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# INTEGRATION OF SURFACE UPLIFT AND INJECTION DATA FOR ESTIMATION OF GEOMECHANICAL PROPERTIES AND RESERVOIR PARAMETERS OF A $CO_2$ SEQUESTRATION FIELD USING ENSEMBLE-BASED ALGORITHMS

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The application of ensemble-based algorithms for history matching reservoir models has been steadily increasing over the past decade. However, the majority of implementations in the reservoir engineering have dealt only with production history matching. During geologic sequestration, the injection of large quantities of $CO_2$ into the subsurface may alter the stress/strain field which in turn can lead to surface uplift or subsidence. Therefore, it is essential to couple multiphase flow and geomechanical response in order to predict and quantify the uncertainty of $CO_2$ plume movement for long-term, large-scale $CO_2$ sequestration projects. In this work, we simulate and estimate the properties of a reservoir that is being used to store $CO_2$ as part of the In Salah Capture and Storage project in Algeria [1]. The CO2 is separated from produced natural gas and is re-injected into downdip aquifer portion of the field from three long horizontal wells. The field observation data includes ground surface deformations (uplift) measured using satellite-based radar (InSAR), injection well locations and CO2 injection rate histories provided by the operators. We implement variations of ensemble Kalman filter and ensemble smoother algorithms for assimilating both injection rate data as well as geomechanical observations (surface uplift) into reservoir model. The preliminary estimation results of horizontal permeability and Biot coefficients confirm the existence and the significance of high-permeability channels (fractures) within the reservoir, especially in the regions around the injection wells. Moreover, the estimation results are used to predict and quantify the uncertainty in the movement of $CO_2$ plume.

## REFERENCES

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