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Simulation of the crosshole ERT monitoring of the CO_2 migration at the Research Laboratory on Geological Storage of CO_2 in Hontomín (Burgos, Spain): assessing its feasibility and the optimal configuration

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The Research Laboratory on Geological Storage of CO_2 located in Hontomín (Burgos, Spain) is a multidisciplinary Technological Demonstration Plant oriented to test the geological storage of carbon dioxide in an onshore saline reservoir. Due to its academic orientation, it will provide a wide set of data obtained with complementary geophysical techniques. In order to allow the integration of the respective results, several geophysical methods will be used on the monitoring process of the storage of CO_2 into a deep saline aquifer. The resistivity of the storage formation will be one of the geophysical properties most affected by the replacement of the conductive brine by resistive carbon dioxide. As the electrical and electromagnetic methods are the techniques most sensitive to such change, their use on the monitoring process of the Hontomín TDP will provide important insights on the migration of CO_2.

The current work is integrated in the electric and electromagnetic monitoring of the CO_2 storage at Hontomín, where two boreholes (injection and monitoring) will be drilled beneath the injection depth. A set of electrodes is planned to be installed at the two wells allowing advantageous experiments in order to determine the resistivity variation into the reservoir. Crosshole ERT and CSEM experiments will be carried out previously to the injection of carbon dioxide and repeated systematically once the storage has started.

The feasibility of the crosshole ERT monitoring is evaluated in the current work. Realistic pre-injection and post-injection experiments have been modeled to assess the potentiality and benefits of the crosshole ERT in order to monitor the stored CO_2. A geoelectrical model obtained from previous characterization works has been used to describe the geoelectrical structure. The metallic casings planned to be installed at the two wells are considered in the simulations, given their possible effect on the experiments. Sets of synthetic data are generated with different ERT configurations and CO_2 distributions, contaminated with noise and inverted. The results of the simulation study demonstrate the key role of the crosshole ERT experiments in the monitoring process of the carbon dioxide stored in the Hontomín TDP. Furthermore, the integration of the results obtained with geoelectric complementary methods, as the CSEM, would enable more specific determinations of the behavior of the CO_2 and will be analyzed in future works.