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Physical Properties Characterization of Shallow Aquifer and Groundwater Quality Using Geophysical Method Based on Electrical Resistivity Tomography in Arid Region, Northeastern Area of Tunisia: A Study Case of Smar Aquifer

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Abstract : In recent years, serious interest in underground sources has led to more intensive studies of depth, thickness, geometry and properties of aquifers. Geophysical method is the common technique used in discovering the subsurface. However, determining the exact location of groundwater in subsurface layers is one of problems that needs to be resolved. While the biggest problem is the quality of the groundwater which suffers from pollution risk especially with water shortage in arid regions under a remarkable climate change. The present study was conducted using electrical resistivity tomography at Jeffara coastal area in Southeast Tunisia to image the potential shallow aquifer and studying their physical properties. The purpose of this study is to understand the characteristics and depth of the Smar aquifer. Therefore, it can be used as a reference in groundwater drilling in order to guide the farmers and to improve the living of the inhabitants of nearby cities. The use of the Winner-Schlumberger array for data acquisition is suitable to obtain a deeper profile in areas with homogeneous layers. For that, six electrical resistivity profiles were carried out in Smar watershed using 72 electrodes with 4 and 5 m spacing. The resistivity measurements were carefully interpreted by a least-square inversion technique using the RES2DINV program. Findings show that the Smar aquifer has about 31 m thickness and it extends to 36.5 m depth in the downstream area of Oued Smar. The defined depth and geometry of Smar aquifer indicate that the sedimentary cover thins toward the coast, and the Smar shallow aquifer becomes deeper toward the West. While the resistivity values show a significant contrast even reaching < 1 Ωm in ERT1, this resistivity value can be related to the saline water that foretells a risk of pollution and bad groundwater quality. The ERT1 geoelectrical model defines an unsaturated zone, while under ERT3 site, the geoelectrical model presents a saturated zone, which reflect a low resistivity values indicate the locally surface water coming from the nearby Office of the National Sanitation Utility (ONAS) that can be a source of recharge of the studied shallow aquifer and more deteriorate the groundwater quality in this region.

Keywords : electrical resistivity tomography, groundwater, recharge, smar aquifer, southeastern tunisia
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