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## Abstract


Underground CO2 detection ensures safe and long-term geological Carbon storage in CCS projects. To achieve desired CO2 monitoring results, we have to take advantage of various data and geophysical methods. Here, a new joint CSEM-seismic inversion method is investigated to detect possible CO2 leakages in an underground geological CO2 storage site. The seismic method has higher resolutions than the geophysical methods. However, the CSEM data is more sensitive to CO2 changes. Knowing this fact and the difficulty of CO2 leak detection in complex media, we introduced a new joint seismic and CSEM inversion method to take advantage of both data. We used two petrophysical equations: Complex Refractive Index Method (CRIM) and White. These equations are used to make the bridge between electromagnetic and seismic parameters. Using advanced monitoring tools is also very important. So, we use the FWI and Occam algorithms in the proposed joint inversion approach. The synthetic marine seismic and CSEM data is calculated for a CO2 storage site in a saline aquifer with its leak with desired structures to evaluate the proposed joint inversion method for detection of possible CO2 leakages. We used a set of realistic physical values for sedimentary rocks that are common for such a media. The proposed joint inversion method's results demonstrate a noticeable boost over the CSEM-only and Seismic-only inversion results, especially for detecting the geometry and location of the CO2 leakage, which is very important. This way, we can have beneficial monitoring information to mitigate the risk of environmental hazards caused later by CO2 leakage migration to the upper layers.