

# CLIMATE CHANGE IN TEMPERATURE IN THE SOUTHERN PART OF IRAQ (BASRAH, AMARAH, NASIRIYAH)

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## ABSTRACT

*The study aims to identify climate change in temperature in the southern part of Iraq. Three stations were selected to represent the south-eastern part of Iraq namely Basrah, Amara, Nasiriyah, and through the analysis of time series from 1980 to 2012 to determine the overall natural trends: normal, great and minor temperatures. It has been shown that there has been a downward trend in some years, while in some years the trend has been on the rise, but the general trend in the rates of change has been positive.*

**Keywords:** Temperature, Climate Change, Trend, Stations, Southern Part.

## INTRODUCTION

The world has witnessed some unprecedented climate changes because of many natural and human factors; the natural factors were the first responsible of those changes through ages whereas the human factor represents human's activities, industrial actions, his use of the fossil fuel which is responsible for the climate changes at the current time. Some of the climate changes take the shape of the melting of glaciers, ice panels, the raising of water levels of rivers and oceans, extinction of some species in the sea, desertification, torrents, and dryness which negatively affect the environment, humans, and the other living kinds as well.

Concerning the eastern- southern part of Iraq, the study (through the period : 1980-2012) proved that climate change causes the high temperature, and decreasing the annual water fall in the all studied stations.

### **First: The Problem of the Study**

Are there effects of the climate change on the rates of temperature in the southern part of Iraq ( Basrah, Amara, Nasiriyah) for the period 1980- 2012?

### **Second: The Hypothesis of the Study**

There is a difference in the rates of heat in the studied area as a sign of the climate change.

### **Third: The Significance of the Study**

It focuses the significance on the difference in the Temperature rates for its special significance in the rural and urban planning and investing the earth surface perfectly. It also has significance regarding the agricultural planning due to its importance in agriculture. Emphasis increases when it is concerned with the area under study for it is large and affects the diversity of temperature, and it becomes very necessary to take the rates of the highest and lowest temperature as well as the normal one into consideration when setting the scientific plans which are necessary for the future architectural planning.

### **Fourth: Justifications of the Study**

They can be summarized through the following points:

1. Knowing the nature and Trend of the climate change concerning the rates of Temperature in the southern part of Iraq (Basrah, Amara, Nasiriya) through the diversity and change in the nature and direction of the annual rates of Temperature.
2. Proving the existence of climate change through the change indicator of the nature and Trend of the annual rates of Temperature in the southern part of Iraq (Basrah, Amara, Nasiriya) from their nature and direction in the previous years.

**Fifth: Limits of the Studied Area****1. Special Dimension:**

The limits of the study have expanded from Ali Al-Garby district from the north till Al-Qurna district from the south, and it includes the eastern marshes (Al- Huwayza marsh) within the Iraqi region; it has boundaries with the Iranian region from the east and with Tigris from the west, and with Al-Snaf marsh from the north, ending with Al-Qurna district from the south. In regards to Al-Hammar marsh, it has boundaries with Euphrates from the north, with the General Outfall Project from the south, with Basrah from the east, ending with the western plateau from the west. Astronomically, the area expands between the two width circles (32.45-29.2) from the north, and (48.3-45.5) from the east, as it is illustrated in the map No.(1).

**2. Temporal Dimension:**

The research has been limited temporally through the climate data within the period (1980- 2012) which have been obtained from the World Meteorological Organization for 33 years, for explaining the monthly and annual rates of the maximum, minimum, and normal temperatures in the southern part of Iraq.

**3. The Concept of Climate Change and its Global Signs:**

It is better to differentiate between the climate fluctuation, and signs of climate change where climate fluctuation is scientifically defined as the differences in the climate elements which continue and repeated through many years lasting for nearly decades of years like: hot and cold waves which are away of being normal in the climate of a specific region (Al-Jubory, 2015).

While the climate change means a change from one case into another such as: from being hot into warm then cold, and vice versa. Such change takes a long duration which lasts for more than a climate circle to cause that change in the normal situation and being of a different distinct nature not like before (Mousa, 2006). In addition, climate change also means a natural process occurs at a certain time and through different periods, astronomical time, geological time, time calculated by decades; this term refers to the sluxes occur in the general climate of the earth, or in the regional climates, which can be caused either by natural powers or human actions (FAO, 2000).

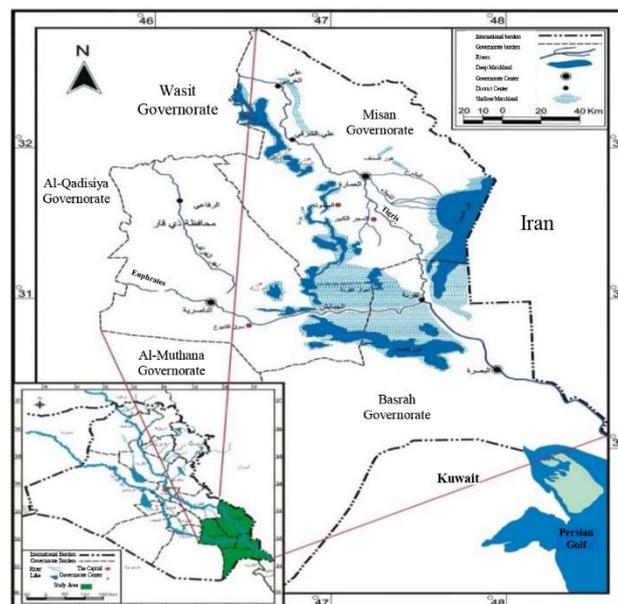


Figure 1. The location of the studied area in Iraq (Ministry of Watery Resources, General Board of Areas- Iraqi Official Map with a measure of 1: 1000000 cm Baghdad and the map of the studied area with a measure 1: 100000 cm)

Many studies and reports- which are interested in the climate change- depend on studying the rates of heat, water falling, the melting of glaciers, increase of the water levels, the nature of the Tropical winds, the nature of the agricultural products for investigating the cases and effects of the climate change on different international, global, and local levels.

These changes have been linked with the increase of warm gases in the Troposphere. The occurrence of global warming phenomena in the ground- Troposphere and the existence of signs of climate change in some different parts of earth become concrete and typical matters with no controversy. Therefore, what happens in a certain station is an indication of a change

but not a radical one – like what might be interpreted from the concept. Consequently, the objective of this study is to determine the signs of climate change through the rates of temperature of the studied area.

### GLOBAL TEMPERATURE CHANGE

Many current trusted studies have discussed the measures of earth temperature during the last five hundred years which refer to an increase of the earth temperature with a rate of one centigrade. It is worth mentioning that 80% of this increase happened in (1800) while the detailed analyses of temperature during the last hundred years refer to the average of the global temperature had increased from (0.3) to (0.6).

In fact, the temperature degrees were static during 8000 years at least, and the earth temperature degrees increased during the 1990s and reached its highest rates in 1998 (since 1861). This conclusion is based on the analysis of the tree's roots, coral reefs, snow, the historical documentation of the North Pole which discovered that the years of the twentieth century recorded the maximum degrees during a thousand of years on the earth (Al-Jubory, 2015). The scientists and specialists emphasize that 2005 is the second year in recording the maximum degrees in the world since the beginning of the accurate climate statistics in the 1960s of the 19th century (when these recordings had been scientifically registered since 1870, and the height degrees increased during 2005 in the northern half with a rate of (0.65) m over the level that was familiar and witnessed between (1961- 1990). The temperature degrees also increased during (2005) to be 0.48 m on the global level (Al-Abaychy, 2009).

Many scientists believe that the increase of the Temperature rates in the world because of the human activities which in turn increased the concentration of the warm gases, specially (CO<sub>2</sub>), in the Troposphere. In addition, the human technological development and the industrial actions and processes are reasons behind the climate change on the earth. In (1990), the report by World Meteorological Organization (W.M.O) with the United Nations of Environmental Program (UNEP) and the (PPC) indicated that the continuing leakage of global warming gases resulted in doubling the rate of concentrating CO<sub>2</sub> - which is the result of the agricultural difficulties , oil burning, and cutting wood – so it is expected in 2025 the general average of the heat in the 21st century will be (2-5) every ten years, and it is expected that in 2100 there will be increase of the height degrees as well as raising of water fall in rivers and oceans Ice melting result. (Al-Jubory, 2015).

The conferences of climate starting with Paris Conference (1976), others specially (Kyoto in Japan), ending with (Le

Mavi) Conference on May, 2008 are all interested in illustrating the obvious increase of temperatures on earth and give various rates between (0.2- 0.5), and the years between (1995-2006) had recorded the maximum degrees according to what had been registered in the devices of measuring the global surficial heat from (1850). On the other hand, the heat of the one hundred years (1906-2005) which is (0.7- 0.9) is regarded the largest length direction, and temperature increases at the northern width lines, and heat on non-water areas is higher than in oceans (Al-Jubory, 2015).

#### The Change of the Minimum Temperatures of the Studied Stations

The average of the minimum temperatures varies among the studied stations during (1981- 2012), when the highest rate (33.7) had been registered in Basra in July 2011, and (30.8) in August 2006 in Amara station, rate (27.4) had been registered in Nasiriya station in September 2009.

On the other hand, the minimum rate (6) has been registered in Basra station in December 1981, and (9) is recorded in Amara station in November 1982, and (5.8) is recorded in Nasiriya station in February 1983.

The figures (2,3,4) show that there is an obvious change in the temporal series between (1981- 2012) in the studied stations regarding the minimum temperature, hence, the years (1980-1997) indicated they had a rate less than that of Basra station when it registered (-0,9) in 1980, (- 1,5) in 1983, and (- 0,3) in 1997 except in the years 1994, and 1996 when they had higher range (0,1) (1,0).

Concerning (1998- 2012), it was higher than the range when it reached (0,4) in 1998, (1,9) in 2004, and (1,1) in 2012 except in 2006 & 2008, it was less than the range (- 0,5) (- 0,4).

On the other hand, there was a change in temperature in Amara station less than the range for the years (1980- 1995) except for the years (1986- 1991- 1994) when the temperature was higher than the range (0,1) (2,5) (0,2) respectively.

The years between (1996- 2012) witnesses' temperature higher than the range except in 1997 when it reached (- 0,5), and in (2000) & (2005) it was (- 0,1) when the temperature was less than the minimum temperature of Amara station.

In Nasiriya station, the temperature was less than the range of the minimum temperature between (1980- 1997) as recorded (- 1,1) in 1980, (- 1,6) in 1992, and (- 0,2) in 1997, except in 1990 and 1994 when it registered (0,4) & (0,6) which are higher than the general range added to the period (1998- 2012) which registered the same case ;i.e., higher, and it registered

(1,0) in 1999, (2,0) in 2010, (0,8) in 2012 and that negative and positive heat change is due to inner and outer factors.

The inner factor affecting the temperature track in the southern regions is the dryness of large areas of marshes which leads to changing the power balance there. While the outer factors include the pressure systems, the movement of Air masses and frontiers and their impacts on the region according to their resources as well as their tracks which lead to a change in its heat characteristics.

Regarding the trend rate for that period, it was positive and the change rate was (0,4) in Basra and Amara stations, while (0,6) in Nasiriya station; thus it pars with the general direction which is referred to by the results of the committees belong to the United Nations which declared that the change in temperature was ( - 0,2, 0,6) as it is shown in the figures (2,3,4) which clarify the minimum temperature change and its direction for the studied stations in the period (1980- 2012).

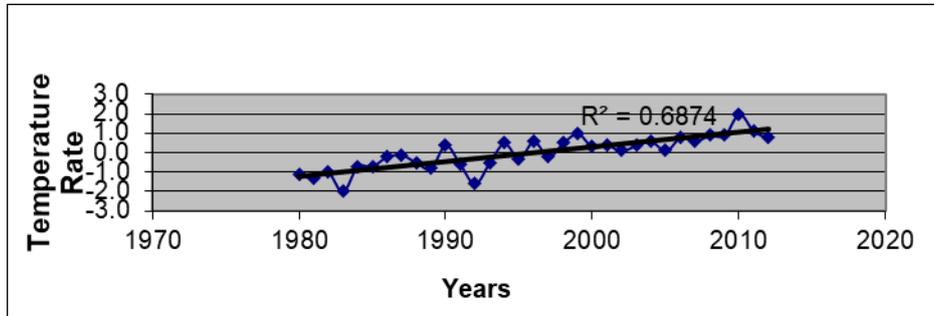


Figure 2. fluctuation and Trend and amount of change in the rates of the minimum Temperature to Nasiriya station during the period 1980 – 2012.

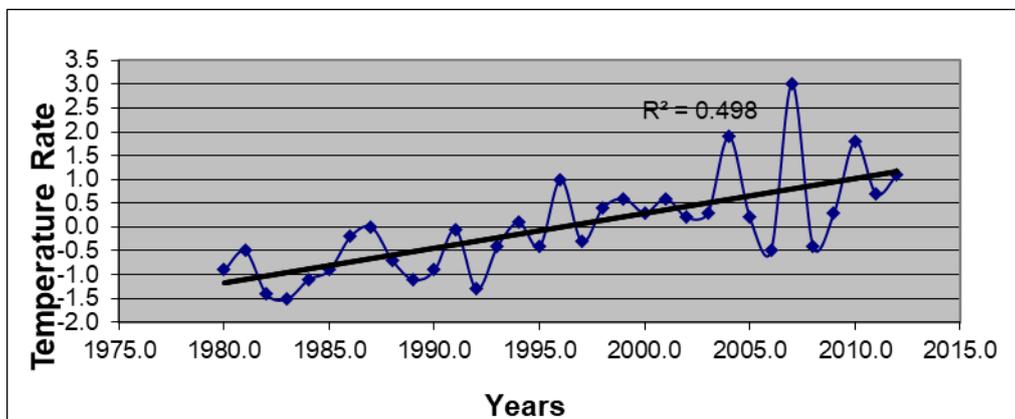


Figure 3. fluctuation and Trend and amount of change in the rates of the minimum Temperature to Basrah station during the period 1980 – 2012.

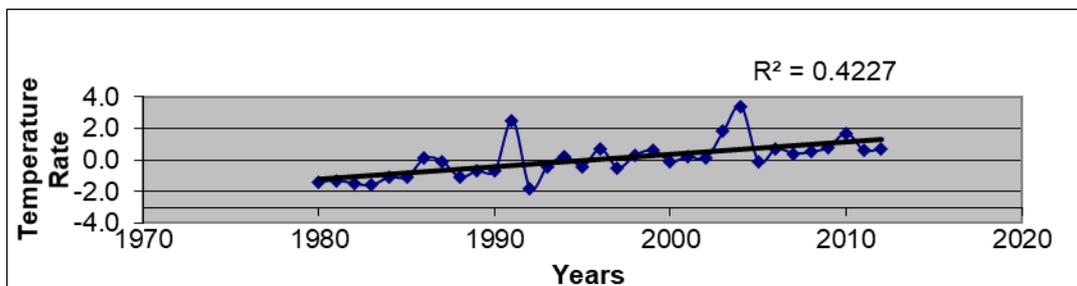


Figure 4. fluctuation and Trend and amount of change in the rates of the minimum Temperature to Amara station during the period 1980 – 2012.

Figures are based on the Iraqi Meteorological Organization, Climate Department, Unpublished data.

The Change of the Maximum Temperatures of the Studied Stations

The average of the Maximum Temperature differ among the studied stations during the period (1980-2012); its highest recording was (48.7) in July, 2011 in Basra station, and (30.8) in August,2006 in Nasiriya station, and (48.1) in January,1999 in Basra station, whereas the lowest average of the highest height degrees was (14.6) in January,2008 in Basra station, and (17) in December, 1986 in Amara station, and (16.7) in February,1989 in Nasiriya station.

That change is obvious through the repetition of the changed cases of the studied stations, figures (5,6,7) indicate the average of the highest changed degrees during the period (1981- 2012) in the studied stations. Average of the changed higher and lower degrees had been registered: Basra station registered higher than the general average between (1998-2012); in the years 1998, 2007, and 2012 it registered higher than the general average for the highest degree (1.0), (3.7), (0.5) respectively. While in (1980- 1997) it registered lower than the general average of the Maximum Temperature in Basra station. In the years: 1980, 1983, 1990, and 1997 it registered (- 1.4), (- 2.1), (- 0.1), and (- 0,5) respectively except the two years (1994) & (1996) when it registered (0.7) & (0.6) higher than the general average of the Maximum Temperature.

While Amara station in (1980- 2000) registered a change lower than the general average of the Maximum Temperature. In the years: 1980, 1988, and 2000 it registered (- 0.7), (- 2),

and (- 2.7) respectively except the year (1991) when it registered (3.1) higher than the general average of the Maximum Temperature. And from (2001- 2012) it registered a change higher than the general average. In the years: 2001, 2004, and 2010 it registered (0.9), (4.4), and (1.1) respectively.

As far as Nasiriya station in (1980- 1997) is concerned, it registered a change lower than the general average of the Maximum Temperature. In the years: 1980, 1989, and 1997 it registered (- 1.1), (- 1.3), and (- 0.5) respectively except in the year (1994) when it registered (0.3) higher than the general average of the highest degree. And from (1998- 2012) it registered a change higher than the general average. In the years: 1998, 2001, 2004, and 2010 it registered (0.4), (1.4), (2.1), and (3.0) respectively.

Regarding the average of Trend during that period, it was positive and nearly (0.4) for Basra station, (0.5) and (0.2) for Amara station, and (0.9) for Nasiriya station so it pars with the general direction which had been referred to by the results of the committees related to the United Nations which clarified the change of the Maximum Temperature for the previous period (- 0.2, 0.6), as illustrated in the figures (3,4,5) which show the fluctuation, Trend , and the change of the Maximum Temperature for the studied stations during the period (1980-2012).

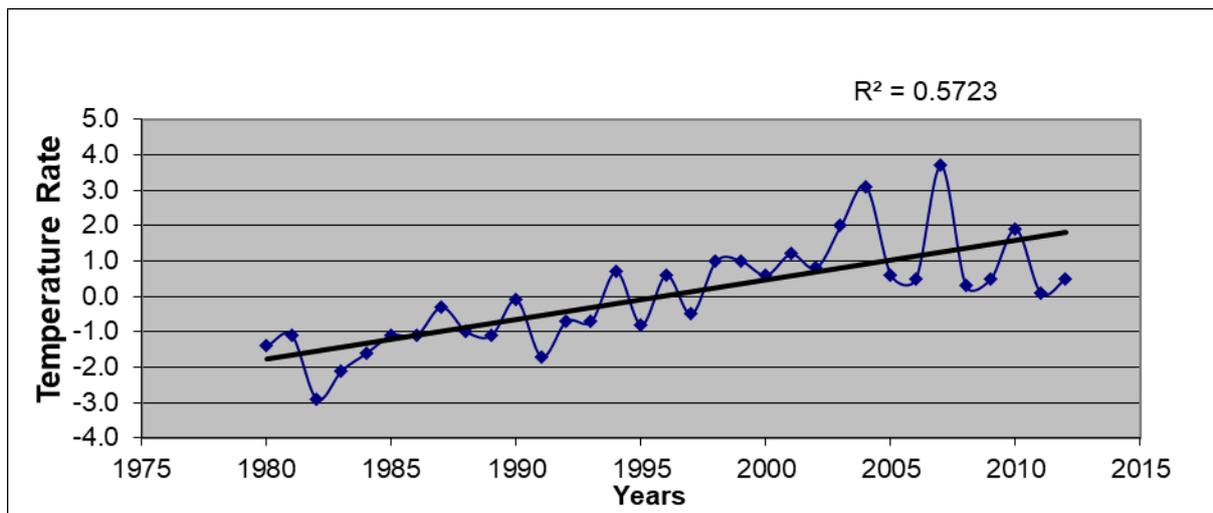


Figure 5. fluctuation and Trend and amount of change in the rates of the Maximum Temperature to Basrah station during the period 1980 – 2012.

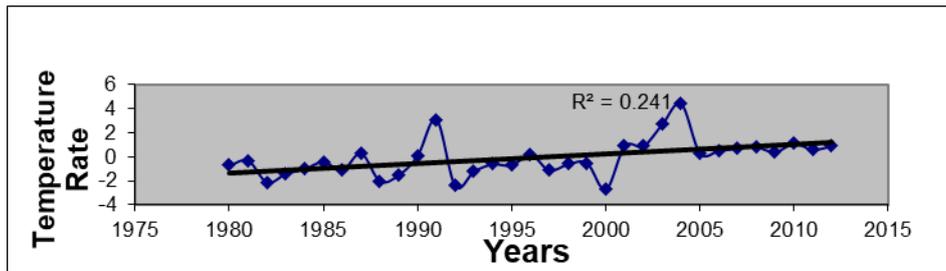


Figure 6. fluctuation and Trend and amount of change in the rates of the Maximum Temperature to Amara station during the period 1980 – 2012.

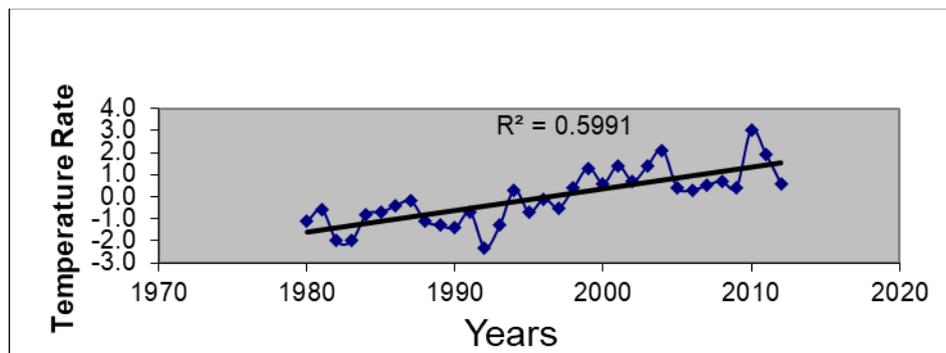


Figure 7. fluctuation and Trend and amount of change in the rates of the Maximum Temperature to Nasiriya station during the period 1980 – 2012.

Figures are based on the Iraqi Meteorological Organization, Climate Department, Unpublished data.

The Change of the Normal Temperatures for the Studied Stations

The average of the normal height degrees had increased among the studied stations during the period (1980-2012); its highest recording was (40.4) in July,2012 in Basra station, and (38.9) in August,2000 in Amara station, and (38) in June,2010 in Nasiriya station, whereas the lowest average of the normal height degrees was (11.5) in December,2004 in Basra station), and (10.1) in February, 1982 in Amara station, and (10.2) in December, 2006 in Nasiriya station.

That change is obvious through the height track of the changed cases of the studied stations, figures (8, 9, 10) indicate a low change of the degrees during the period (1980- 1993) in the studied stations. Average of the changed degrees had been registered: Basra station-except in the year 1987, distinctively registered higher than the general average of climate change between (1994- 2012); when it registered higher than the general average (0.1), (1.8), except in the year 1997 which witnessed decrease in the average of climate change (- 0.2).

While in the two stations: Amarah and Nasiriya, in (1980-2000) they registered a change in the temporal series. In the years: 1980, and 1997, they lower rates were (- 0.3), and (- 1.7), in Amara station, and (- 0.1), (- 1.8) in Nasiriya station except in the year (1990) when there was increase in the average of climate change (- 0.1) in Amara station, whereas in (1987) it was (0.2), and in (1996) it was (0.7) in Nasiriya station.

During the period (1998- 2012) it registered the highest change (0.2) till (1.9), except in the year (2011) when there was decrease in the average of climate change (- 0.6) in Amara station. During the period (1998- 2012), it witnessed the highest average of climate change (0.2) till (1.8) in Nasiriya station. It can be said that the studied stations registered negative and positive height change from the general average during the recorded duration, specially the stations (7,8, and 9) which witnessed repeated changes of height higher as well as lower from the average.

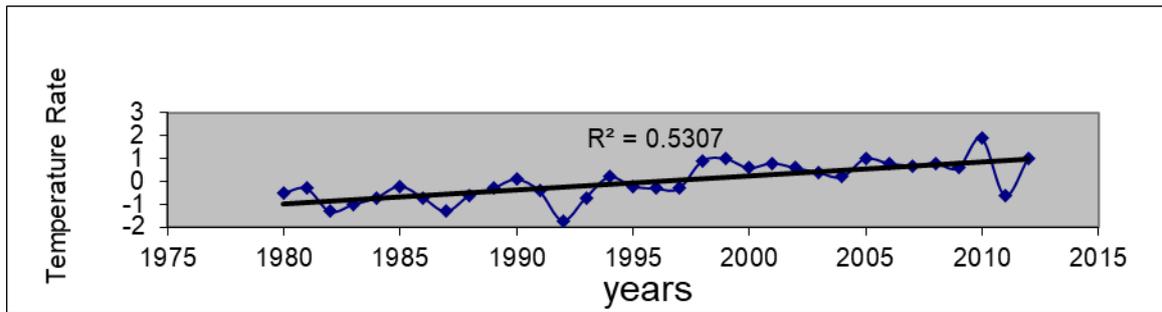


Figure 9. fluctuation and Trend and amount of change in the rates of the Normal Temperature to Amara station during the period 1980 – 2012.

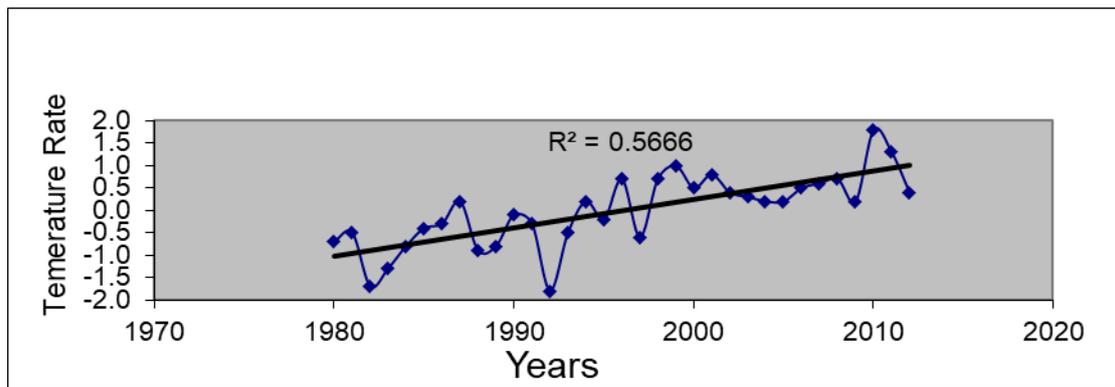


Figure 10. fluctuation and Trend and amount of change in the rates of the Normal Temperature to Nasirya station during the period 1980 – 2012.

Figures are done by the two researchers depending on the Iraqi Meteorological Organization, Climate Department, and Unpublished data.

Through observing the lowest, higher and natural heat degrees are in convenience with the increase and decrease in the studied years and for the all stations – in both negative and positive repetition- due to many reasons, for example: the repetition of heat waves is a result of the natural factors affecting determining the track of those waves (whether repeated increase or decrease). The concentration of high pressure, domination of above Tropical Air pressure, the dry continental Tropical masses (especially those coming from north of Africa and the deserts of the Arabian peninsula sync with the expansion of the seasonal Indian low height) lead to decrease of relative humidity and increase of induction heating to be standard or excessive rates sometimes. Being under the hot front following the mid Air low system- which might keep their continental characteristic and dryness especially if they come from the western-southern direction those which result in greatly increasing temperatures (1), added to the effect on the southern part of Iraq after drying the southern marshes which cover large area, Iraq would be under the effect of a change in

the maximum, minimum, and normal rates specifically on the Iraqi eastern- southern stations.

Concerning the cold waves that the Iraqi studied areas suffer from and because it is located in a semi Tropical position, along with the coming of dry and cold polar Air masses of polar source, all these factors lead to returning the Tropical masses back and that effect lasts south reaching north 30 circle of width. Cold waves that generally come to Iraq are linked to the so cold waves which are typical in European continent in some years. Most of its parts are affected by the air from the frozen areas and they are coincided during the cold months with two kinds of pressure systems that contribute in sharp decrease of temperatures in the passing places which include Siberian hilly and the down fronts.

The effect of the cold waves increases largely at night more than at day for earth loses the solar energy that has been gotten during the short day, as well as the decrease of the temperatures at night and day for successive days.

## CONCLUSIONS

1- The study proves the existence of clear signs of a change in the track of the maximum, minimum, and normal temperatures in the selected stations during the period (1980-2012), and that can be regarded as a very distinctive indication.

2- The change signs of the temperatures indicate that they are directed toward the increase in its general direction in Amara station with a deviation (- 0,2,- 1,9) for the period (1999- 2012).

Whereas there is a direction toward the decrease in Basra station with a change rate (- 0,1) (- 1,7) during the years (1980-1999).

3- The change signs indicate that the minimum temperatures are lowering generally in Nasiriya station with a deviation (- 0,1) (- 1,6) for the years (1980-1997) except in the year 1996 when it recorded an increase of the rate (0,6) for the same station.

4- The existence of a decrease in the maximum temperatures in the three stations (Basra, Amara, Nasiriya) with a deviation (- 2,3) (0,7) (- 4,2) in (1992). Besides, in 2004 the temperatures were toward the high direction with a deviation (2,1) (3,1) (4,4) in the same stations.

## RECOMMENDATIONS

1- Encouraging the Ministry of Transport to construct a climate developed net in the stations for getting more accurate study of the Iraqi climate in future, and it is preferred to be done with the assistance of the accurate electronic stations.

2- Maintaining the natural plants for they are regarded as a deodorizing factor and increasing the heat range.

3- Controlling and decreasing the resurrection of gases cover which leads to the global warming , and it has effects on the rates of heat range.

5- Increasing and enlarging the green areas in cities through growing trees, and making the green belts that fresh and refine air from dust and provide oxygen, and lessen the extreme temperatures consequently it decreases the heat range.

6- Making studies of the local climate in different fields to treat the climate problems for they are considered signs of a change of the Iraqi climate.

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