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Preliminary results of the 3D magnetotelluric characterization of the Research Laboratory on Geological Storage of CO_2 in Hontomín (Burgos, Spain)

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The work presented here is a component of an on-going project in the framework of establishing a Technical Development Plant (PDT) for carbon dioxide (CO_2) storage in a deep saline aquifer. The Research Laboratory is located at the Spanish town of Hontomín, and the project is funded by Fundación Ciudad de la Energía-CIUDEN (http://www.ciuden.es) on behalf of the Spanish Government.
In this setting, magnetotelluric (MT) data are providing a baseline model for estimating CO_2 plume distribution after injection. The bulk electrical resistivity of rocks is expected to increase significantly due to the presence of CO_2 inside the pores of the reservoir rock since the effective volume available for the ionic transport will be reduced.
We present the preliminary results of the electromagnetic characterization of the Hontomín site. In total, 109 broadband magnetotelluric (BBMT) soundings were acquired in the area covering an extent of 3 x 4 km2. The data are organized mainly along five north-south profiles, each of around 4 km in length, in the period range of 15 to 4096 Hz. The stations were deployed at approximately 200 m intervals, recording data during 24 to 48 hours, and the average distance between profiles was 500 m. The instrumentation consisted of Metronix ADU06, Metronix ADU07 and Phoenix V8. A remote reference station was permanently placed around 20 km away from the study area. Different robust processing codes using remote reference methods have been tested and used at all stations to derive optimal MT responses.
The 3D electrical resistivity model of the subsurface is being computed using different 3D inversion codes: commercial 3D inversion of Winglink® (Mackie and Madden, 1993), WSINV3DMT (Siripunvaraporn et al., 2005) and modEM (Egbert and Kelbert, 2012). The model is discretized on 73 x 114 x 113-layer grid and the inversions were undertaken using the 4 elements of the impedance tensor (8 responses) and more than 16 periods in the range of 0.001 to 10 seconds. Topography was included in the case of inversions by Winglink and modEM codes.
Preliminary results are consistent with a previous 2D resistivity model and image the main features of the structure, in particular the reservoir unit and the EW fault located in the South. A comparison of the inversion results of above mentioned codes is being carried out.

References

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