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Novel Detection & Monitoring of Caprock Fracture During Geologic Sequestration

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Motivation/Challenges

- The presence of a geologic uncertainty such as a caprock fracture/fault in the caprock may lead to possible communication of injection fluid with overlying geologic media, which over a period of time can cause changes in fluid pressure signature and ground deformations
- To develop methods to determine possible leakage scenarios during long-term CO_2 injection

Technology/Capability Overview

- The overburden geologic response and flow behavior in the presence of a fracture or a fault in the caprock was evaluated using computational methods.
- Multi-phase fluid flow modeling coupled with geomechanics was performed to simulate water and CO_2 injection into a geologic formation.
- The pressure and displacements signatures can be used to detect the presence of an existing fracture or the activation of a new or an existing dormant fracture in the caprock layer during fluid injection or extraction.
- Advanced modeling methods with limited field instrumentation can be used for detection of caprock fractures or leakage pathways. This method can reduce the cost of field instrumentation for monitoring

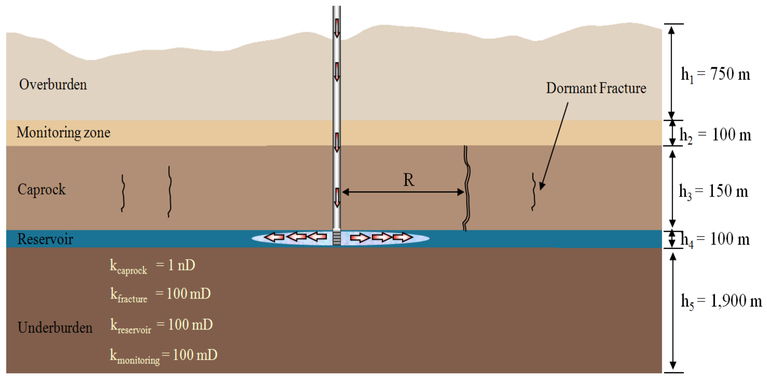

Figure 1: Schematic of the assumed multi-layered geologic profile

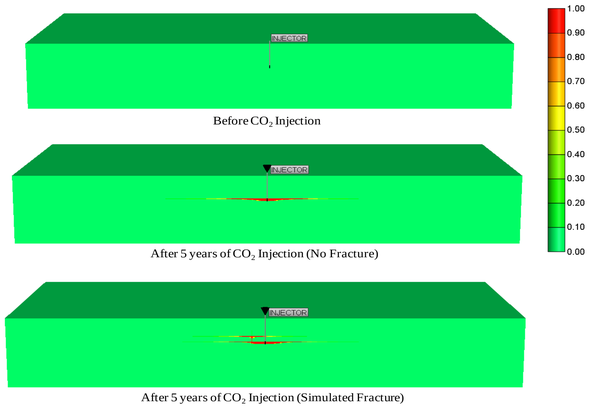

Figure 2: CO_2 migration with and without a caprock fracture

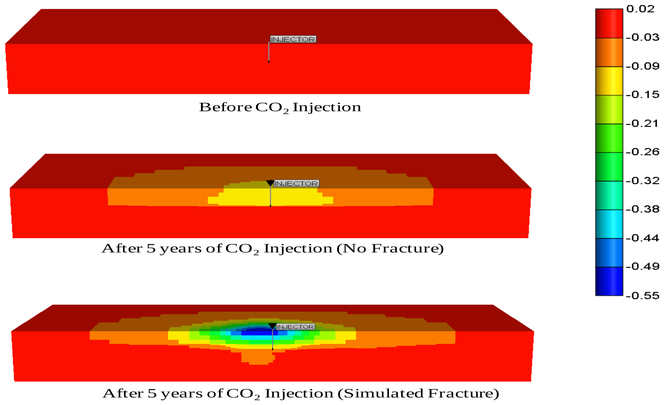

Figure 3: Computed surface displacements

Industry Significance

- Results from this study can be used in the development of smart monitoring technologies with limited field instrumentation coupled with numerical modeling work

Benefits to Partner

- Potential for commercialization of smart monitoring technologies

Development Status

- Computational modeling is underway

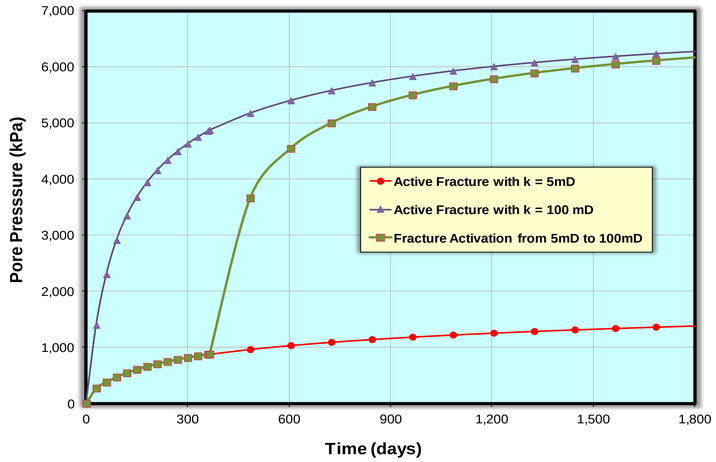

Figure 4: Influence a fracture activation on pressure response

Results

- Presence of a caprock fracture/fault may lead to significant changes in fluid pressure and influence ground deformation behavior.
- Pressure signals at different locations in the monitoring layer can be used to identify the presence of a caprock fracture.
- Activation of a dormant fracture/fault in a caprock layer changes pressure signature in the monitoring layer.

Opportunity

- Opportunity for a CRADA for further development
- Once the equipment array is developed there will be a need for field demonstration
- Computational modeling capability together with development of instrumentation could be used in addressing industry challenges for monitoring safe CO_2 storage
- Opportunity for developing deformation monitoring technology (such as tiltmeter technology)

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