THE UNIVERSITY OF TEXAS AT AUSTIN

WHAT STARTS HERE CHANGES THE WORLD

Update on CCS Research at the GCCC

Susan Hovorka

Gulf Coast Carbon Center

Bureau of Economic Geology

Jackson School of Geosciences

CAGS3 CCS workshop in Urumqi, Xinjiang, China

BUREAU OF ECONOMIC GEOLOGY

TEXAS Geosciences
The University of Texas at Austin
Jackson School of Geosciences

GCCC GULF COAST CARBON CENTER

Gulf Coast Carbon Center

- Established 2002
- Industrial Associates program
  - At University of Texas at Austin
  - Bureau of Economic Geology
- Multi-year "Big Plan"
- Strong leverage via sponsored research
- Field projects

Gulf Coast Carbon Center Current Research

GCCC Major Themes

- Capacity Estimation
- Unconventional EOR
- Monitoring Methods Optimization
- Analog Studies
- Knowledge Sharing

Major Funded Projects

- DOE SECARB – Phase III
- DOE-Offshore Miocene
- Net Carbon Negative Oil
- DOE CCPI: NRG – West Ranch
- DOE EASI-Tool
- DOE Intelligent Design
- GCCC Industrial Associates

Sponsor funded projects

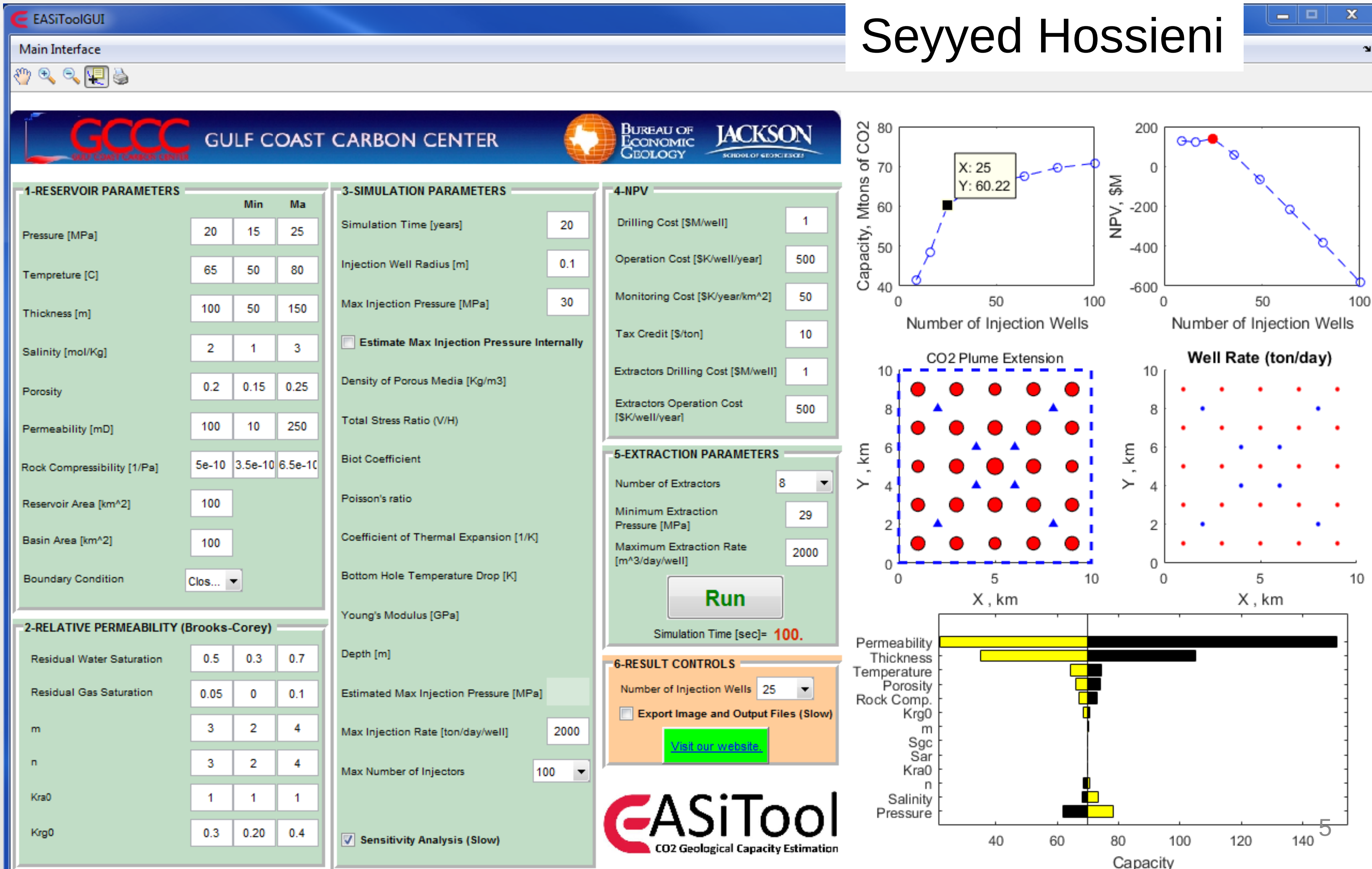
- Links to CCS JIP
- Links to Capture
- Links to BES CFSES
- Links US and global

Capacity Estimation

- What limits storage capacity?
  - Pressure limits
    - EASi-Tool http://www.beg.utexas.edu/gccc/EASiTool/index.php
    - Consider capacity under open and closed boundary conditions
  - Lateral migration
    - Rates and process of migration far from injection point

Easi-tool Capacity calculation

Seyyed Hossieni

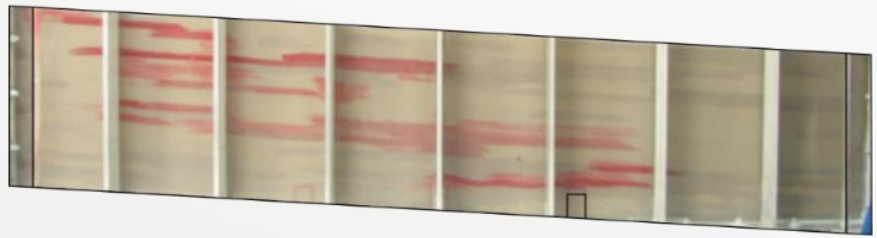


Comparison between Permedia and physical models

Luca Trevisan

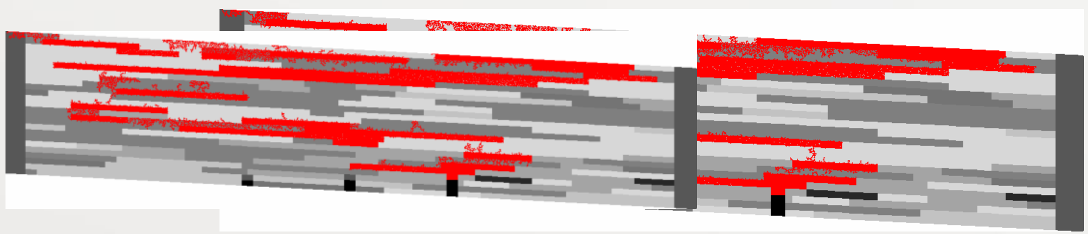
Observations from previous sandbox experiments performed under capillary-, buoyancy-dominated flow, *Trevisan et al. (2017) WRR*

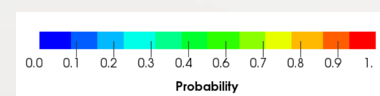
Stochastic modelling approach is able to account for uncertainty of individual numerical simulations



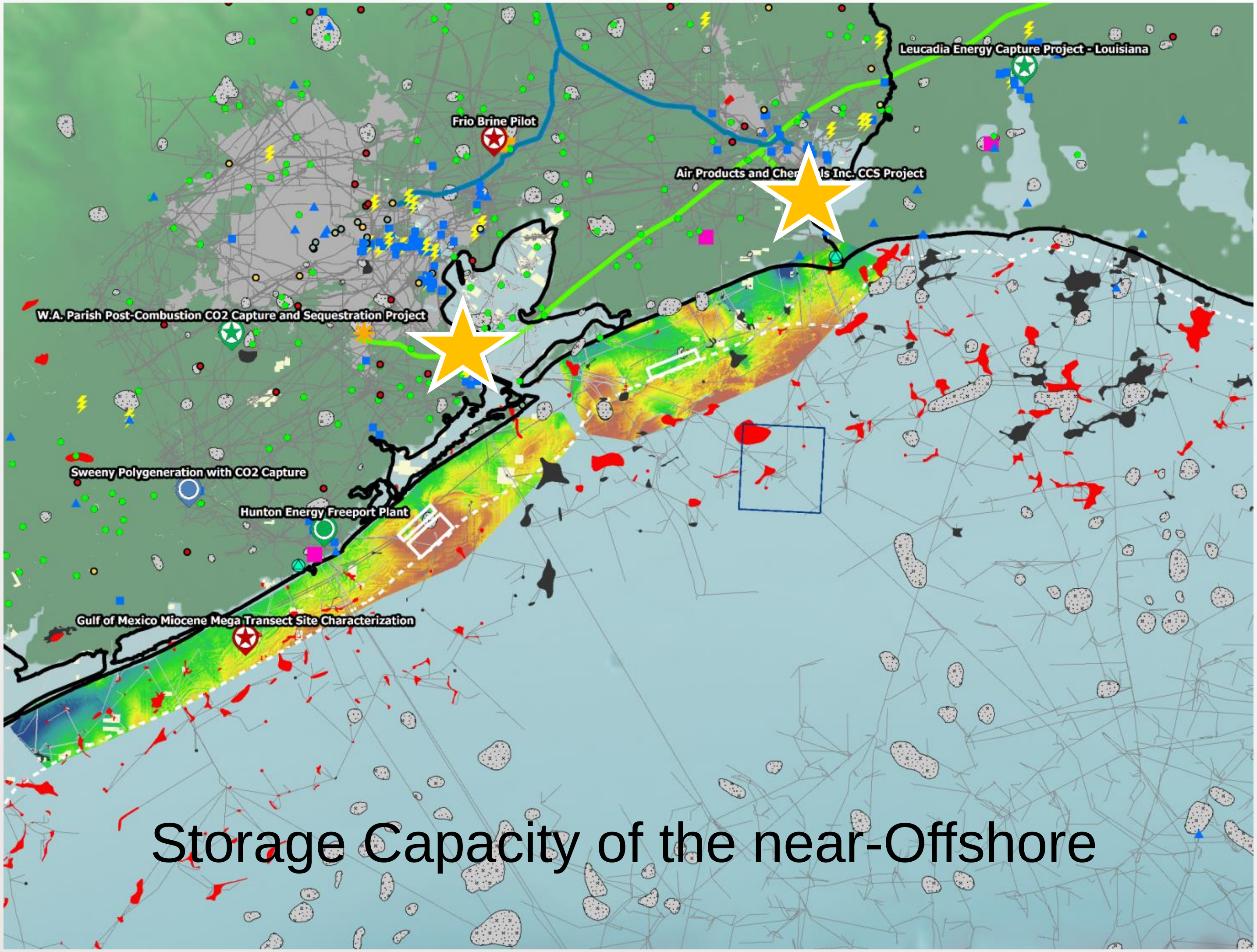
Simulation result for 1 realization

Probability map for an ensemble of 50 realizations





Simulation results for 50 realizations of P_{th} field



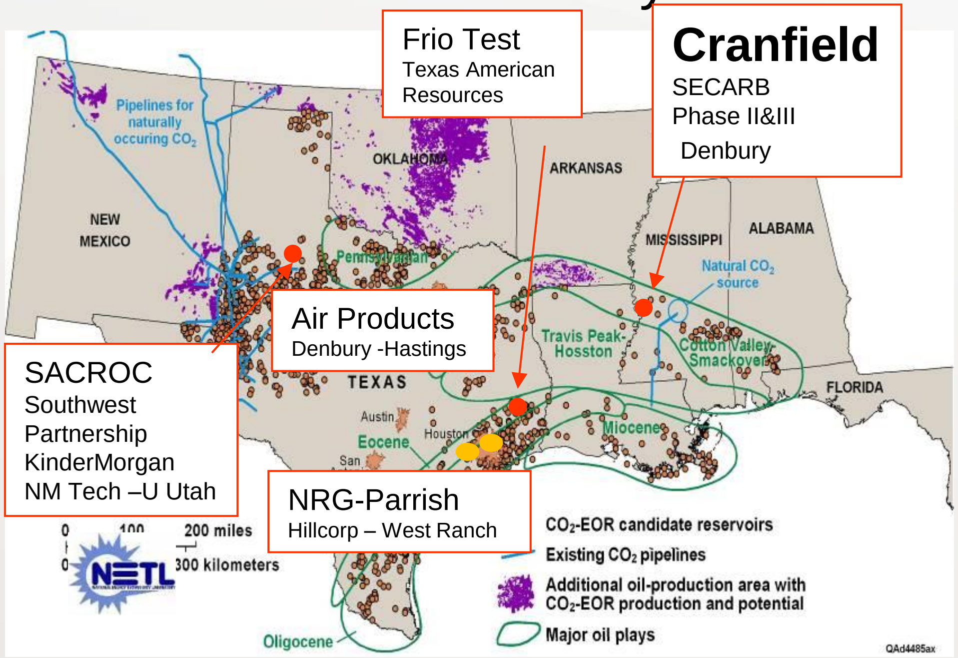
Storage Capacity of the near-Offshore

Optimization of Monitoring

- Field tests for real world solutions and validations
- Development of optimized “process based’ soil gas methods
- Real time instruments for surveillance of groundwater
- Above Zone “AZMI” installations.

GCCC Field Tests for Monitoring Verification and Accounting

DOE-NETL and Industry Hosts



Optimization of Monitoring --ALPMI method

Assessment of Low Probability Material Impact

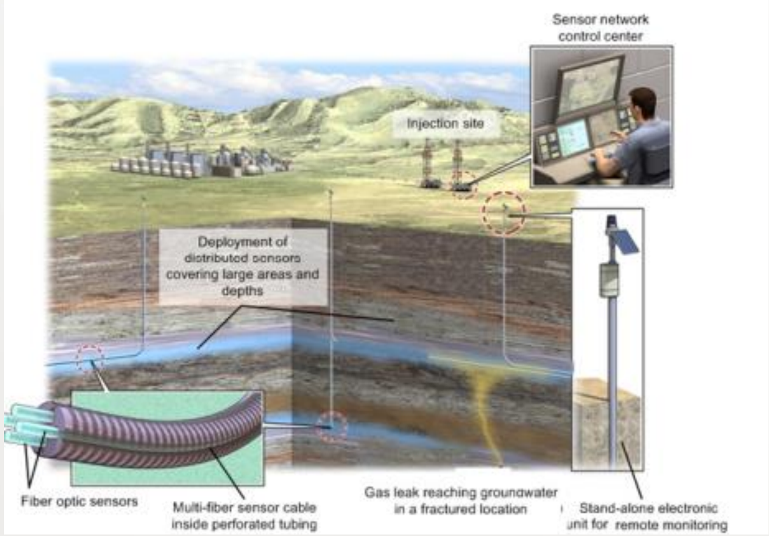
- 1) Define metrics of project success
  - Mass injected
  - Avoid unacceptable project outcomes
    - Loss of CO2 from secure storage
    - Unacceptable Seismicity
    - Damage to resource
- "Material Impact"
  - Defined quantitatively and with a level of certainty
  - "low probability" therefor need to prepare for non-detect.
  - Noise of setting and sensitivity of monitoring array

Real-time sensors for environmental surveillance

- Current geochemical monitoring requires water samples be collected periodically and analysed either on-site or in a chemical laboratory
- Labour and cost intensive

Can we use sensors for real-time in situ monitoring of geochemical parameters in groundwater?

To make geochemical monitoring as simple as pressure monitoring



Changbing Yang, GCCC

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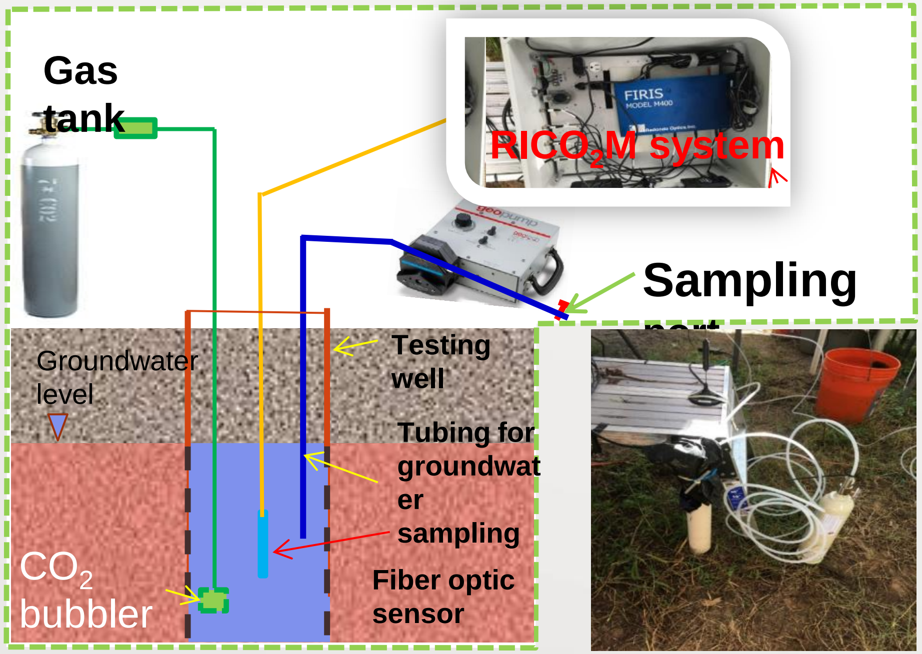
Field Demonstration at the Brackenridge Field Laboratory

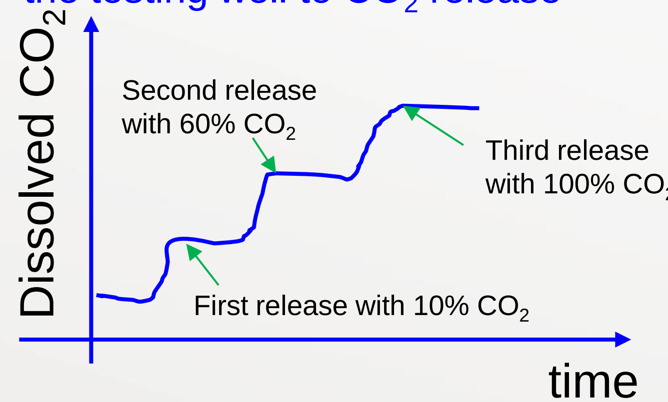
Configuration of the testing well



Not to scale

Step-wise CO_2 release tests

Expected response of dissolved CO_2 in the testing well to CO_2 release



- On-site measurements of pH and alkalinity
- On-site measurements of dissolved CO_2 with a CarbonQC

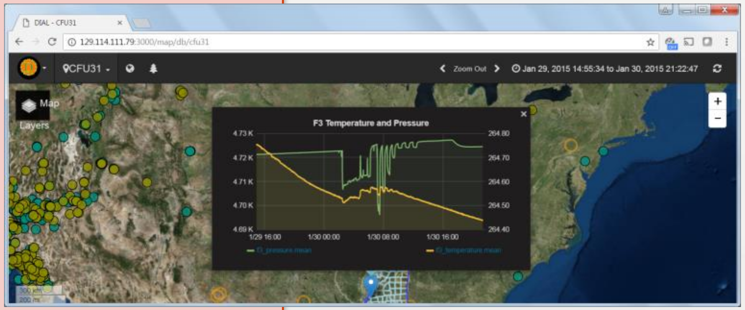
DIAL

- Data Management
- Anomaly Detection
- P

Intelligent pattern discovery

Integrated data manage. & modeling

Instant analytics & reporting



Alex Sun and Hoonyoung Jeong

Gulf Coast Carbon Center

Bureau of Economic Geology

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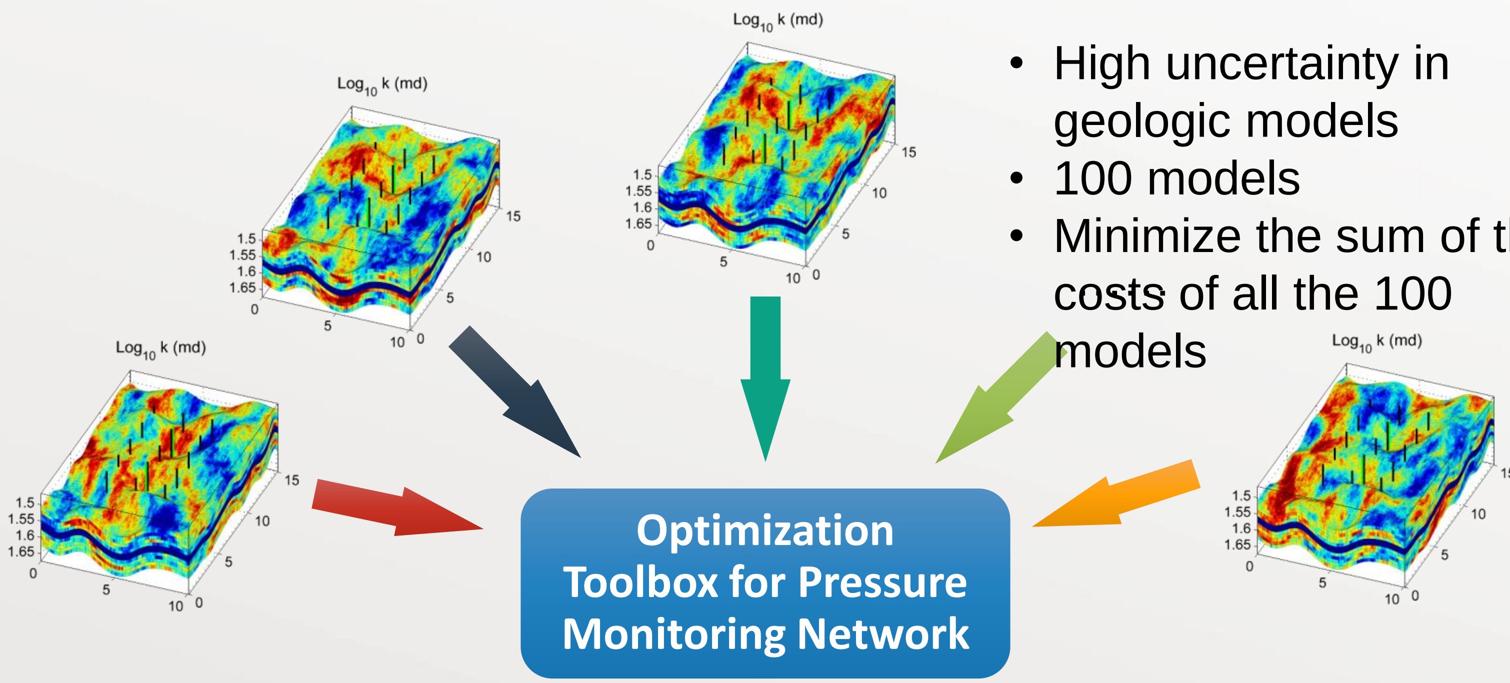
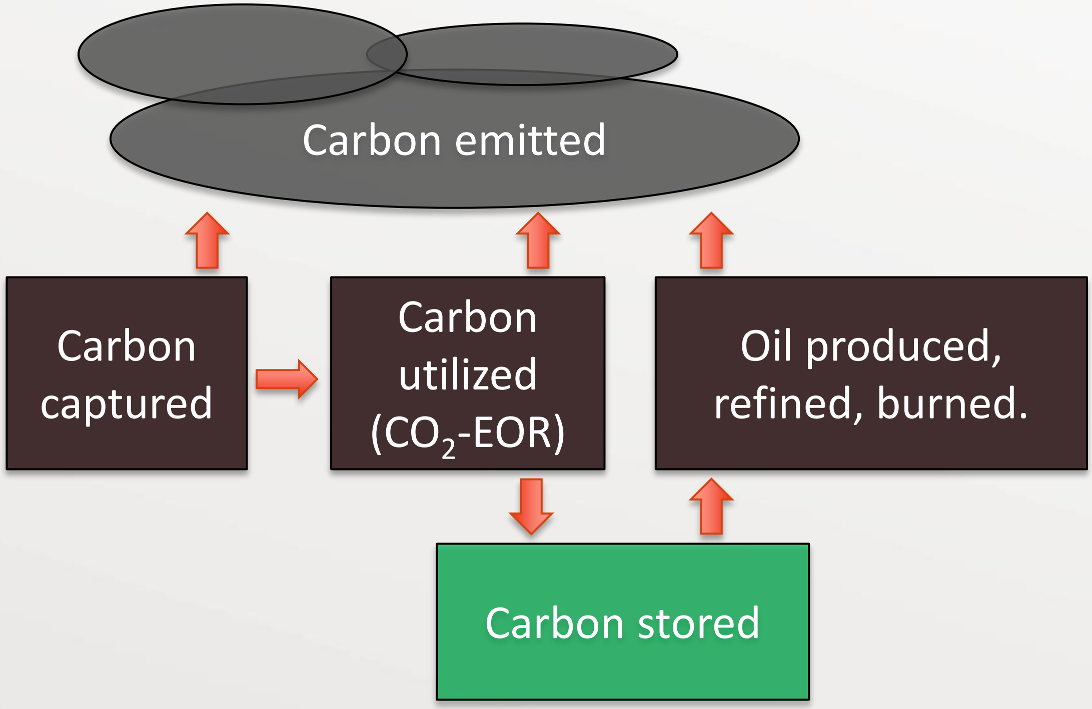
Considering Geological Uncertainty in monitoring

- High uncertainty in geologic models
- 100 models
- Minimize the sum of the costs of all the 100 models



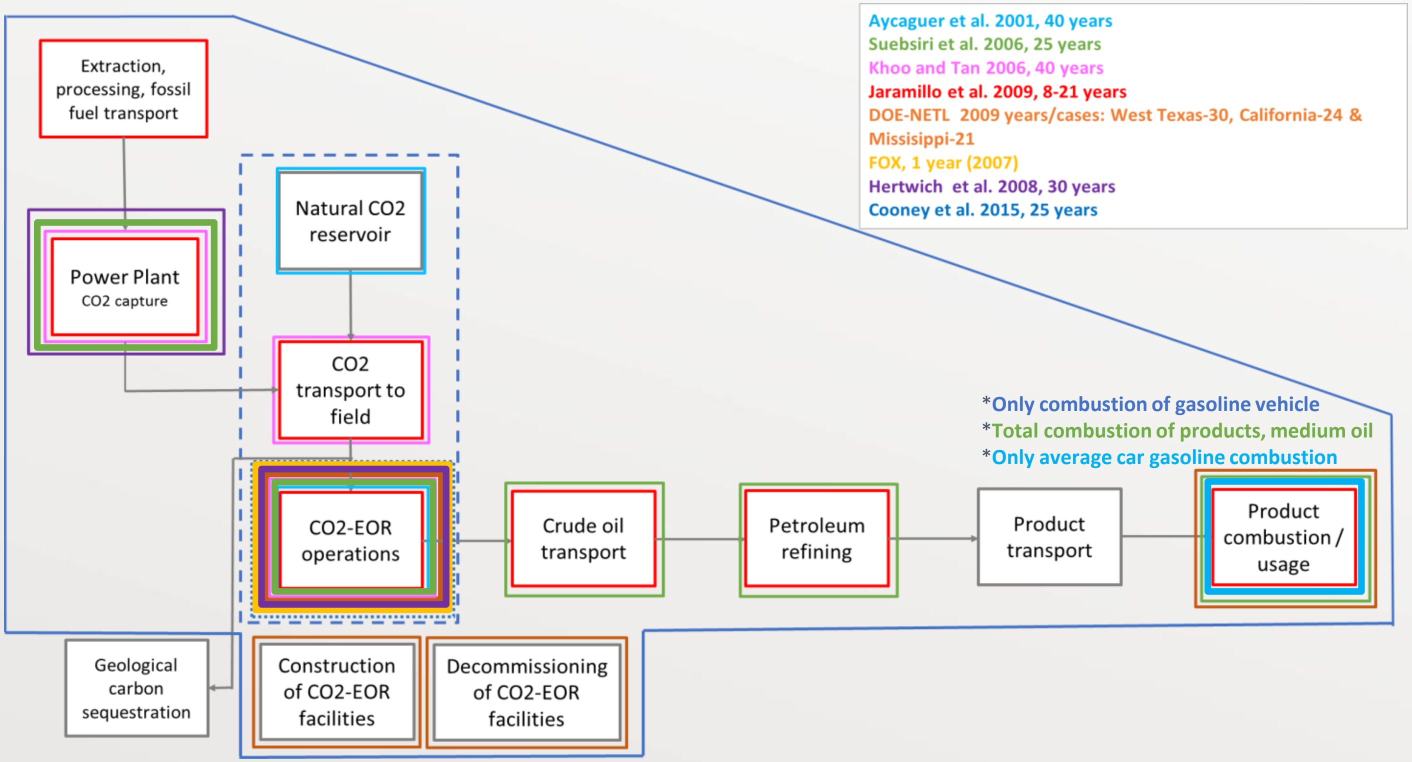
Life Cycle for CO_2 Enhanced Oil Recovery

- Is CO_2-EOR a valid option for greenhouse gas emission reduction? Are geologically stored carbon volumes larger that direct/indirect emissions resulting from CO_2-EOR operations?



Vanessa Nunez and Ramon Gil

System boundaries of previous studies



Vanessa Nunez and Ramon Gil

www.gulfcoastcarbon.org

ExxonMobil

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Gulf Coast Carbon Center

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JX

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U of Mississippi
SECARB
UT-PGE
UT Chem-E
CFSES- BES

UT- DoGS
UT- LBJ school
BEG- CEE
JSG – EER
Univ. Edinburgh
Univ. Durham
RITE
CO2-CRC

SECARB Southeast Regional Carbon Sequestration Partnership

STORE sequestration training, outreach, research & education

EDF ENVIRONMENTAL DEFENSE FUND Finding the ways that work

SOUTHERN STATES ENERGY BOARD

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