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Evaluation of the impact of climate change on the shallow aquifer of Grombalia (Tunisia)

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Climate change presents a serious problem for water resources (WR) and the shallow aquifers are strongly affected. This type of WR presents fundamental importance in certain regions, due to their accessibility and sometimes, for their quality, it is preferred to surface water sources, often polluted. It is also, affected by overexploitation problems, which contribute to the destruction of the sustainability of the aquifer system. This study considers the Grombalia aquifer in Tunisia which has suffered from climate change's impact in recent years due to water resources scarcity. Aim of the present research is to evaluate the impact of climate change on this aquifer that is one of the pilot sites in the European project InTheMed. First, a collection of historical temperature, precipitation and groundwater level data in the period 1976-2020 was carried out. Then, starting from the few available geological cross sections, a two-dimensional numerical model of the aquifer was developed in MODFLOW. The groundwater numerical model reproduces the whole basin, from the recharge area to the outlet in the Mediterranean Sea. The area is characterized by agricultural intensive activities and high-water demand. For this reason, the model required a calibration of hydraulic parameters, recharge and pumping rate. After the calibration, the numerical model was able to estimate the groundwater flow across the entire watershed of Grombalia aquifer. To evaluate the impact of climate change on the future groundwater availability, the model was driven using future precipitation and temperature projections. The water abstractions were assumed to remain unchanged in the future and equal to the condition of existing wells at 2020. To describe the future climate, 17 combinations of Regional Climate Models (RCM) and General Circulation Models (GCMs), developed within the EURO-CORDEX initiative, were used. The simulations were performed for the period 2006-2100, and according to the RCP4.5 and RCP8.5 scenarios. Before their use, the climate projections were downscaled and bias corrected with reference to the historical temperature and precipitation data. The results are evaluated in terms of local variations of the groundwater level and their uncertainty is expressed with reference to the variability of the 17 RCM-GCM combinations.

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