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Integration of resistivity and density models to characterize saline domes: case of La Rosa diapir (Murcia, Spain)

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In this work, we present an integration between magnetotelluric and gravity methods as non-seismic geophysical techniques for the characterization of La Rosa diapir. This diapir is located on the SE of the Iberian Peninsula being the most productive salt exploitation in that region from the production of saturated brine. In plain view, its outcropping cap-rock has an NW-trending elongated shape and is made up of insoluble gypsum, red and grey lutites and restricted carbonates. This diapir generates up to 227 m of topographic relief over the southeastern edge of the Matamoros Basin. This basin is controlled by the Maestre fault, which was active during the Mesozoic and was extensionally reactivated from the Miocene to Quaternary times. In this scenario, salt migrated from beneath the basin towards the edges of the basin creating a salt inflated structure. Afterwards, the later extensional reactivation of the Maestre fault promoted passive salt extrusion into the surface as is recorded by the adjacent Miocene to Quaternary growth strata geometries.
In order to characterize the 3D geometry of this salt structure, two surveys, MT and gravity, were performed on the diapir and surrounding area. The MT survey consisted of 67 stations in the acquisition range of 1000-0.1 Hz to achieve the desired depth. The gravity survey consisted of 210 gravity stations with spacing ranging from 2/km2 in the diapir up to 0.5/km2 in the farther areas. Two independent 3D models were obtained for each technique; both identify the salt dome as an elongated body in the E-W direction under the diapir with high resistivity values (geoelectrical model) and low-density values (density model). To better characterize the materials involved and to classify the different lithologies, an additional fuzzy C-means clustering has been performed integrating both models.