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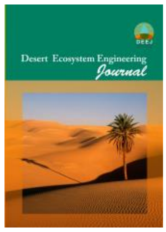

Investigating Climate Change Effects on Groundwater-Level Decline in Kerman Plain via GMS Model

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Extended Abstract

Introduction: Groundwater is considered as one of the main resources for drinking water, agriculture and industry. While groundwater is taken as a reserve resource in some areas, in other areas it may be used for supplying potable water due to their easy availability. Moreover, groundwater analysis is an essential factor in maintaining its access. In fact, modeling and predicting the groundwater level play a significant role in preserving the environment, maintaining the balance of the groundwater system, controlling changes in groundwater levels and preventing the escalation of land subsidence. On the other hand, climate change and the decline in groundwater table have been proved to be one of the main causes of land degradation in the past decades. According to Iranian Ministry of Energy, about 7 billion cubic meters of groundwater reservoirs are declining annually .Also, from among 609 plains in Iran, approximately 350 of them are known as the forbidden ones. The increasing number of prohibited plains from 15 wells in 1968 to 199 ones in 2001, and rising the dried plains into 350 ones in 2015 indicate the inappropriate status of water resources in Iran. Meanwhile, the highest amount of water scarcity in underground reservoirs belongs to the second grade Salt Lake as well as the Kerman Plain which has attracted more attentions in recent years as one of the most important plains of this area due to the large decline in its groundwater.

Materials and methods: This study set out to model the flow of groundwater in the Kerman plain aquifer under the influence of climate change for the upcoming period, using the GMS model. To this end, HADCM3 model, LARS model and A1B, B1 and A2 scenarios were applied for the investigation of the effects of climate change on aquifer volume and groundwater declines. Finally, having applied four different scenarios, the performance of each management options and the effects of different climate scenarios on the

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decline of the aquifer were examined.

Results: The results of the exponential microscopy indicated a minimum increase in the temperature between 0.59 to 0.86 degrees Celsius and a maximum temperature increase of between 0.56 to 0.85 degrees Celsius. The reported increase in minimum and maximum temperature in the upcoming period is consistent with the results of the studies carried out by Zhang and Nyinger (2005), Mosheh Boani and Merid (2006), Khorshid Doost and Ghavidel Rahimi (2006), Kukchi et al (2006), Yano et al. (2007), and Babayan et al. (2009), where temperature increases have been predicted. Comparison of long-term annual precipitations suggested prospective increase in the rainfall which is consistent with the results of the study conducted by Steel Dani et al. (2008). Moreover, according to the findings of the current study, the lowest amount of precipitation in scenario B1 would occur from 2011 to 2030, which is 10.22 mm more than the base period rainfall. This is while the highest rainfall was expected to occur with a rise of 80/15 mm within the time period of 2011-2030 in scenario A2. As found by the simulation of the groundwater model (GMS), there was an acceptable accuracy for simulating the aquifer of Kerman Plain. In terms of Kerman aquifer quantity, the results suggested, after a steady-state calibration, that RMSE, MAE and ME values were 0.38 m, 0.21 m, and 0.20 m, respectively, showing acceptable accuracy of modeling in the mode was lasting. Having set the proper performance of GMS model, four different scenarios were used to simulate the effect of climate change on the station's level, and its changes were compared with the base period. On the other hand, the decline in water level would be 10.6 -10 in the first scenario. The levels of water decline within climate change scenarios A2, A1B and B1 for were 11.9, 12.36 and 16.22 for the second scenario, 16.41, 16.66 and 17.30 for the third scenario, and 16.65, 16.9 and 18.15 meters for the fourth scenario respectively.

Discussion and conclusion: Although climate change directly affects surface water resources changes in major long-term variables such as rainfall, temperature, evapotranspiration and transpiration, it is difficult to determine the relationship between climate change variables and underground water. This study, therefore, attempted to predict the relationship between climate and groundwater levels for the upcoming period. Comparison of long-term annual precipitation indicate in increase in precipitation which is consistent with the results found by Steel Dani et al. (2008). According to the findings of the current study, the calibrated model has acceptable accuracy and the mathematical model can simulate the normal conditions governing the aquifer of Kerman Plain. Having obtained the proper performance of GMS model, four different scenarios were used to simulate the effect of climate change on the station's level, and its changes were compared with the base period. The results showed that an 18-meter water decline would not be expected in such a situation.

Keywords: Climate Change, GMS Model, Groundwater, Kerman Plain.