

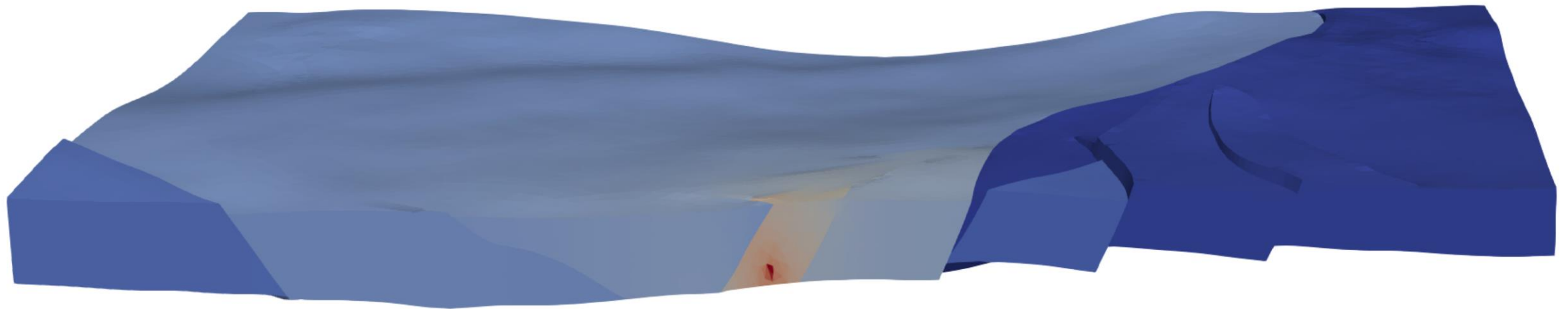
Compositional Poromechanics Simulation of High Island 24L

Julia Camargo¹, Francois Hamon², Antoine Mazuyer², Herve Gross², and Joshua White³

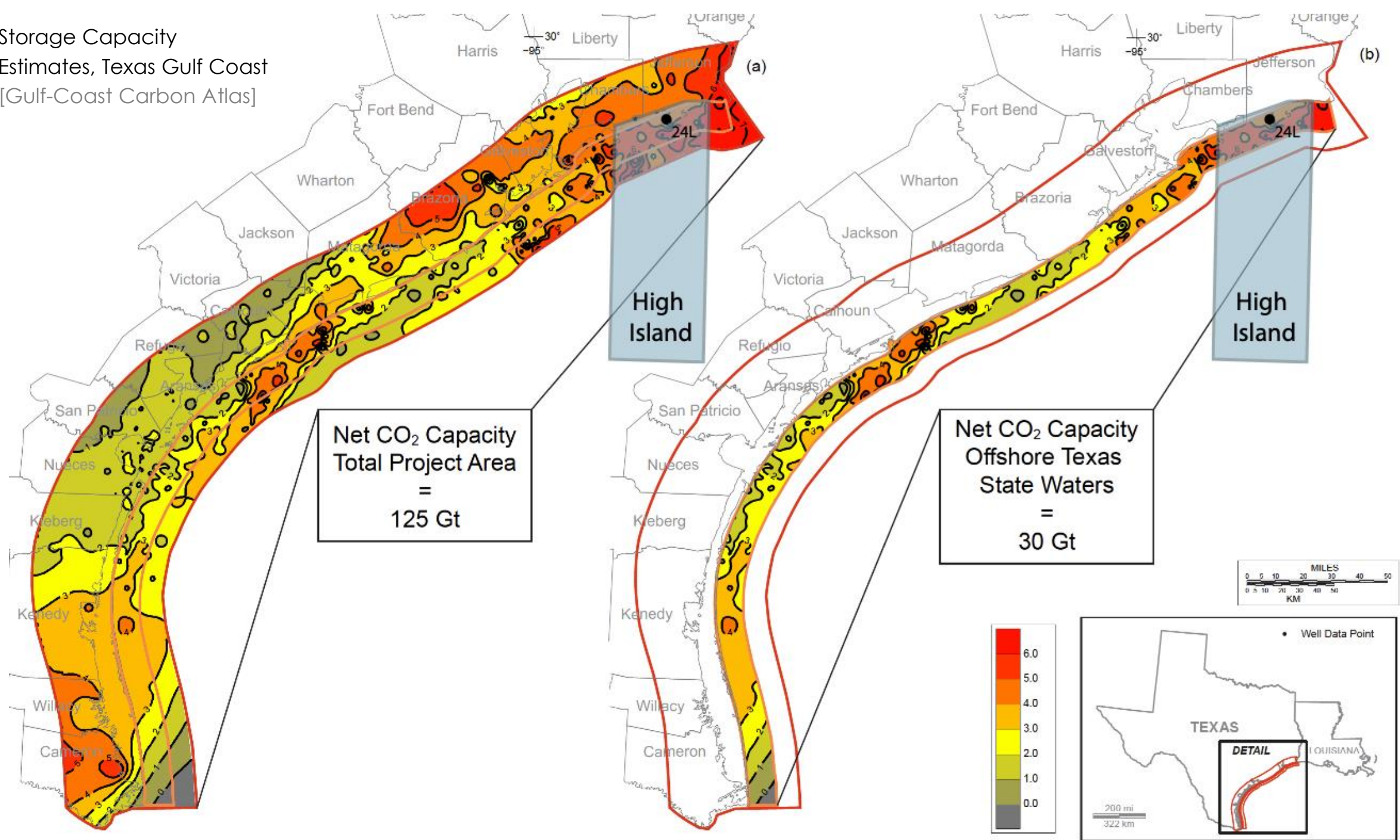
¹ Pacific Northwest National Laboratory

² TotalEnergies.

³ Lawrence Livermore National Laboratory

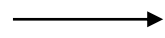


Storage Capacity
Estimates, Texas Gulf Coast
[Gulf-Coast Carbon Atlas]

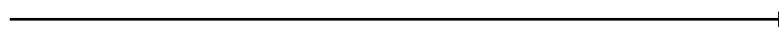


High Island 24L Model

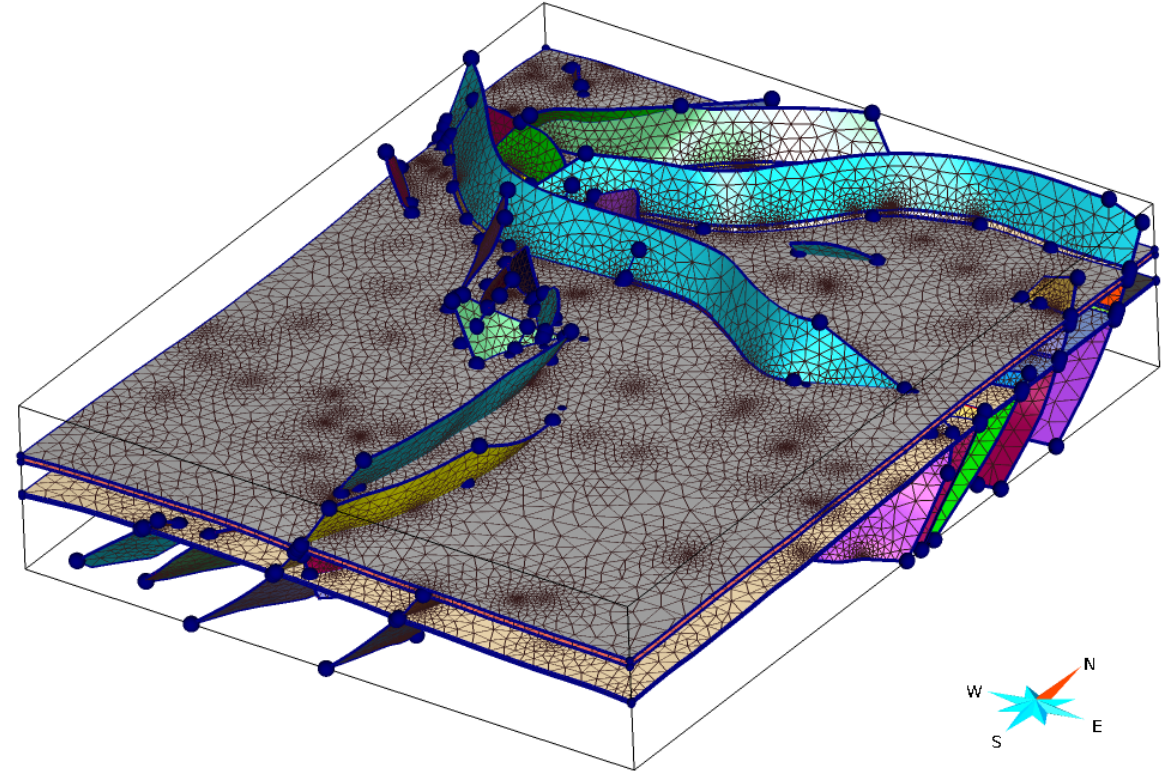
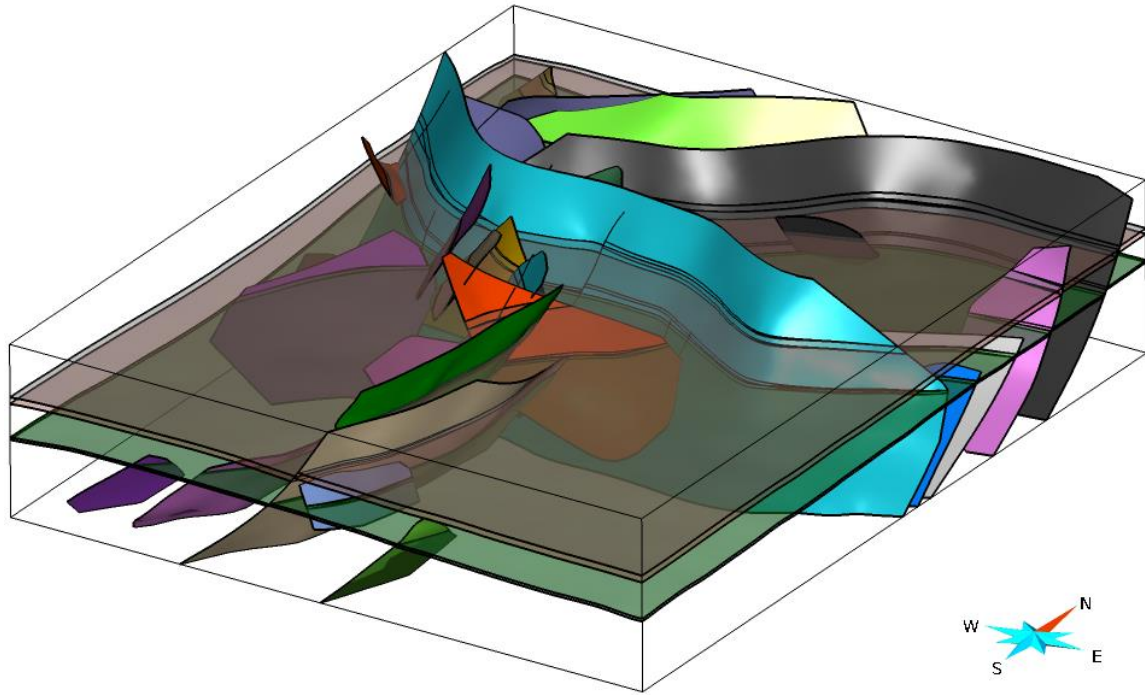
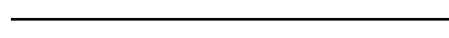
Seismic + Well Data



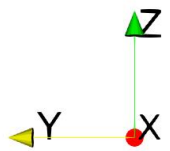
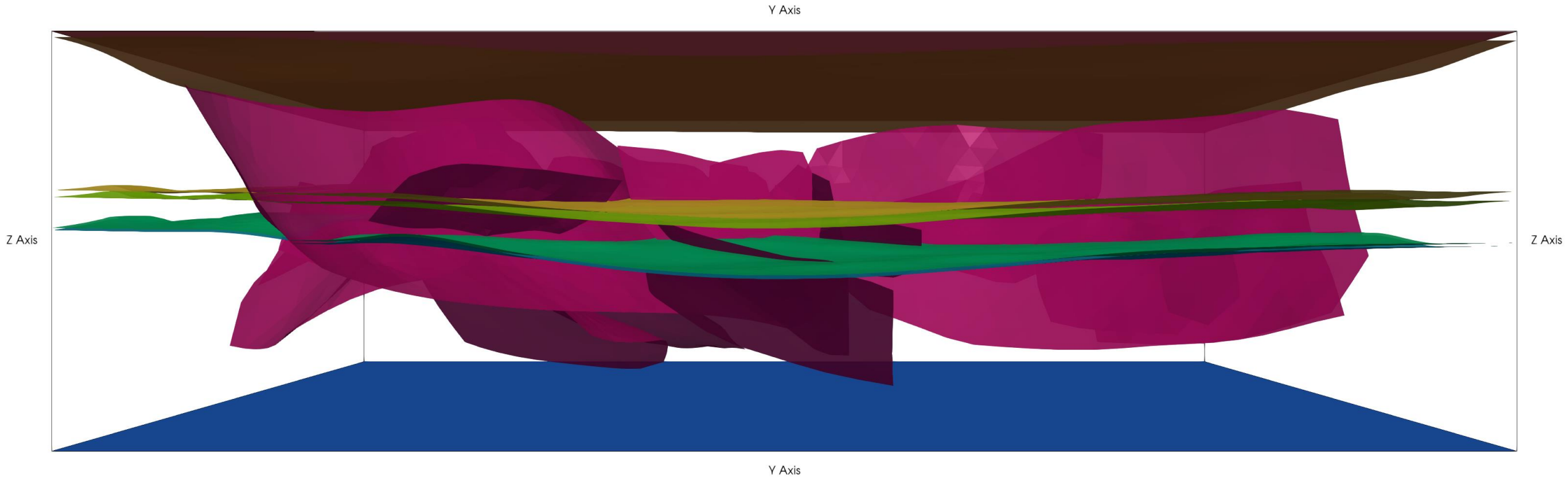
Structural Model



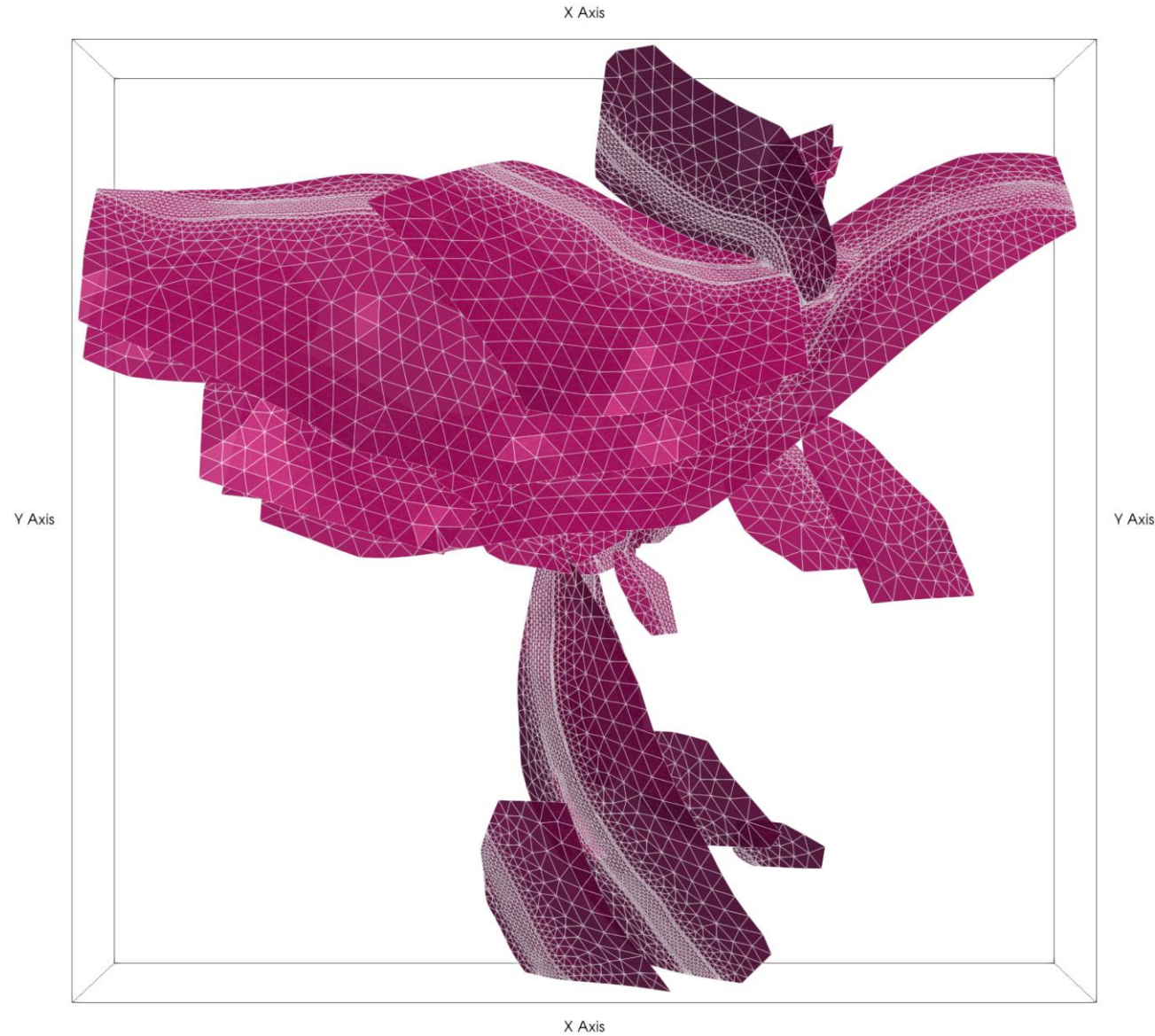
Meshed Model



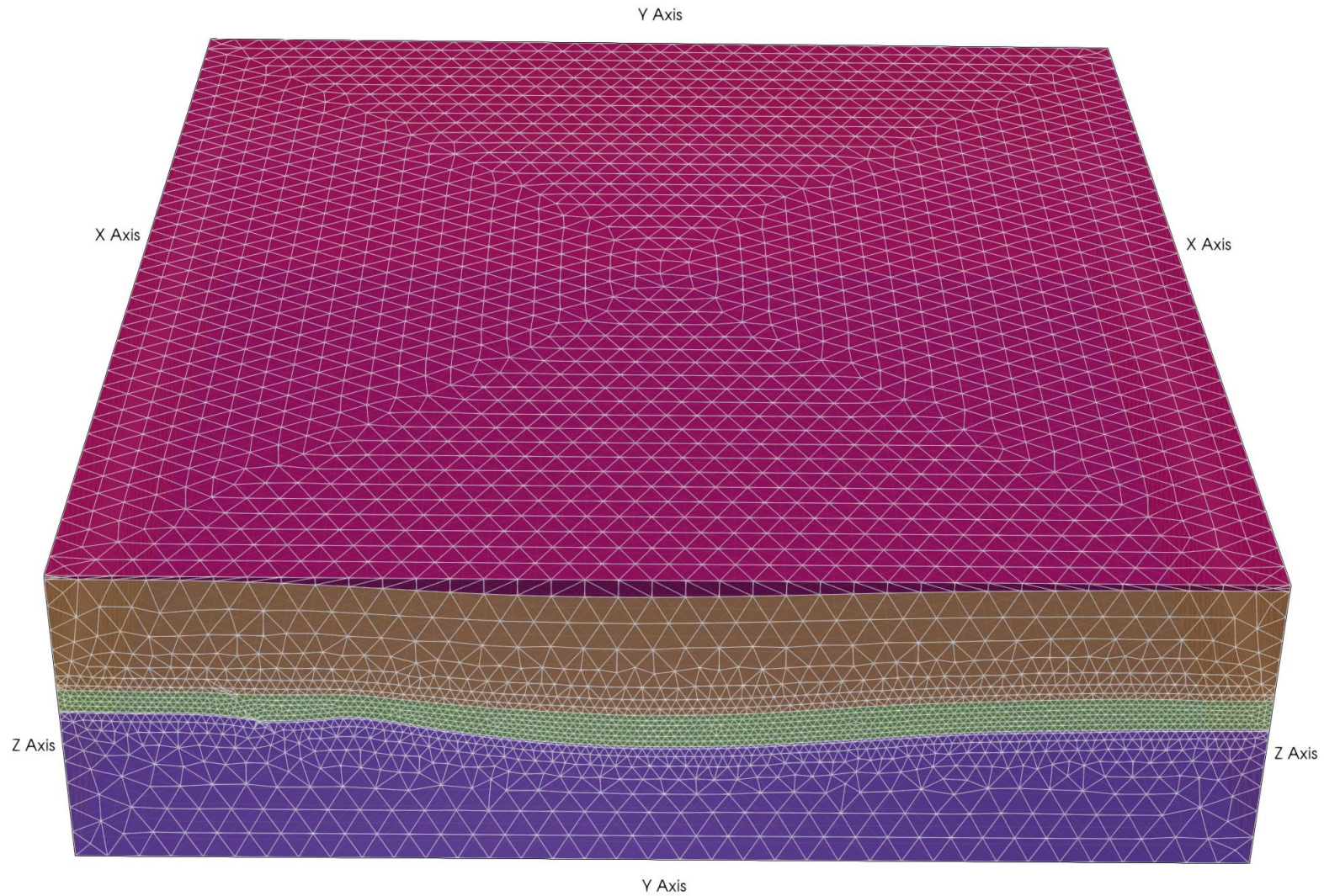
High Island 24L Model



High Island 24L Model



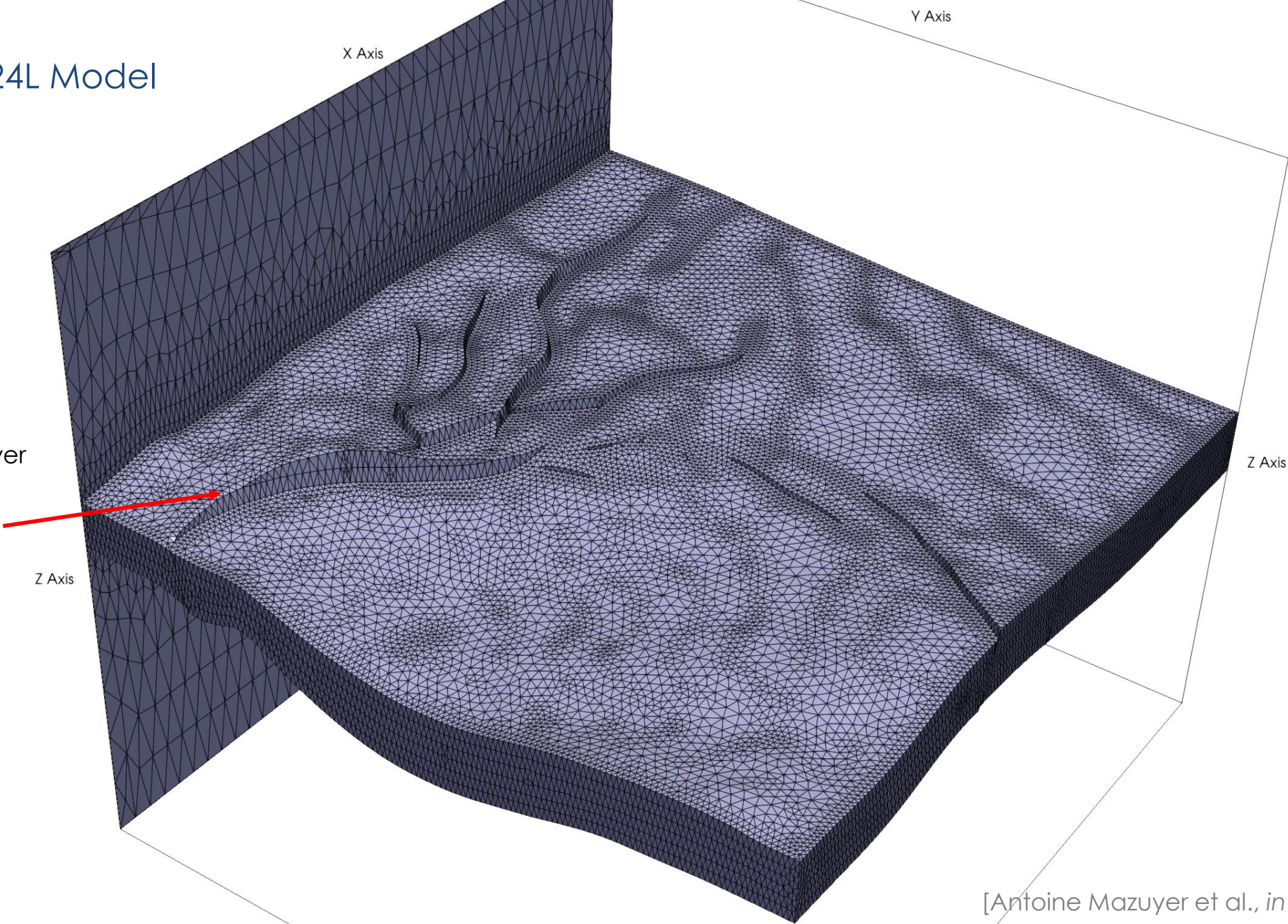
High Island 24L Model



High Island 24L Model

Reservoir Layer

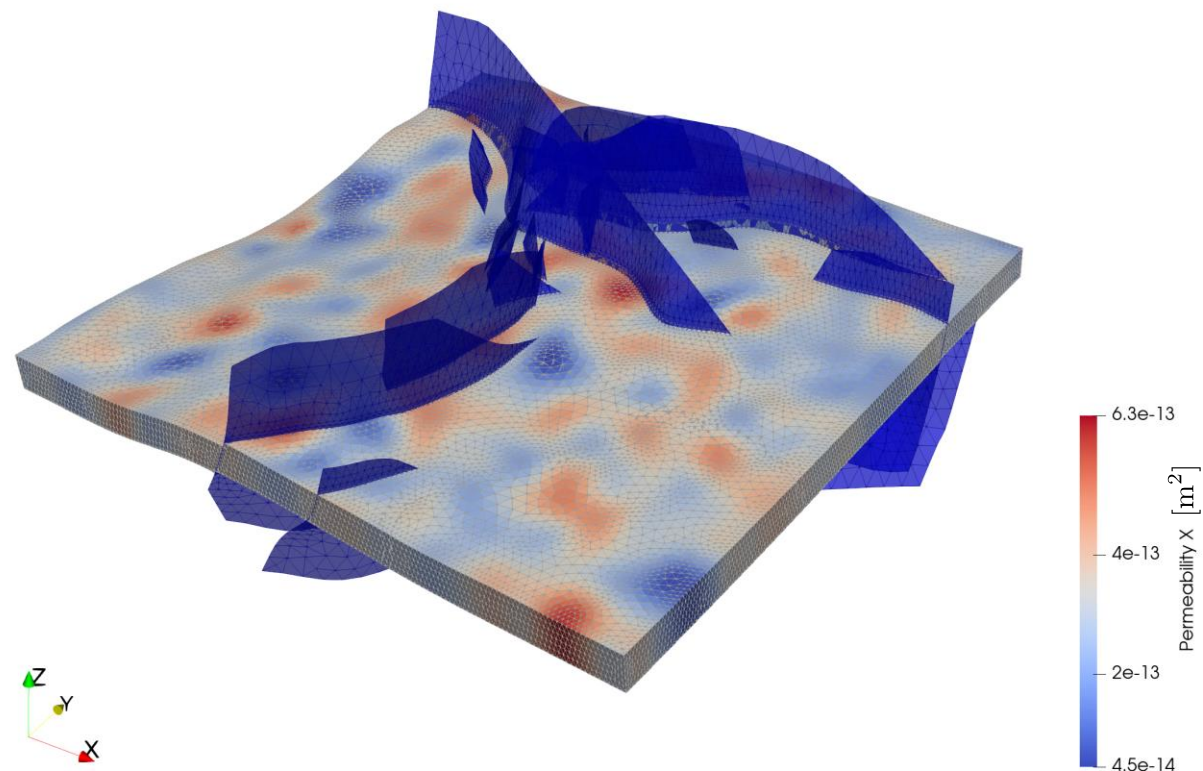
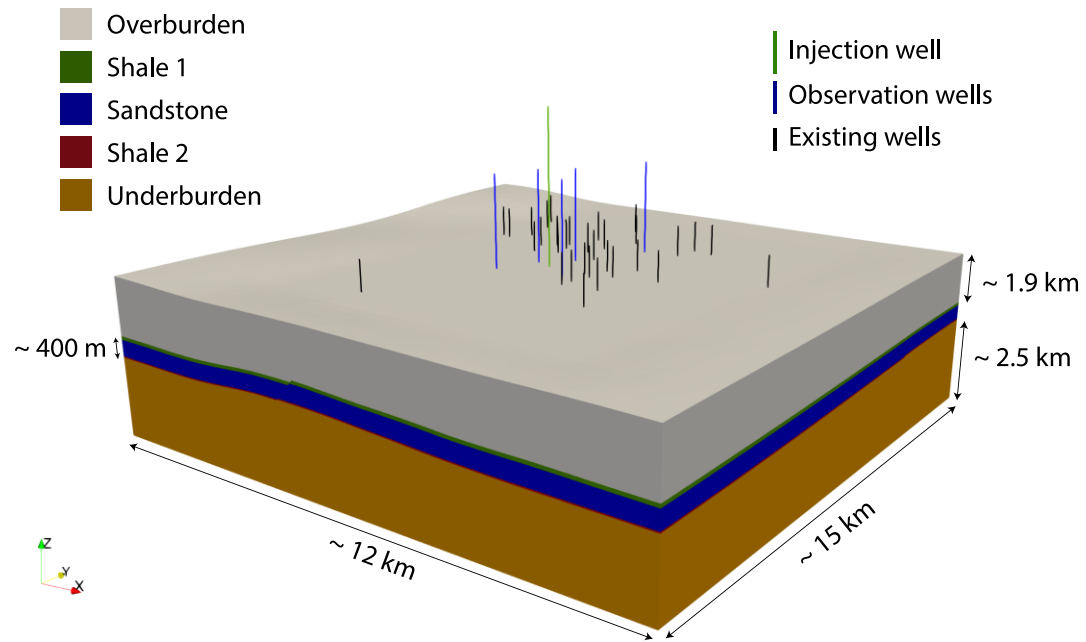
Fault Offsets



+ Wells

+ Mechanical properties *

+ Flow properties *



Compositional Poromechanics Solver

- Simultaneously solving:
 - Two-phase, two-component mass balance (brine+CO₂)
 - Linear momentum balance
- Constitutive Models:
 - Equations-of-state for CO₂ and brine density, viscosity, solubility
 - Linear elasticity
- Software:
 - GEOSX
 - Hypre-MGR linear solver

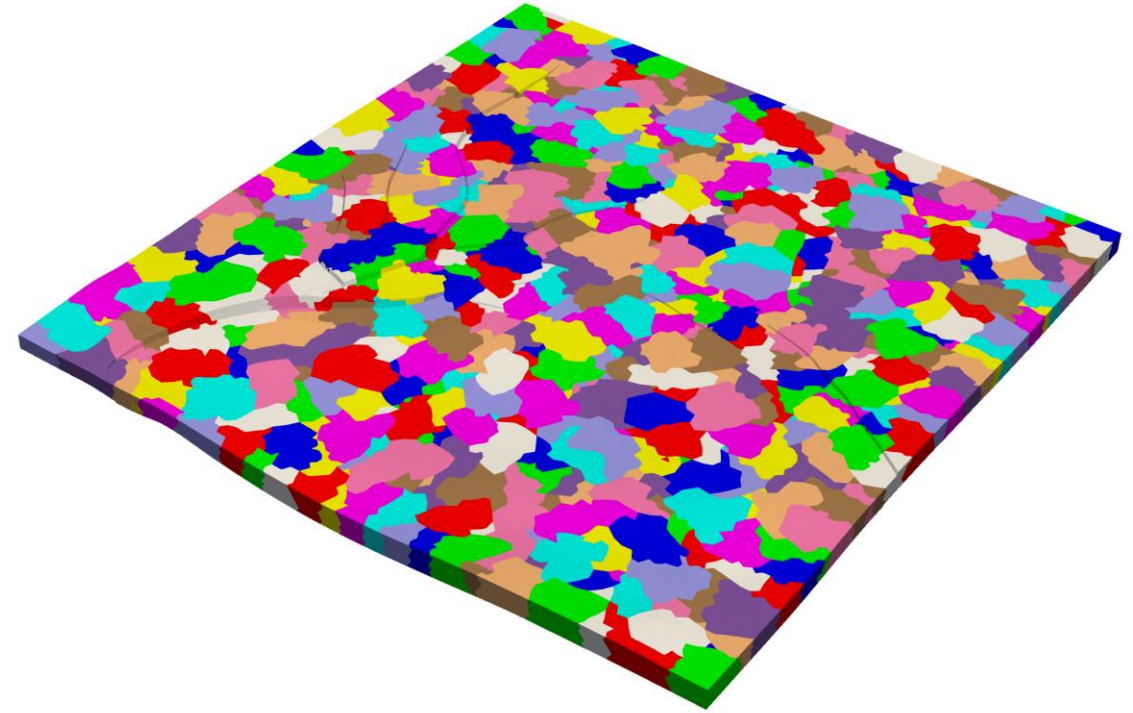
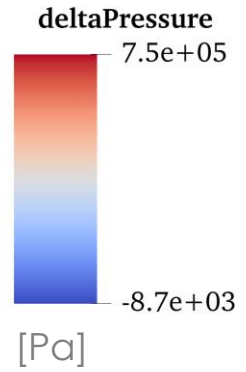
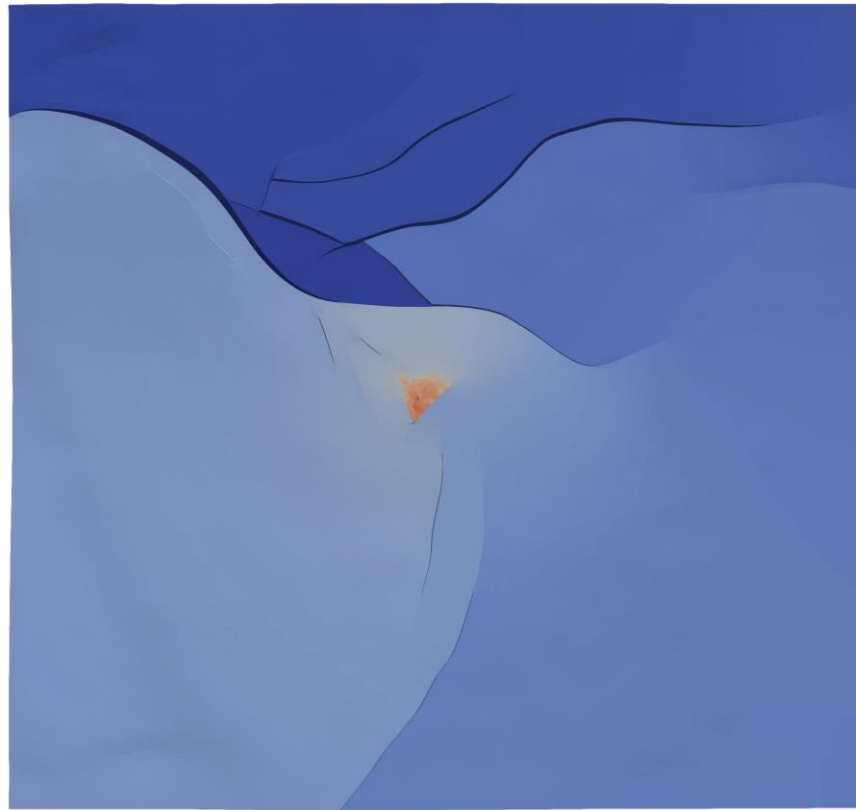


Figure: Domain partitioning with 576 ranks.

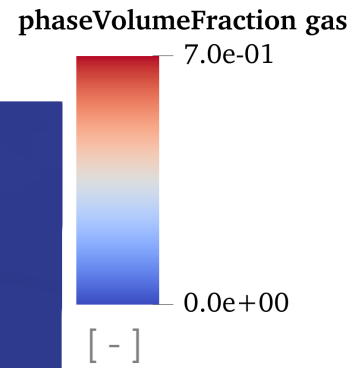
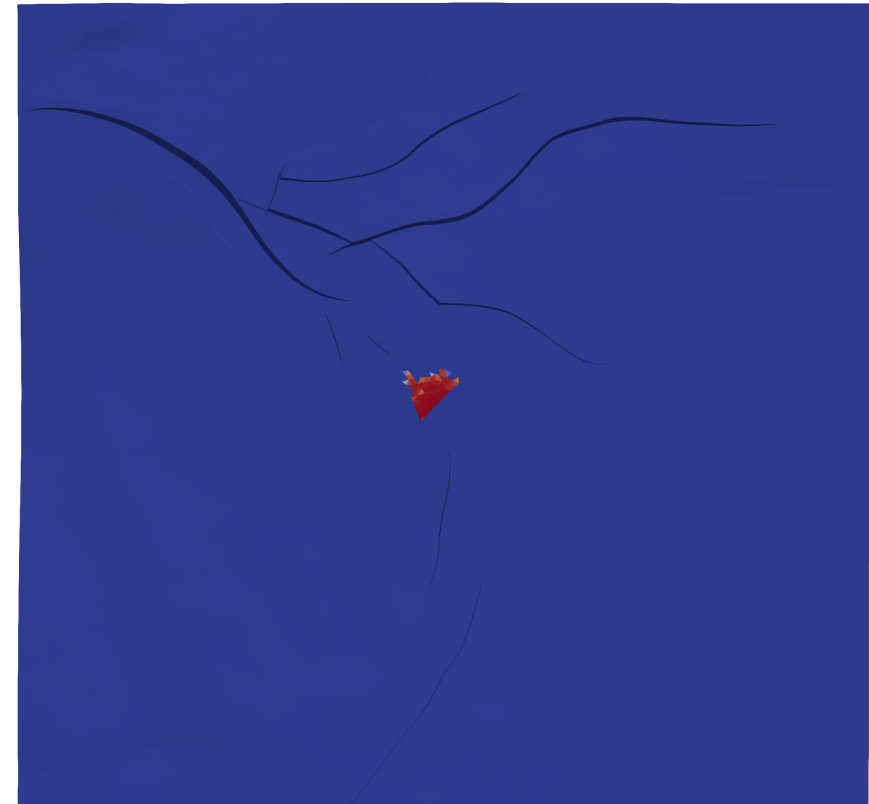
Runtime < 1 hr.

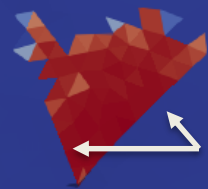
poromechanical
simulations

reservoir excess pressure ($t = 3y$)



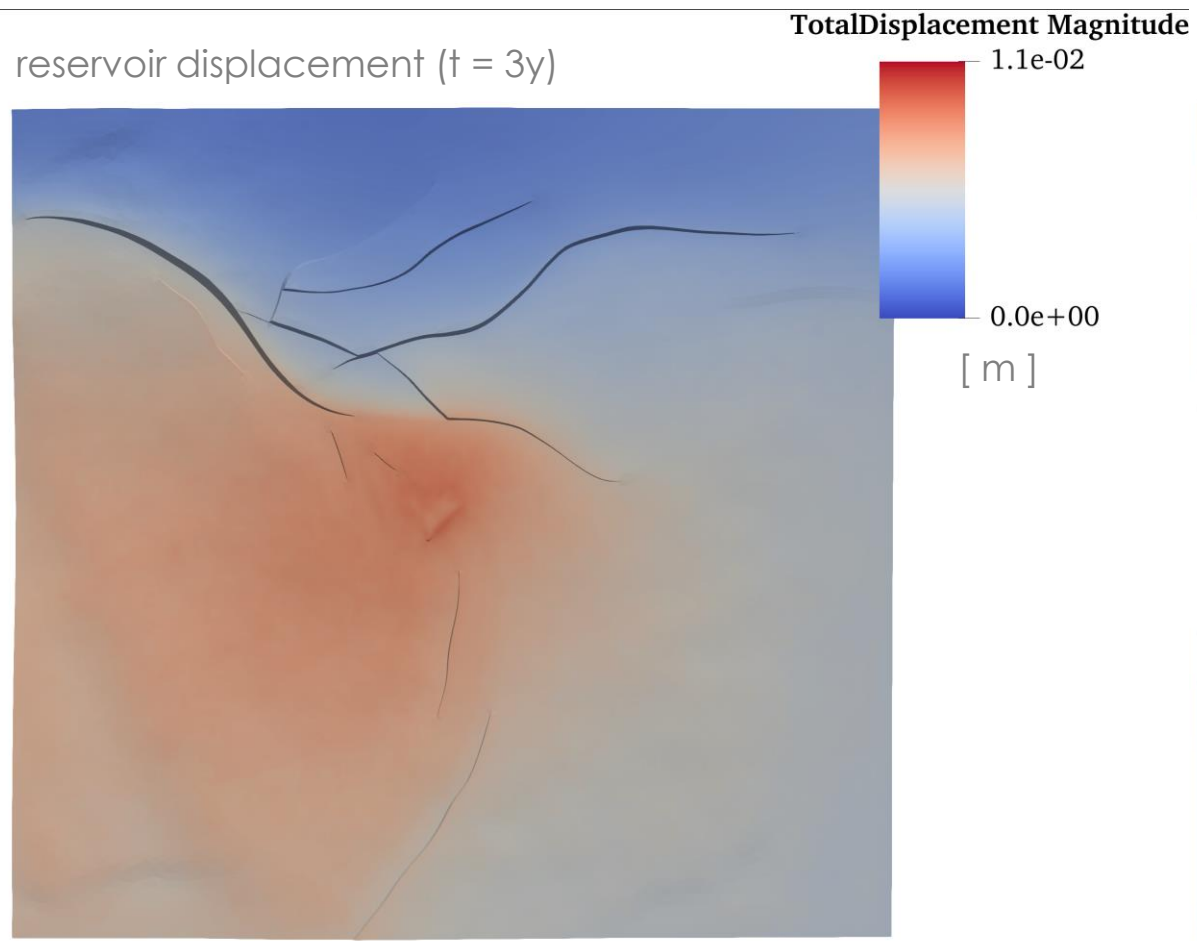
CO2 saturation



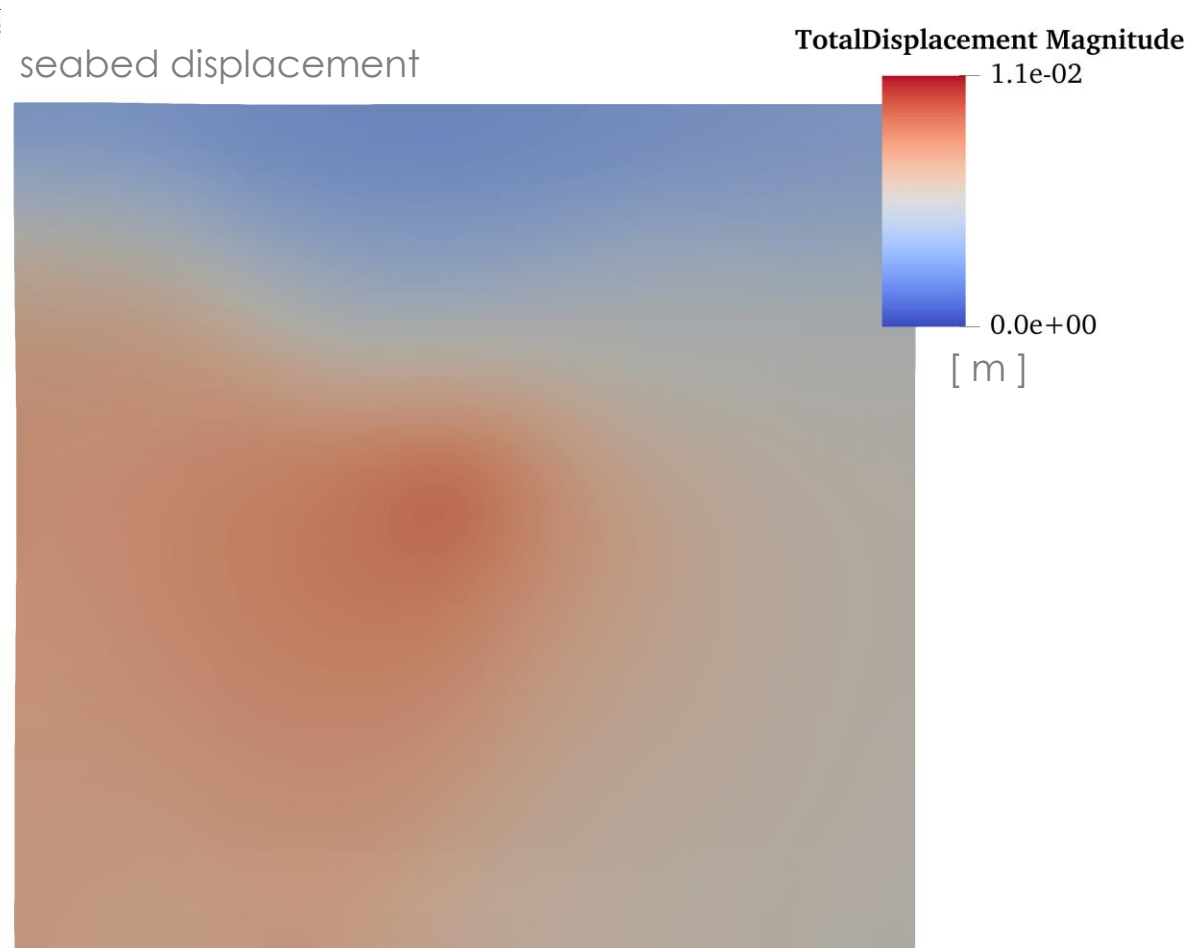


Tiny faults (assumed sealing!)

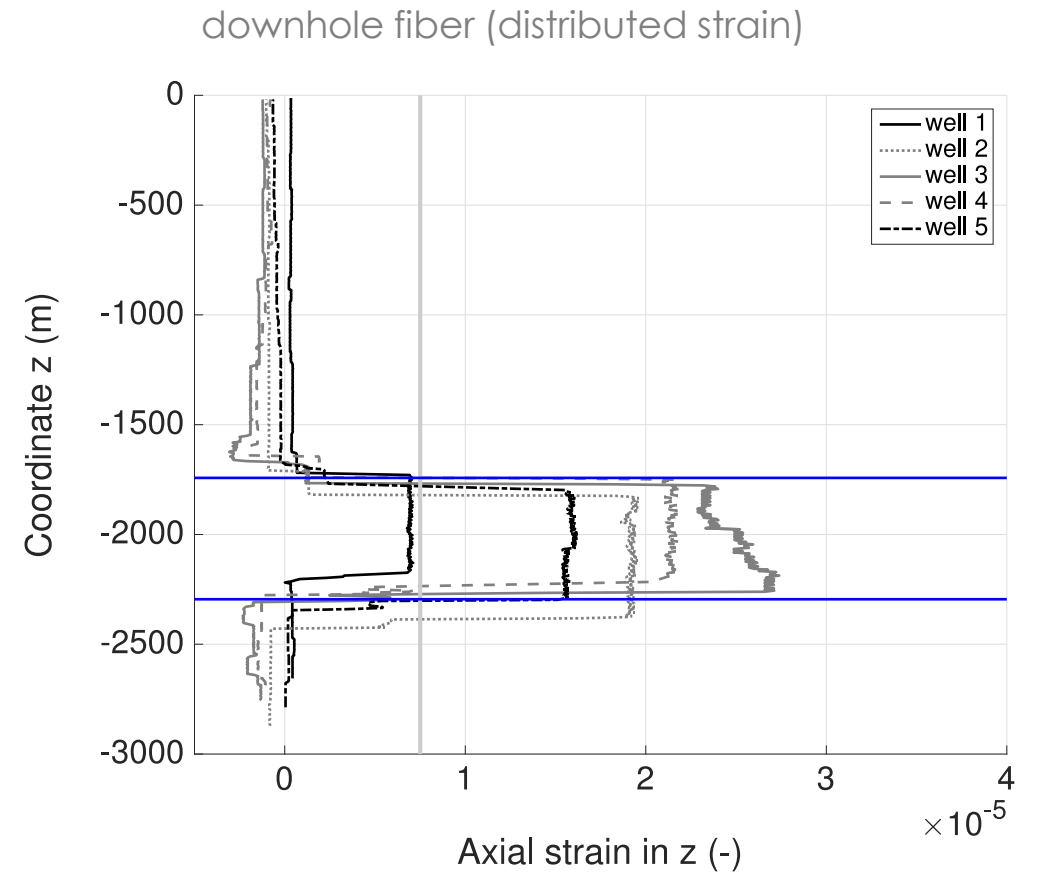
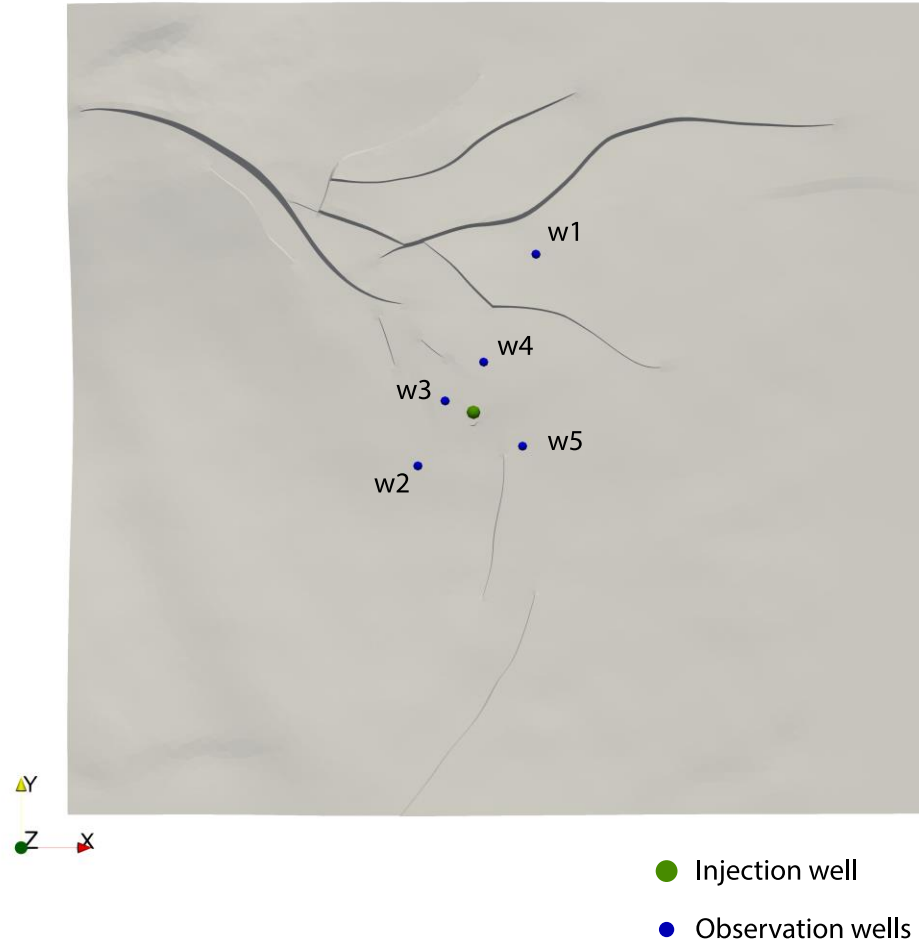
poromechanical
simulations



↑
edge effects (domain too small!)



predict
monitoring
observations



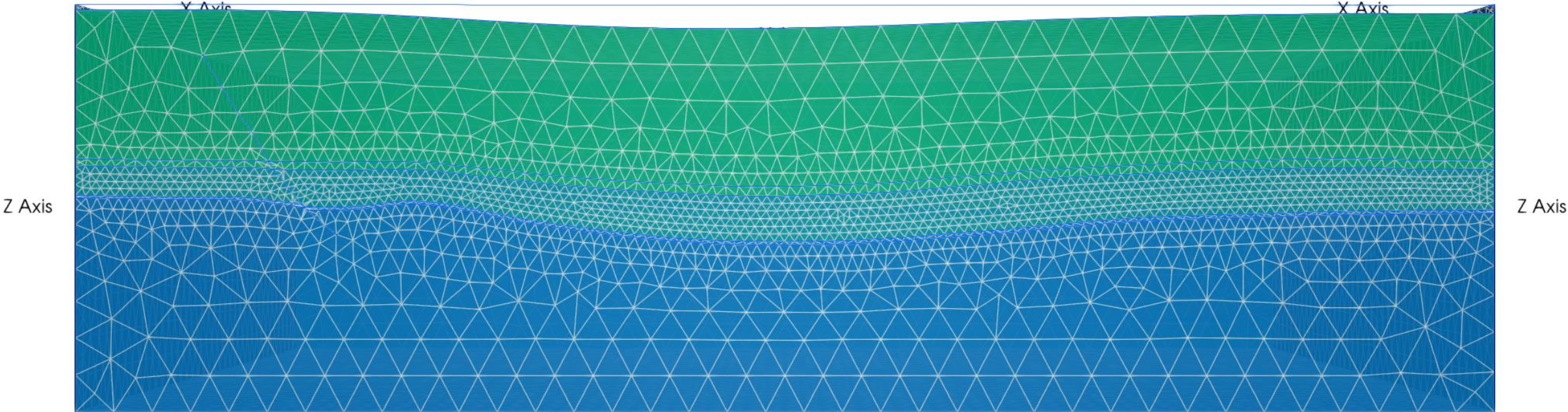
Next Steps

- Improving the static model:
 - Pad mesh boundaries
 - Vertical heterogeneity (baffles)
 - Fault transmissibility estimates
 - Well completion strategy
- Improving the dynamic model

- Plasticity
- Fault stability



Require good in-situ stress estimates to be meaningful!



Questions?

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Key Model Inputs

Input	“Path Forward”	Sources
Lithology + structure	Clear	GCCC Framework Model
Absolute perm + porosity	Clear	GCCC Framework Model
Relative perm	Maybe	Wallace et al. 2017
Fault seal behavior	Clear	Meckel et al. 2017, Nicholson 2012
Formation pressure, temp, salinity	Maybe	Well data?
Static elastic moduli	Clear	GCCC Framework Model (with dynamic/static correlation)
Inelastic properties	Unclear	Analogue data?
Fault friction properties	Clear	Correlations + Limit Analysis
Stress orientation	Maybe	Regionally consistent
Stress magnitude	Unclear	Local stress indicators? Gas-trap and faulting constraints.

Acknowledgements

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