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Assessment of Water Resources in the Tafilalet Oasis System by a Mathematical Model (South East of Morocco)

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The Tafilalet plain is located in southeast of Morocco in a pre-Saharan area characterized by an arid climate with a large deficit water budget, due to low quantities of rainfall. However, agriculture is highly developed and considered as the first source of economy for the region. Agricultural land and date palms (oasis) covering the center of the plain and forming the largest palm grove in the Maghreb (700 km^2), is irrigated primarily by groundwater (Khettara, springs, wells). The plain is crossed by the Ziz and Rheris Rivers coming from the mountains of the High Atlas.

The aquifer system is a hydrogeological unit whose aquifers are composed in the North by conglomerates often incompletely cemented with a few levels of lenticular of alluvial gravel, and in the South by two units: at the base conglomerates and calcareous Lacustrine including levels gravelly, and at the top sand, gravel and pebbles, covered by fairly unevenly distributed thick silt. The values of the hydraulic conductivity are ranging from 3.10^{-7} to 5.10^{-2} m/s, but most of them are located between 2.10^{-4} and 8.10^{-3} m/s.

A comparison of piezometric maps established for different date shows that the flow system remains unchanged. As well as in the center of the plain, the convex areas of the isolines are generally due to irrigation of soils. Piezometric records show also fluctuations with trends to increasing drawdowns due to groundwater overexploitation of the oasis. Groundwater flow is directed from the north-east to south-west, south and south-east with an average hydraulic gradient decreasing from upstream to downstream. The gradients are generally between $2‰$ and $4‰$.

In view of the interest for using groundwater for irrigation and drinking water supply in the region, special attention should be paid to water resources protection and sustainability of agricultural development in the plain, by a better optimization of water resources exploitation. For this purpose, a database and GIS have been developed including geological, precipitation, hydrological, hydrogeological, irrigation, geochemical, and groundwater quality components and other additional data required for the study. In a second phase, a mathematical model of the aquifer system was developed, such a groundwater model can simulate realistically local groundwater flow, drawdowns induced by different groundwater abstractions, water balances within time and how the aquifer system will react under different water-resource management planning scenarios for long and short term exploitation of groundwater supply.