

# PRESSURE SYSTEMS AND THEIR ROLE IN THE SIZE OF THE AREA AFFECTED BY HEAT WAVES

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## **ABSTRACT:**

*The aim of this research is to study the effects of the pressure systems at the level of 1000 millibares and effect of the upper air waves at the pressure level of 500 mb on the area affected by the heat waves by determining the heat waves that affected the selected stations which were distributed over the area of Iraq, Which affected the station of an oasis or only two climatic stations, and public heat waves that affected three climatic stations and more, and then analyzed the climatic conditions of the two levels. . 1000 and 500 millibars by analyzing the weather maps of the days of heat waves, and the systems that accompanied the general waves were identified at the pressure level of 1000 millibars, which recorded the Indian seasonal decline where the largest percentage was accompanied by (64.4%). At the pressure level 500 millibars the tropical conditions were accompanied by public heat waves, accompanied by dizziness (44.4%).*

## **INTRODUCTION:**

The climate of Iraq is characterized by two systems, fluctuating system represented by the rainy seasons (winter, spring, autumn), which vary from year to year, and a fixed system represented by the dry season (summer)<sup>(i)</sup>, due to the exposure of Iraq during the chapter Which is reflected in different climatic conditions. In the dry season, however, the single system of the Indian Monsoon low in most of its days works to push dry tropical water to Iraq, although the variations in the Thermodynamics and kinetic differences only Systems and the resulting wind heat transfer and redistribution, as well as be local thermal depressions Iraq and the region are united with the Indian Monsoon low<sup>(ii)</sup>, Raising temperatures, which is a key factor in the occurrence of atmospheric waves is the result of thermal and motor differences, but the air blocks working on heat transfer and redistribution, as well as depressions works to raise temperatures than A seasonal Indian factor), and when the dominant of this type of lows it works to raise heat degrees that why it become a factor of heat waves .

In order to identify the pressure systems that accompany the heat waves both at the surface level and in the upper atmosphere, the weather maps accompanying the heat waves were analyzed at the pressure level (1000 millibars) and the accompanying conditions in the upper atmosphere at the pressure level (500 millibar).

## **RESEARCH PROBLEM:**

The problem of research is the following question:

Is the Inclusive climatic conditions influencer the area affected by heat waves? It is through this main problem that the following questions arise:

1. Does the Indian Monsoon low depression affect the area affected by the heat waves?

2. Do the pressure systems at the pressure level 500 millibar impact on the area affected by heat waves?

### SEARCH HYPOTHESES:

The hypothesis of the research is as follows.

1. India's low Monsoon increases the area of the heat-affected area.
2. The orbital conditions at the pressure level 500 millibars impacted the increase in the area affected by the heat waves

### RESEARCH METHODOLOGY:

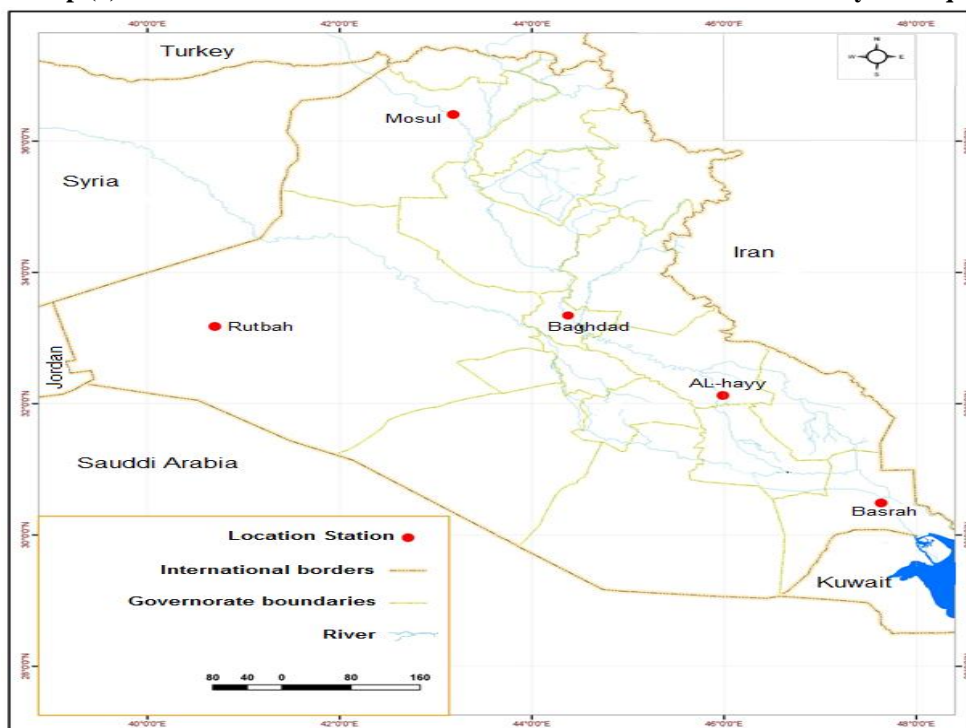
During the research the inventory of heat waves that affected the study stations through the adoption of daily maximum temperature data issued by the General Iraqi Meteorological Organization and seismic monitoring the five stations (Al-Mosul, Baghdad, Rutbah, Basrah, Al-Hayy) and a period of 46 years between 1970 and 2015 and then classified into special (local) waves that affected only one or two climate stations, And (general) waves which Affected by three stations

And then the analysis of the spatial maps of the systems of the most influential pressure systems on the types of heat waves meow research analysis of spectral maps of the level of pressure 500 millibars level when the heat waves. And then analyzed the maps of the spectrum of the pressure level 1000 millibars to know any more impact on the types of heat waves, both local and public, and was the scientific during the pressure level 500 millibars to know the table conditions in that

### spatial dimension of the research:

Reaction of the study area spatial Iraq, which is located in part Southwest Asia, which is within the range of the subtropical cheeks in the Northern Hemisphere, is located between (29° 5) and (37° 22) North and between (38° 45) and (48° 45) East, Five stations distributed in the areas of Iraq (Mosul, Baghdad, Rutbah, Al-Hayy, Basrah) Note map (1)

Map (1) shows the distribution of climate stations that related of the study in Iraq



Source: General Survey Authority, Iraq Administrative Map, Baghdad, Iraq, 2010.

**PRESSURE SYSTEMS AND ITS INFLUENCE OF AREA AFFECTED BY HEAT WAVE:**

The heat waves are different in terms of the area of influence and spatial space occupied by the wave. There are waves affecting one station. There are waves that affect two adjacent stations or more. There are waves that can accommodate a large area. It affected all of Iraq's territory or more. Hence, the waves of heat were divided by the area of the affected area into two types, local waves that affect one station or two stations simultaneously, and waves (general) which affect three Stations or more of the study stations in One time the global recipe results from the distance of the study stations if a free wave and affected at least three stations at the same time, it will cover a large area of Iraq and therefore it becomes a public.

**1: - Classification of heat waves by the affected area.**

Table (1) shows that public heat waves reached during the study period (45 recurrences) during which free waves were recorded at different stations The public waves (173 heat wave) and percentage (57.3%), The local heat waves were recorded during the period of study (90 recurrences) in different stations of the study, the number of heat waves during which (129 free wave) and (42.7 %) of total heat waves during the study period, hence the largest proportion of heat waves came in general waves.

It is also noted in Table (1) that there is a difference between the months of the study in the frequency of general cases and free waves, since the month (May) recorded the highest frequency (13 frequency) waves in general followed by the month (October) recorded (12 frequencies) While the lowest number of public states was recorded during the month of (July) (one repeat) followed by each month (March, June), which recorded (2 recurrence) public heat waves.

**Table 1 the general and located states of heat waves and numbers of heat attacks recorded in each states**

month	General waves	Special waves	Number of waves accompanying the general situation	Number of waves accompanying the special case
march	2	3	6	4
April	8	17	28	26
may	13	12	52	15
June	2	16	8	24
July	1	9	4	12
August	3	6	10	7
September	4	13	15	20
October	12	14	50	21
Total	45	90	173	129
Percentage			57.3	42.7

**Source: From the work of the researcher based on the data of the General Authority for Meteorology, Climate Section, unpublished data**

As shown in Table (1) data, the hot months (June, July, August) reported a few recurrences of public heat waves (2, 1 and 3 recurrences) respectively, which is slightly compared to other months on the one hand and in terms of the number of registered heat waves During these months on the other hand, due to the lack of public waves during these months to increase the temperatures continuously during these days of months and therefore the heat wave requires a higher temperature above the existing height, which is not achieved at all stations of study at the same time Or a number of divergent stations in order to take a general description.

That the difference in the spatial conditions of the stations of the study area, including the location of the latitude and elevation of the sea level as well as the difference received by each station of solar radiation make them asymmetrical in terms of high temperatures, and therefore increase the area of the area affected by public heat waves do not relate to the

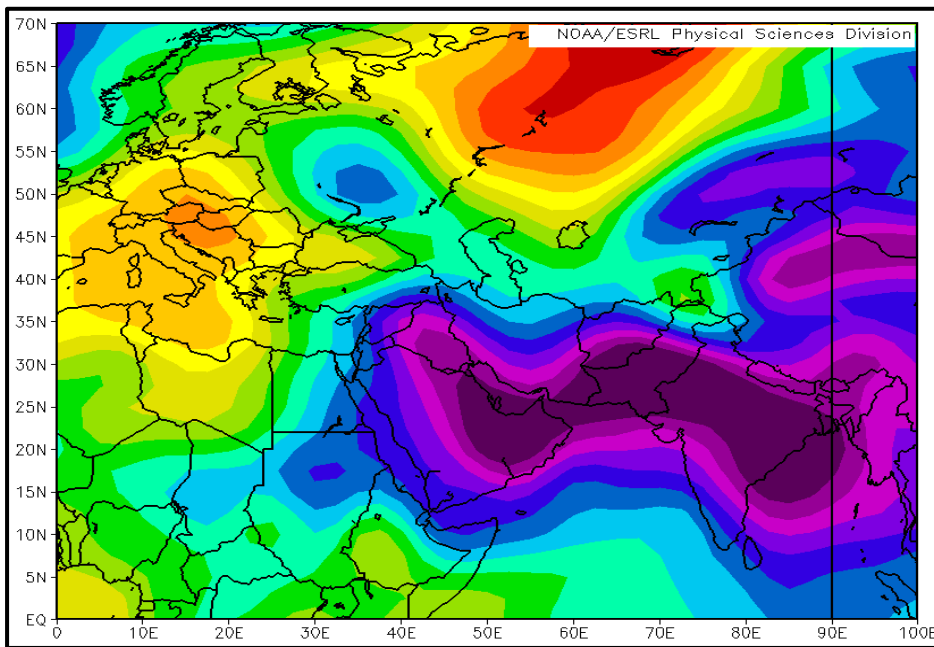
geographical location of stations The study area, but mainly due to the effects of the systems of pressure, whether surface or upper, to be focused on them to highlight the impact of the Indian Monsoon low on them.

**2-Surface pressure systems at the pressure level (1000 millibars) accompanying the public heat waves.**

With surface affective systems during the occurrence of general waves, it is noted from table (2) that the (Indian Monsoon low) was accompanied by most of the general waves during the required period, where (29 recurrences) to accompany the general waves and a percentage of (64, 4%) as in the map (2).

As shown in Table (2), the combined low (Indian + Sudanese) accompanied the control of the Iraqi airspace. Public heat waves recorded (13 recurrences) accompanied by public heat waves and (28.9%), And the presence of the two systems (high semi-tropical, low Sudanese), accompanied by public heat waves, although a few repetitions recorded (1, 2 recurrence) and a percentage of (2.2- 4.4%) of the total public heat waves during the period studying.

**Map (2) Indian low tide control on the Iraqi atmosphere on 1993/7/29.**



As shown in Table (2) data, there is a difference between the months of the study in the frequency of the surface systems associated with the public heat waves. During the month of March, which recorded a frequency of public heat waves (2 public heat wave), one of these waves coincided with the presence of the low While the second wave coincided with the control of the integrated low (the Indian + Sudanese) on the atmosphere of Iraq, and through the analysis of heat waves notes that all the waves of heat, whether public waves or local waves during the month of March, all these waves recorded during the last decade Of the study and follow-up studies Tactful the month (March) has not seen any free registration waves before the last decade and a half, this is a clear indicator for climate change by increasing temperatures for heat waves during the month of March, which is considered moderate heat months in Iraq.

**Table 2 / the number of public heat waves and surface systems accompanied with it during the period 1970-2015**

Month	Number of heat waves	Indian Monsoon low		Tropical high		Sudanians low		Mixed low of indian and sudanies	
		Repetition	Percentage	Repetition	percentage	Repetition	percentage	Repetition	percentage
March	2					1	50	1	50
April	8	3	37.5	1	12.5			4	50

May	13	10	76.9			1	7.7	2	15.4
June	2	2	100						
July	1	1	100						
August	3	3	100						
September	4	4	100						
October	12	6	50					6	50
Total	45	29		1		2		13	
Percentage		64.4		2.2		4.4		28.9	

during the month (April), which scored (8 free public waves) where Indian Monsoon low accompanied with (3 public waves) and the rate of (37.5%) of the total systems accompanied by heat waves during this month, as accompanied by heat waves with integrated low control (Indian + Sudanese), with frequency (4 waves) and (50%), while the lowest frequency of the general waves was recorded with the control of (orbital altitude) accompanied by a general free wave (one) throughout the duration of the study and a percentage (12.5%), During the month of May, which recorded the highest frequency of free public waves during the study period (13 public free wave), most of these waves coincided with the control of the Indian low seasonal (10 waves in general and a percentage of (76.9%) of the total The systems that accompanied the general waves during the month of May, where it is noted that with the beginning of increasing frequencies of the Indian low on the atmosphere of Iraq start increase in frequency of m The general heat waves accompanied the combined low (Indian + Sudanese) with a frequency of (2 waves) and a percentage of (15.4%), The month of May also witnessed the registration of one free public wave Was associated with the control of the Sudanese depression and by (7.7%) of the total systems that accompanied the public heat waves during the month of May throughout the study period.

It is also noted in Table (2) that the months (June, July, August, September) Public frequency free frequencies (2, 1, 3, 4 recurrences) and all public heat waves during these months have been associated with the control of Indian Monsoon low atmosphere Iraq has recorded a percentage (100%) for all months.

Table (2) shows that the month of (October) recorded the second highest total frequency of public waves after May (12 public wave). The number of general waves that accompanied the Indian Monsoon low during this month (6 general waves) and the percentage (50%), They were aligned with the control of the integrated low (Indian + Sudanese) that accompanied each other (6 general waves) and accounted for (50%) of the total systems associated with the public waves during the month.

### 3 - High pressure systems at The pressure (500 millibars ) of the public heat wave

By analyzing weather maps of general heat waves, days indicates that all these waves were obtained during the subtropical orbital conditions.

By noting Table (3) It is noted that the (Ridge) recorded the highest frequency to accompany public heat waves during the study period (20 recurrences) and by percentage (44.4 %) general during the study period Of the total waves recorded, Ridge has been accompanied by the largest proportion of heatwaves, The ridge works to support the atmosphere beneath it with warm air from the south. The high temperature during the summer helps to deepen the temperature in the upper atmosphere and raise the temperature at 500 millibar to show a ridge that enhances surface depressions to keep temperatures high<sup>(3)</sup>, strengthens the surface subsidence of the temperature continues to rise at the bottom of the spike, which explains the accompanying air spasms the surface thermal depressions that are supposed to be accompanied by the grooves, and the continuation of movement to the air will lead to heating the air itself, resulting in the dominance of a weather characterized by the purity of its skies from the clouds with intensity strongly solar radiation and the stillness of the wind, high solar heat and low relative humidity<sup>(4)</sup>, while (Subtropical high) came in second place in the wave accompaniment (13 recurrences) and a percentage of (28.9%) as in map (3) And by stabbing (New

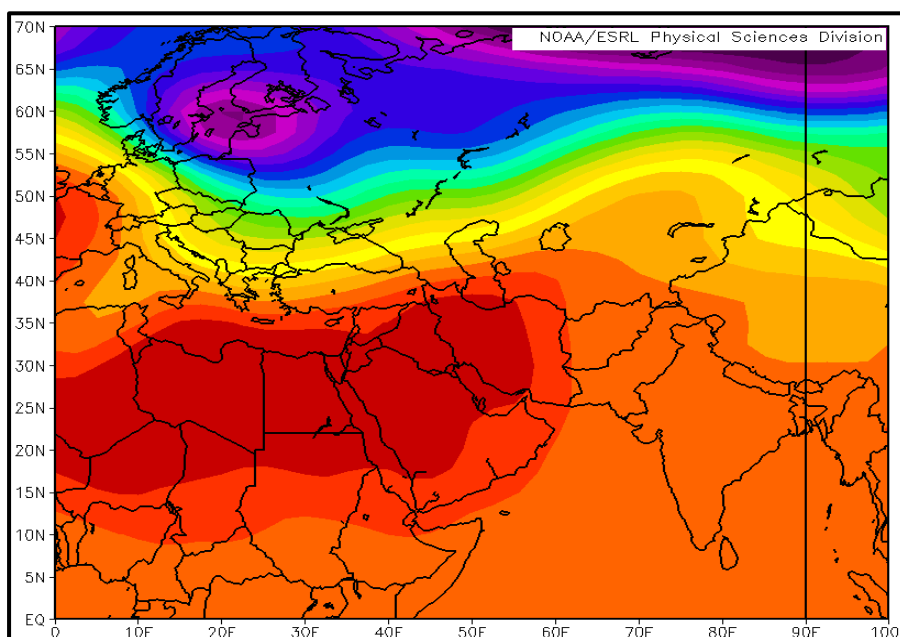
Subtropical high), which was accompanied by repeated heat waves reached (12 repeat) and by its total (26.7 %) of the public heat waves during the duration of the study.

**Table (3) The number of general heat waves and associated pressure conditions at the pressure level 500 millibars**

month	Number of waves	Ridge		Subtropical high		New Subtropical high	
		Repetition	percentage	Repetition	percentage	Repetition	percentage
march	2	2	100				
April	8	8	100				
May	13	5	38.5	4	30.8	4	30.8
June	2			2	100		
July	1					1	100
August	3			1	33.3	2	66.7
September	4			3	75	1	25
October	12	5	41.7	3	25	4	33.3
Total	45	20	44.4	13	28.9	12	26.7

As in appear In Table (3) public heat waves showed a variation in the accompanying upper systems during the months of the study. In (March, April), which were (2, 8 wave), all were combined with the control (100%), while the general wave during the month of (Mayes) was accompanied by all the upper Subtropical phenomena where it was accompanied by (5 waves of general) with the control of the ridge and by (38.5 %), as noted that with the month of May The body of the main Subtropical body begins to directly affect the atmosphere of malaise that has been in the form of or is in the form of a central position of the semi- Dari from the south-west with warm air and dry and desert conditions from North Africa or from the southern part of the Arabian Peninsula, the public heat waves during this month were accompanied by the Subtropical high, Center Subtropical high altitude which accompanied (4 waves) Each with a percentage of (30.8%) of the total waves during the month of May.

**Map 3/control of the Subtropical high at level 500millibars, the notes 12,00 that accompanied heat wave on 2/9/2013**



With the control of the Subtropical high and the Center Subtropical high position, which split the control and accompanying the general waves during the months (June, July, August, September), during the study period, these (2 waves) coincided with the control of the Subtropical altitude on the atmosphere of Iraq and by (100%), as well as during the month of (July), which did not register (one wave) throughout the study period, but it was accompanied by the dominance of the Center Subtropical high position, while the month of (August), which recorded (3 waves general) throughout the study period (one wave) of these waves The general was associated with the control (Subtropical high) while the other two waves during this month were associated with (Center Subtropical high) and by , During the month of (September), which recorded (4 waves), three of these waves were accompanied by the (Subtropical high) percentage (75%), while one wave accompanied While one wave accompanied the (Center Subtropical high) percentage (25%) of all general waves during the month.

Table (3) shows the return of the Ridge of public heat waves during the month of October (12 General wave) during the duration of the study, accompanied by (Ridge) (5 waves) during the month and by a percentage of (41.7%) of the total public heat waves during the month, while accompanied by (Subtropical high) (3 general waves) and a percentage of (25 %), While accompanied (Center Subtropical high) (4 waves) percentage (33.3 %) of all general waves during October during the study period.

By observing the synoptic conditions during the study period, both surface level (1000 millibars) and upper level (500 millibars) shows that the change in the increase of control of the Indian Monsoon low during these months with the increase in the number of days of occurrence of the tropical conditions in all its forms The general trend of the survival of the Indian low has risen to rise in all the stations of the study, as well as the general trend of the survival of the tropical conditions, with the world and Iraq witnessing climatic changes and rising temperatures due to global warming Which indicates that climate change is increasing the duration of the climate-warming conditions, which increases heat waves, but this increase varies between the months of the study. As these conditions increase, heat waves will certainly increase during the moderate months Temperature, which allows the recording of dew waves within the basic rules for calculating these waves, which were mentioned earlier, as we noted in (Table 3) where the highest frequency of public heat waves recorded during the months (April, May, October) High temperatures during these months ie That the summer conditions are expanding in two directions, the first is during the months of (March and April) the arrival of the summer conditions early with the high temperature, and the second side is (September, October) where the summer conditions were delayed with the withdrawal of high temperatures, The progress of the Indian Monsoon low season with the delay of withdrawal from the atmosphere of Iraq, and this indicates that the factors responsible for increasing heat waves and extreme temperatures increased their effects in recent years, notably the Indian Monsoon low , and this is consistent with studies that indicated that Subtropical high orbital may budge To the north where the recent sources indicated that Hadley's cell had been expanded In the period between (1979-2005) this expansion was estimated at about ( $2^\circ$ ) of the display circuits, During the same period the increase in the global temperature was about ( $0.5^\circ\text{m}$ )<sup>(5)</sup> On the other hand, the increase in temperature during the months characterized mainly The increase in temperature is increasing steadily, which does not allow the recording of heat waves because the increase is dependent on all the days of the month, which increases the temperature of the maximum during these months, which does not allow the application of the rules of calculation of heat waves, especially public waves.

## THE RESULTS

1- During the research, heat waves were divided into (general waves) and (local waves) The results of the study were: (45) general wave (173 wave) and percentage (57.3%) of the total heat waves during the study period. The local waves recorded (90 wave) including (129 wave) and percentage (42.7%) of the total heat waves during the study.

2- It was found that the Indian Monsoon low depression had the greatest impact on public heat waves, either directly or indirectly by its integration with the rest of the depressions. It was accompanied by the Indian seasonal extension 64.4% of public heat waves, The combined (Indian + Sudanese) 28.9% of total general waves.

3- Public heat waves at the pressure level accompanied 500 millibars of orbital conditions in all their forms. The Ridge recorded a ratio of 44.4% of the general waves, The semi-orbital high was accompanied by 28.6% in very little variation equal to (26.7%) of total general waves.

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