

THE IMPACT OF CLIMATE EXTREMISM ON PROTECTED AGRICULTURE

¹Muna Abdel Zahra Abdullah Al-Mufarji

University of Karbala - College of Education for Human Sciences - Department of Applied
Geography

mona.a@s.uokerbala.edu.iq

²Prof. Dr. Hussein Fadhel Abd Al-Shibli

University of Karbala - College of Education for Human Sciences - Department of Applied
Geography

hussienf.abd@uokerbala.edu.iq

Abstract

The topic of (climate extremism on protected agriculture) is one of the most important climate studies, this topic was chosen as a complement to the studies that dealt with an aspect of this topic, which aims to affect temperatures in the winter and in the summer have an impact on protected agriculture, by showing the relationship between the climatic elements and the rise and fall in temperatures during the months of January and July, as well as humidity, wind and evaporation, and the two stations have Ain al-Tamr station and Karbala station.

The method of (quantitative approach) was used in the processing and analysis of data by using a number of statistical methods to detect extremism that is exposed to the elements and phenomena of climate in the province through the program (SPSS), as well as calculating the fluctuation ratios of the climate elements that most affect agricultural crops and their productivity.

key words: Climate Extremism, Protected Agriculture.

Introduction:

The subject of climate extremism is one of the topics that have an impact on protected agriculture, as it causes many diseases and reduces the productivity of cultivated crops, climate affects productivity and climate extremism leads to the negative and positive effects of climate extremism, its clear features appear in the province of Karbala through the extremism it is exposed to in the elements and phenomena of the climate during the climatic cycle (2013-2022 AD) the study confirms the existence of the relationship between extremism and productivity, which gives a new meaning to the study, climate with all its elements is one of the main factors that have an important impact on agriculture.

First: Research Problem:

- 1- Does the extreme elements and phenomena of climate affect protected agriculture in Karbala province?
- 2- What are the forms of extremism in the elements and phenomena of climate in Karbala province and their spatial and temporal distribution?
- 3- What is the role and impact of extremism in these elements and phenomena on protected agriculture in quantity and production?

Second: Research Hypotheses:

- 1- (Extremism in the elements and phenomena of climate affects the dates of planting crops grown in greenhouses in Karbala province).

- 2- (A number of crops grown in Karbala province are exposed to death and infection with a number of diseases, including tomatoes and cucumbers as a result of extremism in the elements of climate during its growth stages).
- 3- (The cultivated areas and their crop productivity vary in Karbala province as a result of the extremism in the elements of climate and its phenomena).

Third: Research Objectives and Importance:

The research aims to determine the extent of the impact of extremism in the elements and phenomena of climate in Karbala province on the reality of agricultural production of crops grown in greenhouses in terms of cultivated areas and production quantities, and to know the relationship between what happens from extremism in the elements of production and fluctuating production quantities from another year during the study period, the cultivated crops are exposed to damage as a result of climatic extremism in the governorate, and the impact of this extremism on agricultural crops and their productivity is determined in view of the economic importance of these crops.

Fourth: Research Importance:

The importance of the research comes because the province of Karbala suffers from climatic extremism and extremism has an impact on the crops grown in greenhouses.

Fifth: Research Methodology:

The study relied on the analytical method, the quantitative method, and the statistical analysis that is adopted in the statement of the days of climate extremism.

Sixth: Research Limits:

A. Spatial limits:

The spatial limits are represented by the administrative boundaries of Karbala province, which are located between latitudes (10.32)° and (51.32)° north and longitudes (12, 43° and 44, 19)° east, the area of the province is (8168) km², the province consists of seven administrative units and three districts (the district of the center of Karbala province, and occupies the largest part in terms of area, followed by the district of Hindia and then the district of Ain al-Tamr) it contains four of the aspects (Husseiniya, Al-Hurr, Western Table, Khairat) see map (1).

B. Temporal limits:

The temporal limits of the study were represented by collecting climate data from the General Authority for Meteorology and Seismic Monitoring, and data was collected for the two stations, Karbala Station and Ain Al-Tamr Station, showing the days of climatic extremism in the governorate for the period (2013-2022) AD.

- **Ain Al-Tamr Station:**

- **January**

1- Temperature:

Table (1) and Figure (1) show that the highest average temperature for the period (2013), it reached about (9.1) °C in 2017, while the highest temperature value of about (18.4) °C was recorded in 2013, the lowest temperature value was recorded in 2019, which is about (5.1) °C, while the highest temperature range was recorded, as it was recorded at about (14.8) °C in 2013, while in the same year, the lowest temperature range was recorded during the period 2023-2022 of about (6.0) °C.

- July

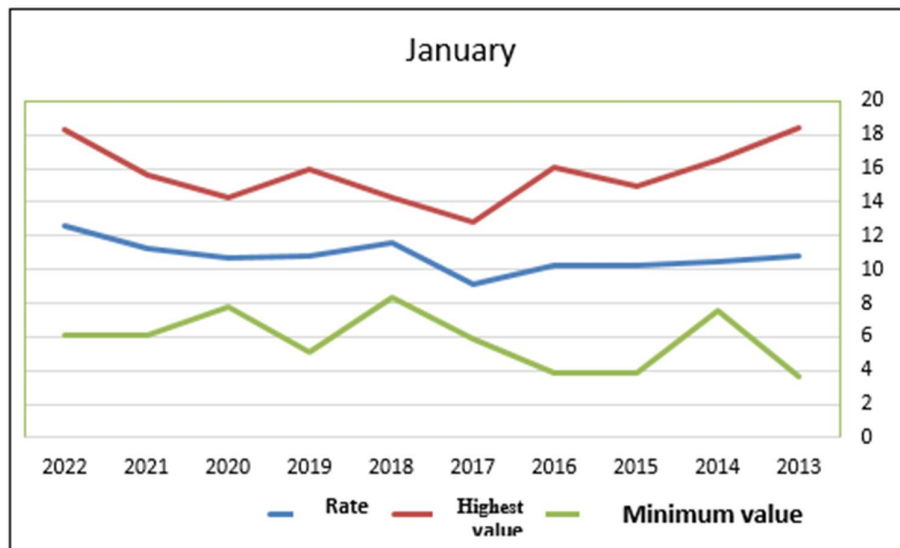
It is clear from Table (2) and Figure (2) that the highest average temperature in July and for the period 2013-2022, where the highest rate was recorded at (42.3) °C in 2022, while the lowest temperature value was recorded during the 2013-2022 period, as it reached about (33.0) °C in 2018, in the same year, the highest temperature value was recorded for the same period of about (38.2) °C, while in 2015 the highest temperature range was recorded at about (8.3) °C, in addition, the lowest temperature range in 2013 was about (4.5) °C.

Table (1) shows the temperature values (°C) for Ain Al-Tamr station for the months of January and July for the period (2013-2022)

Years	January				July			
	Rate	Highest value	Minimum value	Extent	Rate	Highest value	Minimum value	Extent
2013	10.8	18.4	3.6	14.8	35.7	38.2	33.7	4.5
2014	10.5	16.5	7.5	9	36.1	39.4	33.7	5.7
2015	10.3	14.9	3.8	11.1	37.6	40.9	32.6	8.3
2016	10.3	16.1	3.8	12.3	37.2	39.8	35.2	4.6
2017	9.1	12.8	5.9	6.9	38.6	40.7	36	4.7
2018	11.6	14.3	8.3	6	36.1	38.7	33	5.7
2019	10.8	16	5.1	10.9	36.1	38	33.6	4.4
2020	10.7	14.3	7.8	6.5	38.4	41.8	35	6.8
2021	11.3	15.6	6.1	9.5	42.6	45.7	39.1	6.6
2022	12.6	18.3	6.1	12.2	41.1	44.3	38.6	5.7

Source: Ministry of Transport, General Authority for Meteorology Iraq, Climate Section, unpublished data (2013-2022).

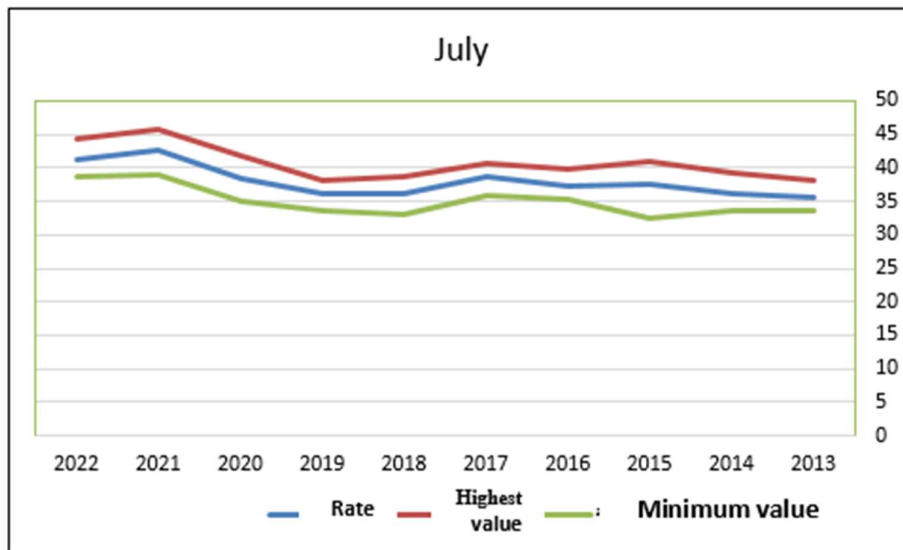
Figure (1) Temperature values (°C) for Ain al-Tamr station for the months of January for the period (2013-2022)



Source: From the work of the researcher based on Table (1)

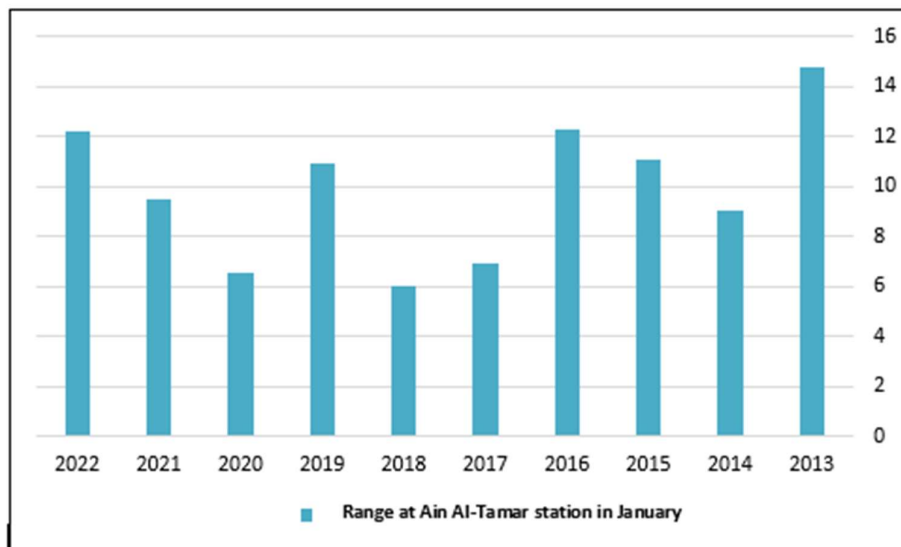
Figure (2) Temperature values (°C) for Ain al-Tamr station for the months of July for the

period (2013-2022)



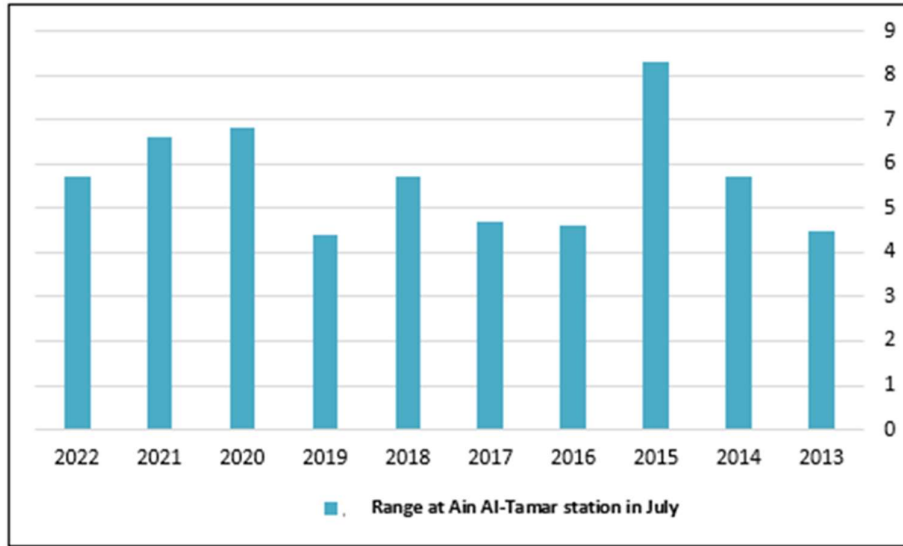
Source is from the work of the researcher based on Table (2)

Figure (3) shows the values of the temperature range (°C) for Ain al-Tamr station for the month of January for the period (2013-2022)



Source: From the work of the researcher based on Table (2)

Figure (4) shows the temperature values (°C) for Ain al-Tamr station for the month of July for the period (2013-2022) °C



Source: From the work of the researcher based on Table (2)

2- Humidity

- January

Table (2) and Figure (5) show that the highest humidity rate for the period 2013-2022 was recorded in 2014 at about (78.7) °C, while the lowest average humidity was recorded in 2022 during the period 2013-2022, if it reached about (52.1) ° C, while the two highest humidity values were recorded in the same period of about (95.0) °C in the year 2013-2020, while the lowest humidity value was recorded during the period 2013-2022, as it was recorded at about (28) ° C in the year 2022, while in the same year, the highest temperature range was recorded during the period 2023-2022 in the year 2022, as it reached about (54.0) ° C, as well as the lowest thermal range, reaching about (33.0) ° C in the year 2021.

- July

Table (2) and Figure (6) show that the highest humidity rate for the period 2013-2022 was recorded, where the highest humidity rate of about (27.5) °C was recorded in 2014, while the lowest humidity was recorded during the 2013-2022 period, reaching about (18.0) °C in 2021, in the same year, the highest humidity value for the same period was recorded at about (36.0) °C in 2014, while the lowest humidity value was recorded in 2022 at about (14.0) °C, also, the highest temperature range was recorded in 2021, which amounted to about (19.0) °C, while the lowest temperature range was recorded in 2013, where it is about (9.0) °C.

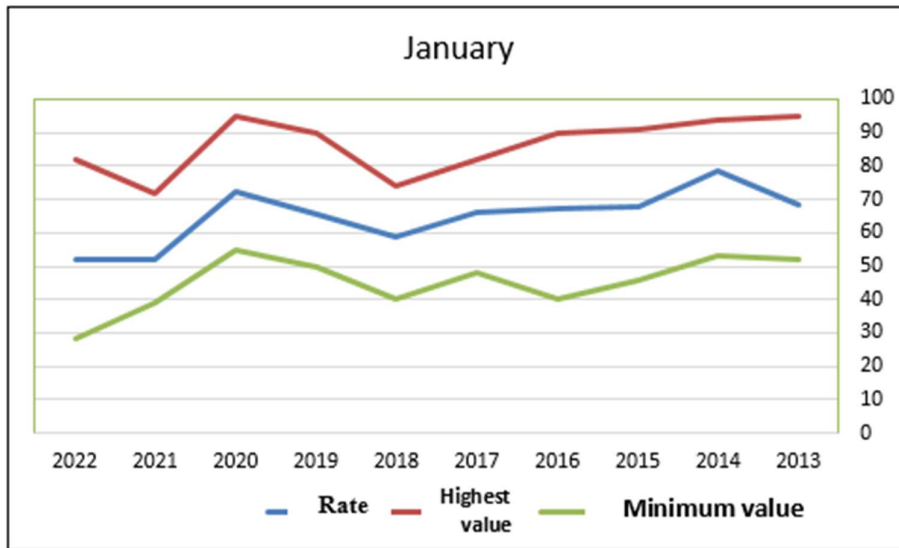
Table (2) Humidity values (°C) for Ain Al-Tamr station for January and July for the period (2013-2022)

Years	January			July				
	Rate	Highest value	Minimum value	Rate	Highest value	Minimum value	Rate	Highest value
2013	68.6	95	52	43	20.3	25	16	9
2014	78.7	94	53	41	27.5	36	19	17
2015	67.9	91	46	45	25	32	20	12
2016	67.5	90	40	50	21.5	26	17	9

2017	66.1	82	48	34	21.1	30	15	15
2018	58.5	74	40	34	22.7	31	18	13
2019	65.5	90	50	40	22.3	28	17	11
2020	72.5	95	55	40	21.2	29	16	13
2021	52.2	72	39	33	18	29	10	19
2022	52.1	82	28	54	19.5	26	14	12

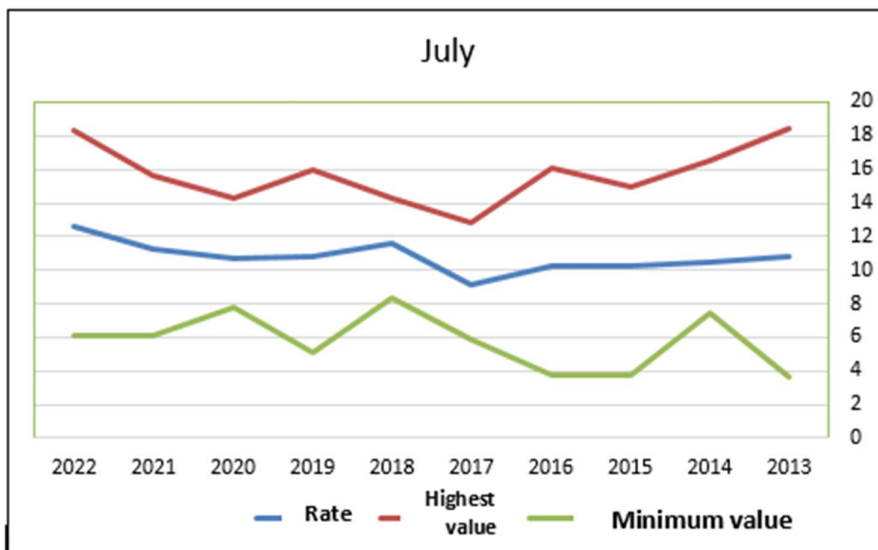
Source: Ministry of Transport, General Authority for Meteorology Iraq, Climate Section, unpublished data (2013-2022).

Figure (6) shows the humidity values (°C) for Ain Al-Tamr station for the month of January for the period (2013-2022) ° C



Source: From the work of the researcher based on Table (2)

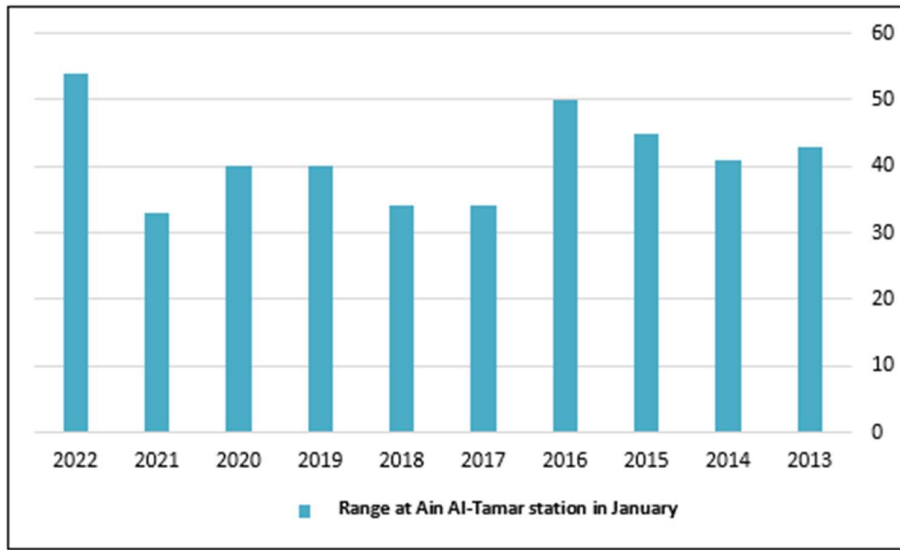
Figure (7) shows the humidity values (°C) for the Ain al-Tamr area for the month of July for the period (2013-2022)



Source: From the work of the researcher based on Table (40)

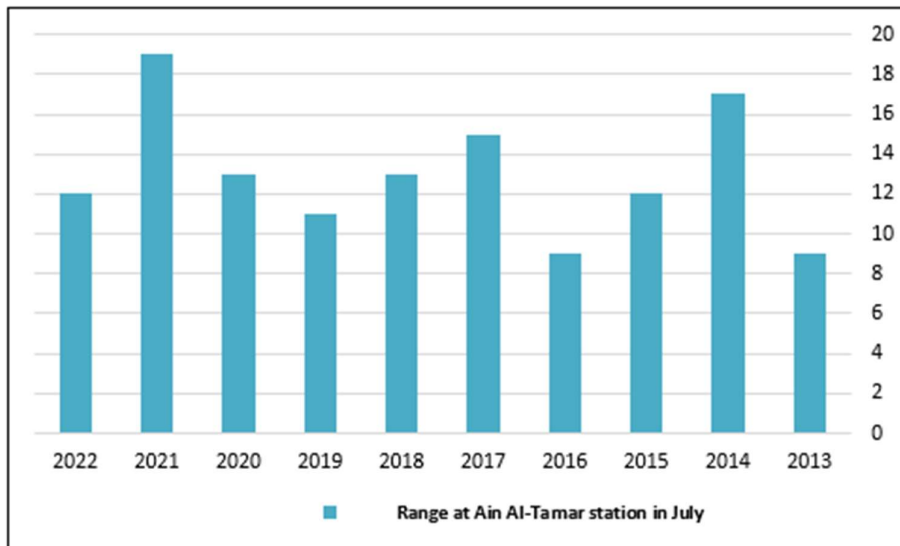
Figure (8) shows the range values of humidity (°C) for Ain Al-Tamr station for the month

of January for the period (2013-2022)



Source: From the work of the researcher based on Table (2)

Figure (9) shows the range values of humidity (°C) for Ain Al-Tamr station for the month of July for the period (2013-2022)



Source: From the work of the researcher based on Table (2)

3- Evaporation

- January

Table (3) and Figure (10) show that the highest evaporation rate for the 2013-2022 period was recorded in 2018 (3.7) °C, while the lowest rate was (2.2) °C during 2014, while the highest value of evaporation was recorded in 2017, as it reached about (8.7) °C, while the lowest value of evaporation was recorded in 2014, where it amounted to about (0.2), and the highest thermal range was recorded in 2017, where it reached about (8.0) °C, while the lowest temperature range for the year 2021 was recorded, reaching about (3.8) °C.

- July:

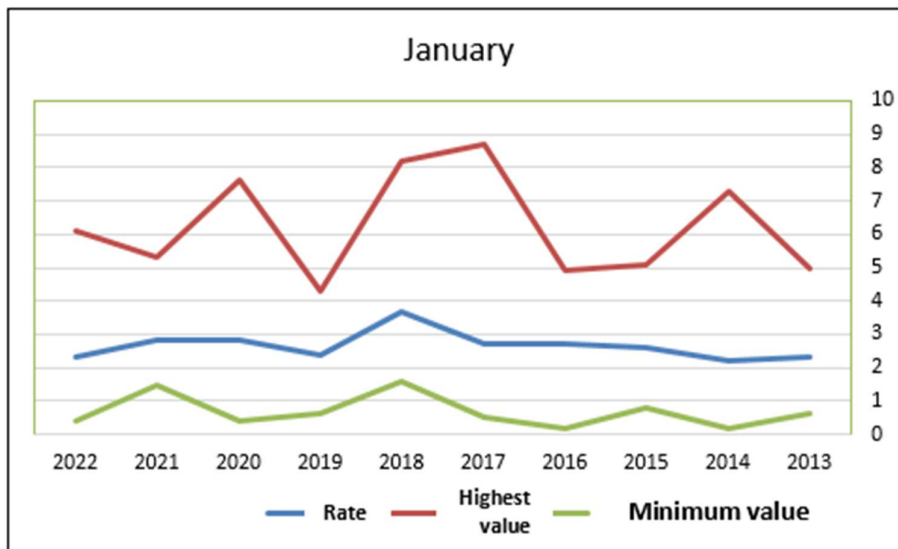
Table (3) and Figure (11) show that the highest evaporation rate for the 2013-2022 period was recorded in 2018 (3.7) °C, while the lowest rate was (2.2) °C during 2014, while the highest value of evaporation was recorded in 2017, reaching about (8.7) °C, while the lowest value of evaporation was recorded in 2014, where it amounted to about (0.2), it also recorded the highest temperature range in 2017, reaching about (8.0) °C, while it recorded the lowest temperature range for the year 2021, reaching about (3.8) °C.

Table (3) Evaporation values for Ain Al-Tamr plant for January and July for the period (2013-2022)

Years	January				July			
	Rate	Highest value	Minimum value	Rate	Highest value	Minimum value	Rate	Highest value
2013	2.3	5	0.6	4.4	14.8	20.5	9.3	11.2
2014	2.2	7.3	0.2	7.1	15.1	26.9	7.9	19
2015	2.6	5.1	0.8	4.3	17.1	22.9	10	12.9
2016	2.7	4.9	0.2	4.7	15.6	21.1	11.8	9.3
2017	2.7	8.7	0.5	8.2	15.5	20.7	9.5	11.2
2018	3.7	8.2	1.6	6.6	17	26.9	11.7	15.2
2019	2.4	4.3	0.6	3.7	14.6	19	10	9
2020	2.8	7.6	0.4	7.2	14.5	22.5	11.1	11.4
2021	2.8	5.3	1.5	3.8	14.8	20	10.7	9.3
2022	2.3	6.1	0.4	5.7	14.7	19.9	2.6	17.3

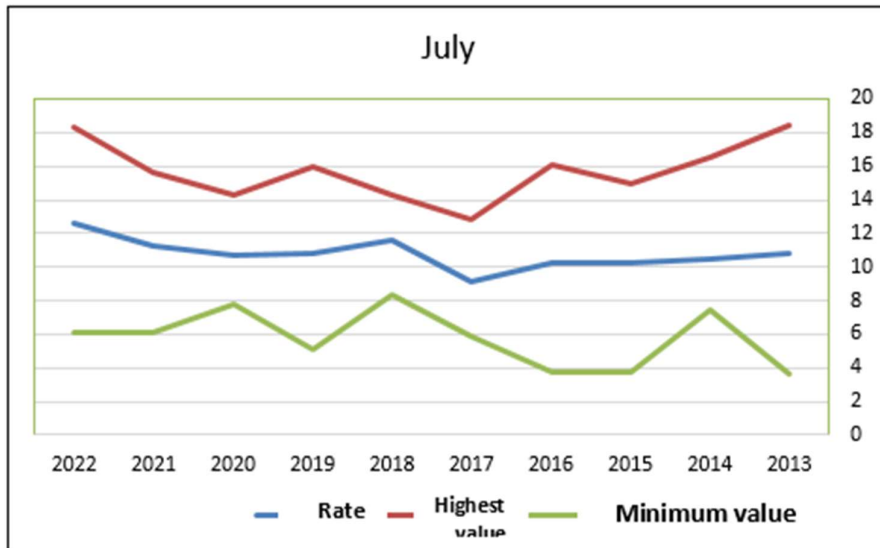
Source: Ministry of Transport, General Authority for Meteorology Iraq, Climate Section, unpublished data (2013-2022)

Figure (10) Evaporation values for Ain Al-Tamr plant for January for the period (2013-2022)



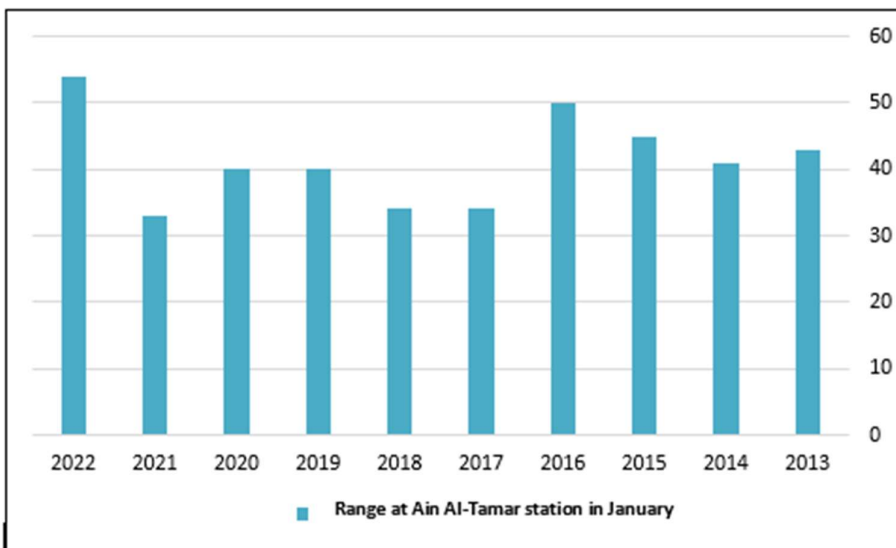
Source: From the work of the researcher based on Table (3)

Figure (11) Evaporation values for Ain al-Tamr plant for the month of July for the period (2013-2022)



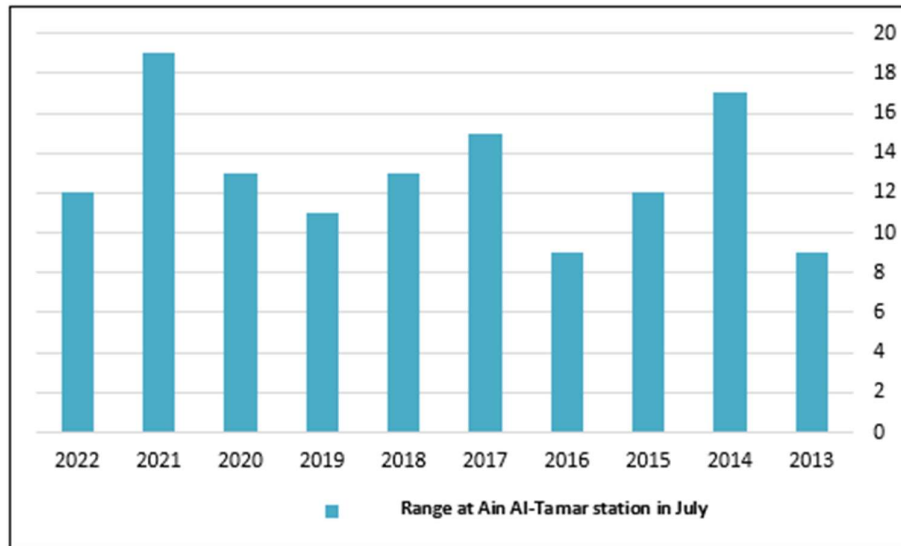
Source: From the work of the researcher based on Table (3)

Figure (12) shows the range values of humidity (°C) for Ain al-Tamr station for the month of January for the period (2013-2022)



The source is from the work of the researcher based on Table (4)

Figure (13) shows the range values of humidity (°C) for Ain Al-Tamr station for the month of July for the period (2013-2022)



The source is from the work of the researcher based on Table (3).

4- Wind speed

- January

Table (4) and Figure (14) show that the highest average wind speed for the period (2013-2022), recorded in 2022, was about (3.6) °C, while the lowest average wind speed during the same period in 2014 was recorded at about (2.2) °C, while the highest value of wind speed was recorded in 2019, as it amounted to about (15.0) °C, as well as the lowest value of wind speed in 2014, which amounted to about (0.3) °C, while the highest peak of the thermal range of wind speed was recorded during the same year 2022, reaching about (13.9) °C, while the year 2021 recorded the lowest thermal range for wind speed, which is about (4.1) °C.

- July

Table (4) and Figure (15) showed that the highest average wind speed for the period (2013-2022) was recorded in the year 2022 (4.6) °C, while the lowest rate was (3.7) °C during 2016, while the highest value of wind speed was recorded in 2022, as it reached about (9.9) °C, while the lowest value of wind speed was recorded in 2018, where it reached about (0.0) °C, also, the highest temperature range of wind speed was recorded in 2022, reaching about (9.3) °C, while the lowest temperature range of wind speed was recorded for the year 2013, which reached about (5.2) °C.

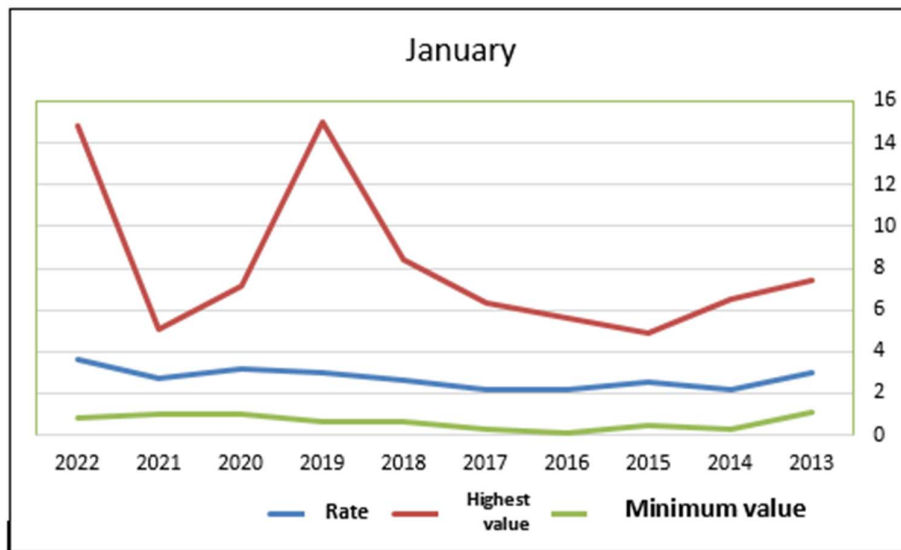
Table (4) shows the wind speed values for Ain Al-Tamr station for the months of January and July for the period (2013-2022)

Years	January				July			
	Rate	Highest value	Minimum value	Rate	Highest value	Minimum value	Rate	Highest value
2013	3	7.4	1.1	6.3	4.5	7.3	2.1	5.2
2014	2.2	6.5	0.3	6.2	4.1	9.6	1.9	7.7
2015	2.5	4.9	0.5	4.4	4	6.6	1.3	5.3
2016	2.2	5.6	0.1	5.5	3.7	7.1	0.8	6.3

2017	2.2	6.3	0.3	6	3.8	6.9	1.4	5.5
2018	2.6	8.4	0.6	7.8	4.3	8.5	0	8.5
2019	3	15	0.6	14.4	3.8	5.8	1.6	4.2
2020	3.2	7.1	1	6.1	3.7	6.5	1.4	5.1
2021	2.7	5.1	1	4.1	4.5	9.1	1.3	7.8
2022	3.6	14.8	0.8	13.9	4.6	9.9	0.6	9.3

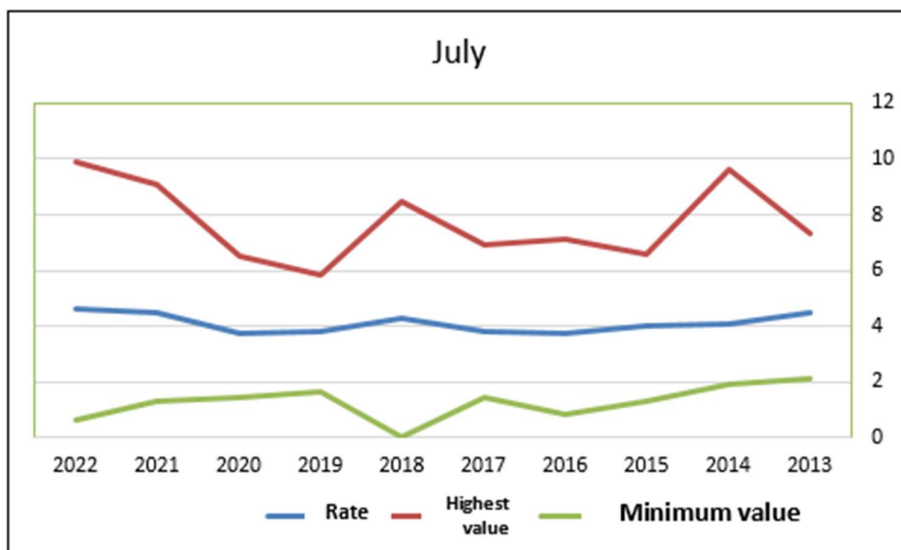
Source: Ministry of Transport, General Authority for Meteorology Iraq, Climate Section, unpublished data (2013-2022)

Figure (13) Wind speed values for Ain Al-Tamr station for the month of January for the period (2013-2022)



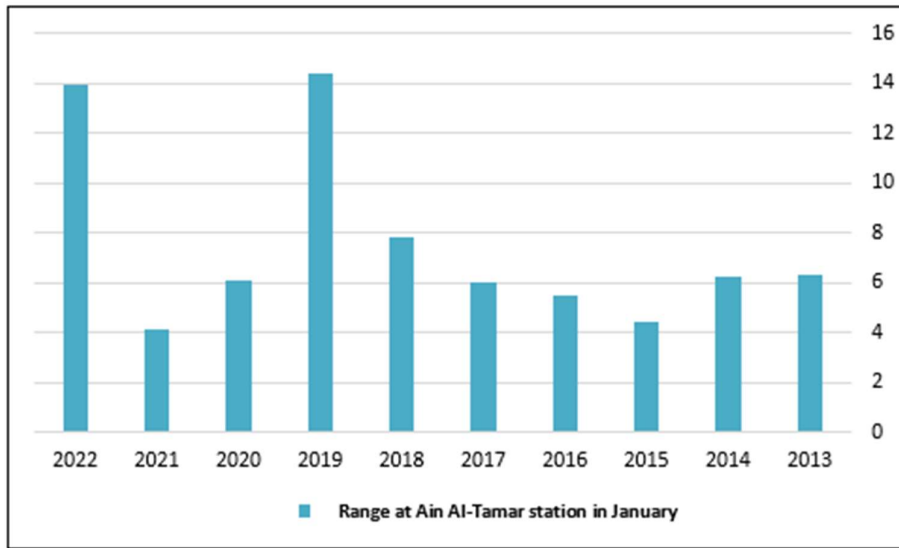
Source: From the work of the researcher based on Table (4)

Figure (14) Wind speed values for Ain Al-Tamr station for the month of July for the period (2013-2022)



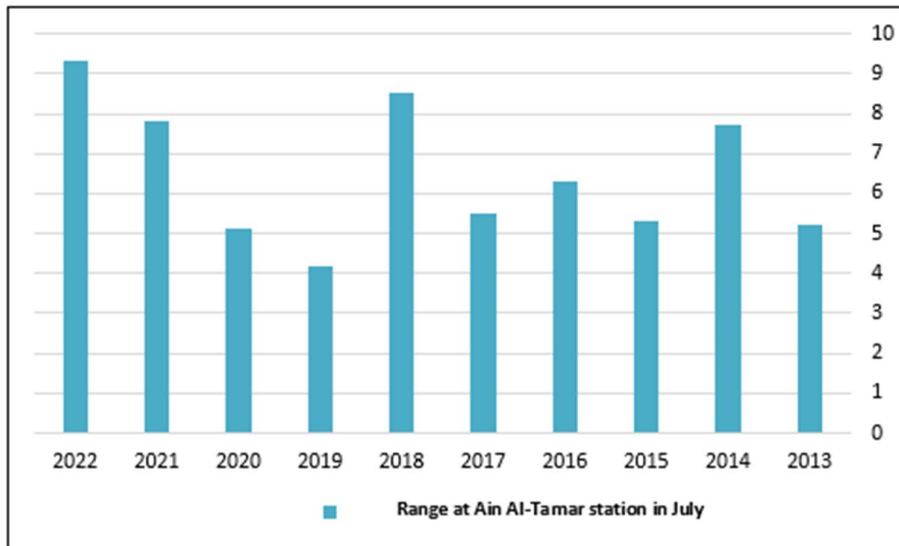
Source: From the work of the researcher based on Table (4)

Figure (15) Wind speed range for Ain Al-Tam Canon station for the month of January for the period (2013-2022)



Source: From the work of the researcher based on Table (4)

Figure (16) Wind speed range for Ain Al-Tamar station for the month of July for the period (2013-2022)



Source: From the work of the researcher based on Table (4)

Third: Karbala Station:

- January

Table (5) and Figure (17) show that the highest average temperature for the period (2013-2022), which was recorded in 2021, amounted to about (12.7) °C, while the lowest average temperature during the same period in 2017 was recorded at about (10.1) ° C, while the highest temperature value was recorded in 2013, as it amounted to about (17.9) ° C, as well as the lowest temperature value was recorded in 2013, where it reached about (5.2) ° C, while the highest peak temperature range was recorded during the same year 2013, reaching about (12.7) ° C, while the

year 2020 recorded the lowest temperature range, which is about (5.7) °C.

- **July**

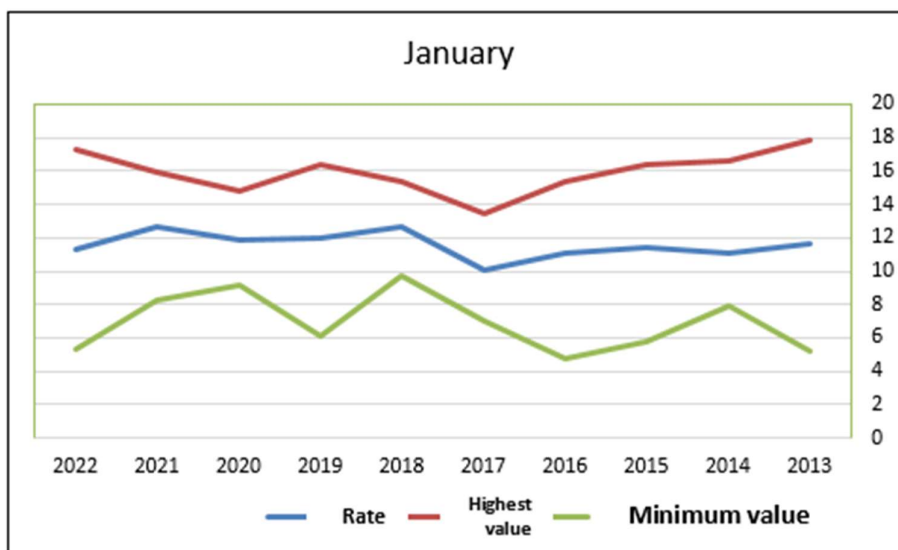
The highest average temperature for the period (2013-2022), where it was recorded in the year 2021, as it reached about (40.7) °C, while the highest temperature value was recorded in 2021, as it reached about (43.8) °C, where the lowest temperature value was recorded in 2014 of about (34.2) °C, while the year 2014 recorded the highest temperature range of about (7.7) °C, as well as the lowest temperature range in 2013 was recorded at about (4.1) °C.

Table (5) shows the temperature values (°C) for Ain Al-Tamr station for the months of January and July for the period (2013-2022)

Years	January				July			
	Rate	Highest value	Minimum value	Rate	Highest value	Minimum value	Rate	Highest value
2013	11.6	17.9	5.2	12.7	36.6	38.8	34.7	4.1
2014	11.1	16.6	7.9	8.7	37.2	40	34.6	5.4
2015	11.4	16.4	5.8	10.6	38.9	41.9	34.2	7.7
2016	11.1	15.4	4.7	10.7	38.5	42	36.6	5.4
2017	10.1	13.4	7	6.4	40.3	42.1	38	4.1
2018	12.7	15.4	9.7	5.7	37.7	40.7	35.6	5.1
2019	12	16.4	6.1	10.3	35.3	39.5	35.3	4.2
2020	11.9	14.8	9.1	5.7	40.7	43.8	38.1	5.7
2021	12.7	15.9	8.2	7.7	40	43.2	36.7	6.5
2022	11.3	17.3	5.3	12	38.3	41.7	36.4	5.3

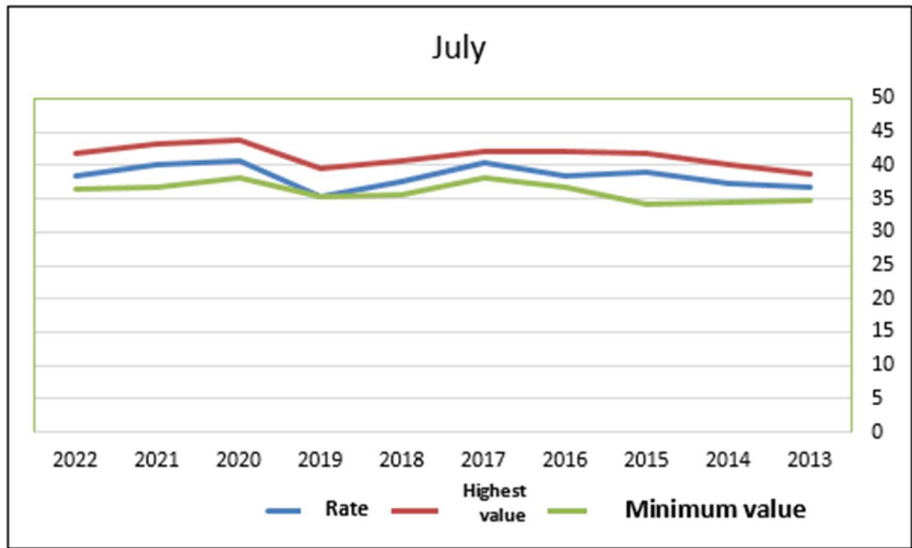
Source: Ministry of Transport, General Authority for Meteorology Iraq, Climate Section, unpublished data (2013-2022)

Figure (17) Temperature values (°C) for Karbala station for the month of January for the period (2013-2022)



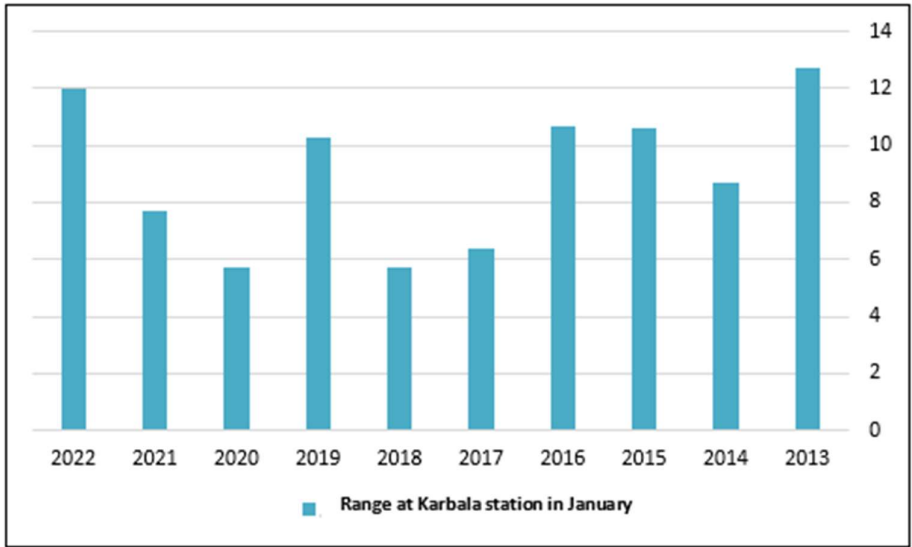
Source: From the work of the researcher based on Table (5)

Figure (18) Temperature values (°C) for Karbala station for the month of July for the period (2013-2022)



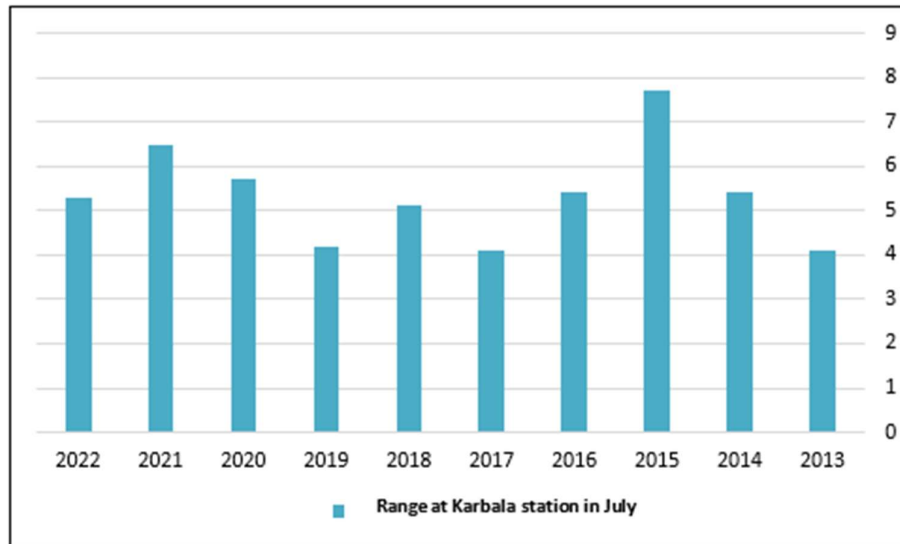
The source is from the work of the researcher based on Table (5)

Figure (19) Temperature range values for Karbala station for the month of January for the period (2013-2022)



Source: from the work of the researcher based on Table (5)

Figure (20) Temperature range values (°C) for Ain Al-Tamr station for the month of July for the period (2013-2022)



Source: from the work of the researcher based on Table (5)

Conclusions:

- 1- The research explained that the elements and phenomena of climate are exposed to fluctuations during the study period, and recorded extremes in normal temperatures as in Karbala station and Ain Al-Tamr.
- 2- The study showed a relationship between the extreme elements and phenomena of climate and the fluctuation of the rate of yield of acres of crops grown in greenhouses.
- 3- The study showed that there is an extreme between temperatures during the seasons of the year in July of the summer and January in the winter, as there is a great extreme in these two months of the year.

Recommendations:

- 1- Through the study, it was found that any success in the cultivation of crops inside greenhouses, it requires taking into account the prevailing climatic characteristics.
- 2- The study showed the size of the losses caused by extremism in the elements of climate and its phenomena and the attempt of the competent authorities.
- 3- The study showed taking the necessary precautions during the summer in July and in the winter in January.

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