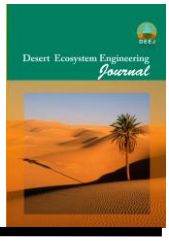
DEEJ (2023) 11 (37) 1-14

University of Kashan

Desert Ecosystem Engineering Journal

Journal homepage: http://deej.kashanu.ac.ir



Investigating Alterations in the underground water level of Ravansar- Sanjabi Plain under CIMP5 climate scenarios

Milad Soltani[1], Karim Solaimani[2]*, Khalil Jalili[3], Seyed Javad Sadatinejad[4], Fatemeh Shokrian[5]

Received: 05/12/2022 Accepted: 18/02/2023

Extended Abstract

Introduction: The water resources of the earth have currently been reduced due to various factors such as rising population, and an increase in human activities, including the growth of urbanization and industries, and increasing agricultural and economic activities. Therefore, water shortage seems to be one of the most important crises that threaten the future life of living creatures.

In this regard, arid and semi-arid regions are subject to more risks due to reasons such as climate change, drought, and excessive extraction of groundwater resources for industrial, agricultural, and drinking purposes. On the other hand, in addition to the increase in temperature, climate change will also cause changes in precipitation and evaporation rates, leading to the loss of large amounts of water by decreasing precipitation and increasing evaporation rates, respectively.

In such a situation, the groundwater resources are highly pressurized, considering the continuous drop in the water level, the fact that the amount of harvest is always more than that of the recharge, and the irreparable damages that may follow. Therefore, this study sought to investigate the influence of climate change on the groundwater level of the Ravansar-Sanjabi basin and to analyze its results. To this end, first, the groundwater simulation was carried out by Mudflow code. Then, the effect of climate change on groundwater resources was investigated during the future period (2021-2040), taking into account different climate scenarios.

Materials and Methods: Known as a relatively rectangular plain with north-south extension, the Ravansar-Sanjabi plain is located in the northwest of Kermanshah city (the center of Kermanshah province) between 18'26°46" to 00'50°46" eastern longitudes and 00'25°34" to 34’50’48’’ latitude".

1. PhD. Student, Watershed Management and Engineering, Sari University of Agricultural Sciences and Natural Resources
2. Professor, Dept. of watershed management, Sari Agricultural Sciences and Natural Resources University; solaimani2001@yahoo.co.uk
3. Assistant Professor, Department of Environmental Resources management, ACECR, Kermanshah Province, Iran
4. Associate Professor of Faculty of New Sciences and Technologist, University of Tehran
5. Assistant Professor, Dept. of watershed management, Sari Agricultural Sciences and Natural Resources

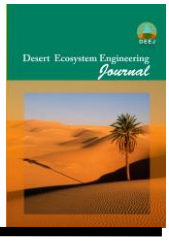
DOI: 10.22052/DEEJ.2023.248647.1001

DEEJ (2023) 11 (37) 1-14

University of Kashan

Desert Ecosystem Engineering Journal

Journal homepage: http://deej.kashanu.ac.ir



According to the latest nationally published statistics, there are 881 wells in the Ravansar-Sanjabi basin with a discharge of 27 million cubic meters per year (Figure (3). Moreover, the main sources of the basin's recharge are precipitation and the amount of water returned from exploitation wells, with approximately 17% of the precipitation in the area being considered as recharge.

Results and discussion: As for the groundwater modeling, there was an acceptable correlation between the simulation and observation data under both stable and unstable states, indicating the appropriate performance of the MODFLOW simulation model in the Ravansar-Sanjabi basin. Moreover, the error-index value was found to be 0.95 for groundwater modeling with RMSE, suggesting an appropriate accuracy of the model in an unstable state.

In addition, the values of the explanation coefficient and MAE were reported as 0.98 m and 0.87 m, respectively, falling in a suitable error range On the other hand, the calibrated hydraulic conductivity values showed that the hydraulic conductivity values varied from 52 and 30 meters per day in the north of the basin. However, the greatest hydraulic conductivity values were found in the southeastern part of the basin, ranging from 16.5 to 29 meters per day. Also, the average values of hydraulic conductivity belonged to the central area of the basin, ranging from 8 to 12 meters per day.

According to the results obtained for the selection of an appropriate climate model, it was found that out of 20 existing models, the HadGEM2-ES, CanESM2, and CSIRO-MK3-6-0 had the greatest values (15.5, 15.5, and 17.25, respectively), being selected as the best models in this research. Moreover, the results of climate change indicated that the precipitation rate did not change much throughout the study period (2021-2040). On the other hand, while changes in the precipitation rate were found to be small under the RCP2.5 scenarios, they were significant under the RCP8.5 scenarios, especially the reduction of precipitation in some months.

As regards the temperature changes throughout the study period (2021-2040) under all three climate scenarios, the results indicated a decrease in temperature rates, with the lowest and highest decrease occurring under the RCP2.6 and RCP8.5 scenarios, respectively. Accordingly, the temperature is predicted to decrease by approximately 0.5 degrees Celsius in the worst case.

It was also found that the groundwater level varied from 20 cm to 60 cm in all months, with the lowest balance reduction having occurred in January, and the highest balance reduction having occurred in April, May, and June. Moreover, according to the results of changes in temperature and precipitation under the three climate scenarios, it could be argued that the greatest and slightest decrease in the groundwater level will occur under the RCP 85 and RCP 26 scenarios, respectively.

Keywords: Ground Water; Ravansar-Sanjabi Basin; Climate Change; Simulation: IPCC.