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Application of geoelectrical methods in the DS sinkhole problem, Israel and Jordan

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We consider a new approach to use the geoelectric methods for studying the both uppermost part of section and salt layer conditions in the sinkhole development sites.
The Electric Resistivity Tomography (ERT) is used here to detect shallow deformations in subsurface sediments. Resistivity prospecting yields information about both lateral and vertical distribution of resistivity through the geological section and can therefore be used in both qualitative and quantitative ways for the identification of structure and features at shallow depths. As it follows from the modified Archie's Law, resistivity of the unsaturated sediments is determined by their porosity. The higher the porosity, the higher is the resistivity. It will also depend on volume of the electrolyte in pores and resistivity of the fluid . Note that after mechanical models available the higher porosity in sinkhole development sites is caused by the void presence at depth. 2D and 3D mapping was carried out in the Mineral Beach area in Israel and in the Ghor Al-Haditha site in Jordan. ERT method shown high resistivity anomaly of some thousands Ohm-m located along the salt edge.
The Transient Electromagnetic Method (TEM) also referred to as the Time Domain Electromagnetic Method (TDEM) is sensitive to the bulk resistivity (conductivity) of the studied medium, especially in the low-resistivity range.
Transient Electromagnetic (TEM) method in its FAST modification was used for studying the salt layer conditions (salt porosity, depth of the salt top and thickness of the salt layer) and distribution of bulk resistivity in vicinity of the salt border (to resolve the problem of water salinity). The methodology includes numerous measurements through the sinkhole development areas. Earlier the TEM method was used extensively worldwide for locating the fresh-saline water interface in coastal areas and for estimating groundwater salinity. In our study we have mapped salt layer geometrical parameters (e.g. depth to salt top, salt layer thickness) as well as salt resistivity that is measure of salt porosity. New methodology permits also 2D and 3D presentation of the acquired results in spite methodology itself of the data acquisition is of 1D in its origin.

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