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Comprehensive Analysis Of The Variation In The Number Of Days Of Survival Of Surface Pressure Systems At The Level Of 1000 Millibars And Its Relationship To The Anomaly Of The East Atlantic-West Russia EAWR Index During The Two Climatic Cycles (1961-1950) (2008-2019) In The Mosul Station

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Abstract

The study aims to know the effect of the pressure anomaly generated in the North Atlantic Ocean at a latitude of (40) degrees north, which accompanies the East Atlantic-West Russia Index, and to identify its most important effects in increasing or decreasing the number of days of pressure systems' survival, whether they are in the state of extension or the secondary center affecting the climate. Nineveh Governorate, the city of Mosul, specifically, by analyzing the daily weather maps of the surface level of 1000 millibars for observation (00) and during two 22-year climatic cycles, the first climatic cycle (1961-1950) and the second climatic cycle (2008-2019) and identifying the types of pressure systems and the average number of days The monthly survival of each system , whether the atmospheric highlands such as the Siberian high, the European high, the semi-tropical high, as well as the air depressions of all kinds, the thermal and frontal depressions represented in the seasonal Indian depression, the Mediterranean depression, the Sudanese depression, the integrated depression, the depressions of the West Asian seas, and the Arabian Peninsula depression for the two climatic cycles (1961-1950) (2008-2019) in both cases, whether they remain an extension or a secondary center and the nature of the work of the mentioned systems during the negative and negative phases Positive for the East Atlantic West Russia EAWR index, and what is the statistical relationship between them.

Keywords: Eurasian index, positive index, pressure systems

INTRODUCTION

The Eest Atlantic West Rusia frequency (EAWR) is located in the North Atlantic Ocean. It is often known as the Eurasian Pattren Type2 (EU2) to distinguish it from the Scandinavian type, which is also known as the Eurasian Pattern (EU1), and both patterns are called European Union patterns, the second Eurasian pattern extends (EAWR) between east and west consists of three main centers, the western center near England or Denmark at (50-60)[1]

The EAWR pattern affects the control of the strength and direction of the westerly winds that reach the European coasts and the location of the storm paths across the North Atlantic extending from eastern North America (eastern Canada and the United States) through European lands, including the Mediterranean basin to the Caspian Sea system, reaching Siberia and eastern Asia, the climatic influence (air bridge) across eastern North America, North Africa, Europe and Asia, and as a result of the effectiveness of the wave exchange, anomalies occur in four main centers. The wave is negative (positive)

Over the middle of the North Atlantic Ocean and large parts of northwestern Russia and the Ural Mountains, extending to the Caspian Sea system [(2)] and reaching the territory of Iraq, especially the northern region of it, including the station of the city of Mosul.

First: the theoretical framework for the study

The theoretical framework of the study included the following

First: the study problem

It is a scientific question that needs an accurate scientific answer. Each research has a basic problem that is the main motive for investigation, research, realization, and then proving the facts Therefore, the study problem revolves around the following main question:
What is the effect of the East Atlantic-West Russia EAWR index with its positive (negative) phase succession on the number of days of survival of the centers and extensions of pressure systems in the Mosul station)

Secondary questions arise according to the main question

1-What is the relationship and effect of the Eurasian Index EAWR on the number of days of survival of the centers and extensions of cold and warm high-pressure systems in the Mosul station

2-What is the relationship and effect of the Eurasian Index (EAWR) on the number of days of survival of the centers and extensions of low-pressure systems (depressions of frontal and thermal types) in the Mosul station

A hypothesis is a conclusion reached by the researcher. It is answers placed to know the connection between causes and causes, and when its validity is proven, it is a general law that can be referenced in the interpretation of all relevant phenomena, which are as follows :
)East Atlantic-Western Russia EAWR index, with its positive (negative) phases, affects the number of days the centers and extensions of pressure systems remain in the Mosul station through the succession of descent and ascent of air waves, grooves and dents)
The secondary hypotheses are formulated as follows

1-The EAWR index is related to an influence relationship in the variation in the number of days of stay for the centers and extensions of cold and warm high pressure systems in the Mosul station according to the pattern of air emissions and the difference in the sources of the emergence of those high and cold and warm types.
2-The EAWR index affects the variation in the number of days of survival for the centers and extensions of low pressure systems (frontal and thermal depressions) in the Mosul station according to the source of its origin and the extent of its depth or shallowness.

Third: The objectives of the study

The study aims to determine the extent of atmospheric interconnection (air bridge) resulting from the pressure anomaly (Eurasian index) in a certain region of the world (Northern Atlantic Ocean) and the possibility of affecting distant regions extending for hundreds of kilometers, including the study area Iraq (Mosul station) and the fluctuation of the frequency of surface systems It and the difference in the number of days of survival centers and extensions.

Fourth: The boundaries of the study area

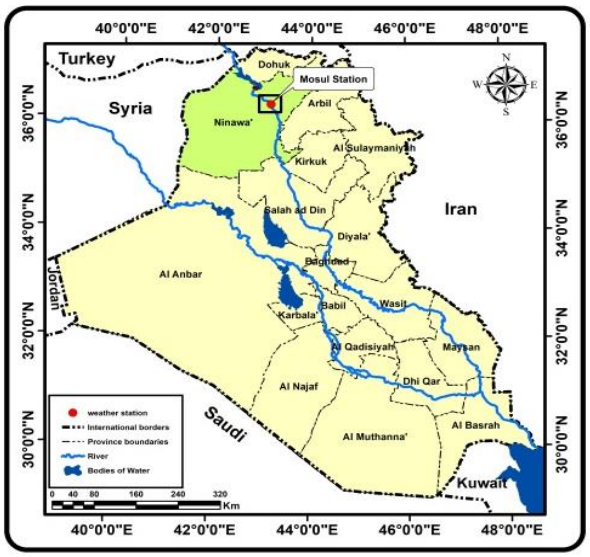
The city of Mosul is a part of Nineveh Governorate, which is located in the northwestern part of Iraq. This governorate is confined between longitudes (41.25 – 44.15) in the east, and between two latitudes (34.15 – 37.3) in the north. It is bordered by Dohuk governorate from the north and from the south, Salah al-Din Governorate, on the east by the governorates of Kirkuk and Erbil, and on the west of the Syrian Arab Republic. Map (1) Maintaining the breadth of its geographical area is a main gateway for the European Atlantic and Mediterranean influences to enter all regions of Iraq according to its topographical nature and its vast extension, as it is the third largest of Iraq's governorates after Anbar and Muthanna governorates with an estimated area About 37,323 km^2.

Second: Analysis of the monthly rates and the rate of change for the duration of survival of the centers and the extension of surface

pressure systems during the two climatic cycles (1950 - 1961) (2008 - 2019) in the Mosul station

It is clear from the analysis of the results of the data of the daily weather maps for the pressure level 1000 millibars [(3)] and for observations (00) to show the duration of survival and the rate of change of surface systems in the Mosul station Table (1) Table (2), that the longest average number of days of staying at the center of the Siberian Highlands during the first climatic cycle in The Mosul station in January increased by (9.4) days, with an average monthly change towards an increase (+1), and the lowest average survival rate in May was about (2.1) days with a positive change of (0.18), and the maximum survival rates were an extension of the Siberian Highlands during this cycle. In November and December, it reached (4.9) days, with a downward change of (-0.09) for the first and an upward trend for the second (0.09), due to the weakness of other competing systems for the strength of the Siberian High during these two months, and the lowest average survival extension in May (1.8)

map (1) Nineveh Governorate, Iraq



Source: Republic of Iraq, Ministry of Water Resources, Directorate of Public Survey, Administrative Map of Iraq and Mosul, Scale (1:1000000), Arc Map 10.4.1, 2021.

days with a positive change amounting to (0.04), which is the month of decline, decay and weakness of the Siberian high above the study area

The longest number of days in the center of the Siberian Highlands during the second climate cycle (2008-2019) was recorded in December (0.5) days with a positive change of (0.09), while the months of November and February recorded the lowest average for the survival of the secondary center at (0.3), and it was not recorded The months of October, March, April, and May mean staying focused, as the results of the analysis of weather maps for the pressure level (1000) millibars showed a clear decrease in the number of centers of surface systems in general, which indicates and gives clear indications of the variation of impulses (strength or weakness) of the upper grooves and dents. In accordance with the evidence of global climate change, the maximum survival period for an extension during this cycle of the Siberian High was in the month of December (21) days towards a change towards negative decreasing (-0.91), and the lowest survival rates were in the month of May (2.5) days, which represents The actual ends of the Siberian Rise and its northward shifting range.

The longest duration of survival for a secondary center of the European highlands was concentrated during the first climatic cycle in March (1.4) days, with an increase rate of (0.09), and the lowest average of days of survival was concentrated in May (0.1) days with a rate of change towards decreasing (-0.1). The maximum survival rate for an extension in February was (0.8) days, and the lowest survival rate for the European high during this cycle in November was (0.2) days, with a downward change of (-0.09)

The number of days of survival for secondary centers decreased during the second climatic cycle, as the results of the analysis of daily surface weather maps indicated that the longest period of stay for a center of the European altitude in The month of January was (0.1) days with a monthly change rate of (-0.09), and the highest survival rate was recorded in December (2.6) days with a positive change rate of (0.09), and the least survival rate was an extension of about (0.4) days with a rate of change towards decreasing Negative (-0.17) in May (which is the month of the end of cold systems and the beginning of the extension of the hot season systems.

The maximum average concentration of a secondary center of the semi-tropical high during the first climatic cycle in the month of April was (0.7) days, at a rate of decreasing that amounted to (-0.08), while the lowest average survival of a center appeared in the month of November (0.1) days (the application of the rate of change equation did not show Any known value for the direction of its change), and it became clear that the longest average duration of the extension was in the month of May (1.2) days in a downward change direction that amounted to (-0.09), and the shortest duration of the extension was in the month of December (0.2) days. The second significantly, as the longest average survival rate for the month of October was (0.8) days with an average positive change of (0.09) and the lowest duration of survival in May was (0.4) days with a negative change (-0.09), while the maximum duration of extensions during this cycle The month of March had about (0.7) days, and the lowest appeared in the month of May (0.1) days.

The longest average lifespan of the Mediterranean depression is during the spring months, especially the months of March and April, as the weakness and irregularity of other systems in these two months leads to their survival for a longer period despite the lack of recurrences in them, as they are not subject to cutting by other systems competing with their season, which indicates the it is deep**(4)**

The Mediterranean depression in the Mosul station and for the second climatic cycle recorded the longest centered survival rate in the month of December (0.7) days, with a trend of change that tends to increase, reaching (0.18), and the lowest centered survival rate during the cycle was in the month of October (0.1) days. The extensions' survival clearly increased During the current cycle at the expense of centers survival, the longest average extension survival during the cycle (2008-2019) of the Mediterranean depression in February was (0.9) days with a downward change rate of (-0.2) and the lowest average extension in May was (0.2) days And the reason for the decline of the Mediterranean centers during this cycle is due to the character of its entry into Iraq, which is characterized by weakness, after losing all the relative humidity and rain it carries in the Levant, so it will quickly vanish, in addition to the change in the areas it passes through, the decline of its natural vegetation cover and the expansion of desertified lands as a result of the change The climate, which led to the rapid demise and decay of the Mediterranean depression and the decline of its**(5)**.
survival centers in most study stations, as well as what is related to the deviation of the directions of the paths of air depressions towards north and northeastern Europe away from the Mediterranean region, which reduces the chances of the formation of warm masses and do not carry it from moisture to the areas it reaches.

It is noted that the maximum survival rates of the integrated depression during the second climatic cycle were the survival of secondary centers in February by (1.2) days with a negative change rate of (-0.09), and the lowest average survival of the center in the month of October was by (0.2) days towards a decreasing change of (- 0.09), and the highest average of the extensions' survival during the cycle was in January (14.9) days with a negative change of (-0.27), and the lowest average of extensions appeared in the month of April (4.1) days towards a change towards increasing amounting to (0.73), and it indicated The results of the analysis of weather maps of the surface pressure level in the Mosul station showed that the longest average survival of a secondary center of the Sudanese depression during the first climatic cycle in January and March was (2.9, 2.5) days, with a direction of change of (0.09, -0.09)

Table (1) Monthly averages of the number of days of survival of surface pressure systems / day during the two climatic cycles (1961-1950) (2008-2019) in Mosul Station

August		July		June		May		April		March		february		january		december		november		october		september		type of stay	pressure system
second cycle	first cycle	second cycle	first cycle	second cycle	first cycle	second cycle	first cycle	second cycle	first cycle	second cycle	first cycle	second cycle	first cycle	second cycle	first cycle	second cycle	first cycle	second cycle	first cycle	second cycle	first cycle	second cycle	first cycle		
0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	0.0	4.3	0.0	6.1	0.3	7.5	0.4	9.4	0.5	7.8	0.3	6.5	0.0	3.8	0.0	0.0	center	Siberian High
0.0	0.0	0.0	0.0	0.0	0.0	2.5	1.8	8.0	2.4	11.7	3.4	17.4	4.3	20.4	4.1	21.0	4.9	16.9	4.9	8.0	2.9	0.1	0.0	extension	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.5	0.0	1.4	0.0	1.3	0.1	1.2	0.0	0.9	0.0	1.0	0.0	0.3	0.0	0.0	center	european high
0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.5	0.6	0.4	1.6	0.5	1.4	0.8	1.5	0.7	2.6	0.5	1.2	0.2	0.8	0.7	0.0	0.0	extension	
0.0	0.0	0.0	0.0	0.5	0.0	0.4	0.5	0.5	0.7	0.5	0.2	0.5	0.3	0.5	0.2	0.5	0.5	0.6	0.1	0.8	0.5	0.7	0.0	center	subtropical high
0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.2	0.3	0.6	0.7	0.6	0.5	0.3	0.4	0.4	0.4	0.2	0.5	0.9	0.1	0.9	0.0	0.5	extension	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	0.2	4.4	0.3	5.2	0.3	4.0	0.6	5.1	0.7	4.5	0.2	4.0	0.1	3.5	0.0	0.0	center	Mediterranean low
0.0	0.0	0.0	0.0	0.0	0.0	0.2	2.1	0.5	2.2	0.5	2.8	0.9	2.4	0.7	2.2	0.6	2.6	0.6	2.7	0.5	2.4	0.0	0.0	extension	
0.0	0.0	0.0	0.0	0.0	0.0	0.3	3.1	0.9	3.6	1.1	4.0	1.2	3.3	1.0	4.5	0.5	3.8	0.0	3.6	0.2	3.9	0.0	0.0	center	combined low
0.0	0.0	0.0	0.0	0.0	0.0	5.4	2.3	4.1	2.1	12.2	2.5	12.5	1.7	14.9	3.1	2.7	2.1	5.6	2.2	11.3	2.4	0.0	0.0	extension	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.2	1.5	0.2	2.5	0.0	1.7	0.1	2.9	0.2	1.9	0.1	2.1	0.0	2.0	0.0	0.0	center	Sudanese low
0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.7	1.7	0.7	2.5	1.8	3.2	1.1	2.9	1.5	1.4	1.4	0.6	1.3	2.4	1.4	0.0	0.0	extension	
12.2	18.4	11.7	18.5	8.4	15.6	1.3	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	4.9	17.5	center	seasonal indian low
18.8	12.6	19.3	12.5	21.1	14.4	10.7	4.5	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	5.2	2.5	24.1	12.1	extension	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	center	low island
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	extension	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.4	0.1	0.1	0.0	0.2	0.0	0.4	0.0	0.4	0.0	0.0	center	low seas west asia
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.5	0.2	0.1	0.4	0.5	0.2	0.4	0.5	0.1	0.3	0.2	0.0	0.0	extension	

Source: the researcher based on:

-National Oceanic and Atmospheric Administration, analysis of daily weather maps for the level of 1000 millibars /https://psl.noaa.gov/data/composites/day

Table (2) Average monthly change of the number of days of survival for the center and extension of pressure systems during the two climatic cycles (1961-1950) (2008-2019) in Mosul Station

August		July		June		May		April		March		february		january		december		november		october		september		type of stay	pressure system
second cycle	first cycle	second cycle	first cycle	second cycle	first cycle	second cycle	first cycle	second cycle	first cycle	second cycle	first cycle	second cycle	first cycle	second cycle	first cycle	second cycle	first cycle	second cycle	first cycle	second cycle	first cycle	second cycle	first cycle		
rate of change	rate of change	rate of change	rate of change	rate of change	rate of change	rate of change	rate of change	rate of change	rate of change	rate of change	rate of change	rate of change	rate of change	rate of change	rate of change	rate of change	rate of change	rate of change	rate of change	rate of change	rate of change	rate of change	rate of change		
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.18	0.0	0.55	0.0	0.72	0.0	0.54	0.0	1.0	0.09	0.73	0.0	0.45	0.0	0.36	0.0	0.0	center	Siberian High
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.04	0.0	-0.09	0.0	-0.18	0.73	-0.18	-0.90	0.0	-0.91	0.09	-0.18	-0.09	-0.36	0.27	0.0	0.0	extension	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	-0.09	0.0	0.09	0.0	-0.18	-0.09	-0.18	0.0	0.0	0.0	-0.18	0.0	-0.09	0.0	0.0	center	european high
0.0	0.0	0.0	0.0	0.0	0.0	-0.17	-0.09	0.18	0.09	-0.36	0.0	-0.07	0.0	0.0	-0.18	0.09	0.0	0.0	-0.09	-0.08	-0.18	0.0	0.0	extension	
0.0	0.0	0.0	0.0	0.27	0.0	-0.1	-0.09	0.0	-0.08	0.09	0.0	0.1	0.0	-0.09	0.0	0.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0	center	subtropical high
0.0	0.0	0.0	0.0	0.0	0.0	0.00	-0.09	0.0	0.0	0.0	-0.1	0.00	0.09	0.09	-0.09	0.0	0.0	0.0	0.0	0.2	0.0	0.0	-0.09	extension	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.18	0.09	-0.02	0.1	0.09	0.0	-0.2	0.18	-0.18	0.1	0.0	0.0	-0.08	0.0	0.0	center	Mediterranean low
0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.18	0.09	-0.27	-0.1	-0.18	-0.2	-0.09	0.1	-0.27	0.09	-0.36	0.09	-0.18	0.0	-0.09	0.0	0.0	extension	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.09	0.0	-0.1	0.2	-0.09	-0.1	-0.02	-0.09	0.1	0.1	-0.09	0.0	0.0	-0.07	0.00	0.0	0.0	center	combined low
0.0	0.0	0.0	0.0	0.0	0.0	-0.63	-0.09	0.73	-0.18	0.18	-0.09	0.36	-0.18	-0.27	-0.18	0.27	-0.27	0.73	0.0	0.09	-0.09	0.0	0.0	extension	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.09	0.0	0.0	0.0	-0.09	0.0	0.0	0.0	0.1	0.0	0.09	0.0	0.09	0.0	0.09	0.0	0.0	center	Sudanese low
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	-0.64	0.02	-0.4	-0.09	0.09	0.1	0.09	0.00	-0.18	0.0	0.0	0.0	extension	
0.21	0.45	-0.73	0.5	-0.64	0.2	-0.09	0.36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	center	seasonal indian low
-0.18	-0.45	0.72	-0.45	0.36	-0.18	-0.09	-0.45	0.27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.36	-0.09	-0.18	0.09	extension	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.09	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	center	low island
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	extension	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.07	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.09	0.0	0.0	center	low seas west asia
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.08	-0.09	0.0	0.0	0.09	0.0	0.09	0.0	0.0	0.0	0.18	0.0	0.0	0.0	extension	

Source: the researcher based on:

Table (1-

Equation of rate of change = difference between the two means / difference between the two times**(6)**.-

for each, while the minimum survival period of a center In the month of April, it was around (1.5) days, and the month of March recorded the maximum duration of the extension (1.8) days in the direction of a change towards the rise, and the minimum duration of the extension remaining in the months of April and May (0.7) days for each.

This is due to the large arrival of its extensions and the diminishing of its coalescence as a center within the territory of Iraq (the confluence of the Sudanese and the Mediterranean)**(7)**, and the control of the air

.The output may be zero in some months according to the application of the change equation, which means there is no rate of change

heights in the areas surrounding Iraq and its progress towards it prevents its formation or its passage (-0.64), followed by the months of the spring season, especially the month of March, in the length of stay, which amounted to (2.5) days, because the control of the Sudanese depression during the months of the spring season is more effective, and its effects reach Armenia and Turkey. About that the seasonal Indian depression did not fully develop during this period to be able to compete **(8)**, and the minimum extension

period was in the month of November (0.6) days towards a positive change (0.09).

The island depression is one of the shallow thermal depressions that appears in the transitional seasons and is often accompanied by a dry continental Tropical (CT) mass laden with dust (9) with a direction of southwesterly and westerly winds that raise temperatures, as the longest average stay centered in the cycle appeared. The first climatic period was in May at a rate of (0.4) days, with a and their swallowing of the island depression, so its effects on the region faded during the cycle (2008-2019).

Conclusions

1- The number of days of survival for a center of the Siberian Highlands varies significantly between the two climatic cycles, as the maximum average survival in January was (9.4) days during the first climatic cycle, while the longest periods of survival were recorded during the second climatic cycle in December (0.5) A day, which indicates a clear decline in the number of centers of cold high systems recently, in line with the climate of global change.

2- The maximum average concentration of a secondary center for the semi-tropical high during the first climatic cycle in the month of April (0.7) days, and the number of days of staying focused during the second climatic cycle increased significantly, as the longest average survival was in the month of October at a rate of (0.8) days .

3- The study revealed a significant decline in the entry of the frontal (Mediterranean) depressions into the study area and the prevalence of thermal depressions such as the Sudanese depression, reaching the longest average survival of a secondary center during the first climatic cycle in January and March (2.9, 2.5) days, while the days of its survival increased as an extension During the second climate cycle to (3.2) days in the month of February.

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