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Multidisciplinary Approach to Mio-Plio-Quaternary Aquifer Study in the Zarzis Region (Southeastern Tunisia)

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Abstract : Climate change has exacerbated disparities in the distribution of water resources in Tunisia, resulting in significant degradation in quantity and quality over the past five decades. The Mio-Plio-Quaternary aquifer, the primary water source in the Zarzis region, is subject to climatic, geographical, and geological challenges, as well as human stress. The region is experiencing uneven distribution and growing threats from groundwater salinity and saltwater intrusion. Addressing this challenge is critical for the arid region's socioeconomic development, and effective water resource management is required to combat climate change and reduce water deficits. This study uses a multidisciplinary approach to determine the groundwater potential of this aquifer, involving geophysics and hydrogeology data analysis. We used advanced techniques such as 3D Euler deconvolution and power spectrum analysis to generate detailed anomaly maps and estimate the depths of density sources, identifying significant Bouguer anomalies trending E-W, NW-SE, and NE-SW. Various techniques, such as wavelength filtering, upward continuation, and horizontal and vertical derivatives, were used to improve the gravity data, resulting in consistent results for anomaly shapes and amplitudes. The Euler deconvolution method revealed two prominent surface faults, trending NE-SW and NW-SE, that have a significant impact on the distribution of sedimentary facies and water quality within the Mio-Plio-Quaternary aquifer. Additionally, the depth maxima greater than 1400 m to the North indicate the presence of a Cretaceous paleo-fault. Geo-electrical models and resistivity pseudo-sections were used to interpret the distribution of electrical facies in the Mio-Plio-Quaternary aquifer, highlighting lateral variation and depositional environment type. Artificial intelligence is used to optimize the analysis and interpretation of exploration data, thus contributing to sustainable management and ensuring water security.

Keywords : Mio-Plio-Quaternary aquifer, Southeastern Tunisia, geophysical methods, hydrogeological analysis, artificial intelligence
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