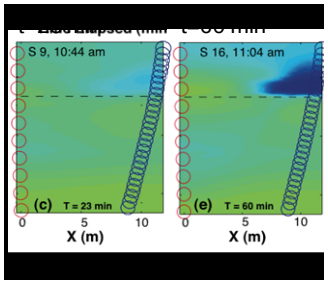
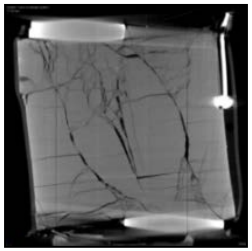
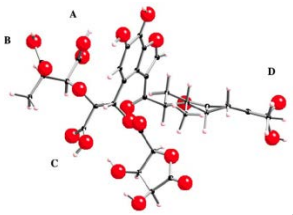
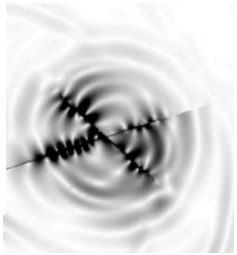
Lab Big Idea: March 12-13, 2014
Adaptive Control of Subsurface Fractures and Fluid Flow

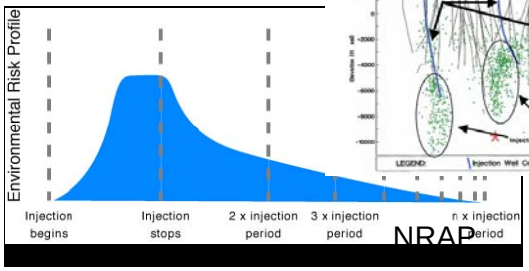
GOAL: Real-time measurement and control of fracture networks & associated flow
APPROACH: Experiments, simulations, theoretical frameworks, & field tests
OUTCOMES: Improved recovery factors, reduced operational and environmental risks, safety and reliability, new energy sectors – *major policy implications*

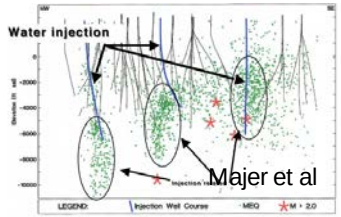












Fracture geomechanics, geochemistry and fluids basics

Characterization, Monitoring and Prediction

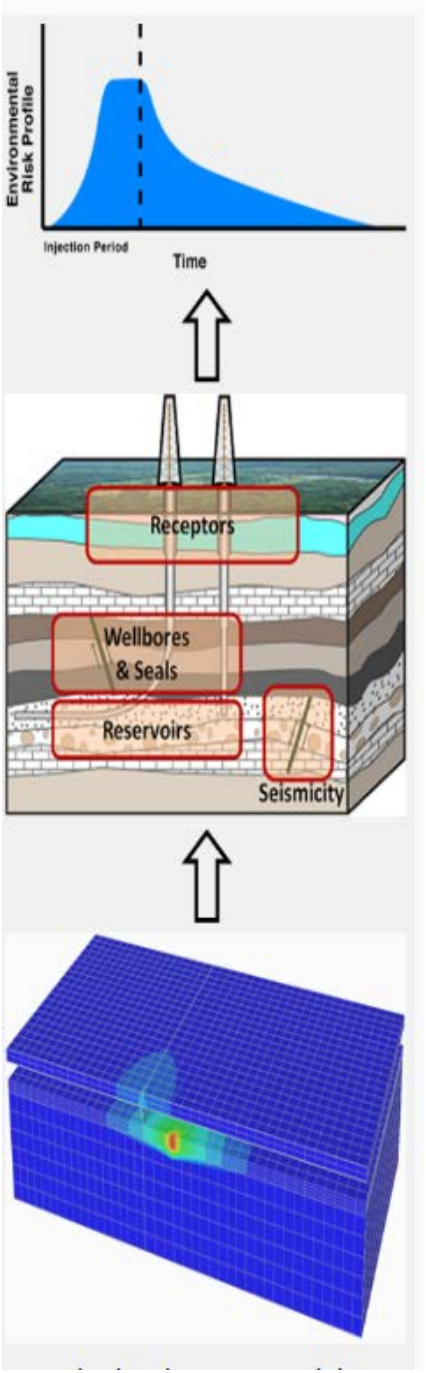
Strategies for Large-Scale Control

Adaptive Control of Subsurface Fractures and Fluid Flow

Environmental Risk

Drilling technologies and materials

Energy Field Observatories



NRAP is using Science-based Prediction to Quantify Potential Risks associated with Carbon Storage

Complete synergy/complementarity with SubTER

Fit For Purpose Simulation Capabilities

Energy Field Observatories

Subsurface Stress & Induced Seismicity

New Subsurface Signals

Permeability Manipulation & Fluid Control

- Development of a methodology and computational platform for quantifying risk profiles (the increase and decrease of risk over time) based on **integrated assessment models and uncertainly quantification**.
- Targeted **scientific investigations at the laboratory and field scale** to calibrate component behavior and reduce uncertainties in predicted risk profiles.
- Integration of **risk-based monitoring and mitigation strategies** to reduce uncertainty and overall risk.

The NRAP tool box

- **Integrated Assessment Model – Carbon Storage (NRAP-IAM-CS)**
  - Simulates long-term full system behavior (reservoir to aquifer/atmosphere)
- **Reservoir Evaluation and Visualization (REV) Tool**
  - Generates pressure and CO_2 plumes sizes over time
  - Suitable for Area of Review (AoR) determination
- **Wellbore Leakage Analysis Tool (WLAT)**
  - Evaluates existing wells for leakage potential
- **Natural Seal ROM (NSealR)**
  - Estimates flux through a fractured or perforated seal
- **Aquifer Impact Model (AIM)**
  - Rapid estimation of aquifer volume impacted by a leak
- **Design for Risk Evaluation and Monitoring (DREAM)**
  - Estimates time to detection for a monitoring system
  - Evaluates and select optimal monitoring designs
- **Short Term Seismic Forecasting (STSF)**
  - Forecasts seismic event frequency over the short term