

Storage to Support Large Volume CO₂ Hubs: Tools for Assessing the Maximum Density of CO₂ Wells in an Area

Susan D. Hovorka

**Senior Research Scientist, Gulf Coast Carbon Center
Bureau of Economic Geology, Jackson School of Geosciences,
The University of Texas at Austin**

**Carbon Management Project Review Meeting
Pittsburg, PA, 8/16/2022**

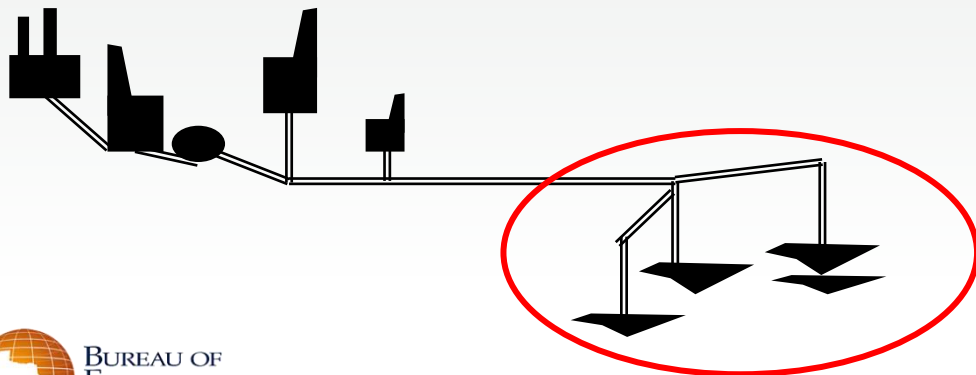


Next Stages for CCS

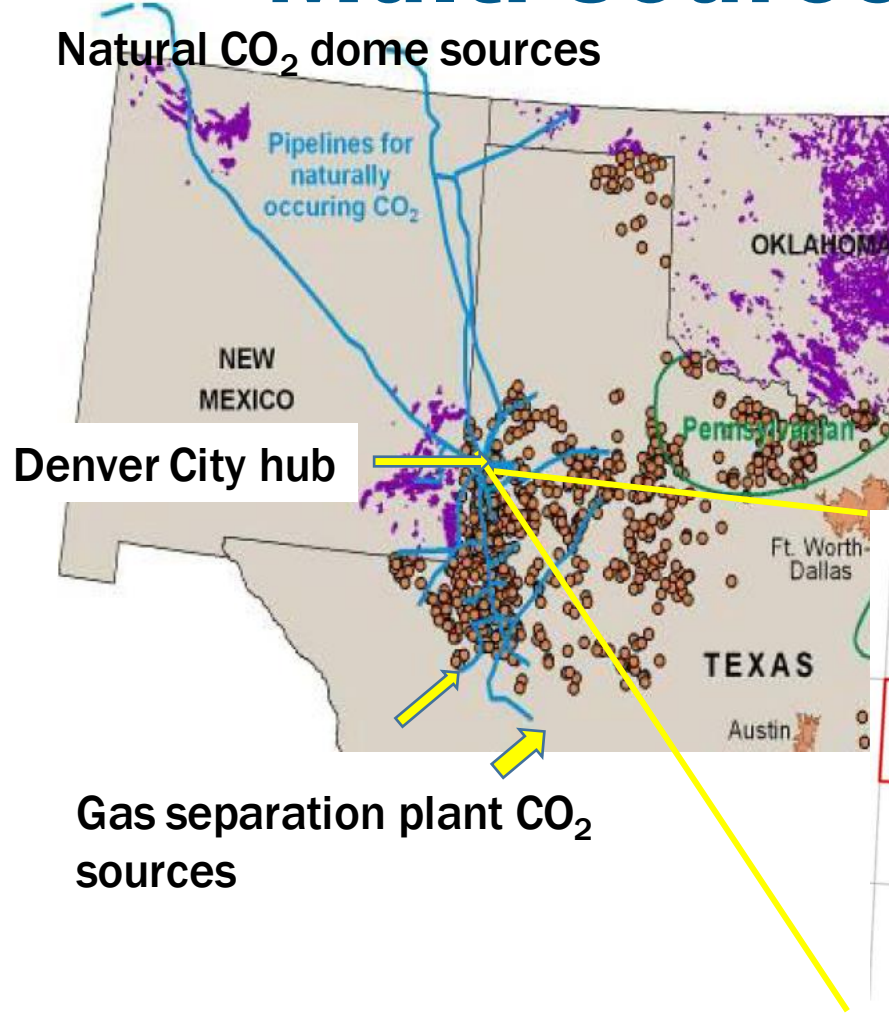
- Past projects: Single source to single sink, 0.5 - 2 MMT per year injection rate.



- Next for large volumes: CO₂ emissions from **clusters** of diverse sources amalgamated at **hub** or **trunkline** and then dispersed to arrays of **storage complexes**.

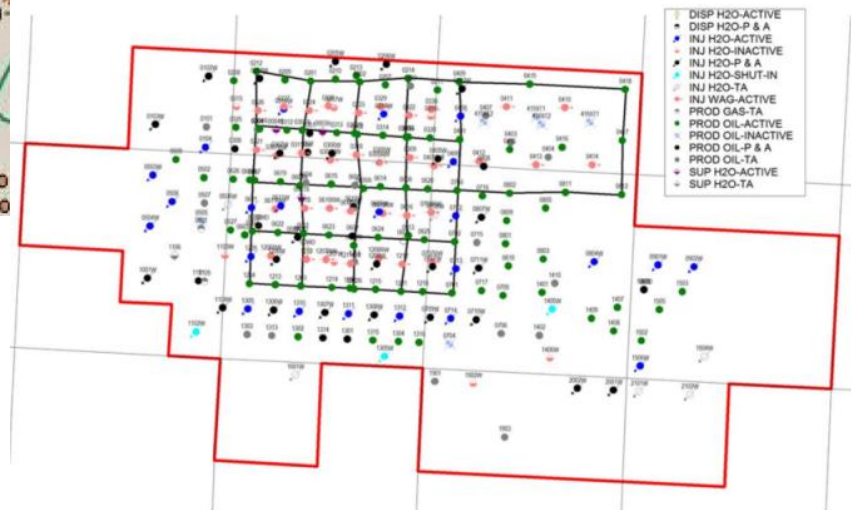


Multi-source, multi-pipeline, multi-sink



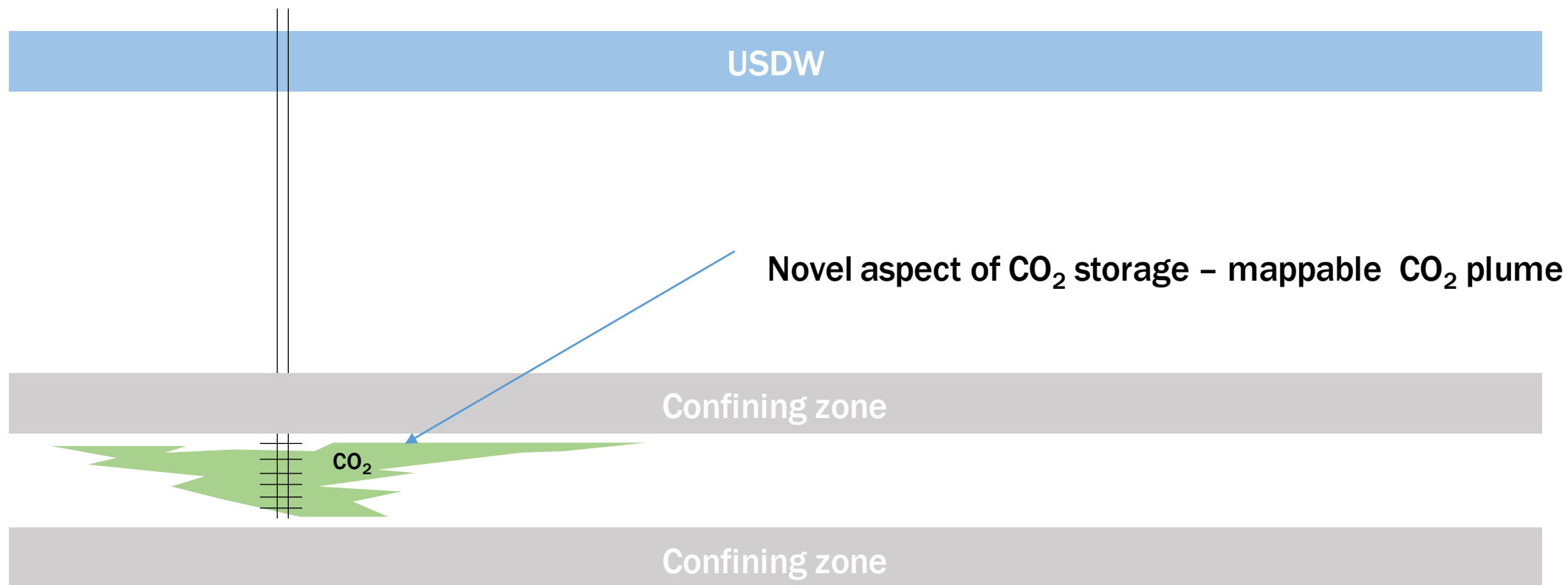
Permian Basin CO₂ pipelines provide a mature model

- Several sources (natural and gas separation)
- Multiple sinks, each with multiple wells

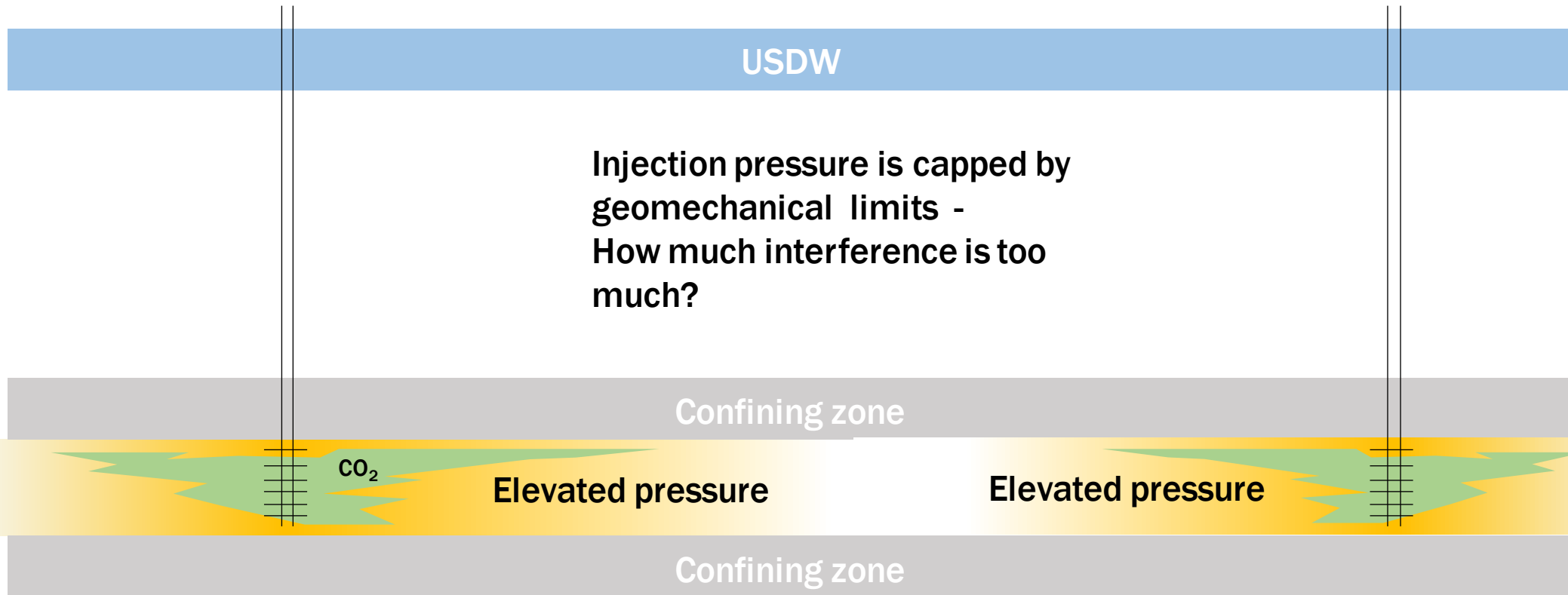


Note: in secondary and EOR extraction produces a “balanced flood”

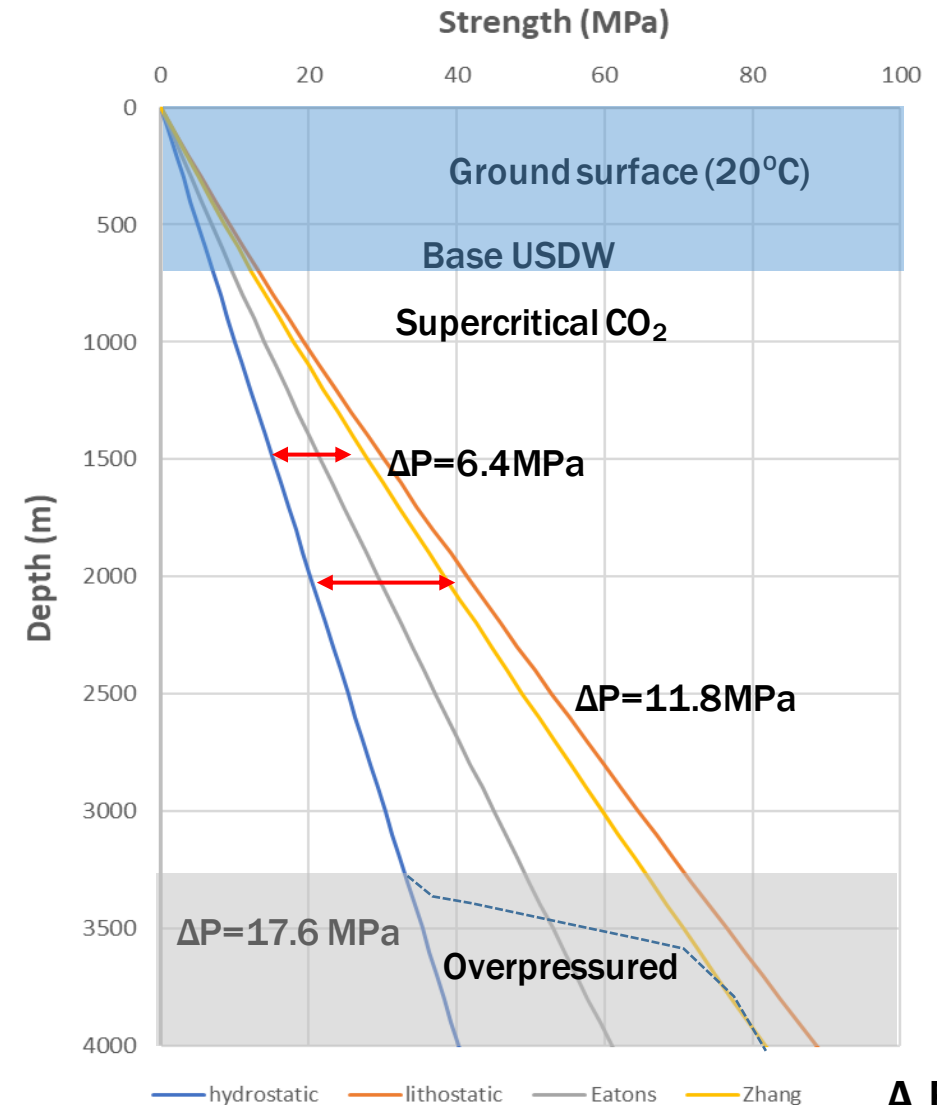
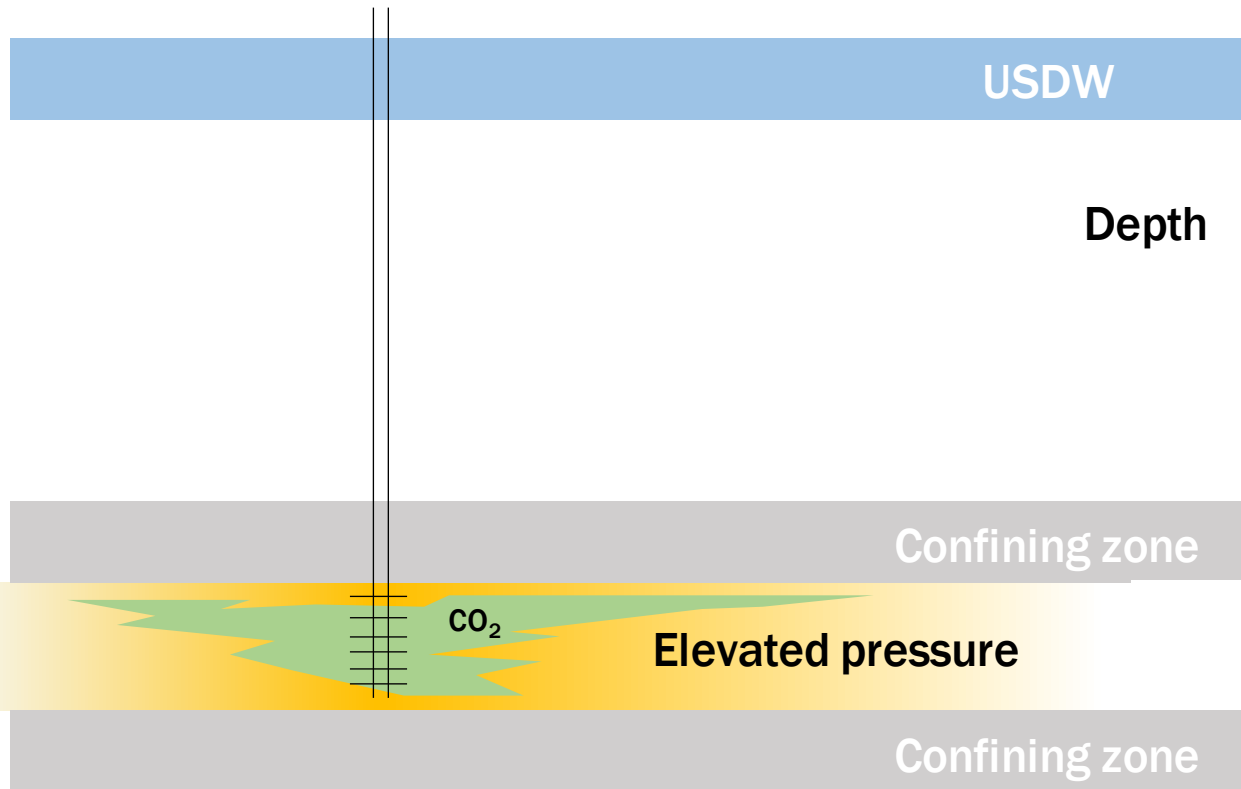
Well Spacing



Well Spacing – “Pressure Space”

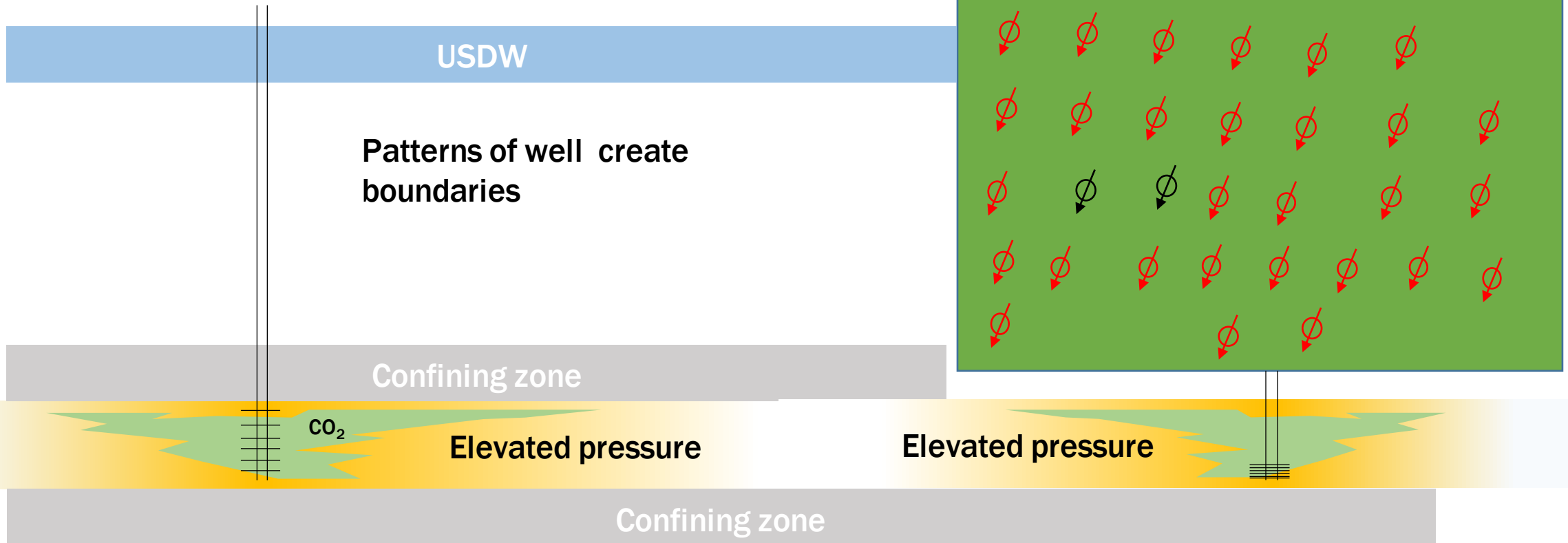


Pressure Space defined by:



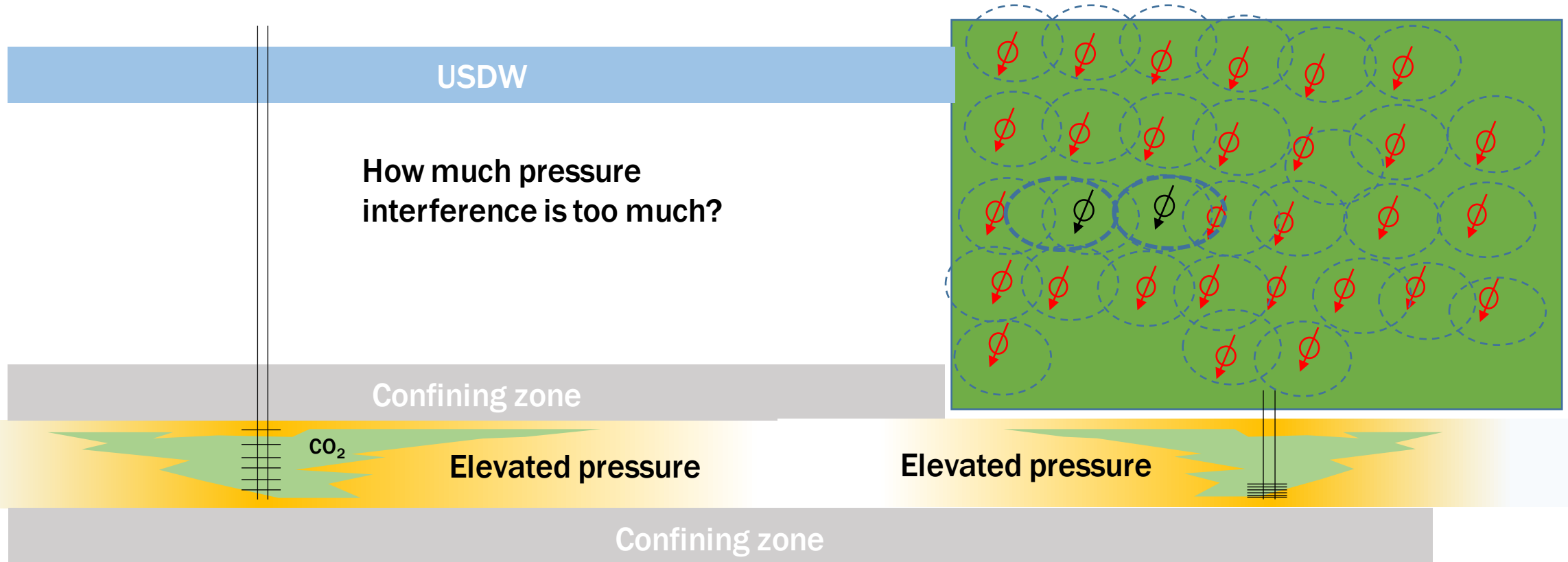
Well Spacing – “Pressure Space”

Large scale- many wells



Well Spacing – “Pressure Space”

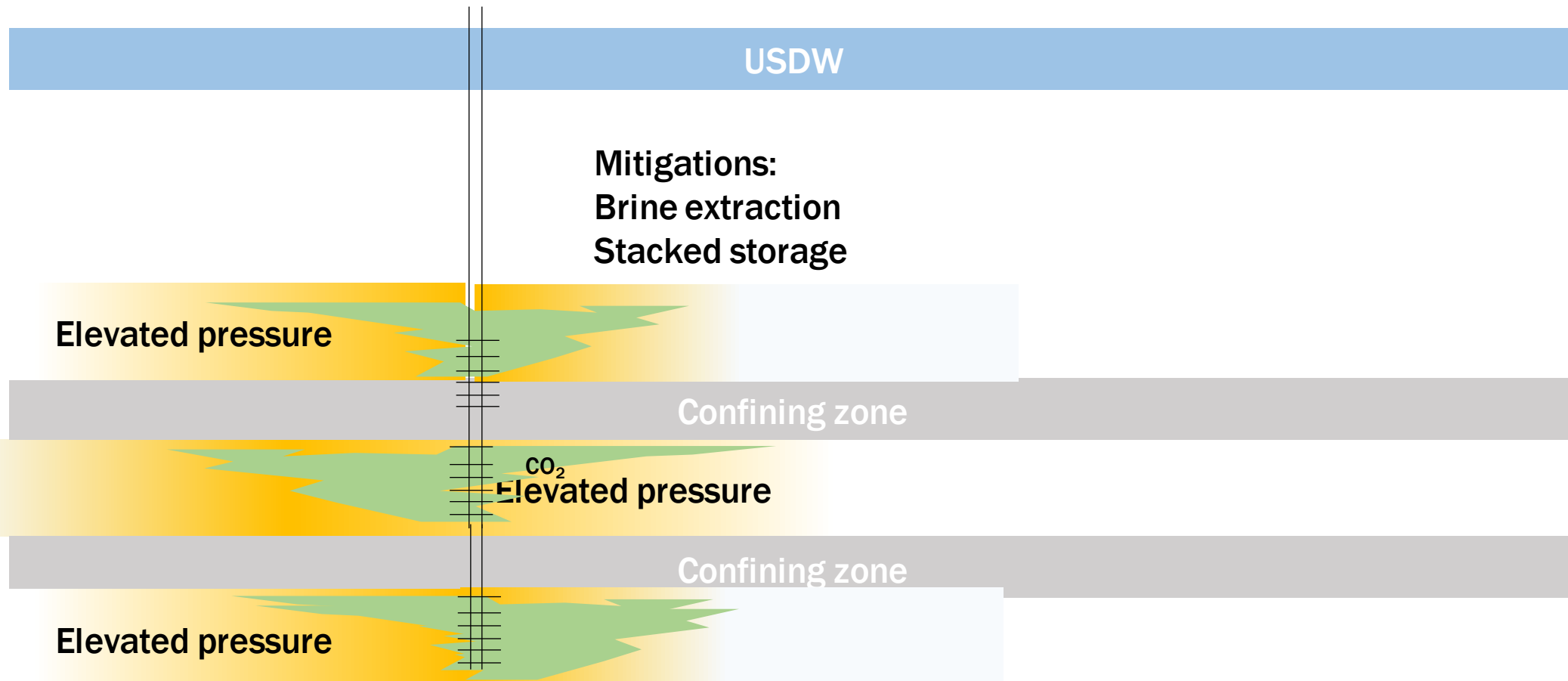
Large scale- many wells



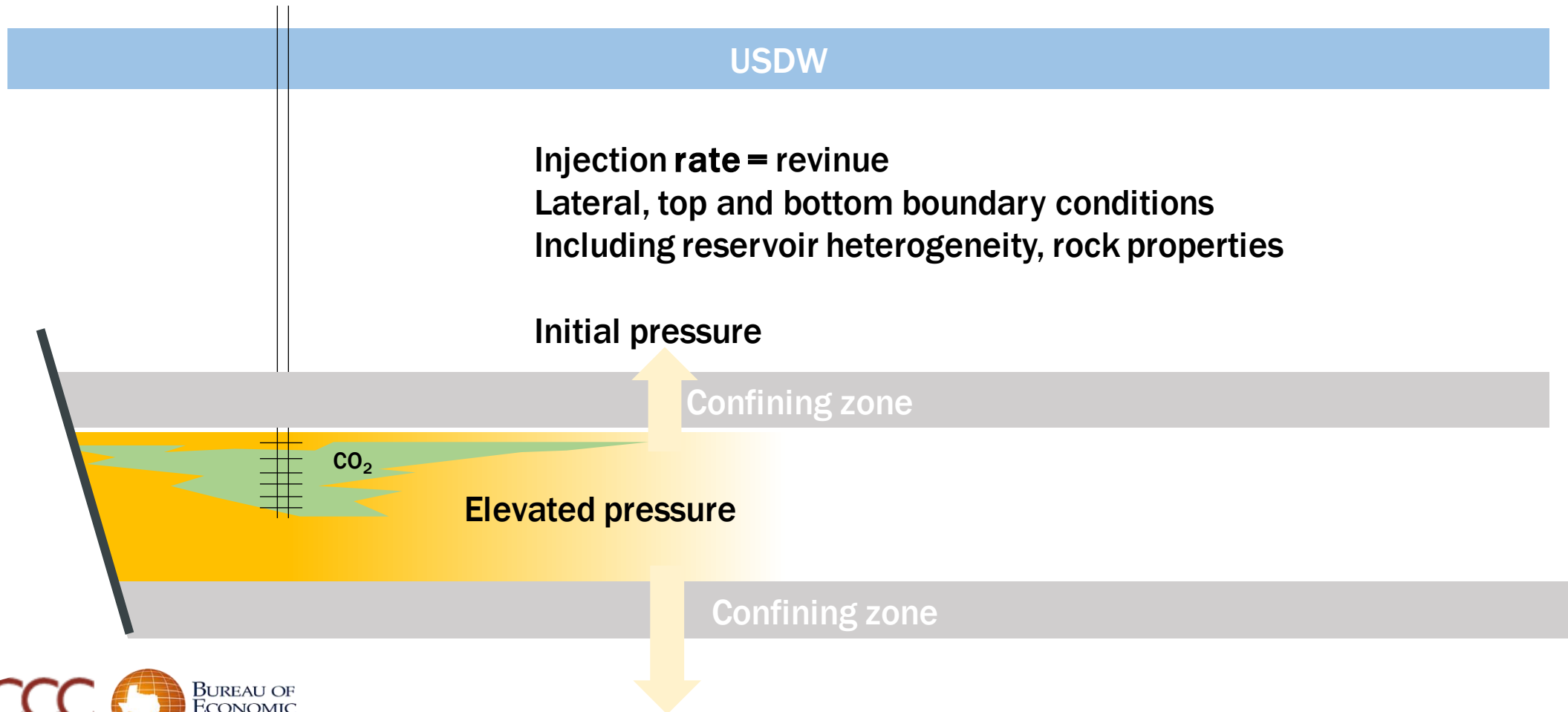
EASI-tool

<https://www.beg.utexas.edu/gccc/research/easitool>

Use of Multi-zone “Stacked Storage” to Increase Pressure-Space

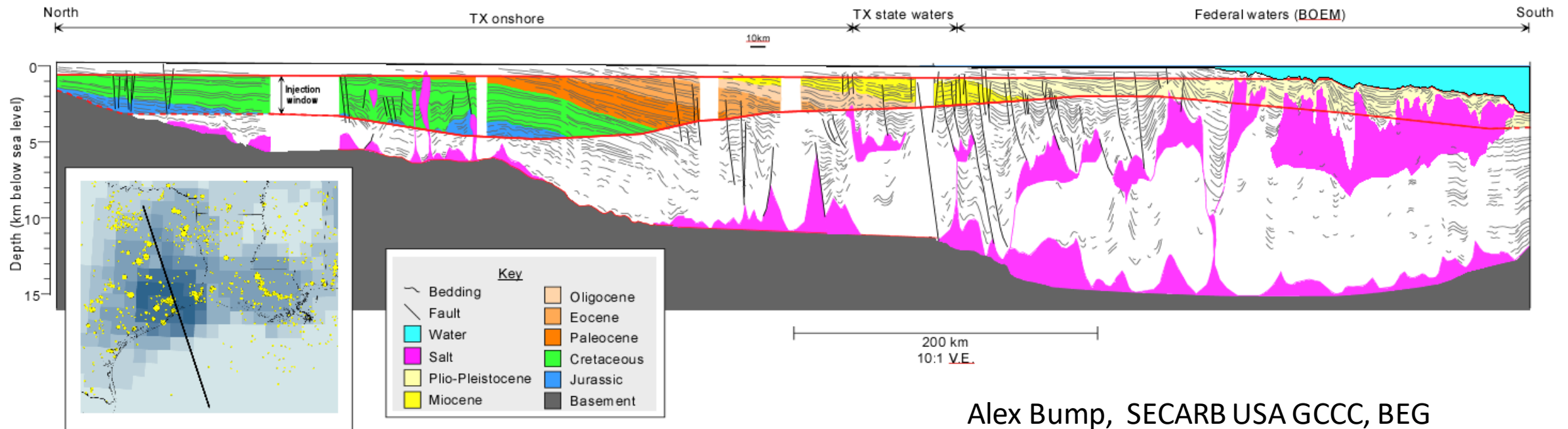


Pressure Space Needed Defined by:

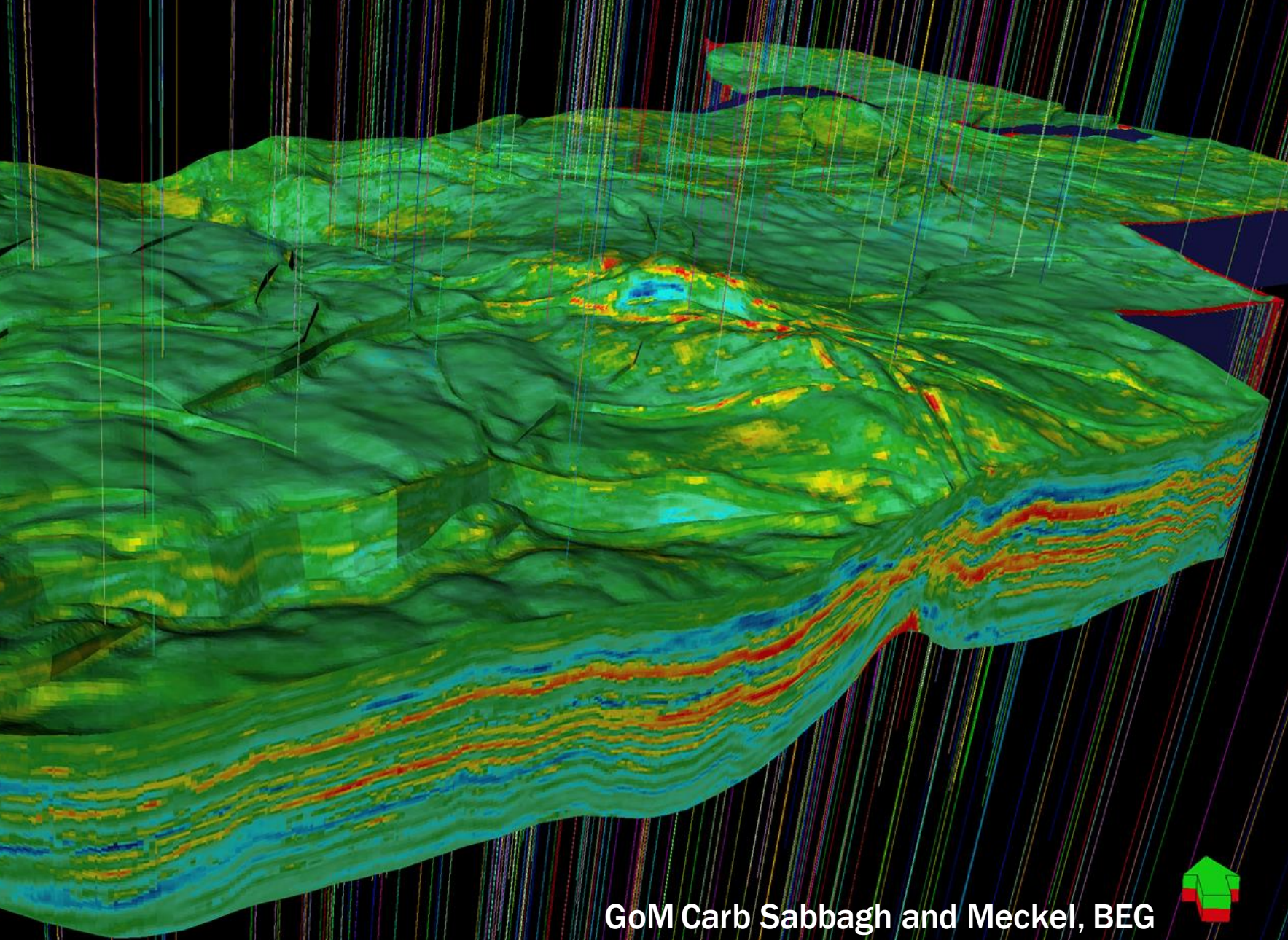


Storage Window for Deep Saline Formations

Base USDW; top supercritical CO₂ Top of overpressure: Burke et al, 2012



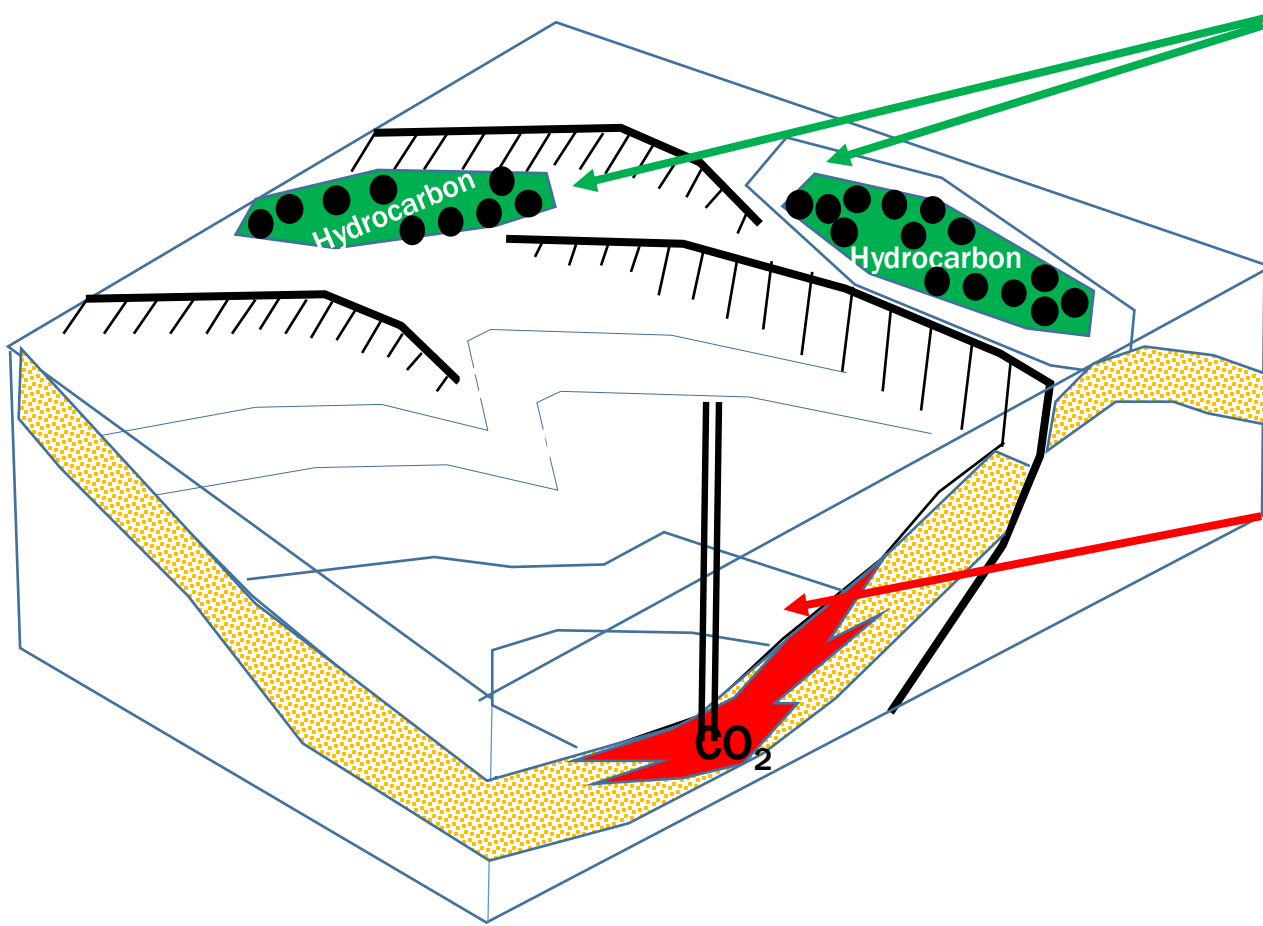
Alex Bump, SECARB USA GCCC, BEG



GoM Carb Sabbagh and Meckel, BEG

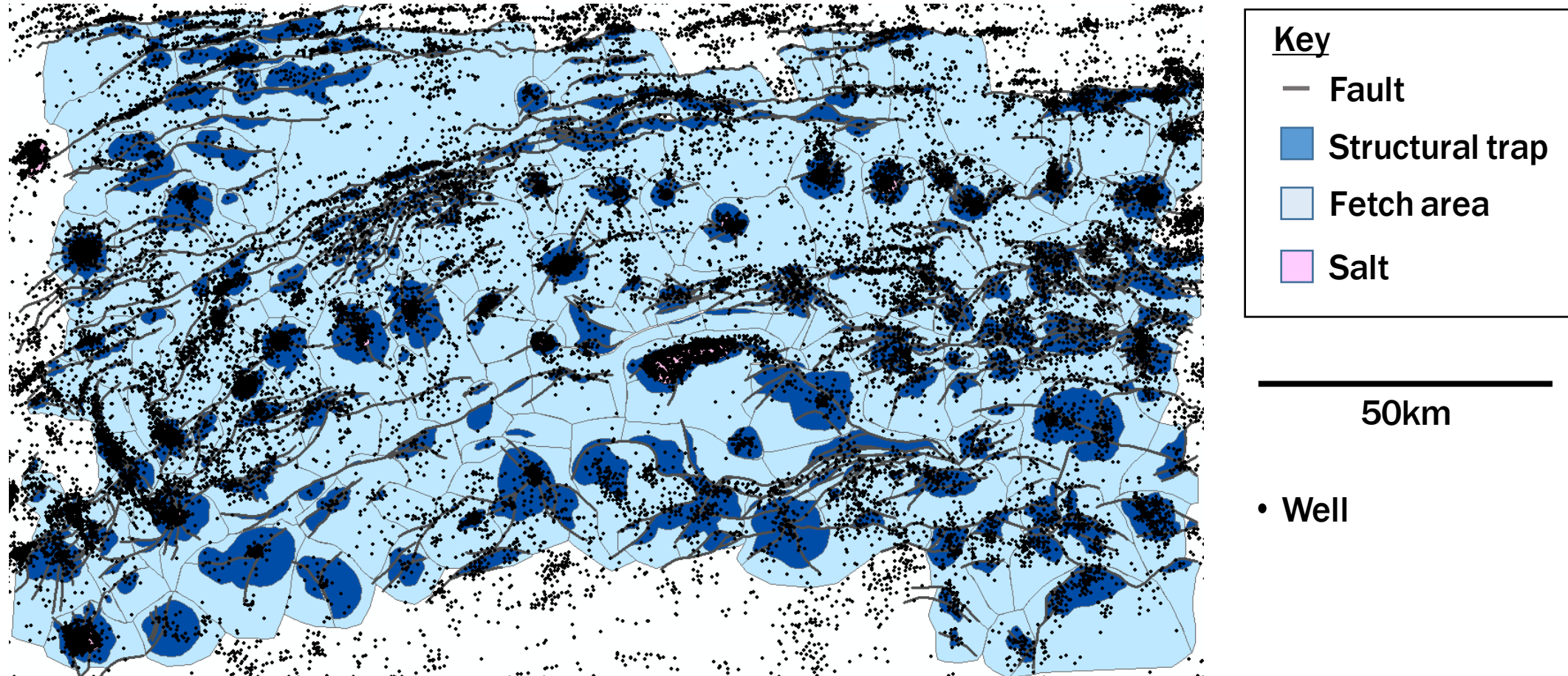


Siting within compartments

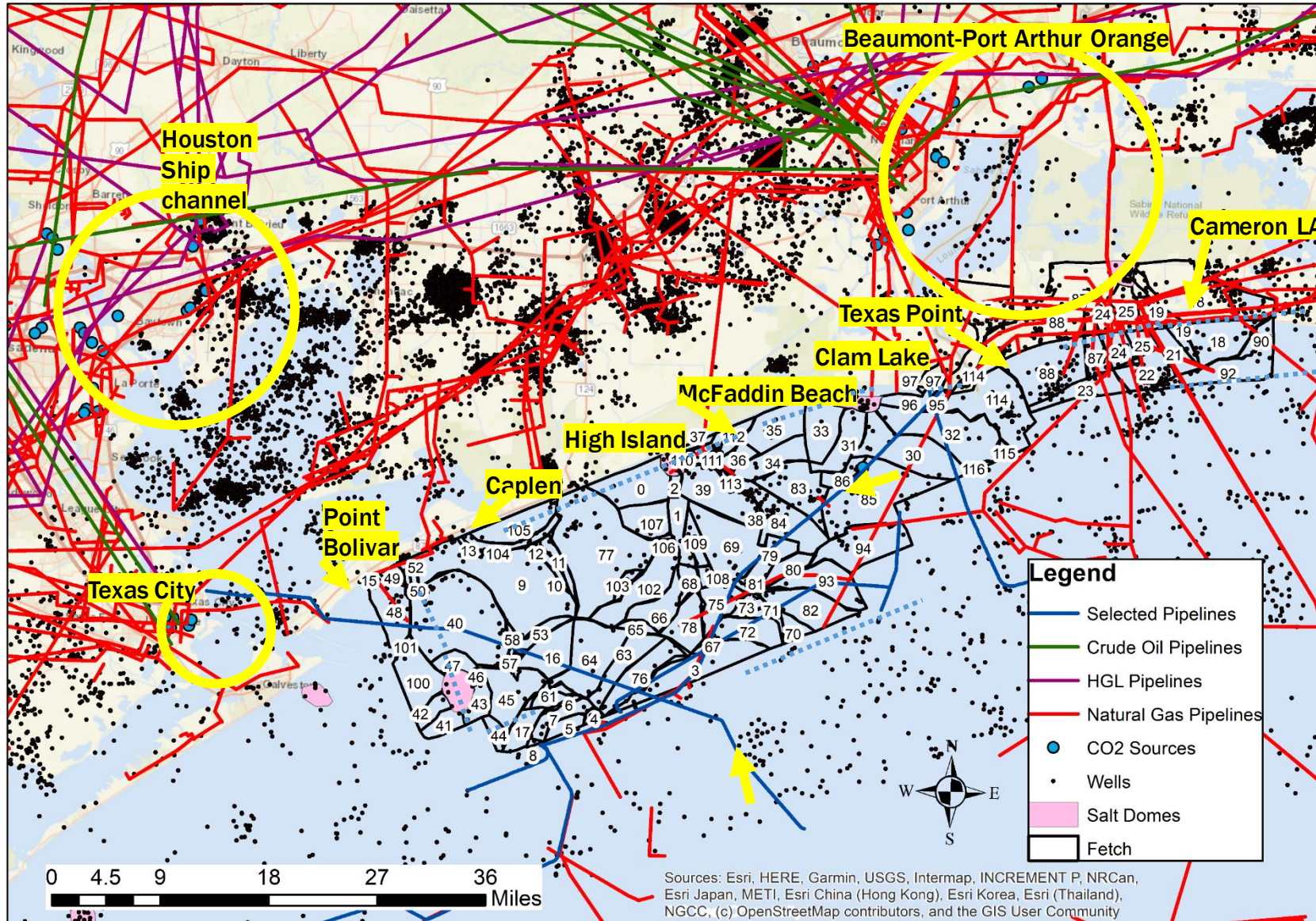


- **Structural highs = traps for buoyant fluids**
 - May develop column height of mobile fluids
 - Exploration and production wells
 - May be faulted
 - May have sand pinch out
- **“Fetch”**
 - In synclinal areas
 - No expectation of hydrocarbons, few penetrations
 - CO₂ will migrate and be trapped by capillary processes
 - May accumulate thick sands

Seeking fetch between dense wells



Linking Sources to Sinks in Gulf of Mexico



Also other uses

Conclusions

- Beyond pore space, each storage project needs “pressure space” that does not conflict with adjacent uses. Conflicts in pressure space will damage project economics, injection rate cannot be continued.
- Hydrologic boundaries (faults or stratigraphic compartments) segment pressure-space



Thank you!

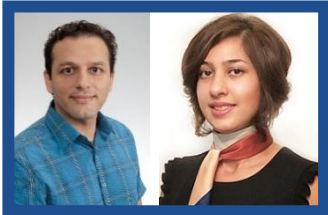
The Gulf Coast Carbon Center (GCCC) seeks to impact global levels of atmospheric carbon dioxide by:

2022 Sponsors



GCCC Research Staff

Fluid Flow Modeling



Seyyed
Hosseini

Sahar
Bakhshian

Surface/Deep Monitoring



Hailun Ni

Katherine
Romanak

Susan
Hovorka

Geologic Characterization



Carlos Uroza

Alex Bump

Timothy
Meckel

Tucker
Hentz

Mariana
Olariu

Seismic Interpretation

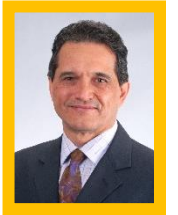


Michael
DeAngelo

Dallas
Dunlap

Ramón
Treviño

Economics and EJ



Ramon Gil

Students



Nicko
Adams

Amanda
Rodriguez

Ilsmail Halim
Faruqi

Angela
Luciano

Shadya Restrepo

Edna
Rodriguez

Chinemerem
Okezie

International Research Fellows



Tim Dixon,
IEAGHG, UK

Susan.hovorka@beg.utexas.edu
www.gulfcosatcarbon.org