NRAP Phase II Tools and Workflows: DREAMv3 at the 2021 GWPC Annual Forum

September 29, 2021
Designs for Risk Evaluation and Management (DREAM) leverages output from reservoir simulators to design risk-minimized monitoring plans.

- Configurations are optimized based on sensor locations and specified monitoring parameters
- A defined budget limits the number of monitoring wells and technologies
- DREAM iterates across placement scenarios until it converges on the optimal configuration of sensors
DREAM Workflow

DREAM V3

- Uses a computationally-efficient simulated annealing approach
- Evaluates 100k+ potential monitoring plans for 1k+ simulated hypothetical leaks
DREAM Workflow

**Site Characterization**
- Site Assessment
- Exploratory Drilling
- Pumping Tests
- Conceptual Modelling
- Simulation
- Sensitivity Analysis

**Leak scenario:** Output from full-physics simulators (TOUGH2, STOMP, ...) or ML approximations

**Sensor information**
- **Type:** Pressure, CO2 sat., gravity...
- **Detection threshold**

**Constraints (budget, drilling access, etc)**

**DREAM V3**
- Uses a computationally-efficient simulated annealing approach
- Evaluates 100k+ potential monitoring plans for 1k+ simulated hypothetical leaks
DREAM Workflow

**Site Characterization**
- Site Assessment
- Exploratory Drilling
- Pumping Tests
- Conceptual Modelling
- Simulation
- Sensitivity Analysis

**Leak scenario:** Output from full-physics simulators (TOUGH2, STOMP, ...) or ML approximations

**Sensor information**
- **Type:** Pressure, CO2 sat., gravity...
- **Detection threshold**

**Constraints (budget, drilling access, etc)**

**DREAM V3**
- Uses a computationally-efficient simulated annealing approach
- Evaluates 100k+ potential monitoring plans for 1k+ simulated hypothetical leaks

**INPUTS**

**OUTPUTS**
- Monitoring plan
- Optimally protective monitoring plan
- Minimize monitoring Cost
Example: Site With Many Wells

- Hypothetical Geologic Carbon Storage (GCS) site
  - Single injection well (250MT over 50 years)
  - Many (37,000) legacy wells
- Probabilistic leak scenarios from NRAP-Open-IAM
- Designated handful of hypothetically leaky wells
- Designed optimally protective monitoring plan

Example: Site With Many Wells
Kimberlina OpenIAM Model
Example: Site With Many Wells
Kimberlina OpenIAM Model
Example: Site With Many Wells
Kimberlina OpenIAM Model

- All leak scenarios detectable within first 20 years
- Quantifies the risks of reducing the post-injection site care period below 50 years

Walkthrough
Kimberlina OpenIAM Model

1. Provide hypothetical leakage scenarios
2. Define impact thresholds, weighting coefficients
3. Define detection thresholds
4. Restrict number/cost of wells, sensors
5. Select algorithm, number of monitoring plans to evaluate
6. Results available within GUI or excel
Thank you!

Comments and Questions:

alexander.hanna@pnnl.gov

NRAP Website: https://edx.netl.doe.gov/nrap/

Sign up for NETL EDX: https://edx.netl.doe.gov/user/register