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Characterization of the Groundwater Aquifers at El Sadat City by Joint Inversion of VES and TEM Data

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Abstract : Vertical Electrical Sounding (VES) and Transient Electro Magnetic (TEM) survey have been applied for characterizing the groundwater aquifers at El Sadat industrial area. El-Sadat city is one of the most important industrial cities in Egypt. It has been constructed more than three decades ago at about 80 km northwest of Cairo along the Cairo–Alexandria desert road. Groundwater is the main source of water supplies required for domestic, municipal, and industrial activities in this area due to the lack of surface water sources. So, it is important to maintain this vital resource in order to sustain the development plans of this city. In this study, VES and TEM data were identically measured at 24 stations along three profiles trending NE–SW with the elongation of the study area. The measuring points were arranged in a grid like pattern with both inter-station spacing and line–line distance of about 2 km. After performing the necessary processing steps, the VES and TEM data sets were inverted individually to multi-layer models, followed by a joint inversion of both data sets. Joint inversion process has succeeded to overcome the model-equivalence problem encountered in the inversion of individual data set. Then, the joint models were used for the construction of a number of cross sections and contour maps showing the lateral and vertical distribution of the geo-electrical parameters in the subsurface medium. Interpretation of the obtained results and correlation with the available geological and hydrogeological information revealed TWO aquifer systems in the area. The shallow Pleistocene aquifer consists of sand and gravel saturated with fresh water and exhibits large thickness exceeding 200 m. The deep Pliocene aquifer is composed of clay and sand and shows low resistivity values. The water bearing layer of the Pleistocene aquifer and the upper surface of Pliocene aquifer are continuous and no structural features have cut this continuity through the investigated area.

Keywords : El Sadat city, joint inversion, VES, TEM
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