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TOWARDS A MACHINE LEARNING TOOL FOR CO2 PLUME TRACKING

INSIGHTS FROM SEABED UPLIFT AND GRAVITY DATA

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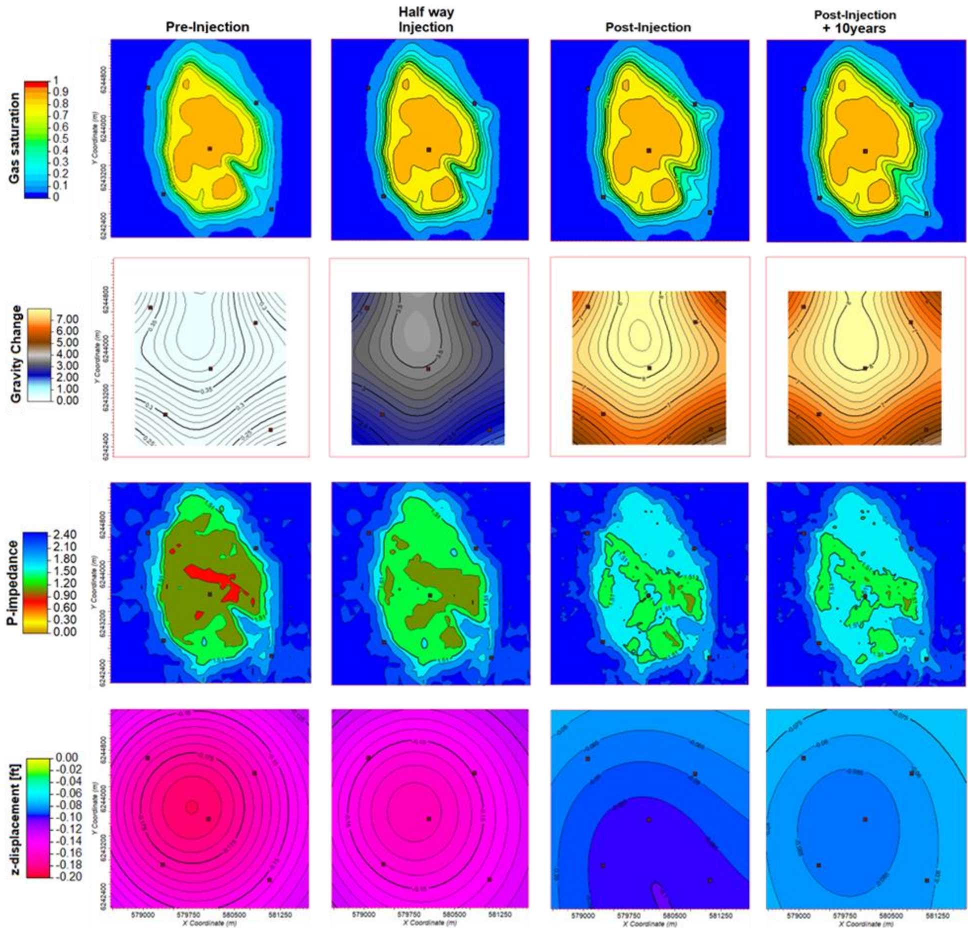
We present an approach to support monitoring the CO_2 plume migration in CCS projects. The focus is on overcoming the limitations of traditional numerical simulations, which are computationally intensive and less effective when geological uncertainties are present. Instead, machine learning (ML) models offer faster and adaptive alternatives for predicting plume behavior using sparse well data, such as well logs and injection history. In this work, we review various ML techniques, including Generative Adversarial Networks (GANs), autoencoders (AEs), and Deep Operator Networks (DeepONets), showcasing their potential and challenges for CO_2 plume prediction. We propose the integration of ML predictions with advanced monitoring methods, including time-lapse seismic data, gravity changes, and seabed displacement measurements. To support our proposal, we conduct numerical simulations using a Harald East gas field analog to predict changes in P-impedance, gravity, and seabed uplift under different CO_2 injection scenarios. Our results demonstrate the potential for tracking the CO_2 plume migration using such monitoring methods, which, combined with ML-based predictions, should enhance real-time tracking of the CO_2 plume, thus offering a promising solution for ensuring safe and effective CCS operations.



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