MODELING CO_2 STORAGE AND MIGRATION IN HETEROGENEOUS SALINE FORMATIONS

In Support of Risk Assessment and Mitigation Strategies
(Task 3.1)

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Task 3.1. Risk Assessment and Mitigation Strategies

Partnership for carbon capture & offshore geologic storage
GoMCarb

GCCC
Gulf Coast Carbon Center

Bureau of Economic Geology

NETL
National Energy Technology Laboratory

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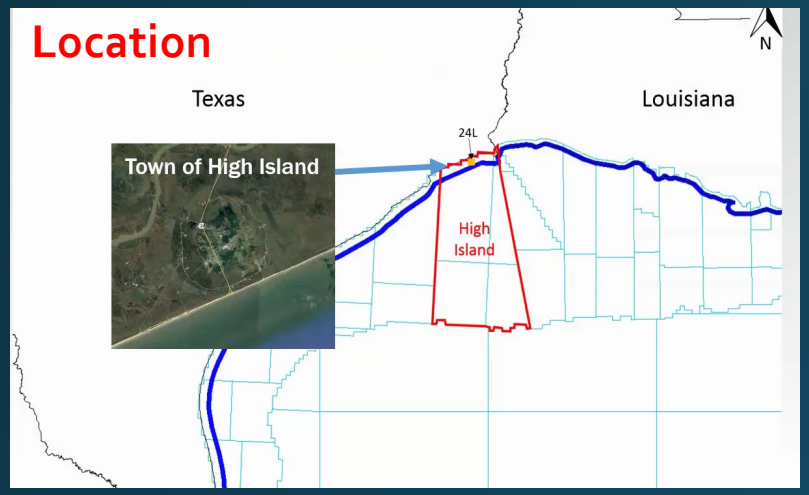
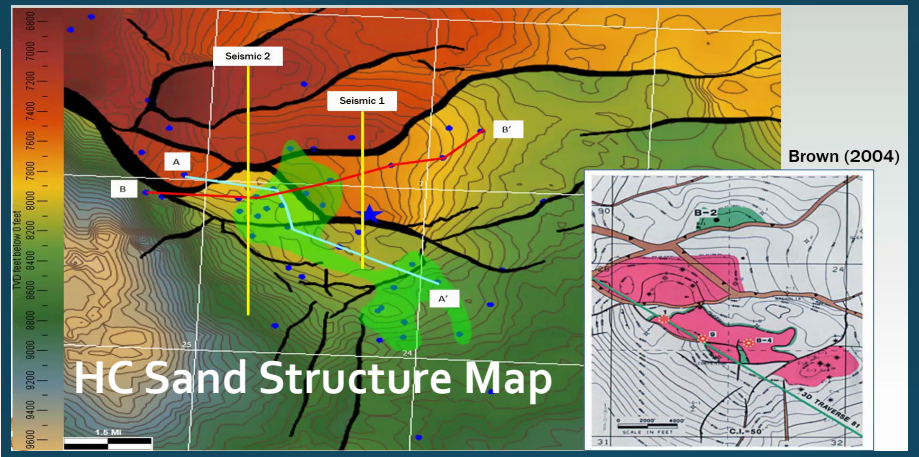
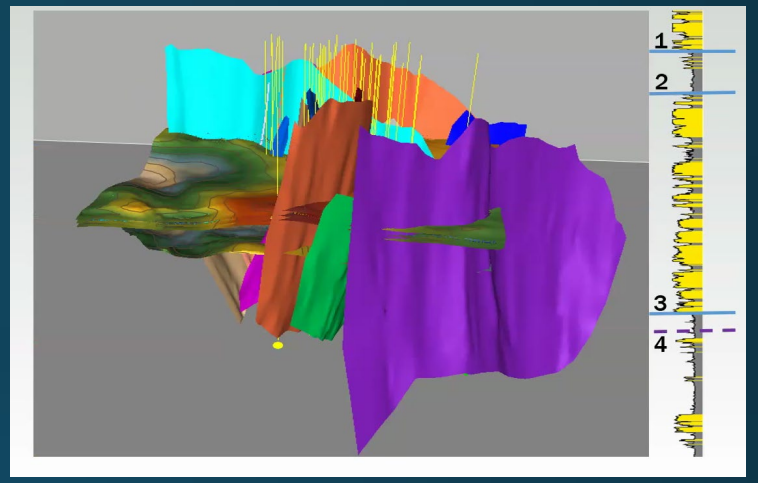
Study Area in High Island

Location

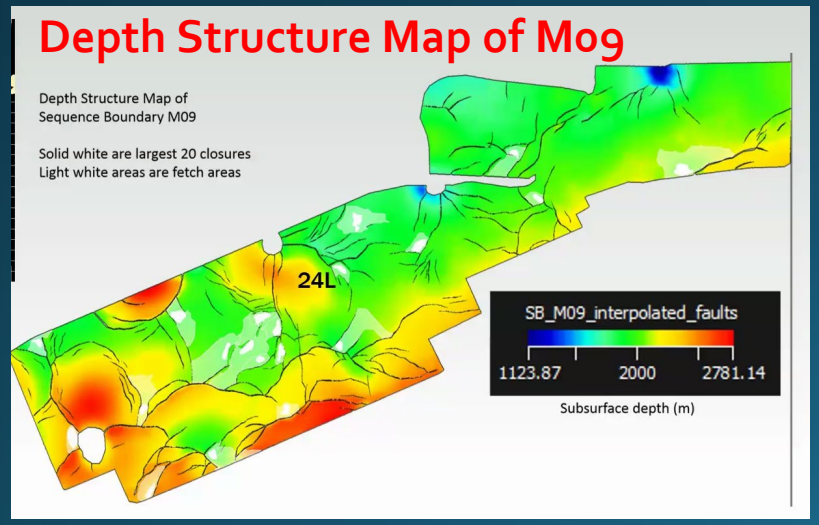




Geological Model Framework

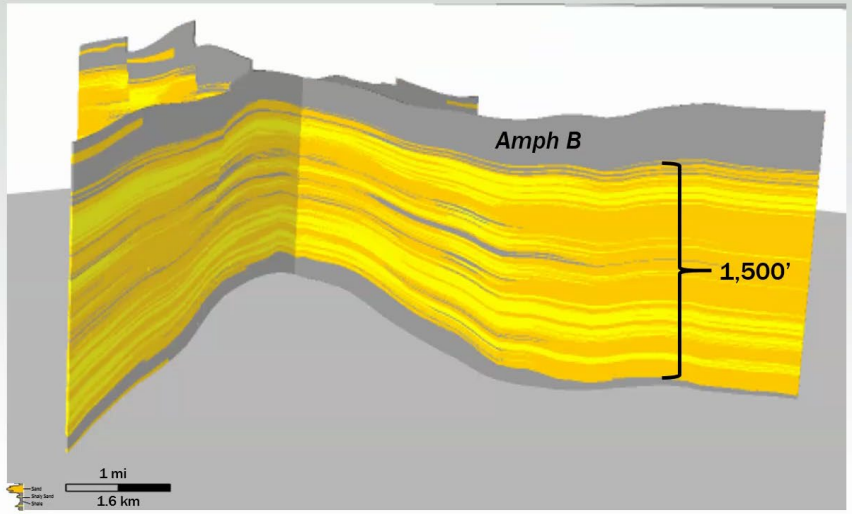


Depth Structure Map of Mo9

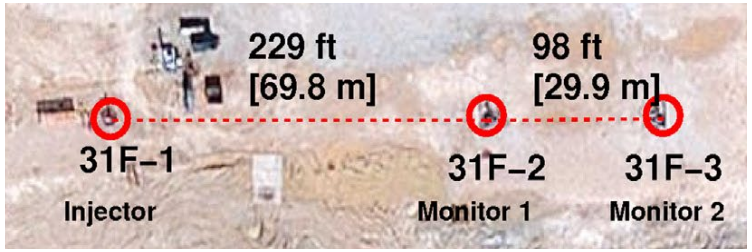


Current Model

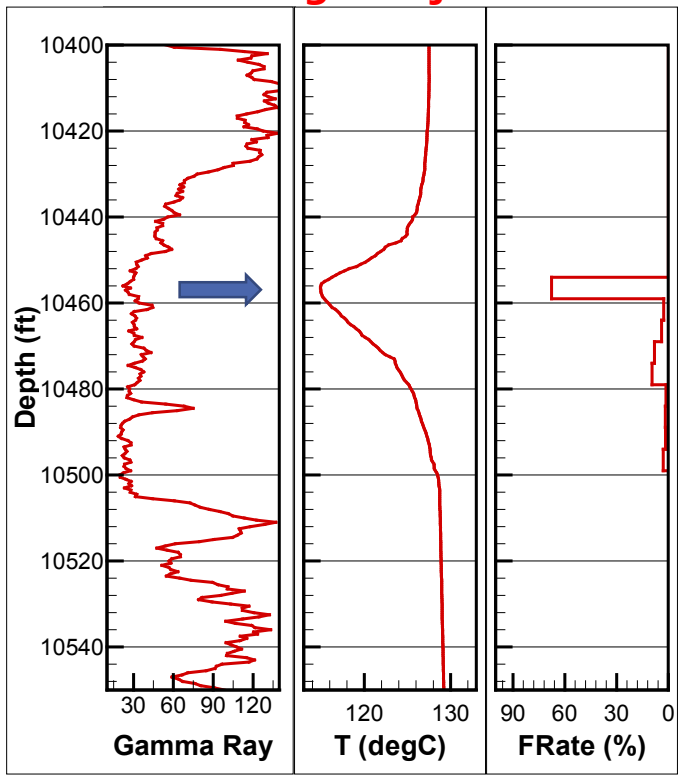
- 175 sq km/67 sq mi area
- 26 million cells
- Amph B Shale can be recognized
- Sandstone and Shaly Sand Facies is the main injection interval
- Thick Shale package lies beneath the Aggradation section

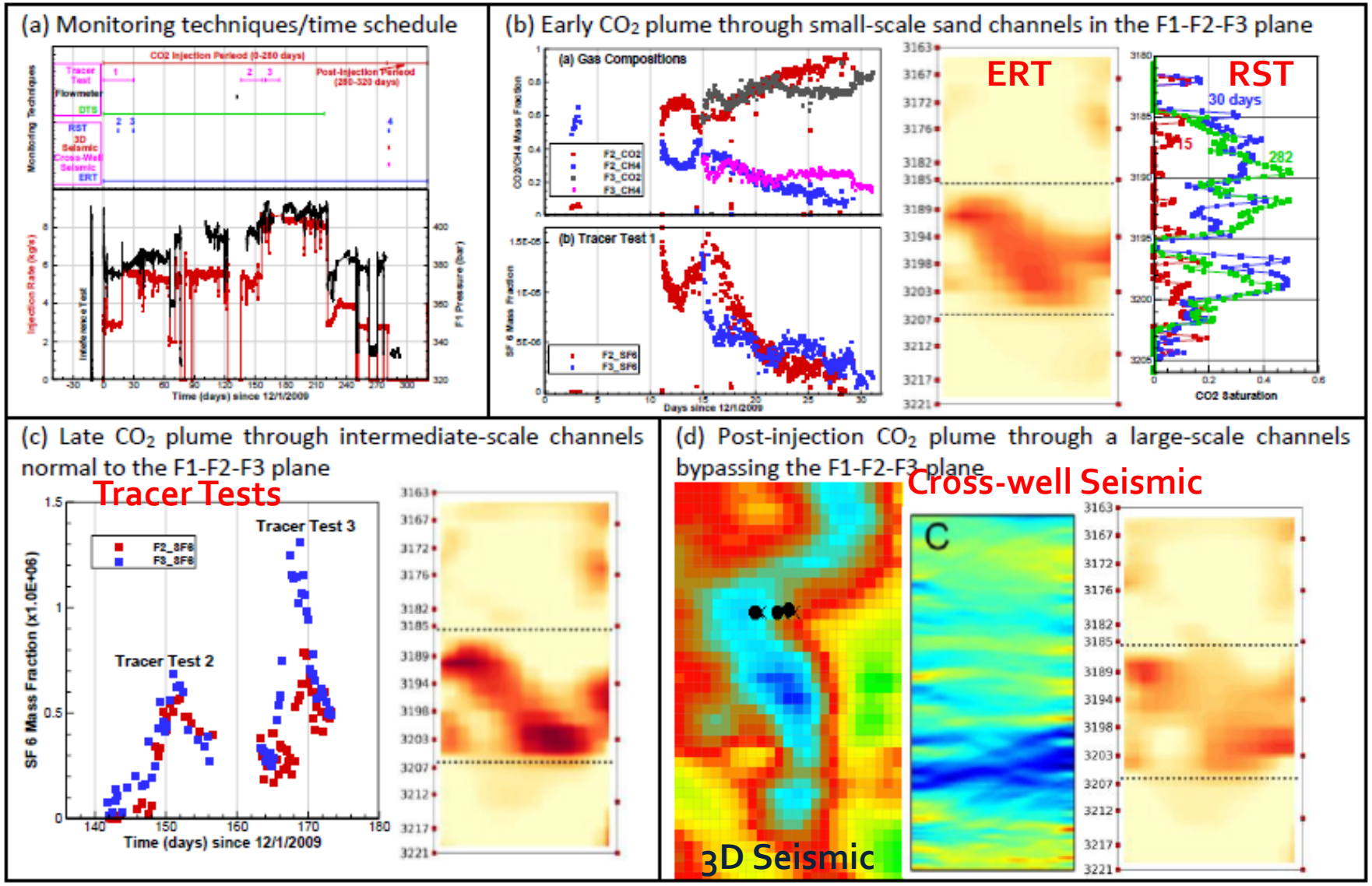


Multiscale Channeling of CO_2 Flow at Cranfield

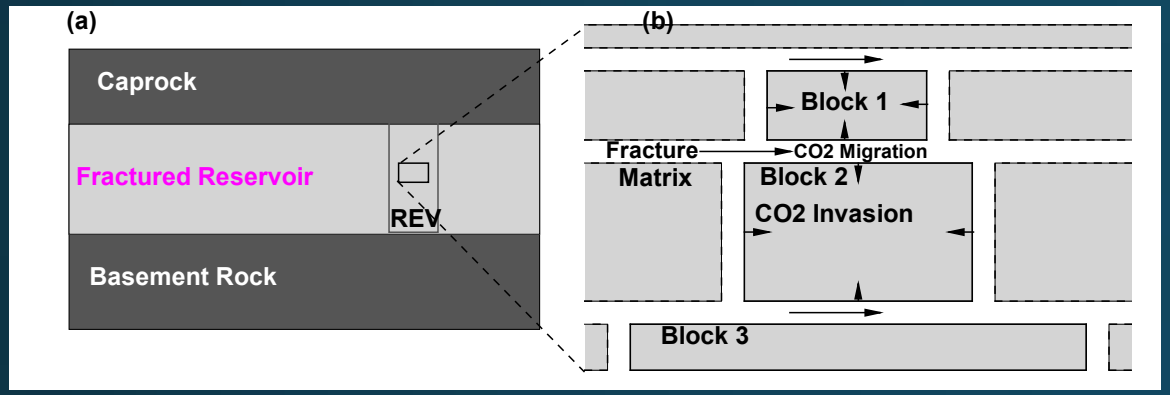


CO2 Channeling at Injection Well

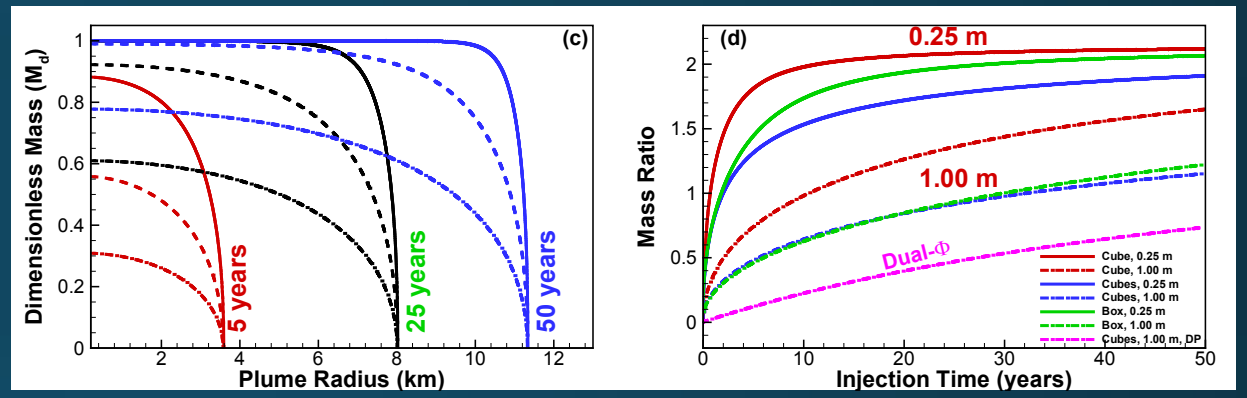




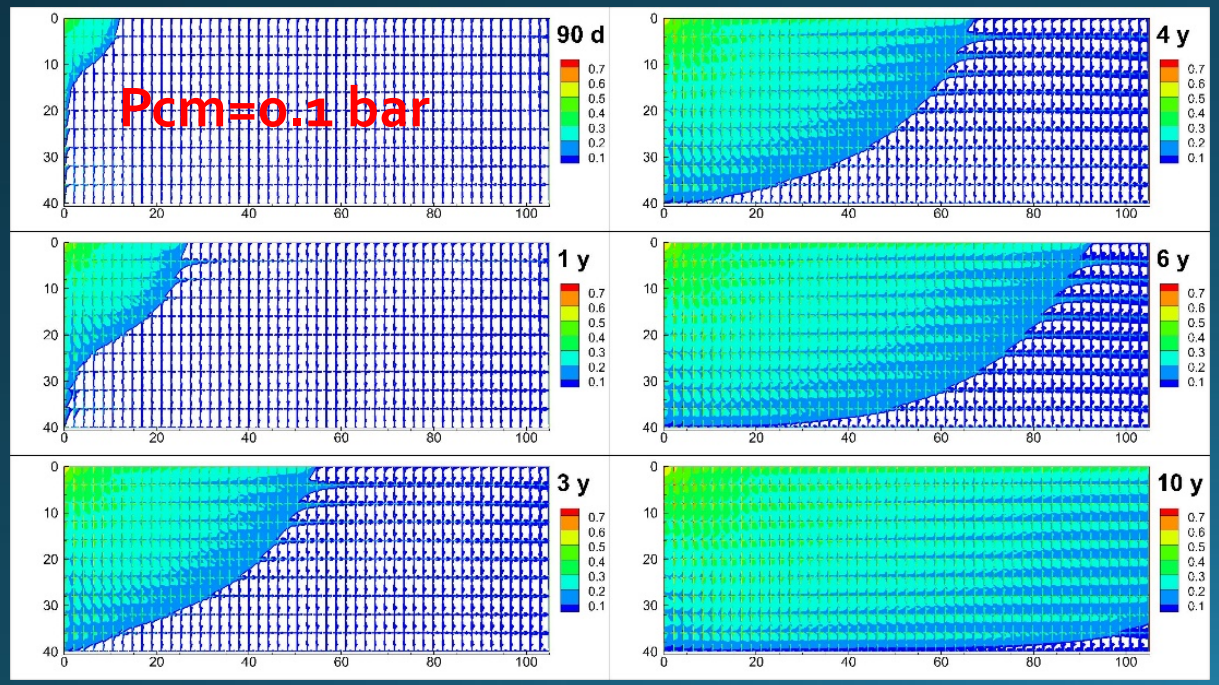
Modeling of Channelized CO_2 Flow and Storage in Fractured Reservoirs

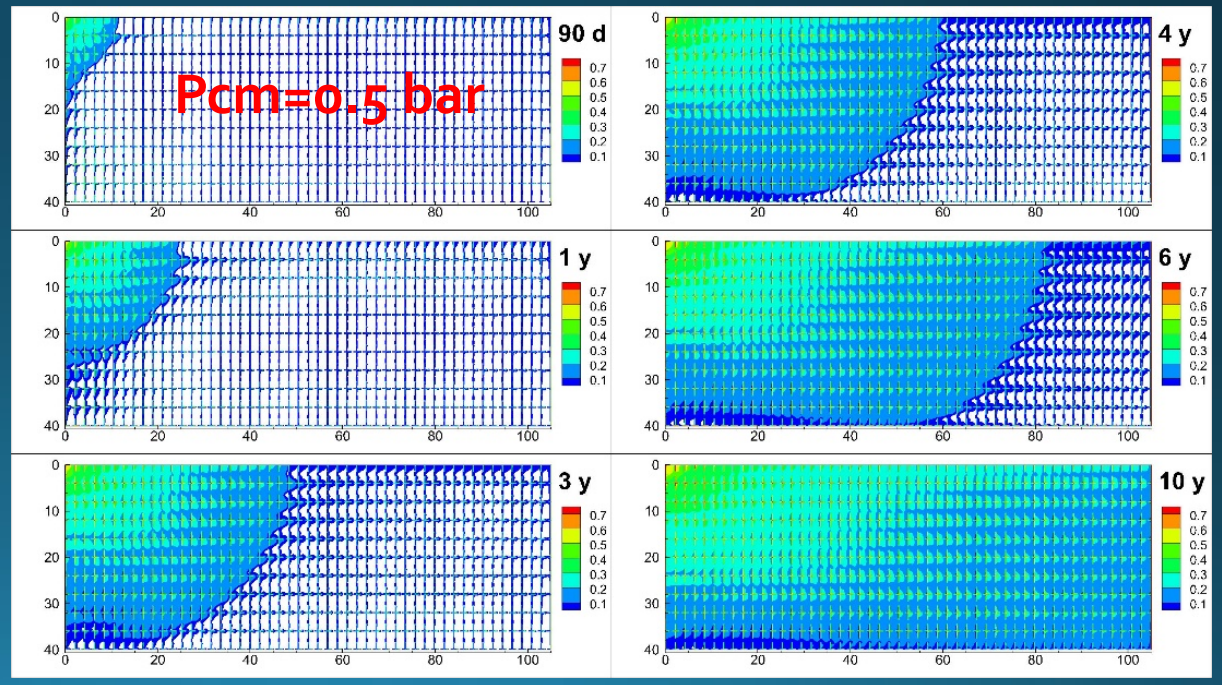


Dissolved CO2 Storage (Zhou et al., 2017a, b, 2019)



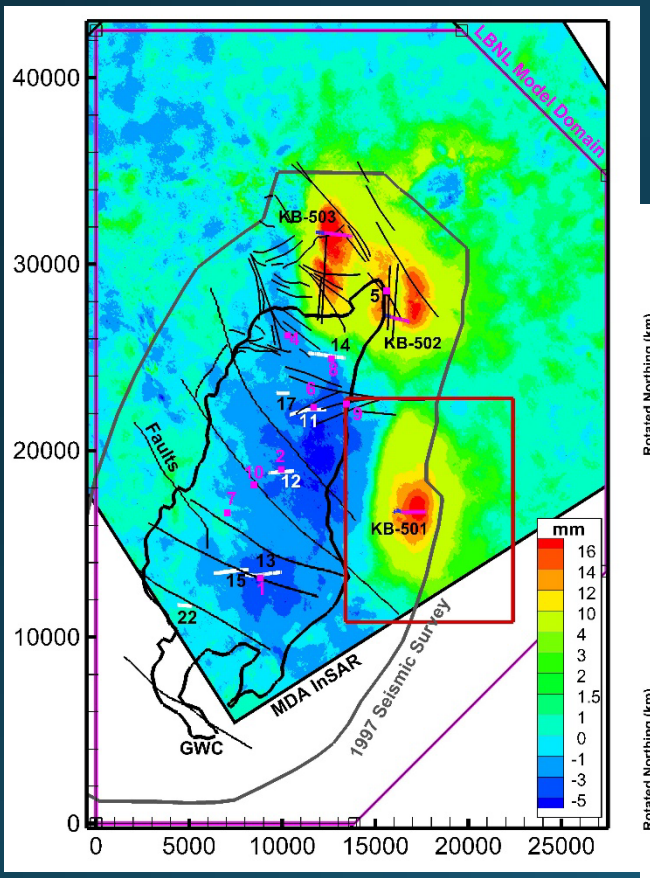
Free-Phase CO2 Storage



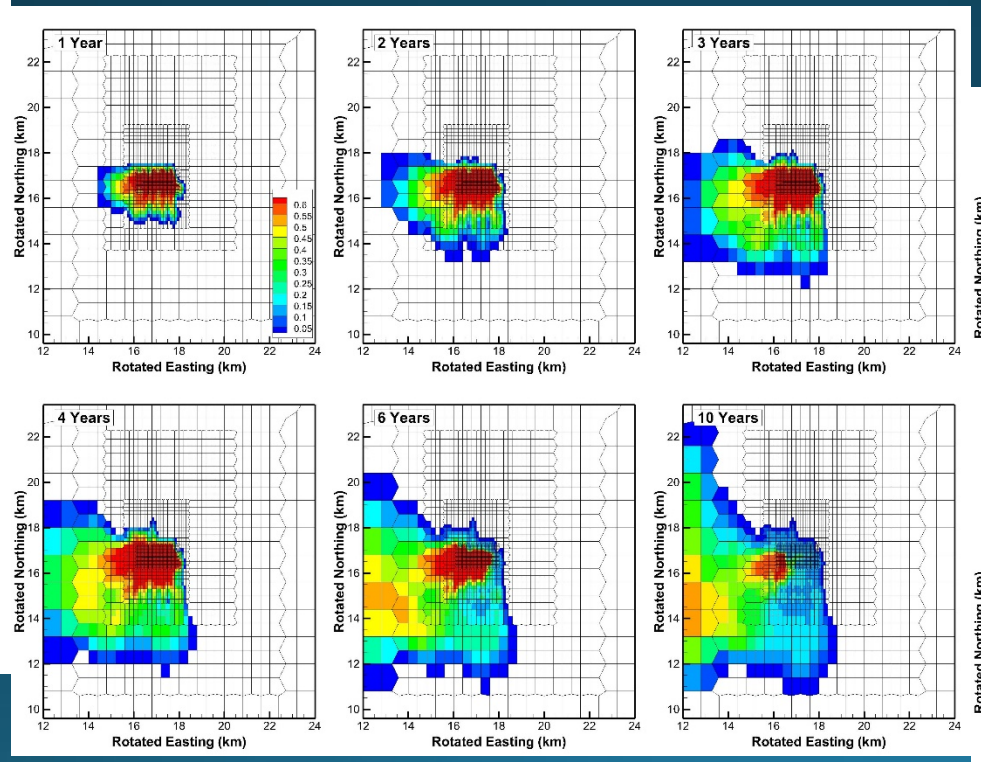


Modeling of CO_2 Storage in the Fractured Reservoir at In Salah

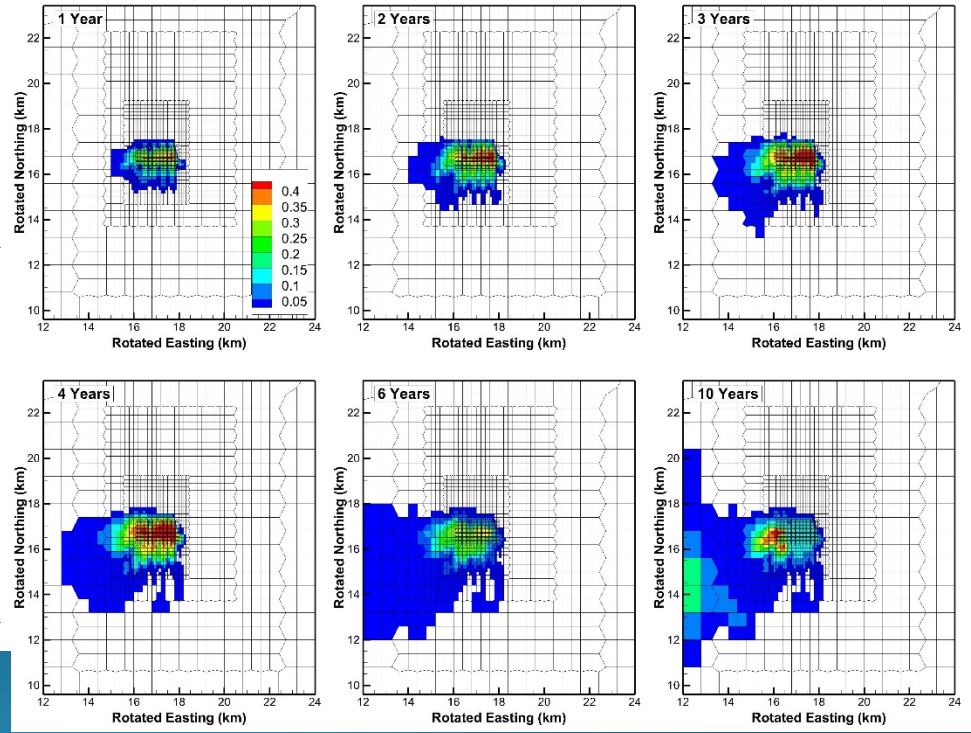
Site Map



CO2 Saturation in Fracture Continuum



CO2 Saturation in the Matrix



Relevant Publications

- Zhou, Q., Oldenburg, C. M., Spangler, L.H., & Birkholzer, J. T. (2017). Approximate solutions for diffusive fracture-matrix transfer: Application to storage of dissolved CO_2 in fractured rocks. *Water Resources Research*, 53(2), 1746–1762, doi:10.1002/2016WR019868.
- Zhou, Q., Oldenburg, C. M., Rutqvist, J., & Birkholzer, J. T. (2017). Revisiting the fundamental analytical solutions of heat and mass transfer: The kernel of multirate and multidimensional diffusion. *Water Resources Research*, 53, 9960–9979, doi:10.1002/2017WR021040
- Zhou, Q., Oldenburg, C. M., & Rutqvist, J. (2019). Revisiting the analytical solutions of heat transport in fractured reservoirs using a generalized multirate memory function. *Water Resources Research*, 55, doi: 10.1029/2018WR024150.
- Zhou, Q., Oldenburg, C. M., & Birkholzer, J. T. (2019). Multirate invasion of supercritical CO_2 in fractured reservoirs: Effects of buoyancy and matrix capillary continuity. Water Resources Research (to be submitted in May 2019).
- Zhou, Q., Oldenburg, C. M., & Birkholzer, J. T. (2019). A hybrid discrete-continuum model for modeling supercritical CO_2 storage in fractured reservoirs. Water Resources Research (to be submitted in July 2019).