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## Title

### ***Groundwater quality evaluation for drinking and agricultural purposes. A case study in semi-arid region (Zab El-gharbi SE-Algeria)***

## Abstract

The current research delved into the geochemical attributes of groundwater and assessed compliance with drinking water standards. 35 samples of Zab El Gharbi region groundwater in the province of Biskra were analyzed to evaluate the physico-chemical quality. The obtained results were compared to World Health Organization drinking water standards as well as Algerian Standards. It appears that nitrate concentrations in all samples were acceptable since they were less than 50 mg/L. The results of the WQI classification showed that WQI values ranged from 95 to 269; only 3 % of samples had good quality, 80 % had poor quality, and 17.14 % had very poor water, indicating the need for treatment before use for human consumption. Two main hydrochemical facies were dominated and predominated, Ca-SO<sub>4</sub> type and Mixed Ca-Mg-Cl-SO<sub>4</sub> type, respectively. Q mode hierarchical cluster analysis (HCA) was employed for partitioning the water samples into hydrochemical facies, revealed the presence of two distinct water types based on principal ion concentrations. Hydrochemically, group 1 was characterized by two primary facies, with 90.32 % categorized as Ca-SO<sub>4</sub> type and 9.67 % as Mixed Ca-Mg-Cl-SO<sub>4</sub> type. While group 2 was characterized by a Ca-SO<sub>4</sub> type. The estimated values of sodium adsorption ratio (SAR), percent sodium (Na%), permeability index (PI), Kelly's ratio (KR) and Magnesium hazard (MH), averages for the study area is reported to be in the range of 0.90 to 5.60, 4.46 % to 41.26 %, 12.50 % to 44.47 %, 0.10 to 0.73 % and 9.69 % to 75.06 % respectively. Parameters such as Permeability Index (PI), Kelly's Ratio (KR), and Magnesium Hazard (MH) indicated that 37.14 % of groundwater samples were in the excellent category,

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while the remaining 62.85 % were in the good category, making them suitable for irrigation across various soil types. They indicated that the considered water exhibits favorable characteristics for agricultural irrigation applications, ranging from excellent to good. These findings are encouraging for agriculture and land-use planning. This study lies in addressing the water quality in this promontory area, where no prior research has been published. We assessed water quality using statistical, geostatistical, and cartographic methods to estimate quality in unsampled areas. Additionally, we examined how climatic conditions, particularly high evapotranspiration during the festive season, affect water and soil quality. This study will help farmers and scientists in the region make informed decisions to protect natural resources. This work is meant to highlight the issues and also provide practical solutions to optimize the management of natural resources. © 2024 The Author(s)

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Arid area; Groundwater quality; Multivariate statistic; Water quality index (WQI)

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