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Pressure and AoR Assessment for Multiple CCS projects within the Same Geological Setting Using EASiTool

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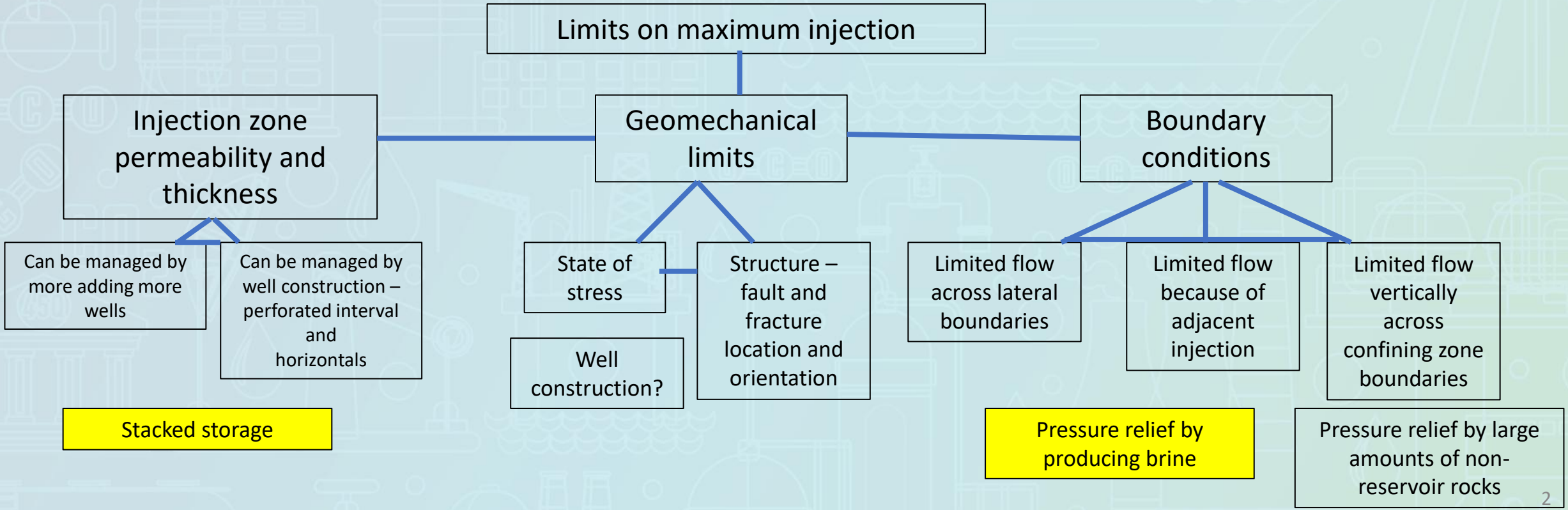
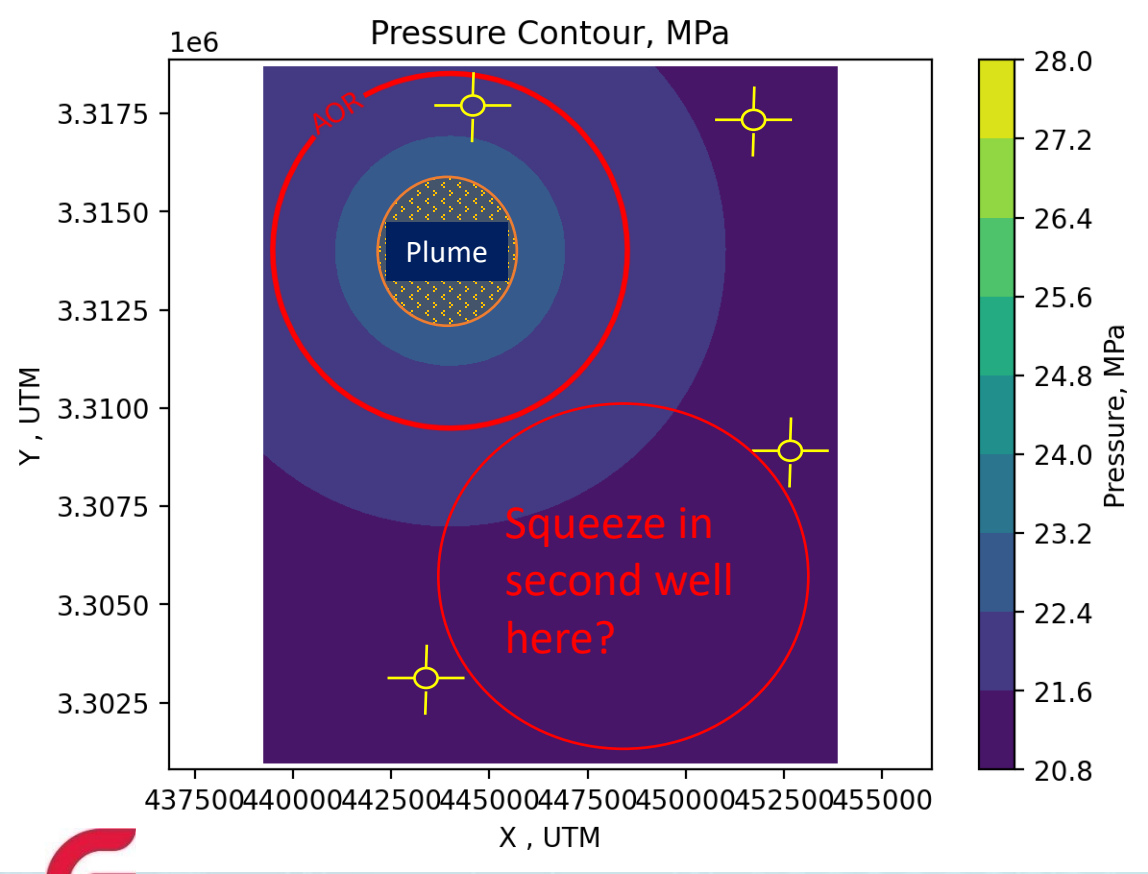
All space in the subsurface is limited

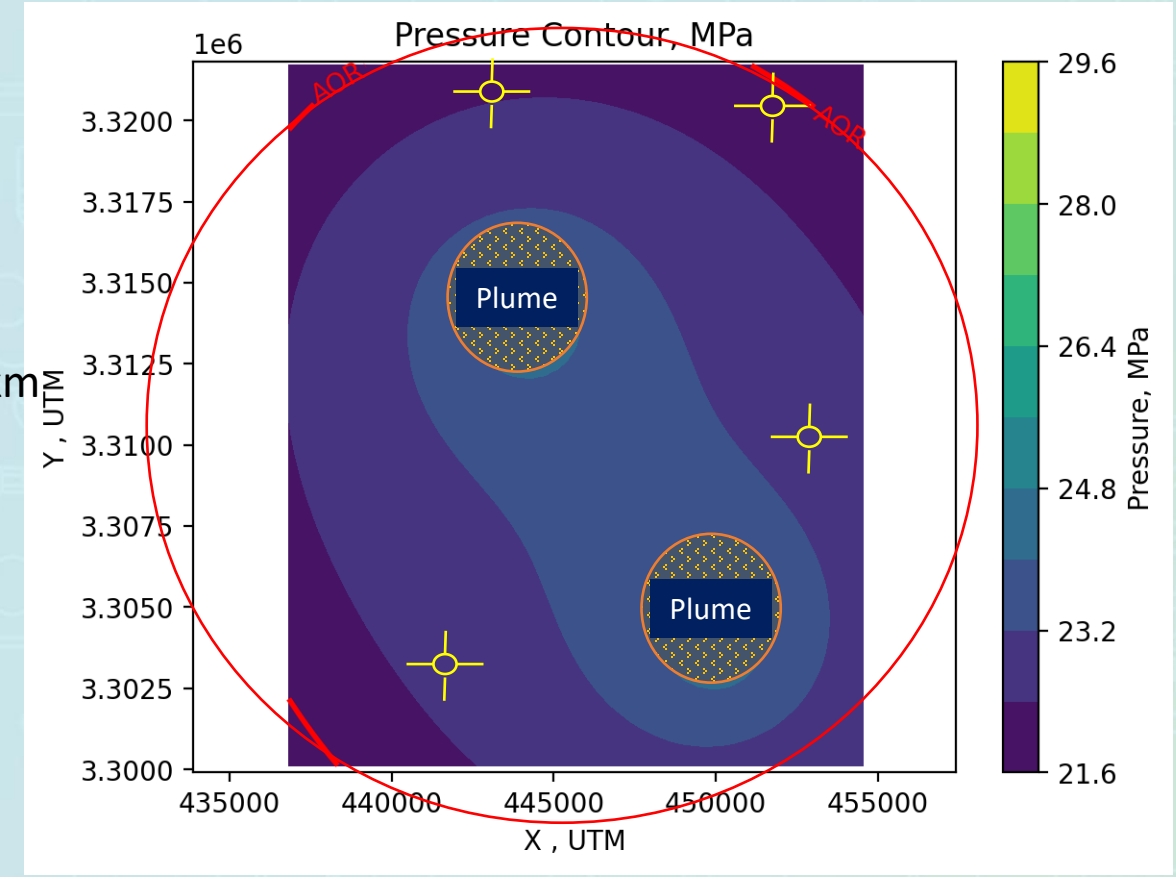
- **Pushing to maximum scale at hubs will probe these limits**
- **This brings management questions how to manage interferences**



Impact of two wells/projects on AOR



20 km

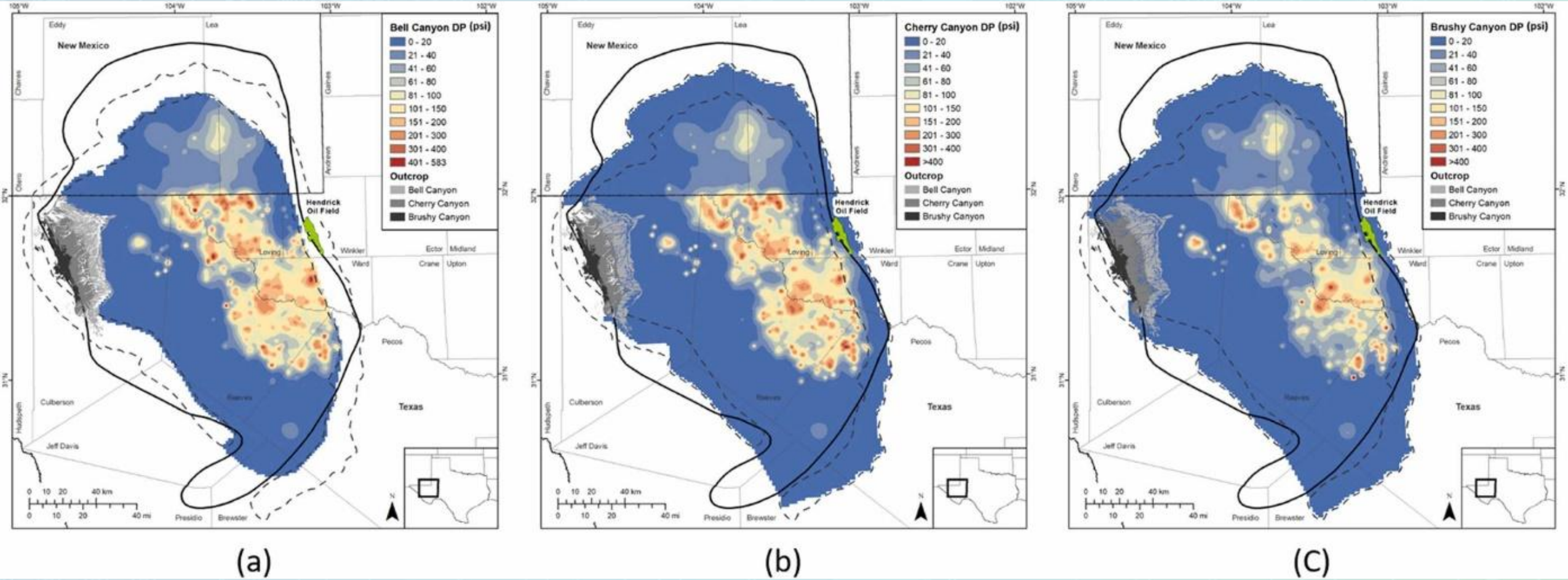


20 km

P&A well

EASi-tool 5.0

Example of basin–scale pressure build up, DMG TX -NM

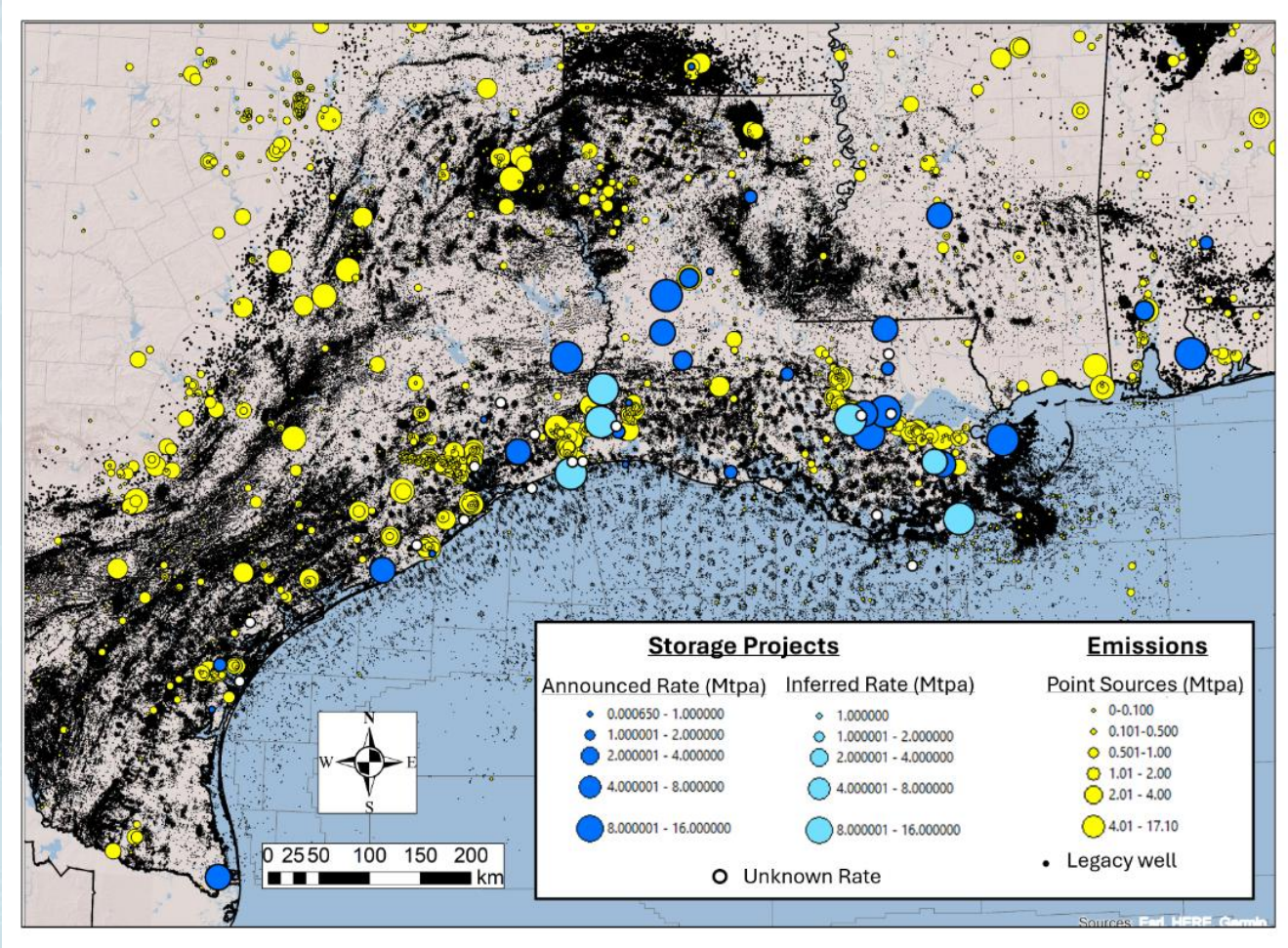


Ge et al. 2022

(a) Bell Canyon; (b) Cherry Canyon; and (c) Brushy Canyon.

- Class II water injection from many wells has aggregated and interferes with continued injection
- A lesson for class VI

Point source of emissions at the gulf coast

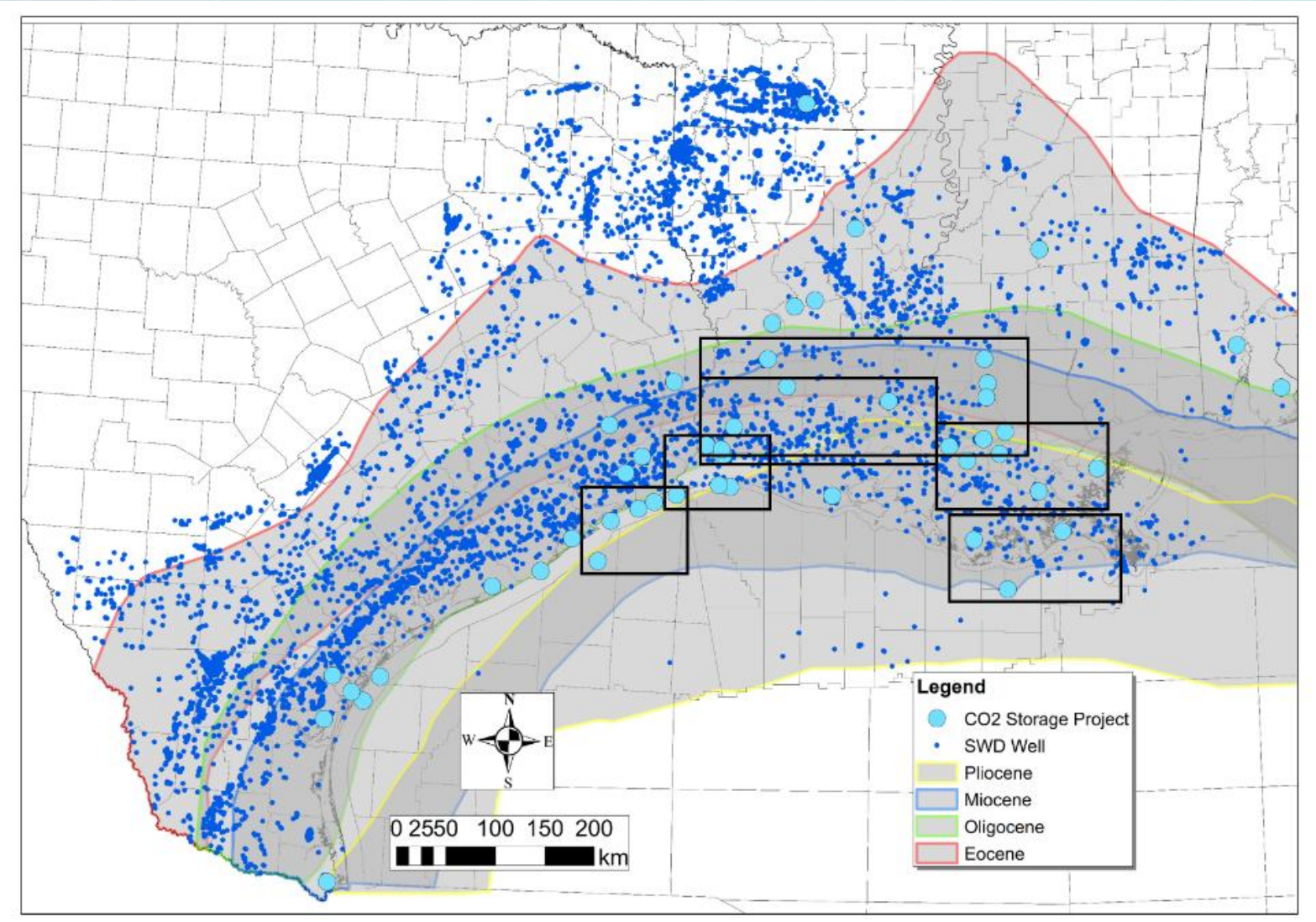


Yellow: Point-source CO2 emissions;

Blue and white: GCS projects currently in development;

Black: legacy wells

Modeled sections by EASITOOL



Black: 6 study sections (from W to E):

- Houston Miocene;
- Port Arthur Miocene;
- Oligocene(the smaller section);
- Central LA Eocene (the bigger section);
- New Orleans Miocene;
- New Orleans Pliocene

- Results shown here are a case study and not representative of current or future state of CCS.

Using EASiTool to explore options for pressure-space management

- **EASiTool: Enhanced Analytical Simulation Tool for CO_2 Storage Capacity Estimation and Uncertainty Quantification**
- **Links full physics analytical models**
- **Free and online**

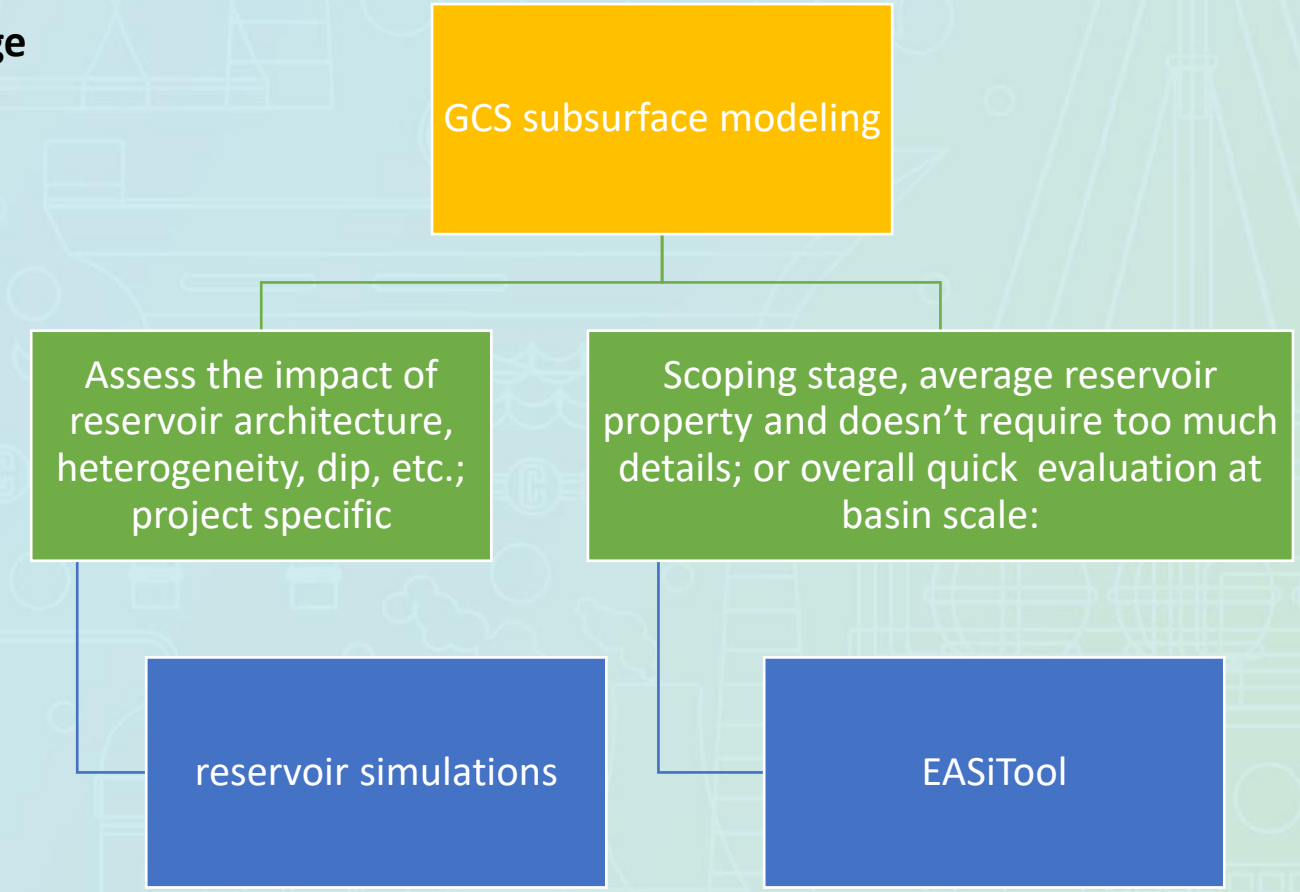
https://gccc.beg.utexas.edu/research/easitool

Excel spreadsheet input of parameters

Reasonable defaults for difficult-to-find parameters

Graphic and tabular output

Few second runtime



Assumptions and models

Assumptions

- Vertical well
- Homogeneous/isotropic properties
- Open or closed boundary conditions
- Constant rate injection/extraction → new version will accept variable rate
- No faults→ new version with faults

Models

- Two-phase flow (Brine and supercritical CO_2)
- Fluid properties are pressure dependent
- multi-well/sites scenarios
- Map estimated size of plume
- Estimate Area of Review

- Excel spreadsheet input of parameters
- Reasonable defaults for difficult-to-find parameters

→ Graphic and tabular output

Critical Pressure Estimation

Inputs	TX-LA-Mio	Oligocene	Wilcox	HOU-Mio	NOLA-Mio	NOLA-Plio
Surface water depth (m)	0	0	0	0	0	0
Mean annual surface (C)	70	100	100	70	70	70
Geothermal gradient (C/km)	25	25	25	25	25	25
Overburden sand fraction (%)	0.5	0.5	0.5	0.5	0.5	0.5
USDW depth at base (m)	800	700	700	800	100	0
USDW salinity (kg/l)	0.006	0.006	0.006	0.006	0.006	0.006
Injection zone depth (m)	1800	2200	2000	2000	2500	1500
Injection zone brine salinity (kg/l)	0.116	0.1461	0.1461	0.116	0.116	0.116
Max operating pressure (% of Frac. P)	90	90	90	90	90	90
Coefficient of friction	0.6	0.6	0.6	0.6	0.6	0.6
Critical pressure build-up (MPa)	0.38	0.74	0.65	0.46	0.92	0.54

A simplified EPA Method 2 Method:

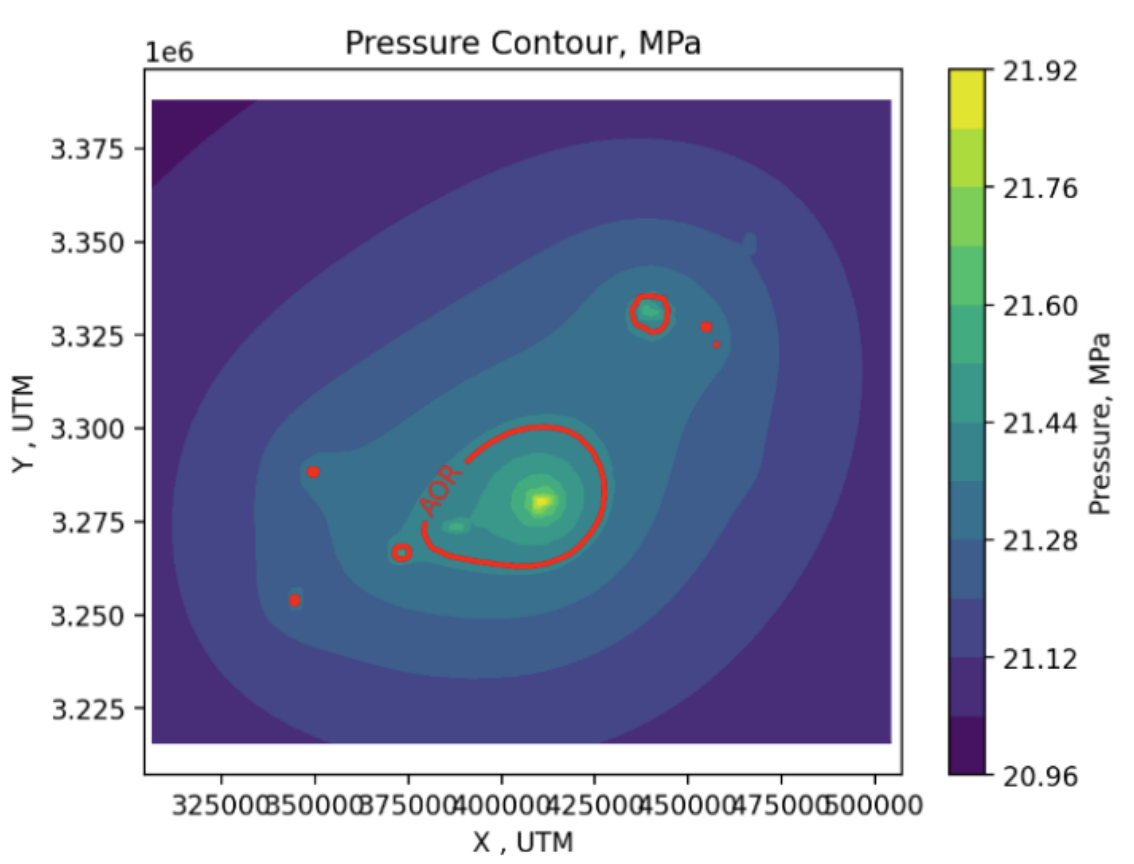
$$\Delta P_{crit} = g \cdot \frac{(z_i - z_u)(\rho_{i,u} - \rho_u)}{2},$$

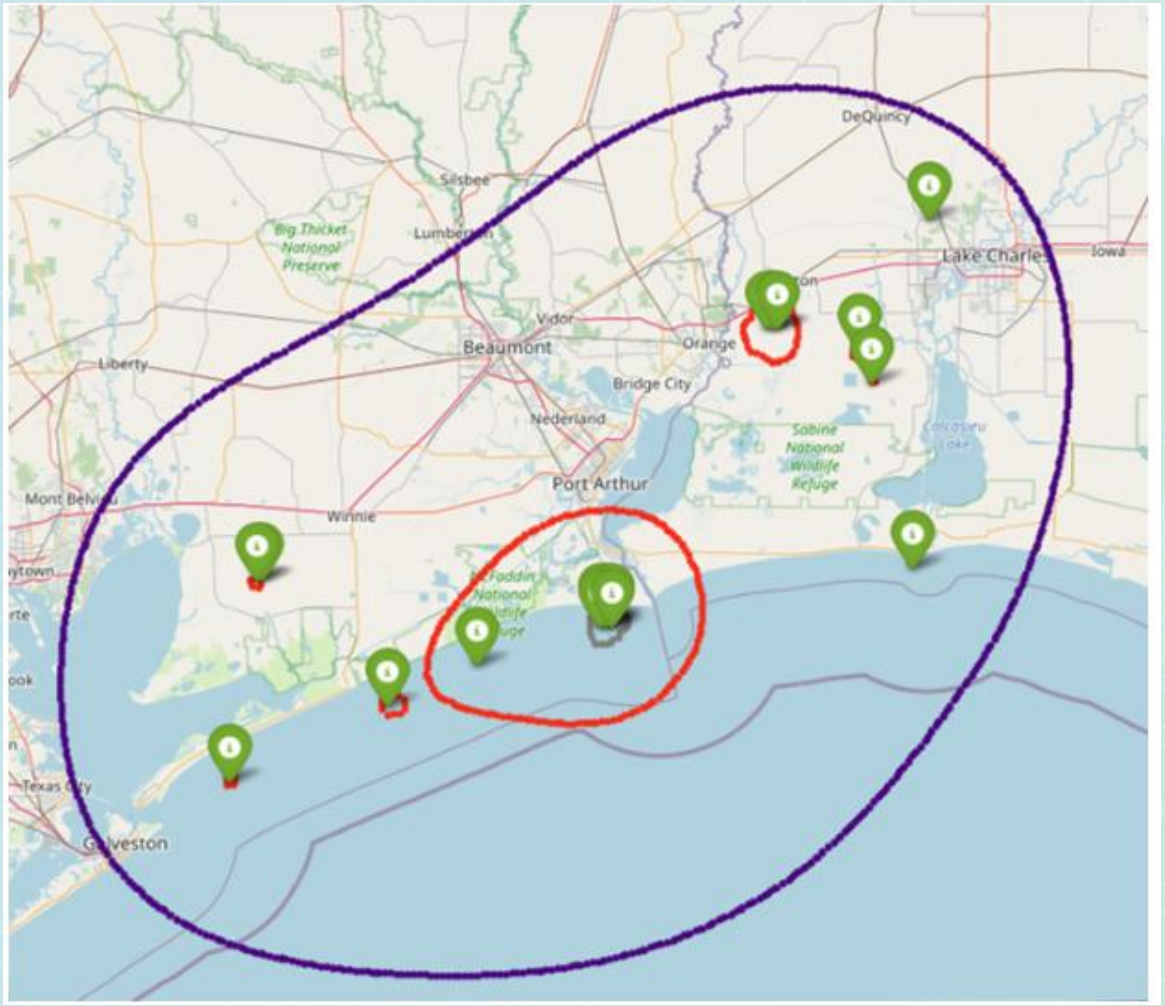
Reservoir properties

Reservoir Property	Miocene/Pliocene	Oligocene	Wilcox
Initial Pressure (MPa)	21	30	30
Temperature (°C)	70	100	100
Thickness (m)	400	300	200
Salinity (mol/kg)	2	2.5	2.5
Porosity	0.25	0.225	0.2
Permeability (mD)	500	400	300
Rock Compressibility (1/Pa)	$5.45e-10$	$5.45e-10$	$5.45e-10$

- CO_2 Wells: max 2 MMT/year
- SWD wells: all 5000 bbl/day
- 25 years injection
- All Closed Boundary conditions

Port Arthur Miocene

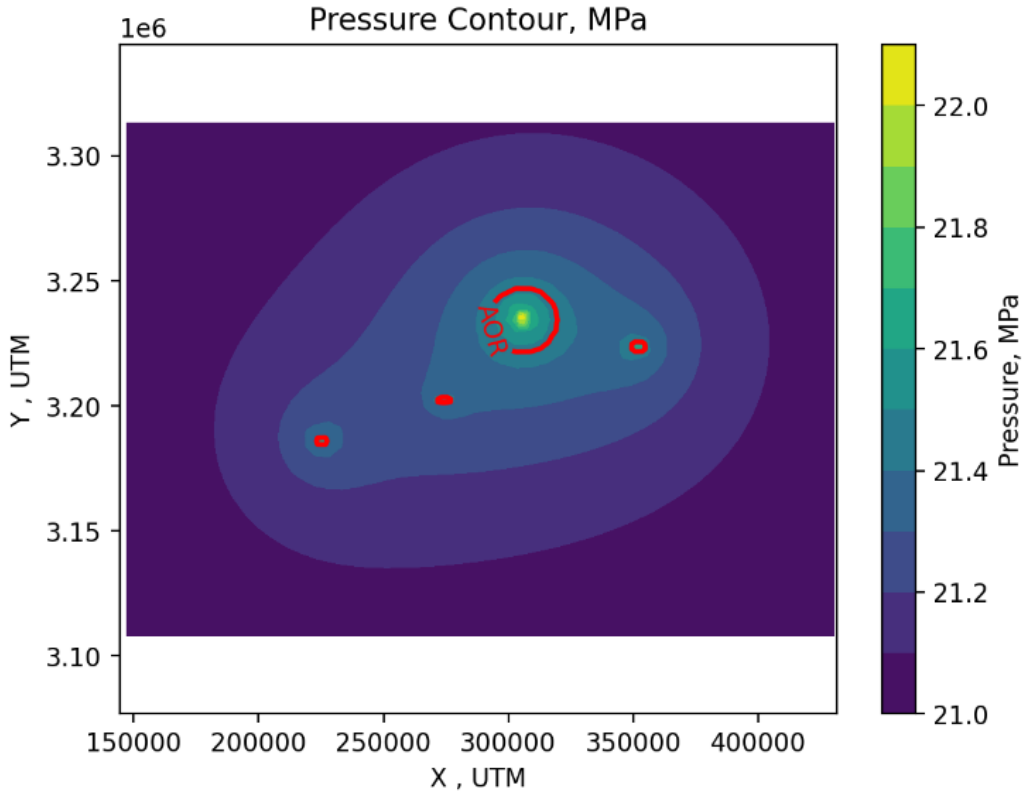


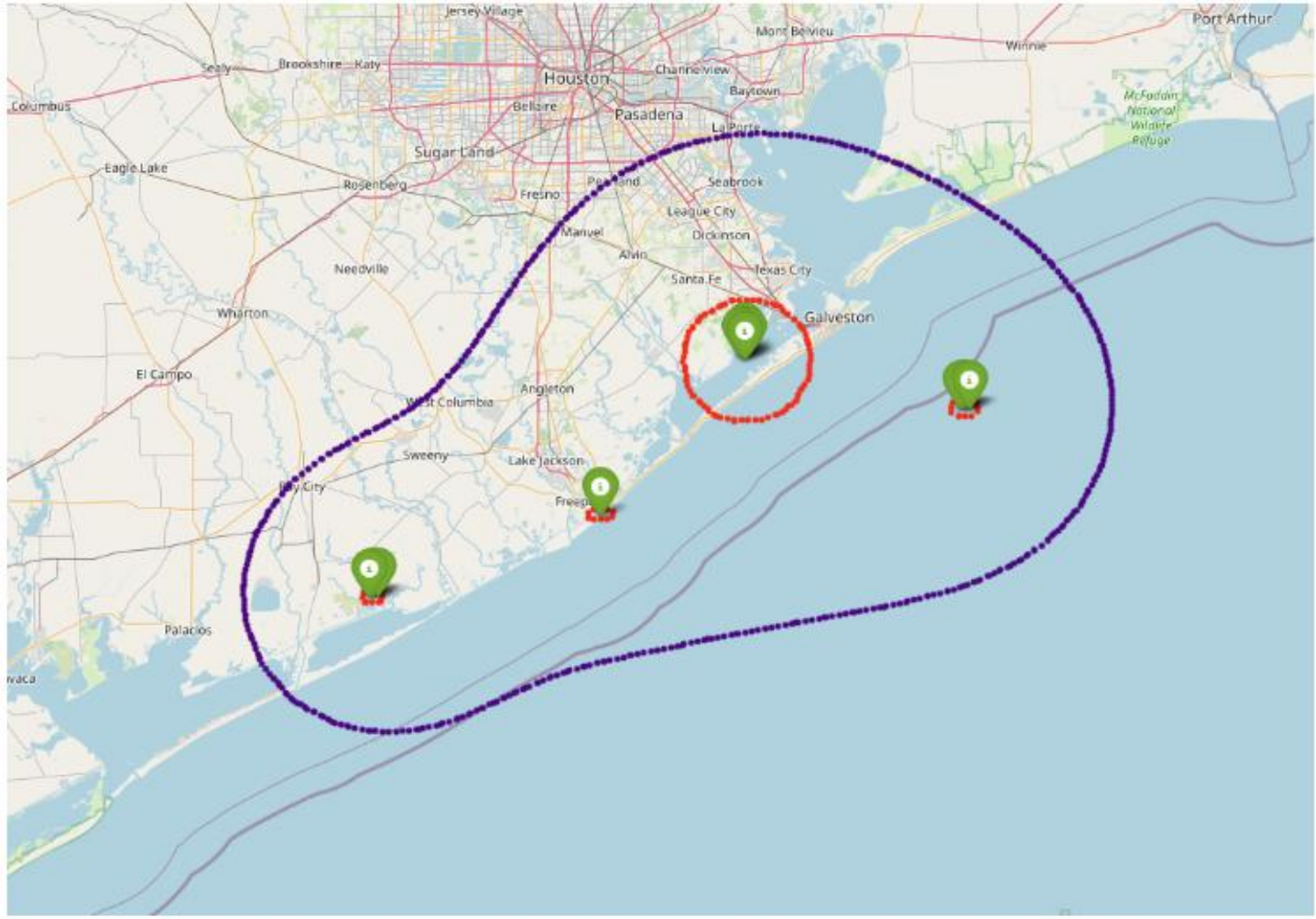


Houston Miocene

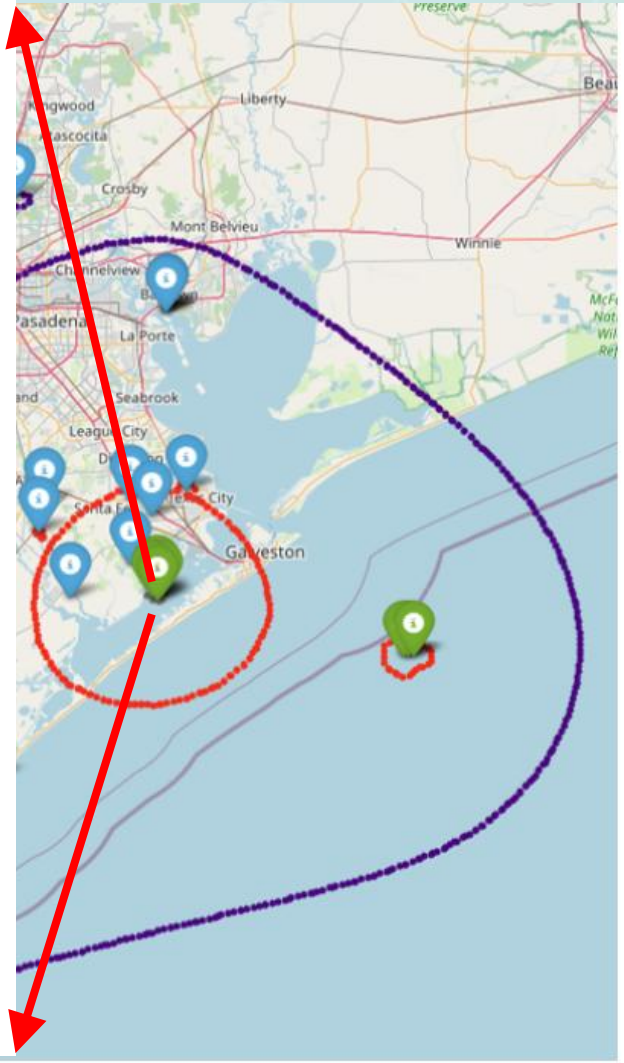
Purple: worst case;

Red: most likely cases





Houston Miocene with SWD wells



Conclusions

- EASiTool is well-suited for quick, early-stage multi-site/well injection evaluations.
- EASiTool can be used to study Class I/II and Class VI wells interference.
- Quick analysis shows no significant risk based on current announced projects/volumes.
- The presence of Saltwater Disposal (SWD) wells does impact AoR size and wells with various classifications can interfere with each other.
- Better quality input dataset is needed to refine the results.

Thank you the GCCC 2024 Sponsors

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GULF COAST CARBON CENTER

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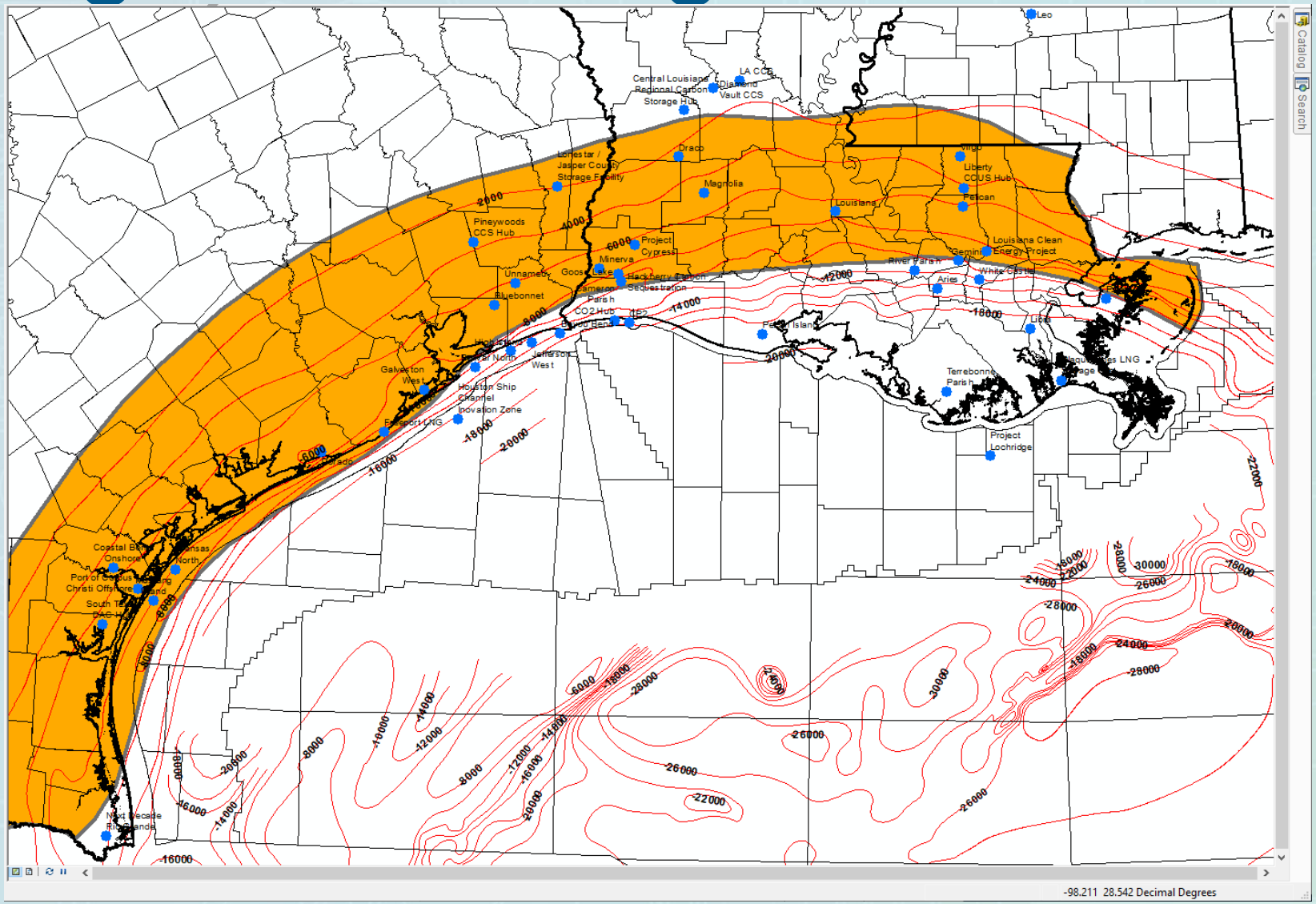
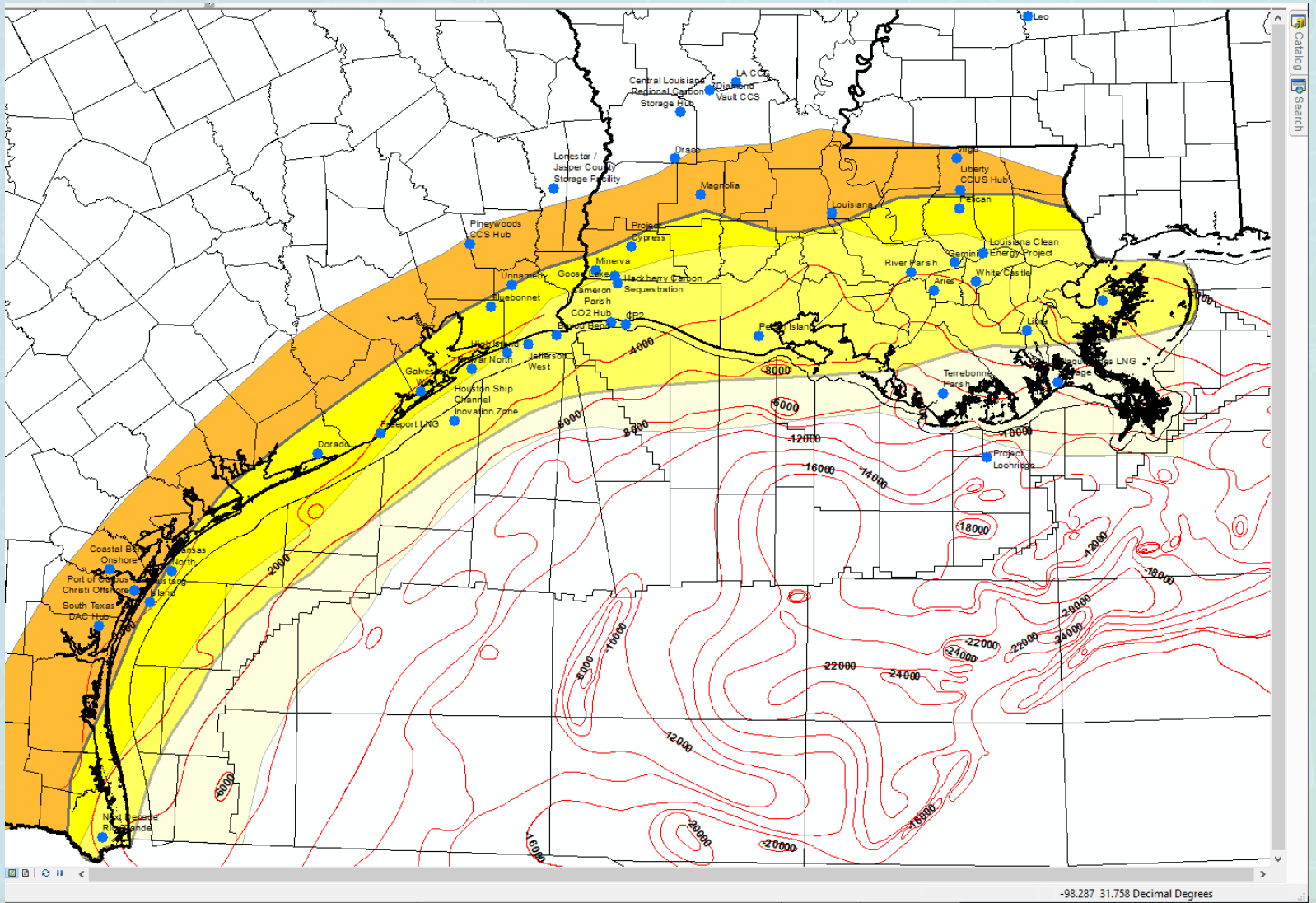
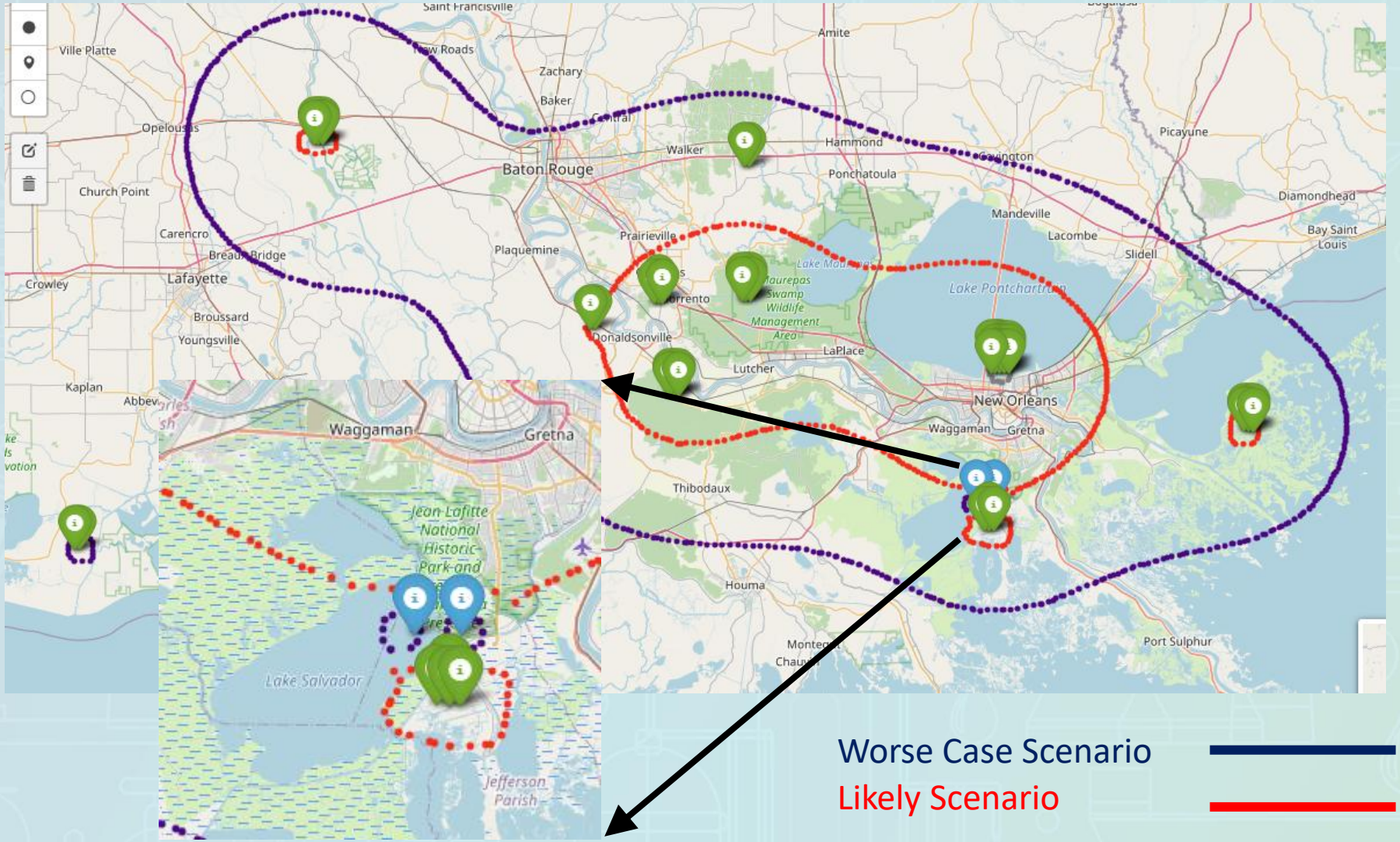
Oligocene storage at the GOM



Upper, middle, lower Miocene and Pliocene storage at the GOM



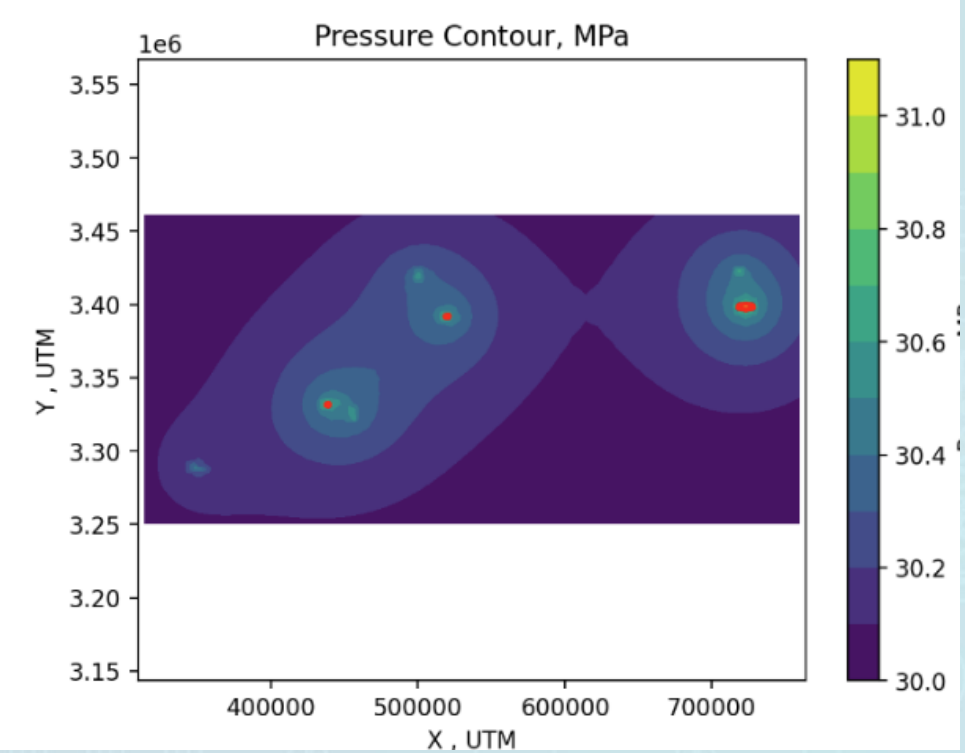
New Orleans-Miocene-CCS+Extraction

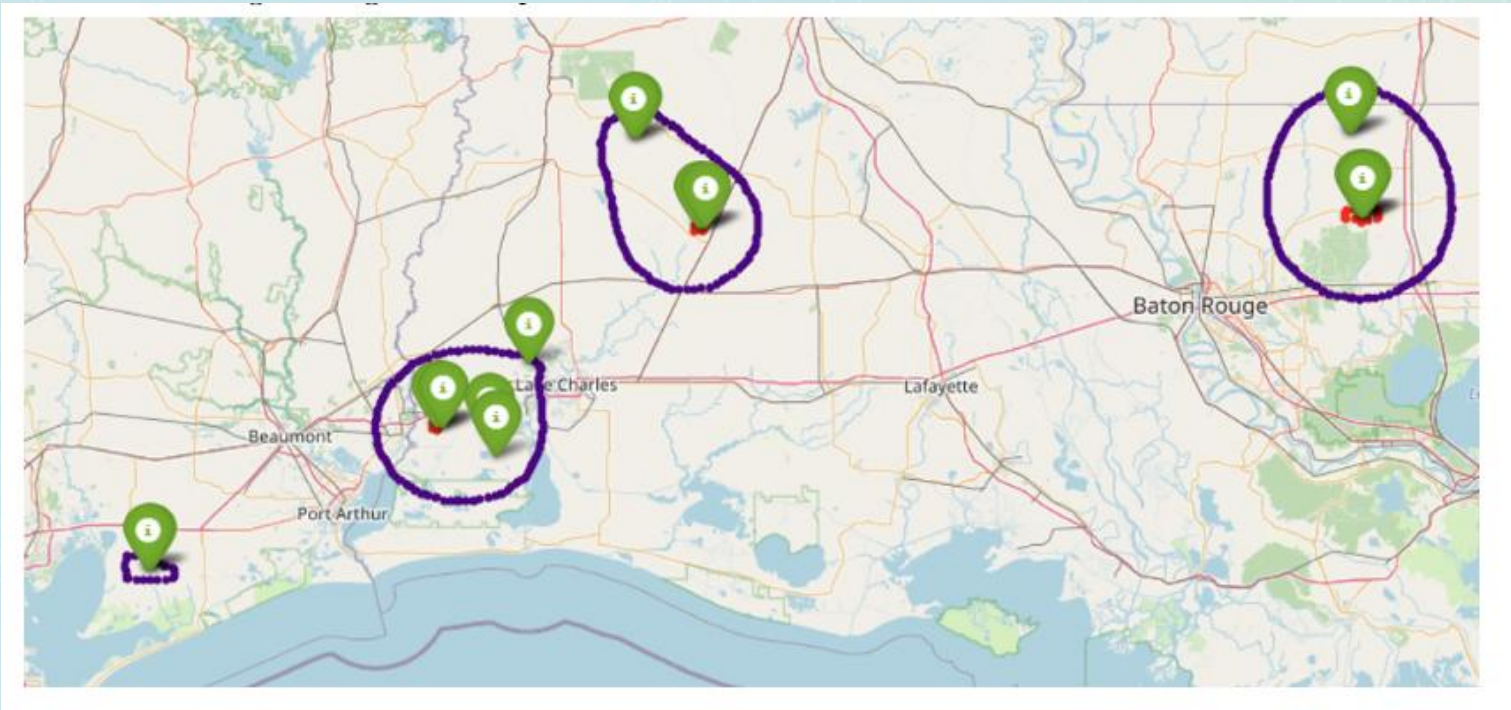


Worse Case Scenario

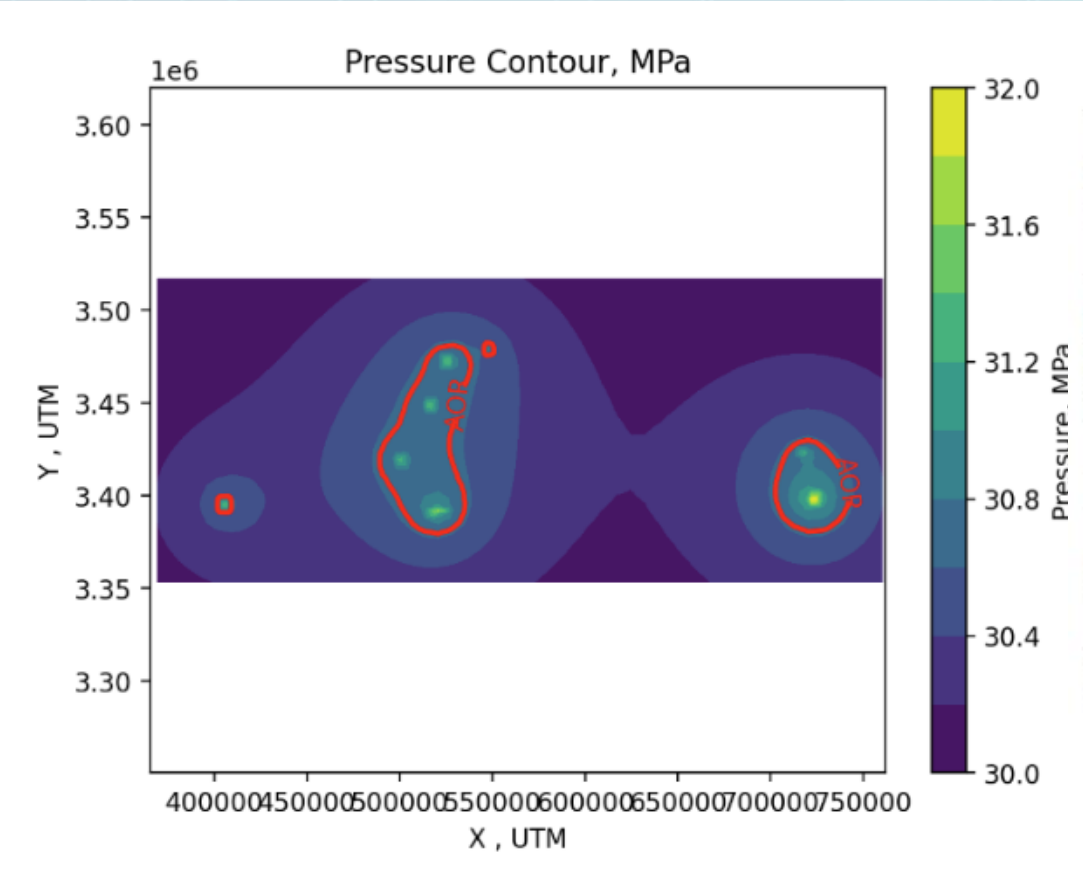
Likely Scenario

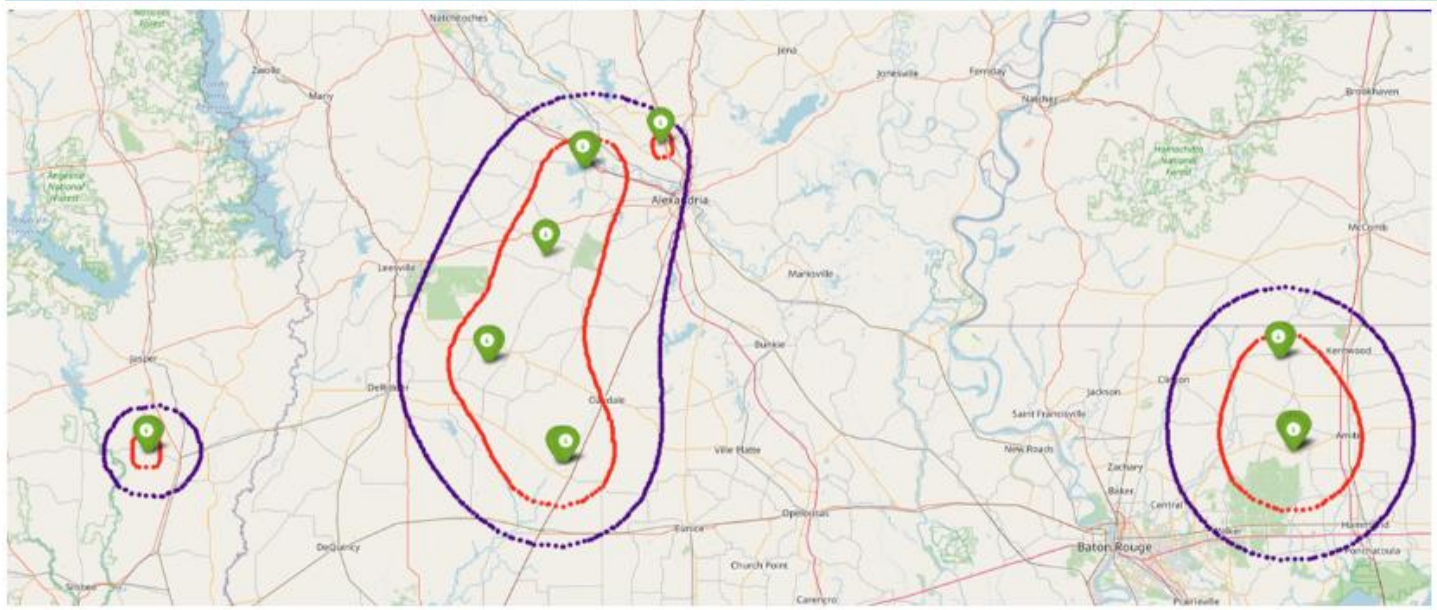
Oligocene


Pressure Contour, MPa
1e6
3.55
3.50
3.45
3.40
3.35
3.30
3.25
3.20
3.15
Y , UTM
400000
500000
600000
700000
X , UTM
31.0
30.8
30.6
30.4
30.2
30.0

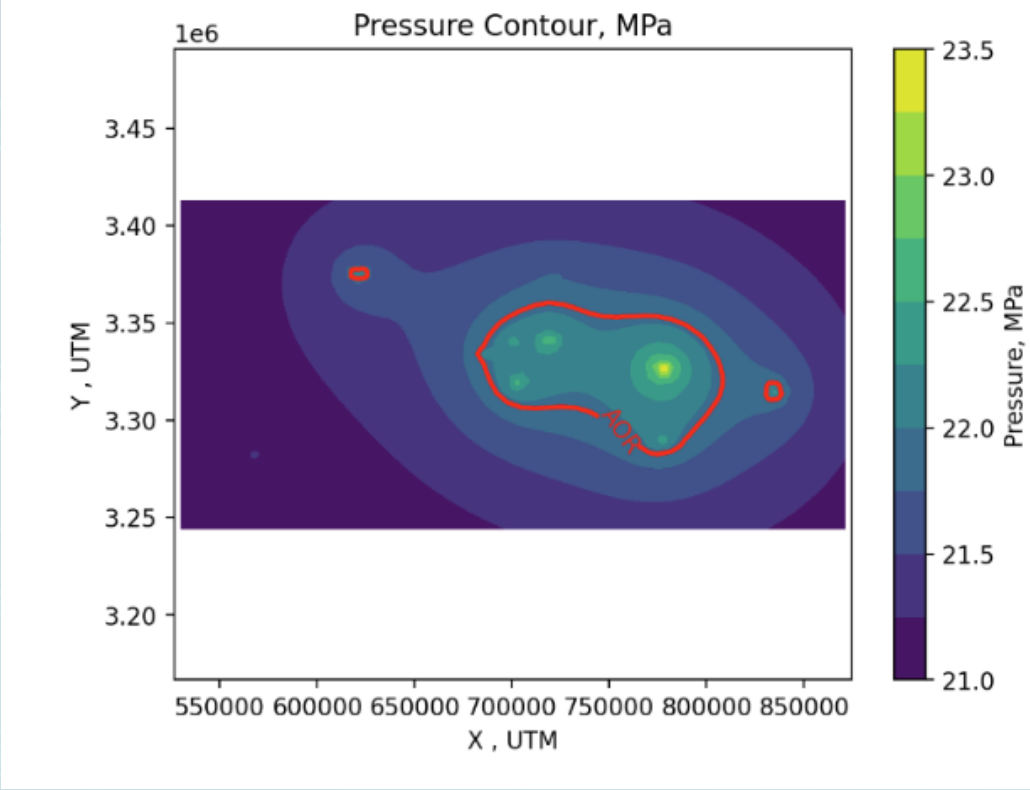

Baton Rouge
Lafayette
Beaumont
Port Arthur

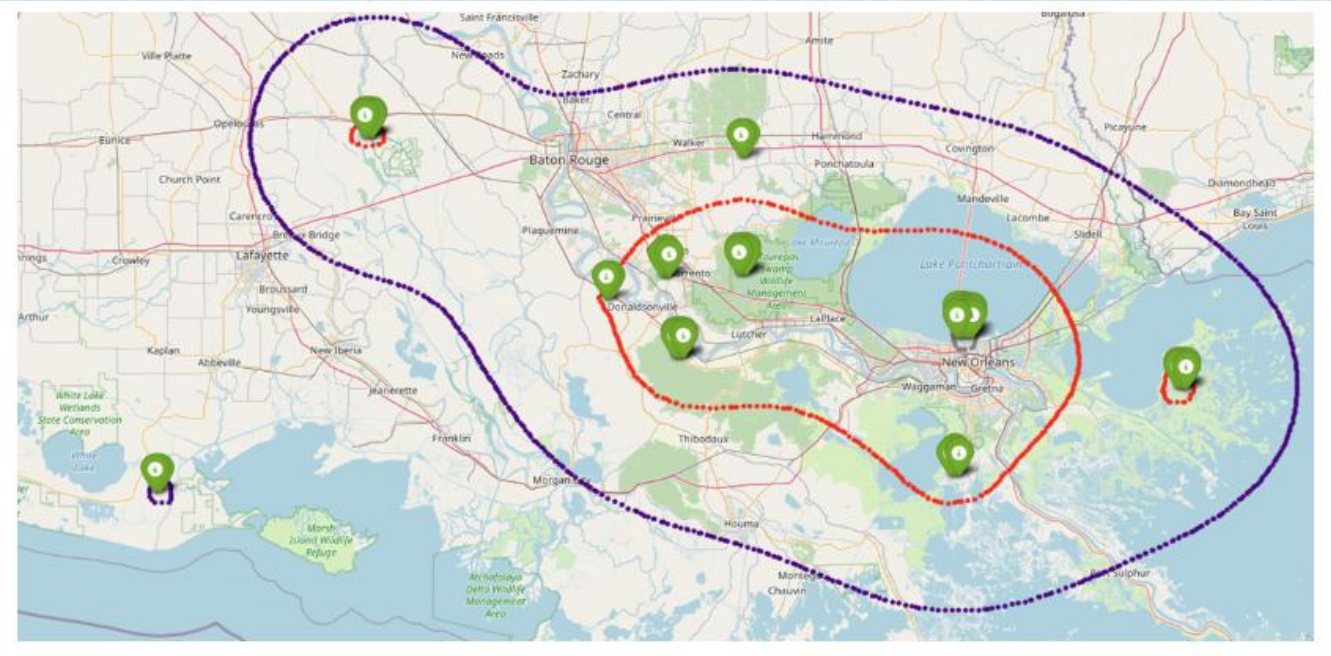
Central LA Eocene



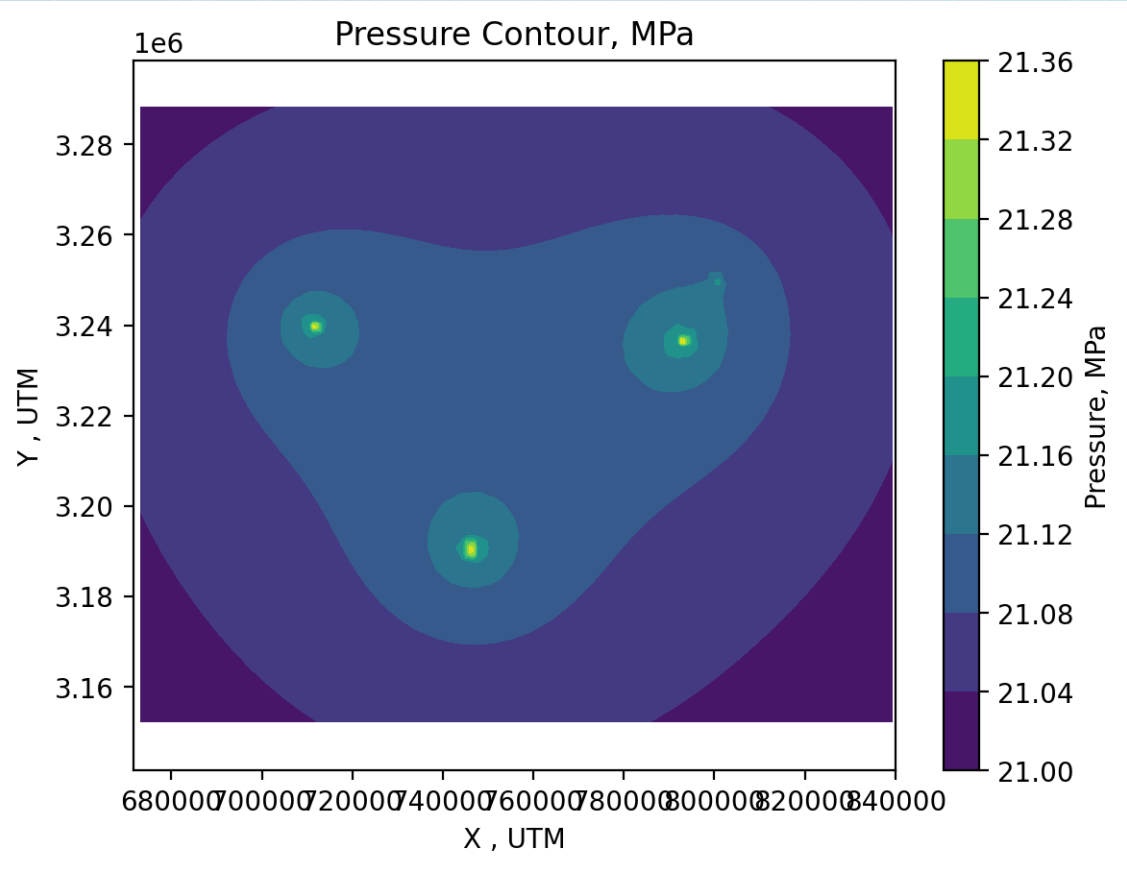


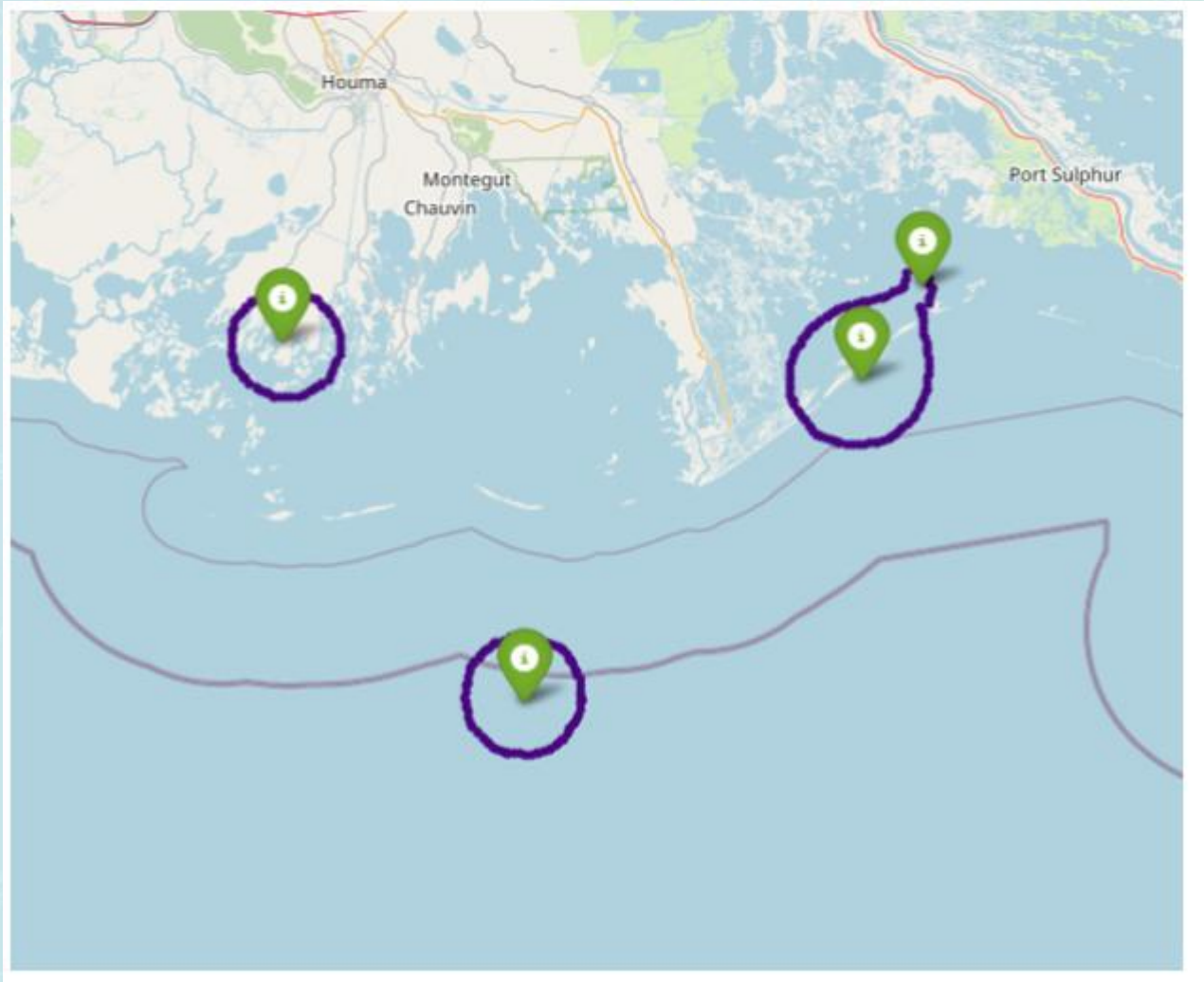
New Orleans Miocene



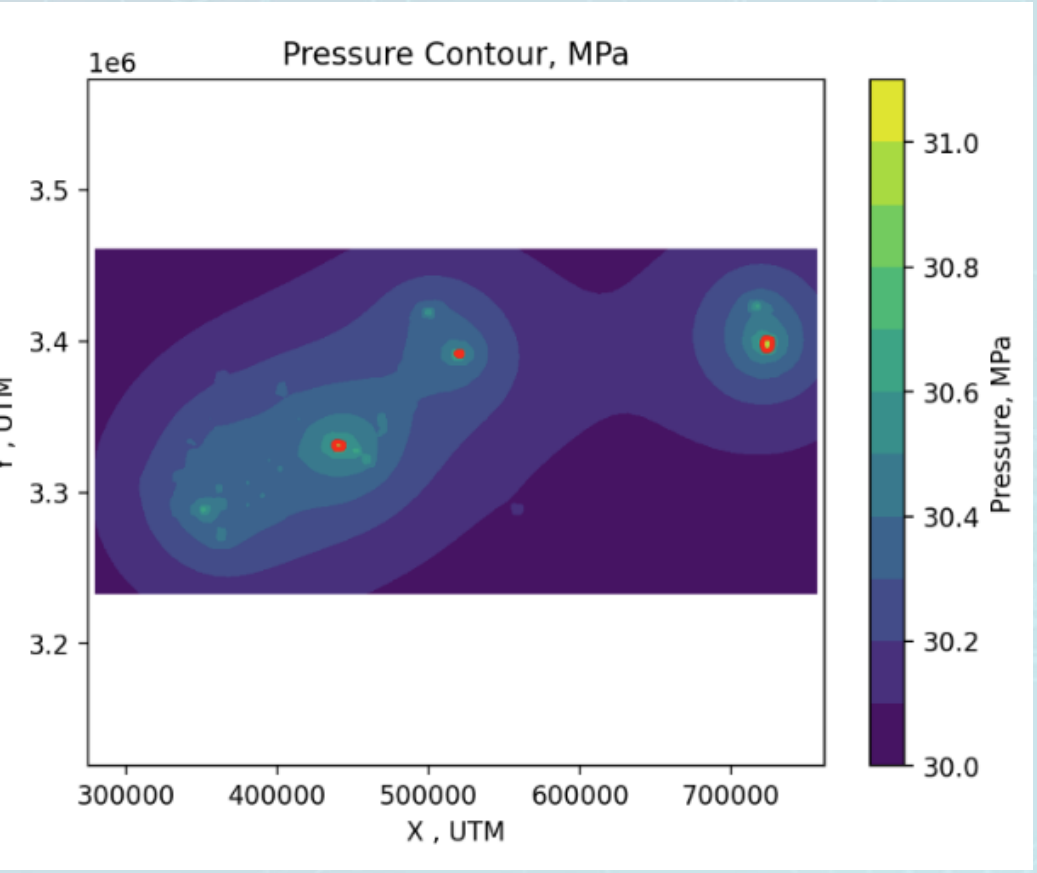


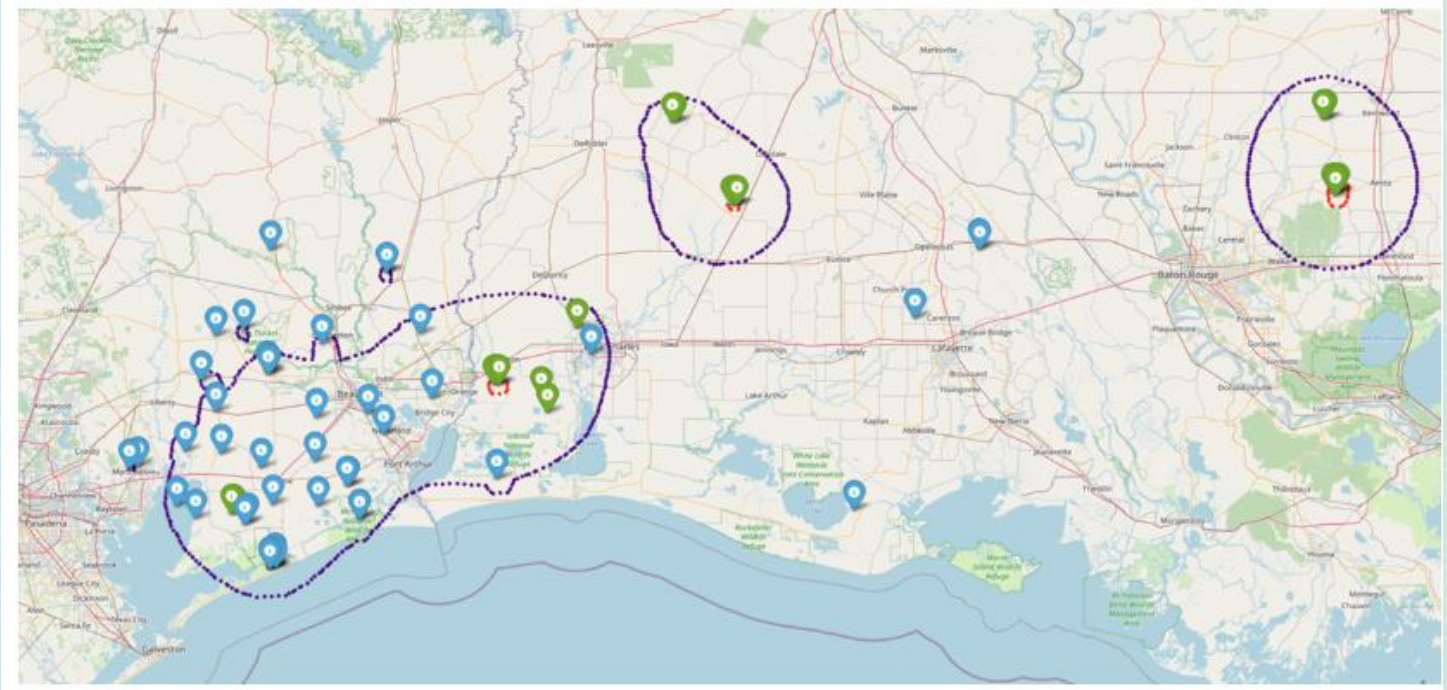
New Orleans Pliocene





Oligocene with SWD wells





New Orleans Miocene with SWD wells