Global Warming and Climate Change; Local Scale Meteorological Indicators

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ABSTRACT

The increase in global temperatures will have profound effects on climatic phenomena and, in the first instance, they will have the highest rainfall levels throughout the world. Therefore, the purpose of this research is to predict the country's meteorological parameters in conditions of climate change and compare these parameters with the current conditions. For this purpose, the UKMO general circulation model was used for the years 2025 and 2050. By implementing the general circulation model, the monthly minimum and maximum monthly and monthly forecasts for different stations (which provide a complete coverage of the climatic points of Iran and provide a general indication of the state of the country) and the effects of climate change based on the scenario defined in the model for the parameters Climates were determined. The results of this study show that the average temperature rise in spring for 2025 and 2050 in all studied stations was 3.1 and 9.3, for the months of summer season were 8.8 and 7.7 for fall season 2 / 3 and 0.3 and for winter 0.2 and 4.2 degrees centigrade. In addition, the temperature increase will increase from north to south and from west to east. According to the results, the severity of rainfall reduction in arid and semi-arid regions of the country is more than wet areas and precipitation decrease in autumn and winter is more than spring and summer. According to the predictions, the average fall of autumn rainfall for all stations under study in the years 2025 and 2050 is 8 and 11 percent, respectively, and is relatively low for the months of the summer season. Also, the spatial pattern of precipitation variation in 2025 and 2050 is largely similar to that of temperature variation. On the other hand, the climatic conditions predicted by the general circulation model indicate a longer drought season in 2025 and 2050 at all stations under study, So that the average dry period in 2025 and 2050 will increase to 214 and 223 days, respectively.

Keywords: Climate Change, Temperature, Rainfall, Dry Season Length.

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1. INTRODUCTION

Climate or, in other words, the prevailing atmospheric conditions at one time and a certain region is the most important environmental element affecting life on Earth (1,4). Climate is not a constant region and is affected by two groups of factors: (1 factors causing annual climate change and (2) factors that cause long-term trends. The phenomena of El Niño, Lanina and Navo are the main causes of short-term climate change in the world. While the long-term climate change in the world (on a scale of 10 to 1000 years) is affected by two main factors, namely the change in the energy input from the sun and global warming due to the intensification of greenhouse effects. Depending on the fact that future climate change depends strongly on global warming, predicting the future temperature of the earth is of particular importance. Different scenarios of general circulation models have predicted an increase in the temperature of the planet in the year 2060 from 2 to 2.5 degrees centigrade. (8) While the latest report by the Intergovernmental Panel on Climate Change (IPCC) estimates the average temperature rise for the year 2060 at around 1.5 degrees centigrade. (12) If the concentration of greenhouse gases at current speed increases to 7.0% per year, then most of the existing models for increasing the average Earth's temperature by about 2100 are about 2 ° C. (13) Despite the uncertainty in these predictions, it should be remembered that if the current temperature is increased by 1 ° C, the Earth will reach its warmest temperature over the past 10,000 years. [22].

Many researchers (5), (9) and (11) have emphasized that because the areas located in the middle latitudes (15) to 40 degrees north (based on future climatic predictions, with a significant increase in temperature and a significant decrease in precipitation, the index Drought is the most appropriate criterion for assessing the regional effects of climate change in these areas. Based on the available evidence, the expansion of the severity and extent of drought in tropical and subtropical areas is a feature of the future climate. (3) Is the occurrence of droughts in the past two decades, most of the world's regions, which have a history in terms of breadth and durability, and in Iran, It has been related to natural climatic trends, it is caused by phenomena such as invasive or that there are signs of climate change trend. It is different from the researchers. There is no general agreed about (7,17). Currently, public circulation models 1, despite some of their deficiencies, are the most reliable tool for predicting the future climate of the world. The basis of the work of all models of general circulation is based on the global

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warming and the effect of increasing the concentration of greenhouse gases, and the subsequent climatic consequences are all predicted based on the increase in ground temperature (8, 15 and.). 21 general circulation models with simulation of the effect of temperature rise On the drought-ocean-atmospheric cycle, they can predict the extent and extent of future climate change for different regions of the world. Considering that the increase in global temperature will have profound effects on climatic phenomena and at the top of their rates and patterns of rainfall around the world, the aim of this research is to predict the country's meteorological parameters in conditions of climate change, comparing these parameters with your current and most presenting data. It is necessary to carry out studies on climate change.

2. METHODOLOGY

The required data for this study were prepared by the Meteorological Organization of Iran and the National Center for Climatology. These data include long-term statistics (at least 30 years) between 1378-1384 and longer, including minimum, maximum and average monthly temperatures, monthly declines, monthly and annual potential evapotranspiration rates. In this study, data on the stations of Tabriz, Tehran, Isfahan, Mashhad, Shiraz, Bandar Anzali, Bandar Abbas, Zahedan, Kerman, Urmia, Babolsar, Qazvin, Gorgan, Sabzevar, Saghez, Shahrood, Zanjan, Rasht, Ramsar, Khoy, Arak, Hamedan, Kashan, Kerman, Kermanshah, Khorramabad, Semnan, Sanandaj, Torbat-Heidarieh, Abadan, Ahvaz, Bam, Birjand, Bushehr, Shahrekord, Yazd and Zabol were used. Stations are selected to provide a comprehensive coverage of different climatic points of Iran and to represent the general state of the country. To study the effects of climate change on the country's meteorological indicators, the UKMO general circulation model was used. This model was used to predict atmospheric parameters in climate change conditions for 2025 and 2050 (according to the years 1404 and 1429). The networking methodology for the implementation of general circulation models in Iran is described by Nasiri and Kuchiki (2).

ith the implementation of the UKMO general circulation model, the monthly, minimum and maximum temperature and monthly forecasts for different stations were calculated and the effects of climate change were determined based on the scenario defined in the model for climatic parameters. The length of the drought period was determined in the studied stations. The length of the dry period is, according to the definition, a period in which the amount of precipitation is less than the amount of water loss due to

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evapotranspiration (1). Therefore, in this research, the length of the dry period based on long-term rainfall and evapotranspiration statistics for different stations Was determined. In conditions of climate change, temperatures and rainfall in different stations will be affected. On the basis of this, it seems that increasing the duration of the dry period is due to the combined effect of decreasing precipitation and temperature rise. In order to investigate the effect of these two variables on variations in the length of the dry season, the response reaction technique 1 was used. For this purpose, data on temperature and rainfall changes in two prediction periods, namely, 2025 and 2050, were studied in conjunction with the length of the drought period, and the response level was determined for the stations under study.

3. RESULTS

The effect of climate change on meteorological indices with the implementation of general circulation models for 2025 and 2050 (respectively, in accordance with the years 1404 and 1429), the monthly values of these two variables were estimated for different stations in the country and the rate of change was predicted with the current conditions of comparison Became The prediction of general circulation models indicates a monthly average increase in temperature for all stations in the country and on this basis, we will see the public heating in the next 25 and 50 years. Of course, the temperature increase for all stations is not the same. The results show that the temperature increase in the years 2025 and 2050 in spring and summer is more than autumn and winter. As the average temperature rise in spring for 2025 and 2050 in all stations studied was 3.1 and 9.3, respectively, for the summer months are 8.3 and 7.7 for autumn, 3.2 and 0.3 respectively, and for winter is 0.2 and 4.2 degrees centigrade. In addition, this increase in temperature has a kind of spatial pattern, so that the rate of increase in temperature from the north to the south is more and southern regions of the country will experience more heat. Also, the increase in temperature from the west to the east will intensify and in the western regions of the country we will see a rise in temperature. The increase in temperature due to future climate change is predicted in most parts of the world, and the results of the implementation of general circulation models are different depending on the scenario defined in the model. Based on these predictions, the average global temperature increase for the year 2050 in various climate change scenarios varies from 3.5 to 0.5 ° C (22), in addition to the intensity of temperature variation in different regions, there are significant differences (23) and (12).

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Some studies suggest that The effect of climate change on the increase in temperature is due to the increase in the night temperature and, in general, the temperature of the night is more than the temperature of the day influenced by the phenomenon (13). While in general circulation models, night and day temperatures are not estimated separately, but in the event of such a phenomenon, changes in daily patterns of temperature in turn will have new effects on plant growth and development. The results predicted by the general circulation models confirm the decline in rainfall compared to the current situation for most parts of the country. Table 2 shows the variation in the average monthly rainfall of 2025 and 2050 compared to the current average for 36 different stations in the country. Based on these results, the severity of rainfall reduction in arid and semi-arid regions of the country is more marked than wet areas. The results also show that precipitation decrease in autumn and winter months is more than the decrease in rainfall in spring and summer months (in areas with rainy summer). Based on the predictions obtained from the general circulation models, the average fall of autumn rainfall for all stations under study in the years 2025 and 2050 is 8 and 11 percent, respectively, and for the months of the summer is almost negligible (due to the lack of summer rainfall at most stations Is under investigation). It should be noted that the general circulation models in their estimation, regardless of monthly rainfall, predict the rate of change, so it may even be for months of the year (such as July or August) that are unrivaled in most parts of Iran. Also predict some changes which, of course, have no particular meaning and should be neglected. (2) Changing rainfall patterns is one of the most prominent causes of climate change worldwide. Which is, however, a different geographic region varies depending on the direction of changes. For example, predicted variations in rainfall are almost negative for all regions of the United States and Asia, and part of Canada, the United States and Australia, while most continental regions of Europe will experience positive changes as a result of rising annual declines (22). Overall, the results Existing estimates indicate that dry and semi-arid points in the world will become dry. The results of this research also show that the spatial pattern of precipitation changes in 2025 and 2050 is largely similar to the temperature variation pattern. Therefore, areas with lower rainfall will also be subject to higher temperatures. The simultaneous occurrence of these two phenomena affects many of the agro-climatic indices and will also affect the plant's growth and development. The effects of climate change on temperature and precipitation will affect the duration of the drought period. The severity of this effect,

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depending on the seasonal variation of the two main variables determining the length of this course, is different. The results presented in previous sections confirm the variation of seasonal patterns of temperature and rainfall in climatic conditions of 2025 and 2050 for most of the stations under study in this study; therefore, it is expected that the length of the drought period will be prolonged under climate change conditions. In this research, the length of the drought period of the studied stations is calculated in the current conditions and under climate change conditions. The results indicate that the length of the drought period in the present situation is very long in most parts of the country. Overall, the average of 204 and 35-day standard deviation for this period in 36 studied stations indicate the dominance of the dry period in Iran, among which Gorgan has the shortest period of drought (141 days) and Bandar Abbas has the longest period of drought (289 days). The predicted climatic conditions of the general circulation model indicate a longer drought season in 2025 and 2050 at all stations under study. The prediction of the length of the dry season in conditions of climate change clearly indicates that this period is prolonged in the country, with the average dry period in the years 2025 and 2050 increasing to 214 and 223 days, respectively. The results also indicate that the increase in dry period is due to acceleration at the start and also due to delays in the end of this chapter. It seems, however, that in most of the studied stations, the effect of climate change on the early start of the dry season is more than the effect of this phenomenon on the later conclusion of this chapter. The prolonged period of drought is one of the most important consequences of the climate change phenomenon, which has been reported in many parts of the world, including Australia (16), parts of the United States (17) and China (14). Evidence suggests that the longer the dry season, especially in the middle latitudes, will be more pronounced. [18] Although there are several reports of drought in the tropical regions and the vast sections of the continent in the future in the future climate, this type of drought has been influenced by other climatic phenomena such as ENSO and in fact indicate the severity of drought during the dry season. [20] Prediction of the general circulation model showed that in conditions of climate change, temperature and rainfall in the studied stations will be affected. On the basis of this, it seems that increasing the dry period is due to the combined effect of decreasing precipitation and temperature rise. In order to investigate the effect of these two variables on changes in the length of the dry season, a response technique was used. For this purpose, data on temperature and rainfall changes in two

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periods of forecasting, namely 2025 and 2050 was studied in conjunction with the length of the drought period. The response level for the stations under study is shown in Fig. 1. As it can be seen, the length of the dry season is dependent on both variables that affect it; however, the effect of the variables on the increase in the length of the dry season is not the same. Paying attention to Iso-Lines (lines of equivalence) clearly illustrates this situation (Fig. 1). Following Iso-Lines corresponding to 4.15 days, increasing the dry season in this figure shows that, for example, 20% decrease in precipitation with 1 ° C increasing the temperature will have the same effect as 10 percent decrease in precipitation and 3.7 degrees Celsius of temperature increase over the dry season length variation. In other words, in some conditions, increasing the length of the dry season mainly due to decreasing precipitation and de Some conditions have been due to the increase in temperature (Fig. 1). The results of this study confirm the dryness of arid regions in climate change conditions, which has been proven in many studies in different parts of the world. [19] Researchers believe that increasing the length of the dry period will affect the soil's useful moisture through growth and crop production (24). For example, the results of studies in the United States have shown that in the so-called corn belt area, even Under prolonged dry season, in the case of irrigation, the yield of corn decreases (6). According to the predictions made in the 2060s, the Corn Belt was compared to the condition of the corn Lee himself will move about 50 kilometers. The results of this study showed that overall the temperature of the country is high due to the climate change phenomenon and decreases will decrease, and the severity of these changes varies depending on the location of the region. The severity of temperature and rainfall variations in the country has a similar pattern in the model, and their amplitude rises from north to south and from west to east. Since all agricultural climatic indices are in some way related to temperature and precipitation, it is evident that, if the predicted changes in temperature and precipitation occur, many climatic indices will also be affected, one of the most important of which is the dry season Is The results of this study showed that the length of the drought period in all studied stations in the climate change conditions has increased and in other words, the dry lands of the country will become dryer, and this is an event that has been predicted in many parts of the world. Obviously, the realization of these conditions will have a significant impact on agricultural systems and especially on the production systems of

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the country's dry products, studying these effects and finding adaptation strategies are among the research priorities in the field of climate change.

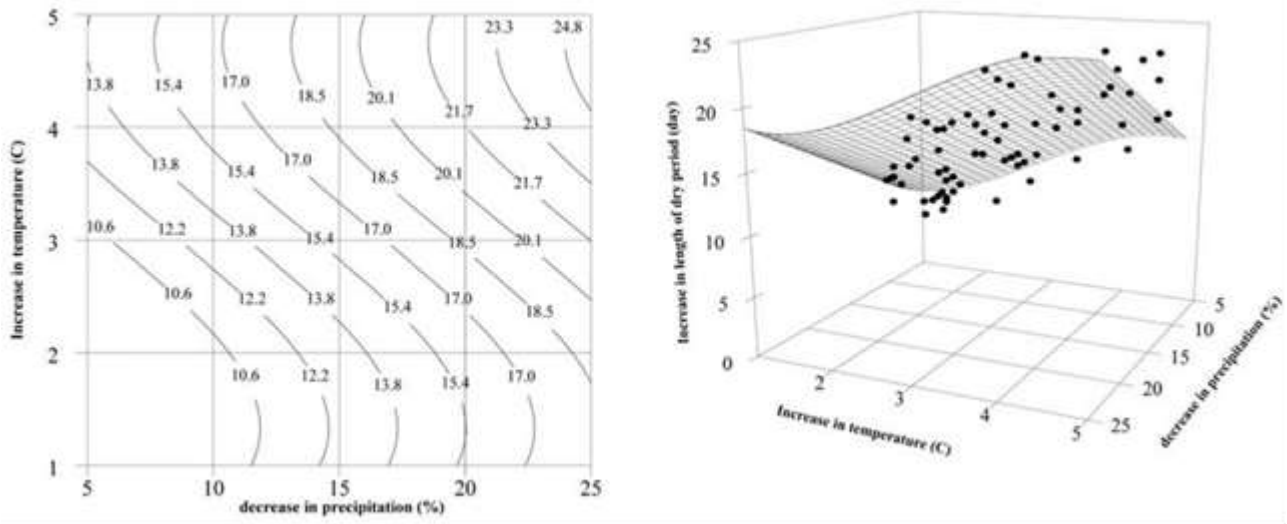

Figure 1: Response diagram of the relationship between changes in the length of the dry season in response to changes in temperature and rainfall in conditions of climate change for the stations under study, the equivalent lines (Iso-line) are also shown.

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