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Numerical modelling of CO2 migration in saline reservoirs using geoelectric and seismic techniques - first results

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The research project “CO2 MoPa” (modelling and parameterisation of CO2 storage in deep saline formations for dimensions and risk analysis) has been initiated in 2008 by partners from different disciplines (e.g. geology, hydrogeology, geochemistry, geophysics, geomechanics, hydraulic engineering and law). It deals with the parameterisation of virtual subsurface storage sites to characterise rock properties, with high pressure-temperature experiments to determine in situ hydro-petrophysical and mechanical parameters, and with modelling of processes related to CCS in deep saline reservoirs. One objective is the estimation of the sensitivity and the resolution of reflection seismic and geoelectrical time-lapse measurements in order to determine the underground distribution of CO2.
Compared with seismic, electric resistivity tomography (ERT) has lower resolution, but its permanent installation and continuous monitoring can make it an economical alternative or complement. Seismic and ERT (in boreholes) applications to quantify changes of intrinsic aquifers properties with time are justified by the velocity and resistivity decrease related to CO2 injection. Our numerical 2D/3D modelling reveals the capability of the techniques to map CO2 plumes and changes as a function of thickness, concentration, receiver/electrode configuration, aspect ratio and modelling and inversion constraint parameters. Depending on these factors, some configurations are favoured due to their better spatial resolution and lower artefacts.

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