Stanford

Dylan Marshall Crain

Ph.D. Student in Energy Resources Engineering, admitted Autumn 2022

Bio

EDUCATION AND CERTIFICATIONS

- Master of Science, Stanford University , Petroleum Engineering (2020)
- Bachelor of Science, Missouri University of Science and Technology , Petroleum Engineering (2018)

SERVICE, VOLUNTEER, AND COMMUNITY WORK

- Pop-Up Food Pantry (September 20, 2021)

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

My current research revolves around optimizing the monitoring design of Carbon Capture and Sequestration (CCS) projects in such a way that the posterior (after data assimilation) predictions are as close to reality as can be hoped for.

In CCS projects within the U.S., it is important to have monitoring plan, which can consist of wells with pressure, saturation, salinity, et cetera sensors, seismic lines, or gravimetric above-ground measurements, before any injection has begun into the subsurface. This is due to the permitting requirements that must be satisfied before operations are begun.

Due to this constraint, any monitoring optimization (at least initially) needs to be determined using only a prior (highly uncertain) understanding of the subsurface. This makes the optimization much more challenging. We utilize a prior optimization scheme from a previous student which allows us to optimize a monitoring plan using only prior information to get the minimized, expected uncertainty reduction in the posterior models for a given quantity of interest. This scheme is limited by some Gaussian assumptions. We optimize it using a genetic algorithm.

From this point, with the monitoring plan established, the information gathered from the optimized monitoring scheme (using only monitoring wells at the moment) is used to history match (data assimilate) our understanding of the subsurface. The results can be used to predict the CO_2 plume flow and behavior into the future.

This work was initially developed to assist a project in Illinois that is currently seeking Class VI injection well permits in the self-same state in order to begin injecting CO_2 produced from two companies paying for the work from the Illinois Geological Survey.

Publications

PUBLICATIONS

- **An integrated framework for optimalmonitoring and historymatching in CO2 storage projects** *COMPUTATIONAL GEOSCIENCES*
  Crain, D. M., Benson, S. M., Saltzer, S. D., Durlofsky, L. J.
  2023