Prediction of Drought in the Khorasan Razavi Province During 2011-2030 by Using Statistical Downscaling of HADCM3 Model Output

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Introduction

Because of the vital role of water in human life, examining the phenomenon of climate change effects on drought severity and frequency is important for any area of interest. Nowadays, climate Researchers considers the effects of climate change and climate simulations by using the atmospheric-ocean general circulation models. To achieve the prediction of climatologically parameters, various statistical and dynamical models have been developed to simulate and downscaling of GCM output models. The statistical model of LARS-WG is such a model, which is very powerful for this aspect.

Study Area

The province of Khorasan Razavi with an area of 144802 Km^2 is located in the northeast of Iran. Based on De Martonne's climate the study area included indicator, Khorasan Razavi classified in arid and semiarid climate zones. The highest point of province is Binalud Mountain with an elevation of 3420 meter and the lowest point in Sarakhs plain with an elevation of 299 meter above the sea level. The LARS-WG model is one of the stochastic weather data generators, which is using to generate data for daily precipitation, radiation, maximum and minimum temperature for present and future times.

Material and Methods

To run the model of LARS-WG, daily precipitation, minimum and maximum temperature, and sunshine hours of 10 synoptic stations of Khorasan Razavi for 20-year duration were Selected for Model inputs (1991–2010). All data obtained from the data center of Iran meteorology office.

The aim of this study is assessing the effects of climate change on drought occurrences in Khorasan Razavi by using drought index such as decile (DI) and the standardized precipitation Index (SPI) for the next two decades. The daily data from the output of general circulation model HADCM3 under scenario A2 is downscaled by LARS-WG statistical model version 5, and the ability LARS-WG5 model is validated in simulations of past climate (1991-2010), in 10 synoptic stations. Then the climatic variables of the minimum temperature, maximum temperature, precipitation, and sunshine hours are simulate for 2011-2030. Then, rainfall and drought conditions are monitored to extraction of inter annually list of drought indicators.

Results and Discussion

The results showed that the LARS-WG model has high ability to simulate climatic variables. The most error in simulation of climatic parameters is related to rainfall. While the model shows higher accuracy for estimation of minimum and maximum values but for average amount, the rainfall has

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increased in the 75 % to 77% of months the first and second decades of forecasting period. The noteworthy result of calculated index deciles is that the number of months, with average, severe and very severe drought conditions in the twenty next years is reduced considerably compared with the base period.

Furthered Results showed a very good agreement between deciles (DI) and the standardized precipitation Index (SPI) for assessment of drought for next two decades. Torbat-jam station is an exaction point Due its difference results compare with other stations. The differences results of Torbat-jam station is by increasing of sunshine hours and it's consequent rainfall based on our analysis more than 90% of the study area will face to increasing the drought intensity over the next twenty years.

Conclusion

Check the status of drought in Khorasan Razavi province during the next two decades, shows most of the stations in most years of study period, the drought decrease and the number of wet month's increases. Comparing the results of two different (first and second) decades implies that the number of wet months in the second decade increases respect to the first decade. The results also show the climate of Khorasan Razavi will be quiet difference with the current situation. The result of drought situation in this study is agreement with the results of some other studies and of course is not agree with the results showed by few researchers. The reason of the similarity of the results can be confirm the ability of the model and thus as error reduction in output of climate parameters. Also the reason of disagreement of the results could be due to run time error of the model in climatic parameters simulation in other studies.

Key Words: Climate change, Drought, General Circulation Model (GCM), LARS-WG model, Downscaling, DI index, SPI index.