

Using Groundwater Modeling System to Create a 3-D Groundwater Flow and Solute Transport Model for a Semiarid Region: A Case Study of the Nadhour Saouaf Sisseb El Alem Aquifer, Central Tunisia

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Abstract : The Nadhour Saouaf Sisseb El Alem (NSSA) system comprises some of the most intensively exploited aquifers in central Tunisia. Since the 1970s, the growth in economic productivity linked to intensive agriculture in this semiarid region has been sustained by increasing pumping rates of the system's groundwater. Exploitation of these aquifers has increased rapidly, ultimately causing their depletion. With the aim to better understand the behavior of the aquifer system and to predict its evolution, the paper presents a finite difference model of the groundwater flow and solute transport. The model is based on the Groundwater Modeling System (GMS) and was calibrated using data from 1970 to 2010. Groundwater levels observed in 1970 were used for the steady-state calibration. Groundwater levels observed from 1971 to 2010 served to calibrate the transient state. The impact of pumping discharge on the evolution of groundwater levels was studied through three hypothetical pumping scenarios. The first two scenarios replicated the approximate drawdown in the aquifer heads (about 17 m in scenario 1 and 23 m in scenario 2 in the center of NSSA) following an increase in pumping rates by 30% and 50% from their current values, respectively. In addition, pumping was stopped in the third scenario, which could increase groundwater reserves by about 7 Mm³/year. NSSA groundwater reserves could be improved considerably if the pumping rules were taken seriously.

Keywords : pumping, depletion, groundwater modeling system GMS, Nadhour Saouaf

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