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Modeling the quantitative and qualitative changes in groundwater of Garmsar Plain using the MODFLOW model

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Abstract

Groundwater is a vital resource for meeting drinking, agricultural, and industrial needs in arid and semi-arid regions of Iran. In this study, quantitative and qualitative changes in groundwater in the Garmsar Plain were modeled using GIS, MODFLOW, and MT3DMS software during the period 2011-2013. Spatial and climatic data were comprehensively processed and prepared in the GIS environment, and groundwater flow was simulated using the MODFLOW model and water quality changes were analyzed using the MT3DMS model. After validation with field data from 2012 to 2013, the model showed acceptable accuracy with statistical indicators of mean absolute error (MAE) in the range of 0.4 to 0.5 meters and root mean square error (RMSE) between 0.5 and 0.6 meters. The modeling results showed that a 15% increase in water withdrawal led to a decrease in the water table of up to 8 meters, a constant withdrawal led to a decrease of 7 meters, and a 15% decrease in withdrawal led to a decrease of 5 meters in the water table. From a quality perspective, the decrease in withdrawal improved the quality of irrigation water but increased the concentration of some pollutants, which requires the development of effective management strategies to protect groundwater resources. The findings of this study illustrate the importance of sustainable exploitation and smart management of groundwater resources in the Garmsar Plain.

Keywords: Quantitative analysis of water resources, qualitative analysis of water resources, groundwater resources, numerical modeling, Garmsar.

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