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Climate Characteristics of Nasiriyah City

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Abstract

The aim of this study is to investigatingthe climate characteristics of the southern Iraqi city of Nasiriyahusing Modern-Era Retrospective Analysis for Research and Applications, version 2 (MERRA-2) data for the period 1980-2016. The data includes monthly mean values of air temperature, relative humidity, atmospheric pressure, wind speed and direction, and monthly total of rainfall. Results indicate that the temperature is ranging between 10 (during winter) and 40 ^{o}C (during summer). The city is characterized by wet winter and a very dry summer. Low pressure values prevail during summer and higher values prevails during winter. Wind speed ranges from 1 during winter to more than 7 during summer and mainly blowing form west and north west. The rainfall pattern shows that rainfall during the rainy season (October-May) in the city varies form one year to another and there is no distinct trend for rainfall. Time series and trends analysis of temperature and rainfall showed an increasing in temperature during July and slight decreasing in January. The relative humidity has showed very small variation during the period 1980-2016. The annual rainfall was found to be decreasing.

Introduction

The concept of climate change is certainly not new area of interest ,however by the late 20th century it had moved from be area of research interest only to historians and palaeontologists to being a topic of almost daily conversation. Global warming is now at the heart of a political and social debate about human involvement in climate change[Eggleton, 2013]. The evidence that the earth is warming consists of its rising sea levels, warming atmosphere and oceans, widespread melting of sea ice, ice sheets, glaciers, and permafrost. Short- term temperature numbers over the last century were measured by thermometers, on the other hand longer term records are mostly derived by interpreting ice cores from ice sheets and glaciers, deep sea sediment cores, tree rings, and corals [Zolin et al., . There has been an extensive research on climate change worldwide and on the possible consequences of human activities on the earth climate. In Iraq many researchers have investigated the influence of global climate change on the local climate. Recently many research works have been conducted on the influence of climate change on Iraq e.g. Zakaria et. al., (2013), Bilal et al., (2013), Al-Ansari et al., (2015), Azooz and Talal (2015), and Abbasa et al. (2016).

Iraq is a country in western Asia spanning most of the northwestern end of the Zagros mountain range, the eastern part of the Syrian desert and the northern part of the Arabian Desert. The climate of Iraq is characterized by sub-tropical, continental, arid to semi arid with dry hot summers and cooler winters. The average annual temperature is varying from 8.5ºC to 49°C . The summer temperature range is ranging between 16ºC – 49ºC while the winter temperature range is between 8.5ºC - 14ºC. Rainfall is low in central and southern of Iraq (100-200mm). but it concentrates in northern of Iraq which reach about 1000mm and falls in November to April [Al-Falahi, 2008]. Roughly 90 percent of the annual rainfall occurs between November and April, most of it in the winter months from December through March. The remaining six months, particularly the hottest ones of June, July, and August, are dry. except in the north and northeast, Mean annual rainfall ranges between ten and seventeen centimeters[Zolin et al., 2016].

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Data and Methodology

Nasiriyahis largest city of ThiQar province in the southern Iraq. Its geographical coordinates are 31.05^{o} Nand 46.27^{o} E. The climate in Nasiriyah is a desert climate since there is virtually no rainfall during the year. The average annual temperature in Nasiriyah is 23.9 °C**.** Precipitation here averages 101 mm. To asset recent climatic variation of Nasiriya monthly means of various weather

elements for the period 1980-2016 were used. The data were obtained from the Modern-Era Retrospective Analysis for Research and Applications, version 2 (MERRA-2). MERRA-2 which is the latest atmospheric reanalysis of the modern satellite era produced by NASA's Global Modeling and Assimilation Office (GMAO) [Gelaro et al., 2017]. The data includes monthly means of air daily air temperature, relative humidity, atmospheric pressure, wind speed, wind direction, and monthly total of rainfall. Surfer commercial software was used to grid and generate month-year maps for these weather elements. Time series were used to determine the trends of the elements.

Results and Discussion

Figures 1 to 5 show the variations of monthly means for temperature, relative humidity, pressure, wind speed and wind direction. Figure 6 shows the variations of monthly total of precipitation. These results indicate that temperature ranges from 10 to 15 ^{o}C during winter months (December-February) and 35 to 40 ^{o}C during summer months (Jun-Aug). It is clear that temperature cloud be lower than 10 ^{o}C during winter and may slightly reach more than 40 ^{o}Cduring summer. The relative humidity results illustrate that Nasiriyah is characterized by dry air during summer and moderately wet air during winter. The pressure patterns indicates a low pressure (less than 1000 hPa) and high pressure systems prevail over the city during summer and winter seasons, respectively. The wind speed results show that summer months are more windy than winter months and wind speed may reach more than 7 m/s during July. It has been noted that the westerly to north westerly winds are prevailing in the city of Nasiriyah which is a result of the shamal wind. The rainfall pattern shows that rainfall during the rainy season (Oct-May) in the city varies form one year to another and there is no distinct trend for rainfall.

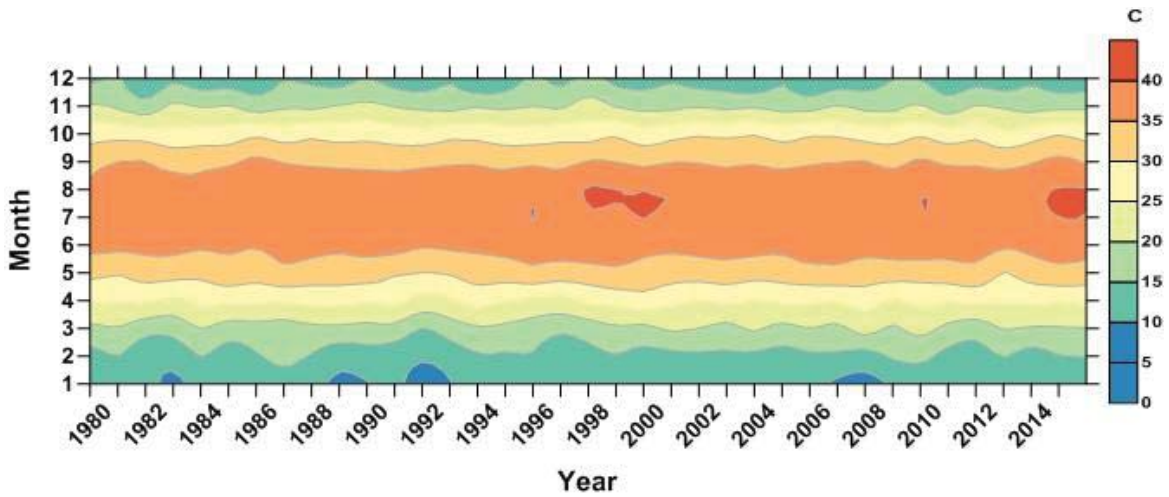


Figure (1): Monthly variations of air temperature for Nasiriyahduring the period 1980-2016.

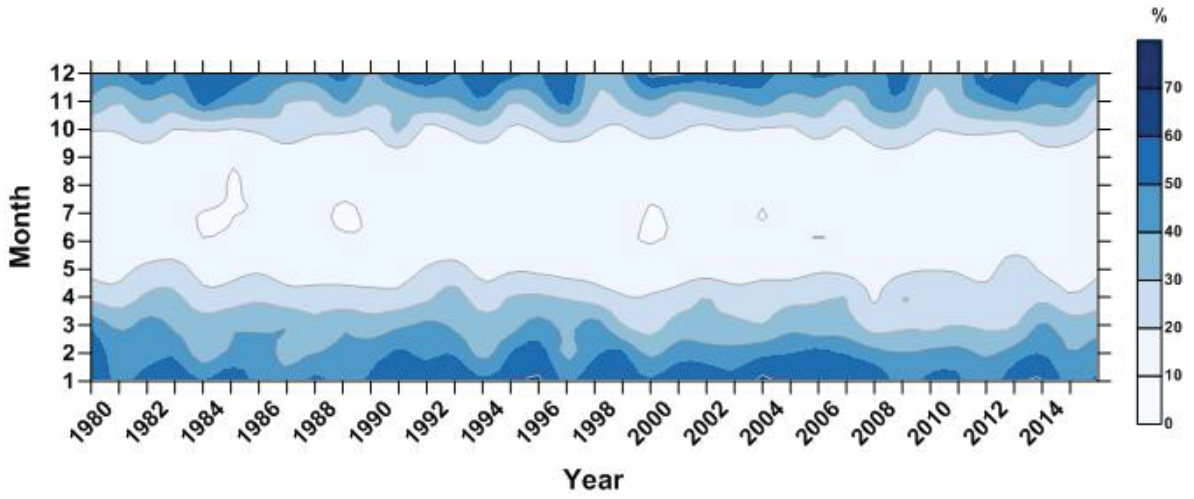


Figure (2): Monthly variations of relative humidity for Nasiriyahduring the period 1980-2016.

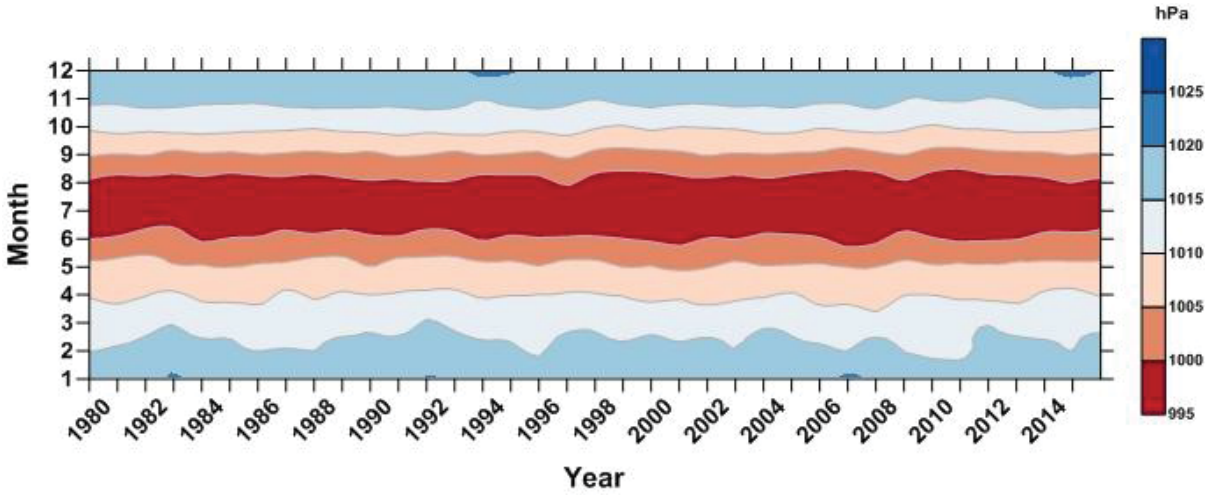


Figure (3): Monthly variations of pressurefor Nasiriyahduring the period 1980-2016.

To investigate the effects of global warming on the city of Nasiriyah the temperature and relative humidity datafor the moths of January, April, July, and October were chosen to represent winter, spring, summer, and autumn seasons. Figures (7) and (8) show the time series and trends for the two weather elements for the period 1980-2016. Table(1) gives**a** and **b** coefficients of the trends. It has seen that there is a noticeable increasing in temperature during July and slight decrease in January. The relative humidity shows very small variation during the 1980-2016. Figure (9) shows the time series for annual rainfall. It is clear that rainfall was varying and decreasing from one to another.

Table (1): Linear regression coefficients for temperature and relative humidity time series.

Month	Temperature		Relative Humidity	
	A	b	a	b
January	15.38	-0.0021	34.64	-0.009
April	4.52	0.011	115.1	0.005
July	-8.14	0.023	-34.49	0.022
October	-26.34	0.027	-15.36	0.019

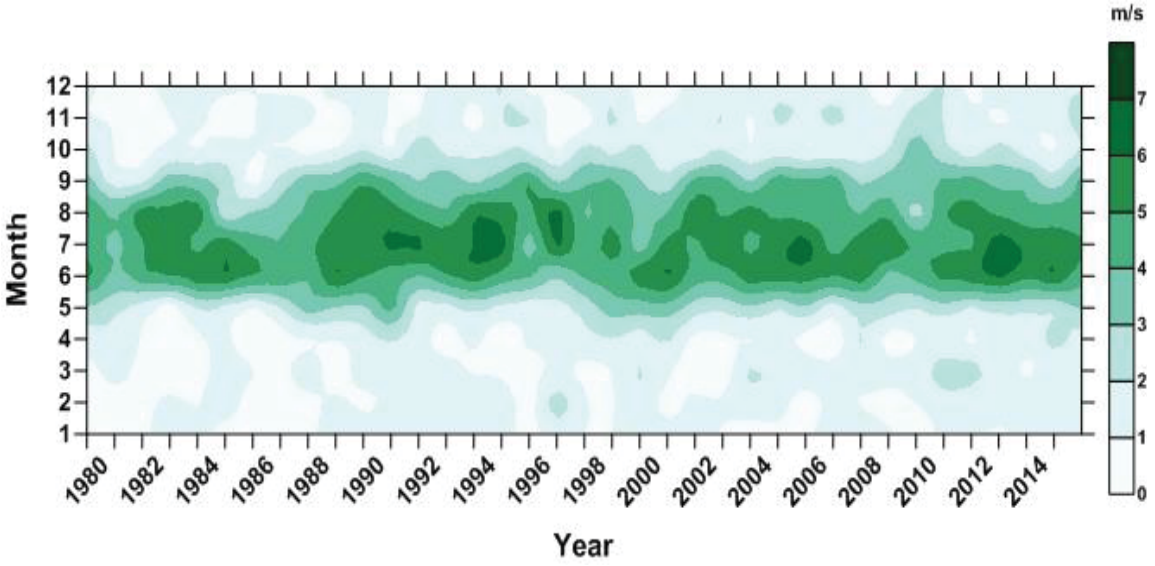
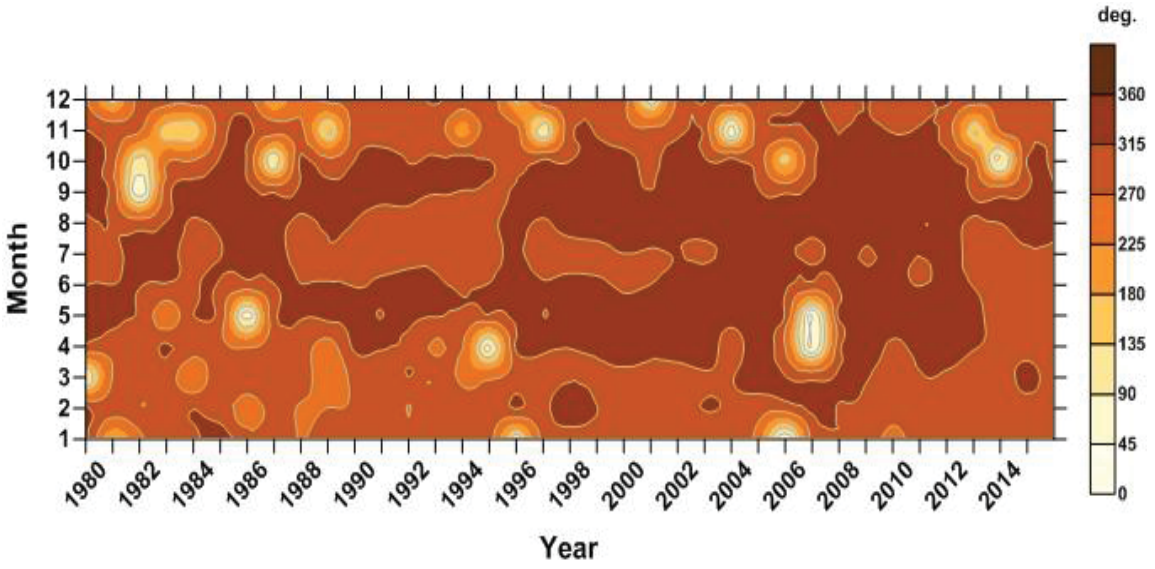


Figure (4): Monthly variations of wind speed forNasiriyahduring the period 1980-2016.



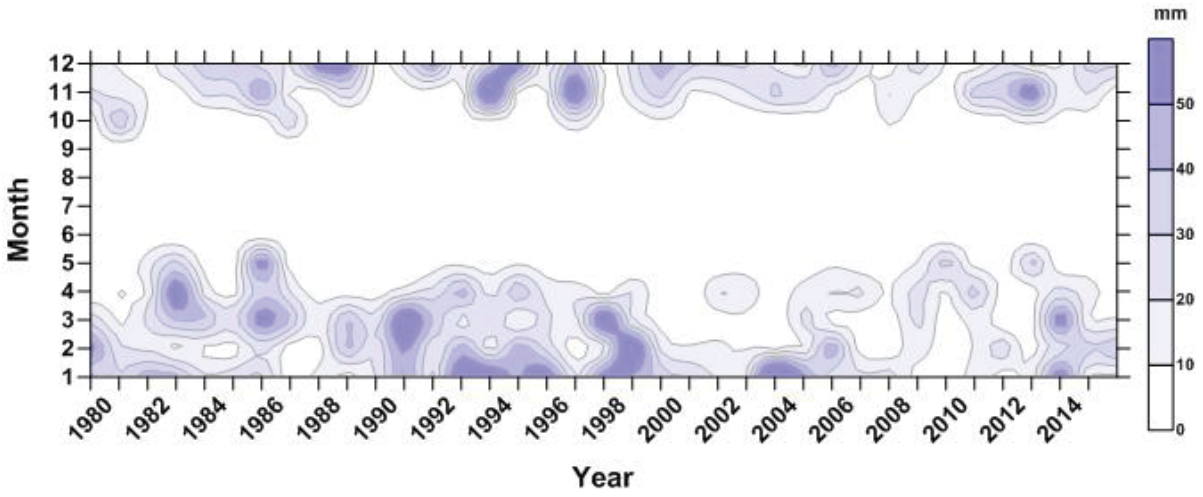


Figure (6): Monthly variations of rainfallforNasiriyahduring the period 1980-2016.

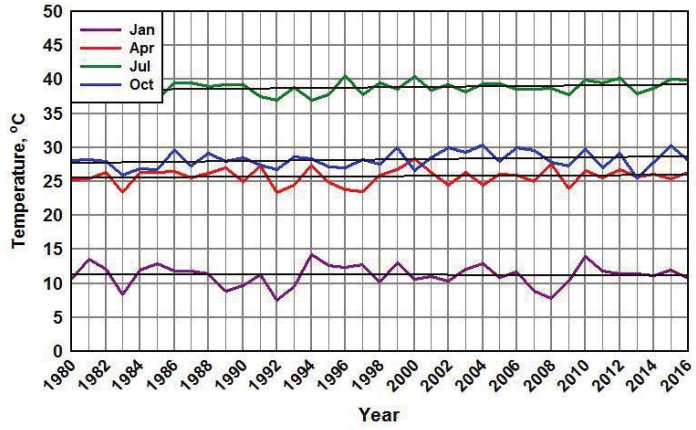


Figure (7): Time series of monthly means of air temperature for Nasiriyahduring the period 1980-2016.

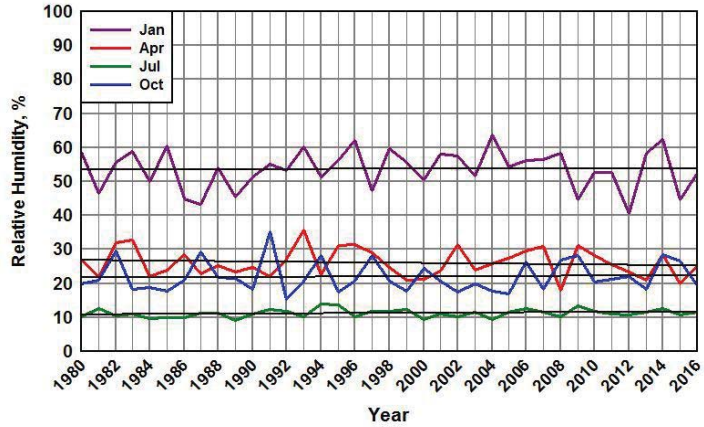


Figure (8): Time series of monthly means of relative humidity for Nasiriyahduring the period 1980-2016.

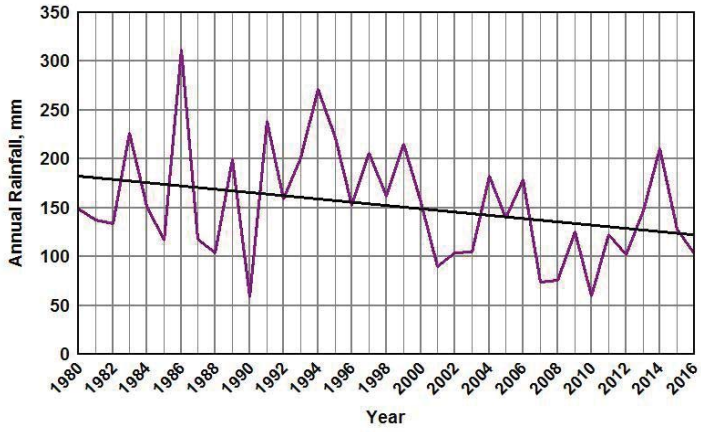


Figure (9): Time series of annual rainfall for Nasiriyahduring the period 1980-2016.

Conclusions

In this work MERRA-2 monthly means of various weather elements during the period 1980-2016 for Nasiriyah city were analyzed. Results indicates that the city is characterized by mild winter and very hot summer.Wind is mostly westerly to north westerly as a result of the Shamal wind and can reach 7 m/s during summer and beingcalm during winter. Regression analysis have shown an increasing in temperature during July and slight decrease in January and notable decreasing in annual rainfall.

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