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Multiscale joint interpretation of seismic and magnetotelluric data in Hontomín (Spain): From shallow subsurface to reservoir.

Xènia Ogaya (1), Juan Alcalde (2), Ignacio Marzán (3), Juanjo Ledo (4), Pilar Queralt (4), Alex Marcuello (4), Eduard Saura (3), David Martí (3), Ramón Carbonell (3), and Beatriz Benjumea (5)

(1) Dublin Institute for Advanced Studies, School of Cosmic Physics, Dublin, Ireland, (2) Department of Geology and Petroleum Geology, University of Aberdeen, Aberdeen, United Kingdom, (3) Institute of Earth Sciences Jaume Almera ICTJA-CSIC, Barcelona, Spain, (4) Institut de Recerca, Centre Mixt d'Investigació GEOMODELS, Group of Geodynamics and Basin Analysis, Dept. Geodinàmica i Geofísica, Universitat de Barcelona, Spain, (5) Institut Cartogràfic i Geològic de Catalunya ICGC, Barcelona, Spain

The village of Hontomín (north of Spain) hosts the first Technological Development Plant (TDP) for CO_2 geological storage located in Spain. The study area has been extensively surveyed to produce a multidisciplinary characterisation, including a 36 km2 3D seismic survey and a circumscribed 15 km2 3D magnetotelluric (MT) survey. In this work, we use the outcomes of these two methods to produce a combined characterisation of the subsurface of Hontomín. This characterisation is carried out at three different scales: reservoir, borehole and shallow subsurface. (1) At reservoir scale, characterisation is obtained by comparing the 3D structural model, obtained from the interpretation of the seismic dataset, with the resistivity model obtained from the 3D MT survey. This joint interpretation highlights the similarities and disagreements between the two models, which informs of their good complementarity. (2) At borehole scale, there is an outstanding correlation between the resistivity logs and the resistivity model obtained by the inversion of the 3D MT data. This allowed building resistivity-velocity pairs from the wireline-log data across the entire sedimentary sequence with confidence, and furthermore computing resistivity-velocity relationships for each formation. These relationships are used to calculate a 3D velocity model from the resistivity model. The agreement between the two velocity models is evaluated at the target depth (reservoir and seal formations). (3) At shallow subsurface (40 m depth), the derived velocity model is compared to the inverted model used in the static correction calculations in the seismic data. The results allowed extracting information about the characteristics of the shallow sediments, suggesting geometry and location of potential karstic structures present in the study area. This work explores the compatibility of the seismic and magnetotelluric methods across scales highlighting the importance of joint interpretation in characterisation surveys.