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Simulation of Marvdasht Groundwater Level and Investigation of Forecast Scenarios Using MODFLOW Mathematical Code

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1-Introduction

This study is one of the first studies on spatial modeling of water quality parameters with geological formations in the basin. Groundwater is the most important water source in many parts of the world, used in drinking water, agriculture, industry, and related ecosystems.

2-Methodology

Marvdasht-Kharameh aquifer is located in the Bakhtegan Lake catchment area, one of Iran's important water sources. Hydrologically, in this basin, the Kor River is a main and permanent river that originates from the northwestern heights of the basin, its length to Bakhtegan Lake is 351.5 km, and the area of Ker aquifer is 1470.540 km2.

In the present study, data and information from the study area, such as exploitation and observation data, including data related to 81 exploration wells and 7500 exploitation wells, were collected from Fars Water Resources Management Organization (Fars Water Organization Statistics, 2019). This equation is given as (Equation 1) in unstable, inhomogeneous, and three-dimensional conditions.

$$T_{XX}\frac{\partial^2 h}{\partial x^2} + T_{YY}\frac{\partial^2 h}{\partial y^2} + T_{zz}\frac{\partial^2 h}{\partial z^2} = S\frac{\partial h}{\partial t} \pm R\,(x, y, z) \quad (1)$$

In this equation, h: height of the hydraulic load; ((x, y, z: flow directions; t: time; [T]: Tzz, Tyy, Txx; aquifer transfer coefficients in the directions (x, y, z); S is the storage coefficient; R (x, y, z): Power supply (positive sign (or discharge) is a negative sign.

After entering all the required data of the model and implementing the groundwater flow model for the period 2008-2019, the hydraulic conductivity, feed values, and coefficient of conductivity of riverbeds and drains were selected as calibration parameters by changing them within the allowable range of final values. For calibration operations inunstable conditions, 70% and 30% calibration of piezometric data was used during

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tenyear periods. Subsequently, the validation of the calibrated model in long-term 126-month data was evaluated based on the height of the hydraulic load values. Moreover, it is calculated according to the groundwater level and the water level in the river. 10 and 30% over the next ten years, the model was fitted.

3-Results and Discussion

The simulation of groundwater level reduction in the Marvdasht-Kharameh basin showed that this model with high spatial variability power well determines the effect of different parameters on groundwater level in different parts of the aquifer.

The results of calculating the water balance in the Marvdasht aquifer, which was done for 126 months, indicate that the amount of 1100 million cubic meters of water has been reduced from the constant storage of the aquifer.

4-Conclusions

This study is one of the first studies on the simulation of the Marvdasht-Kharameh aquifer with the MODFLOW model in the basin. The model calibration results in both permanent and non-permanent states show that the middle parts of the plain, such as Ramjard and Band Amir Plains, have the highest hydraulic conductivity and special discharge values. The decrease of groundwater level in the central areas of the plain, especially in Shool, Band-e Amir, and Ramjard, is more than other parts of it due to the high concentration of exploitation wells and indicates that the crisis is progressing in this part of the basin. Therefore, the discharge of exploitation wells is one of the most fundamental elements affecting water level changes in the Marvdasht aquifer. Also, by examining the scenario of 10 and 30% reduction of groundwater abstraction from the region, it was determined that these scenarios would be the only housing to reduce the groundwater level in the region. The area should also be examined. The results showed that the highest drop is 24.83 meters in the first scenario, and the lowest drop is 2.184 meters. In the second scenario, the drop has decreased by 4.523, and the water level has reached 20.30 meters.

Keywords: Aquifer balance, management scenarios, groundwater level, Modflow model, Marvdasht basin – Kharameh.

5-References

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