Integration of Geophysical and Geomechanical Modeling to Monitor Integrity of Carbon Storage

Award Number: DE-FE0026825

Project Summary:

The goals of this project were to: (1) model and identify effective and low-cost monitoring techniques for carbon capture and storage; (2) derive geophysical techniques (seismic) and attributes for an accurate and robust carbon dioxide (CO_2) monitoring system; and (3) evaluate geophysical monitoring ideas for safe CO_2 storage, and identify any geohazard risks. To achieve the objectives, the project scope consisted of fluid flow and geomechanical simulation, rock physics and 4D seismic modeling, and validation of rock physics models with field data. The study was conducted using datasets from the Farnsworth Unit (FWU) oilfield.

Prime Performer:
University of Southern California

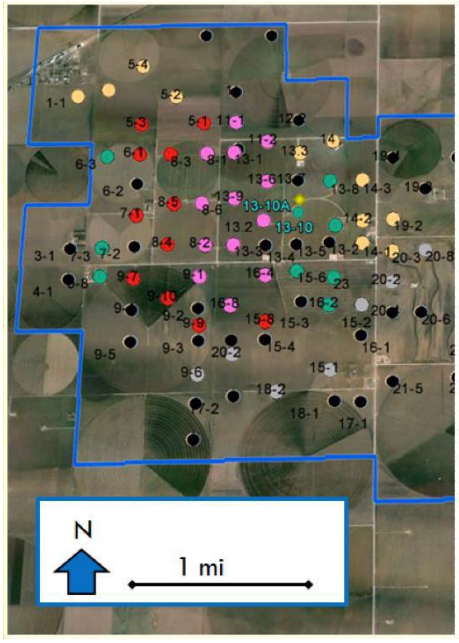
Principal Investigator:
Fred Aminzadeh

Project Duration:
10/15/2016 – 6/15/2018

Performer Location:
Los Angeles, California

Field Sites:
Farnsworth Unit, Texas

Program:
Carbon Storage



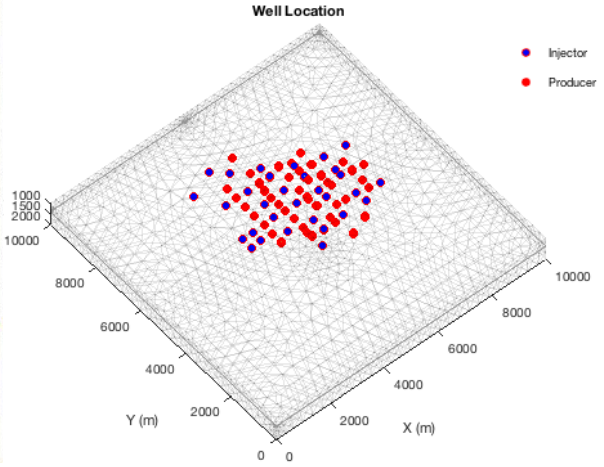


Figure 1: ***Left:*** **Field map and well locations,** ***Right:*** **Simulation model and well locations**

Project Outcomes:

The project outcomes can be broken down into three major products. First, a coupled, multiphase flow-geomechanical model and simulation of FWU was constructed, which may predict changes in pressure, stress, CO_2 saturation, stress-dependent permeability and elastic moduli. Second, a new reverse time migration (RTM) imaging technique was derived to visualize the effect of CO_2 injection, using a rock physics model to account for the effect of fluid substitution on elastic properties. Finally, geomechanical experiments performed on FWU cores provided a characterization of dynamic elastic moduli due to changes in the CO_2 core pressure. This may determine constitutive model parameters in the rock-physics model and the coupled simulation model.

Presentations, Papers, and Publications

Final Report: Integration of Geophysical and Geomechanical Modeling to Monitoring Integrity of Carbon Storage (July 2018) Fred Aminzadeh