lower Miocene, Texas Gulf Coast: The University of Texas at Austin, Master's thesis, 88 p.

Wallace, K J., Meckel, T. A., Carr, D. L., Treviño, R. H., and Yang, C., 2014, Regional CO_2 sequestration capacity assessment for the coastal and offshore Texas Miocene interval: Greenhouse Gases: Science and Technology, v. 4, no. 1, p. 53–65.

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