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Synoptic Analysis of Polar and Subtropical Jet Streams and their Influences on Baghdad City

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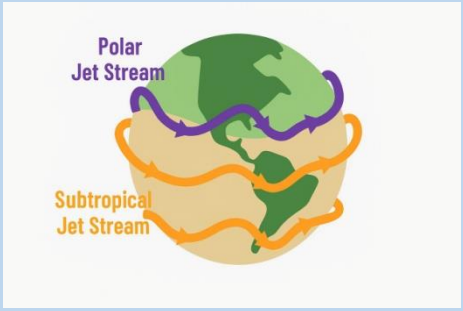
Abstract: The jet stream is considered one of the basic engines of the synoptic systems in the atmosphere and has a major impact on different regions of the world. Therefore, this study addresses the movement of the polar jet stream and the subtropical jet stream and the extent of interaction between them, as well as the extent of their impact on the 300 hPa layer over Iraq in terms of some variables such as pressure and temperature. The study was based on data taken from the University of Wyoming data center in the United States for the period from January 26, 2024 to February 9, 2024. This period witnessed active polar and subtropical jet streams. The study reached that the subtropical jet stream has a faster impact on the 300 hPa layer over Iraq compared to the polar jet stream, and there is a consistency in the change in pressure and temperature values between the polar and subtropical jet stream to a large extent, as it can be said that the pressure and temperature values increase and decrease at the same period, but with no very large time difference over the duration of the study. Also the study mentioned that both of polar and sub-tropical jet streams influence on Baghdad city in the layer of study (300hPa) in winter but the subtropical jet stream has more correlation than polar jet in this season.



Keywords: Polar Jet Stream, Subtropical Jet Stream, 300 hPa, Synoptic Systems. Atmospheric Dynamics.

Introduction

The atmosphere that surrounds the Earth is dynamically fluid, so it noticed the fluid laws are used in studying the atmosphere for several reasons, and that they have succeeded in prediction tests with greater efficiency than statistical laws. Fluid laws depend on friction, gravity, and viscosity, and these laws are controlled by them in most cases, its movement and flow can be measured and calculated, and governing equations are used, including momentum equations, which go back to Newton's laws [1].

The best example of this transfer is through the representation of this movement is by waves because they provide basic information about the properties of the transmission of motion or energy. Therefore, the movement of these waves can be compared to the movement of the atmosphere, especially because it requires knowing both the direction in travel and the amount of energy that the waves possess (growth or decay of waves), and also the amplitude and frequency can be represented, and all of these characteristics provide a good opportunity to understand the movement of the atmosphere [2].

Hydrological cycle affected directly by synoptic system because it responsible for rain formation as well as evaporation techniques and all these are a results of atmospheric dynamics containing the activity of polar and subtropical jet streams [3].

The accuracy of weather forecasting depends on several factors, the most important of which know the state of the atmosphere early on, and the efficiency of the numerical methods used [4]. Calculations of numerical weather forecasts require a long time, so there is great interest among researchers in studying methods with appropriate and accurate details for weather forecasting [5].

Scientific progress in meteorological data systems has led to the emergence of multiple research centers because they represent the backbone of medium and long-term studies, as well as the emergence of specialized predictive centers to study the state of the atmosphere and meteorological factors, and One of the important phenomena that characterize the large-scale atmospheric wind general circulation system (GCM) is the jet stream [6].

The importance of relying on the jet stream is many and varied and has ramifications and relationships with many variables and weather phenomena, which makes it subject to reliance by most international studies, because it falls within the field of predictive equations in atmospheric sciences, and when knowing the potential height, the difference in the thickness of the potential height layers generates trough, also ridges and troughs are located at the opposite end of the air depressions and highs [7].Therefore have a clear and significant effect in moving the atmospheric systems, moving the general circulation

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model of winds (GCM), and determining the air masses and the nature of their atmospheric characteristics [8].

The deep trough region means that there is a region of convergence in the stress-height lines on the left side of this trough, and thus a convergence of air flow occurs in that region. As for the right side of the trough, a divergence region will be formed, for the ridges; their behavior is opposite to the behavior of the trough in that they are to the left of the areas of convergence and to the right of the areas of divergence [9]. As for the areas of divergence, they generate a low-pressure area at the surface, and the convergence at the upper level generates a high-pressure area at the surface. Therefore, they give clear indications of the occurrence of disturbances at the surface, as in Figure (1), and this gives a clear idea of the expansion or contraction of the atmospheric layer [10].

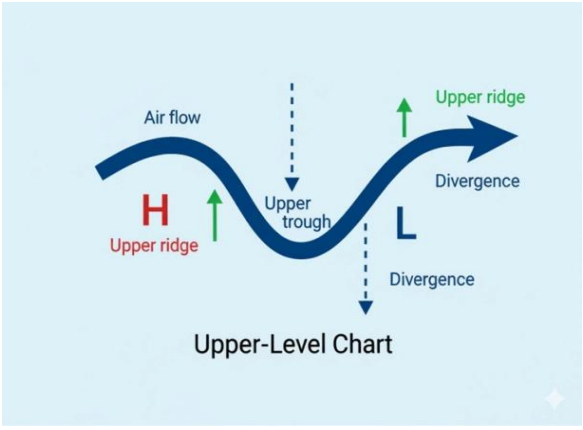


Figure (1): Jet air flow shape showing Ridge and Trough region [11].

When the difference between two levels is known, the mean temperature in that layer can be determined. The contour lines drawn for the heights (the lines that are drawn along the points with equal values of the geopotential heights in one layer) can be used to calculate the speed of the geostrophic wind, as it is faster when the contour lines are closer together. Therefore, the jet stream is distinguished by its high predictability because observing its behavior gives clear and accurate indicators in predicting the behavior of many weather variables and phenomena [12].

Many studies cover the jet stream in general as well as a subtropical jet stream for many cases, for example,Namias and Clapp in the last century studied jet stream troughs and ridges and they showed the main positions of the strong currents in the northern half during January and July, and that these currents coincide strongly with the semi-permanent grooves, for example over East Asia, above the east coast of North America, and above North Africa and the Mediterranean [13] , also Shapero (1990) studied the upper front that correlated with a jet stream passing through the region of study depending on upgraded study balloons that consist of meteorological sensors [14], another study from Y. Bau and Q. You in (2019) studied the relation between jet stream and the snow cover depth in .the Tibetan plateau (from Nov. to Apr. months) for the period from 1979 to 2014 depending on satellite data and European center for medium range and weather forecasting, the result showed that there was a high correlation between the snow cover and the jet stream because of upper cold air advection existence [15], N. Nakamura (2018) studied the meandering of the jet stream and the flow of wind that can be blocked causing heat wave over the area and this depend on the topography which causes variations in climate conditions [16], Hussain A. in (2023) studied the activity of subtropical jet stream in on the variation of weather elements in different seasons and its interaction with Baghdad city , and he found that the summer jet stream can affect Baghdad weather with low influence but cannot be neglected at all.[17]

The study aims to demonstrate the extent of the interaction between the alternating jet stream and the subtropical jet stream. It also aims to demonstrate the extent of their impact on the Baghdad city in terms of two important atmospheric influences, namely temperature and atmospheric pressure. Therefore, a specific period was chosen in which the jet stream and the subtropical jets are active at close times, which is for the date from 26 Jan. 2024 to 9 Feb. 2024.

Since this period witnessed the activity of the polar and subtropical jet streams, therefore the focus was on it using the data of the American University of Wyoming. The two study areas are Europe and the Middle East, they chosen at the level of 300 hPa to show the activity of the polar jet stream and the extent of its impact on the tropical region, which is located directly above Iraq, and the extent of its impact, specifically over the capital (Baghdad), for this reason, the study extracted a number of maps showing its activity in the two regions. The maps of Europe at the level of 300 hPa were chosen to show the activity of the polar jet stream, and the maps of the Middle East to show the activity of the equatorial jet stream, which will help to know the nature of the two streams and the extent of their influence on Iraq.

Polar current jet

The polar current is the most important current in the weather and climate conditions, as most of the changes that occur in the atmosphere above the middle latitudes are associated with it. It is variable in its location, continuity, speed and altitude and goes south in winter and heads north in the summer, and its height decreases when it moves north[18]. The polar jet stream represents the maximum speed of the prevailing westerns in the upper troposphere, and when it is located in the southern regions, it sometimes merges with the suborbital jet current in one current [19]. This polar current is also strongly associated with the polar front, because of this association it migrates daily and quarterly north and south, following the polar front in its movement. Its intensity varies according to the intensity of the polar front. The current speed reaches 250 knots, sometimes with the strongest fronts that occur in the winter in the middle shows, while its intensity decreases in the summer, because the baroclinial range is less developed and is located far north[20]. The torsion of the jet current towards the south and its return from it twisted to the north is in parallel to the edges of the cold air masses, and since the air is colder on the side of the pole, this current blows from the west and the weather systems tend to move with it east, and when the current twists south, it transfers with it blocks of orbital air with all its characteristics and throws it when it returns north in the atmosphere of cold shows [21]. A similar thing happens when this current twists north, when it returns, it transports with it blocks of cold air with all its characteristics and throws them in orbital and subtropical widths. Therefore, it can be said that the jet currents and their disturbances are always inherent to the air masses [16].

Suborbital jet current

The subtropical jet current is fairly fixed in position unlike the polar current, and it indicates the northern boundary of the commercial wind cell (Hadley cell) in the upper shell, and appears permanently in winter and weakens in the summer, this current is located south of the polar front current in the northern half, and where the polar current is associated with a border range that separates polar air and tropical air, such a relationship does not exist with the suborbital current, as it is not subject to large deviations and effective weather disturbances such as

weather depressions and the opposite of moving cyclones in the upper widths[22]. The state of the lower troposphere is below the suborbital current of Barotropic, so there is no wide-scale lifting movement and the frontal range is absent. However, weather disturbances can occur in certain circumstances. In the winter, the belt of precipitation extends from East Asia to eastern Pakistan [23]. Some climates have indicated that this weather situation may be related to wave disturbances in the suborbital jet current, and that the rain belt in the Middle East follows the movement of this current to move from southern Jordan in March to southern Turkey in mid-May[24]. This current is associated with geopotential height and the last one is affected by temperature variation along the years and some studies showed that the value of geopotential height is increased as a result of increasing the temperature by the global warming and this in order effects on the jet stream.[25]

Also, some studies improved that the climate changes effected on dynamical weather systems and that will lead to shift global circulations of cells which in role lead to decrease the rain and less storage of basins in some area of the north hemisphere.[26]

The current study aims to demonstrate the extent of the interaction between the polar jet stream and the subtropical jet stream. It also aims to demonstrate the extent of their impact on the Baghdad city in terms of two important atmospheric influences, air temperature and pressure. Therefore, a specific period was chosen in which the jet stream and the subtropical jets are active at close times, which is for the date from January 26, 2024 to February 9, 2024.

Results and Discussion

Analyzing synoptic variables within the polar jet stream.

Map images were obtained from the University of Wyoming data center which includes wind speed, temperature, and pressure data values that estimated over each study area to show the extent of its interaction with the passage of the alternating jet current at the level of 300 hPa.

The values of atmospheric variables were tabulated and visualized by using the Sigma Plot program in order to display the relationship between the two types of jets over Iraq. The impact of these jets on the behavior of 300 hPa layer was also investigated. The passage of the jet over the region was at January 30, 2024.

It has been shown that the date of January 26 was the beginning of the appearance of the polar jet stream, as it can be observed in the figure (2-a), where it extended from the northwest in a straight line forward, and notice how the isobars lines approached each other, as the pressure ranged between 850 hPato 920 hPa. Temperatures dropped sharply, reaching -55 C0, and high wind speeds exceeded 60 m/s. However, in the chosen study area, which is located directly above Iraq at a longitude of 44 C0, the pressure in the study area was about 921 hPa, while in Baghdad it was about 912, suggesting no fluctuations were occurred. In pressure, the effect of the jet stream has not yet reached the study area; this is also the case with regard to temperatures, as it was -48 in the study area, while in Baghdad it was -45 C0. This shows that the effect of the jet stream has not reached them yet.

But On January 27, 2024in figure (2-b), it can see that the polar jet stream reaches the upper middle of the study area and extends towards the east, leaving behind a disturbance and convergence of the isobars lines, as they ranged between 876 hPa to 930 hPa approximately, but we notice a fluctuation in Temperatures are slightly between -53 and -55 C0, and there are also differences in wind speeds depending on the direction of the polar jet stream. In the study area, the pressure was about 933 hPa, while the pressure in the Baghdad city was about 910hPa, that is, relatively stable, and there is no fluctuation or disturbance, and so on. As for the temperature in the study area, it was about -46, meaning it decreased by two degrees from the previous day, while in the Baghdad city it was about -45, and there was no change in it.

After that when the polar jet stream still passing the area on the 28th of January, which shown in the map (2-c), it was observed that the jet stream was heading towards the north, where its path changed after it had been extending in a straight line towards the east, and the rest of its extension was heading towards the south (which was the weakest band in the polar jet stream) notice that the isobar lines were about 900 hPa, while the temperature lines were between -46 and -50 C0, and there were definitely disturbances in wind speeds depending on the polar jet stream. As for the study area, which is located directly above Iraq, specifically the Baghdad city, the pressure was there about 925 hPa, while in the Baghdad city it was about 912 hPa. There is no strong fluctuation, but the temperatures in the study area lower by one degree Celsius but in the Baghdad city the temperature was constant and there was no change - 45 C0.

Regarding the day of the 29th of January, which is shown in the map (2-d), the activity of the polar jet stream and its extension were observed as it headed south from the map shown to the chosen study area, where the pressure of the jet stream was about 900 hPa, while the temperature was about -50 C0 with a clear disturbance in the wind speed, as it exceeded 60 m/s. In the study area, which was very close to the polar jet stream, the pressure was about 929 hPa, and in the Baghdad city on the same day, the pressure was about 912 hPa, while the temperatures were in the study area was about -49 C0, which was very close to the temperature of the polar jet stream due to its proximity to the region, and in the Baghdad city it was about -45 C0 as well, no obvious change.

When observing the map in Figure (2-e) on the 30th of January, the polar jet stream was weak while passing through the study area, which is located directly above Iraq, specifically Baghdad, as we mentioned previously, where the pressure was about 932 hPa, and in the Baghdad city on the same day, the pressure was About 924 hPa, while the temperature in the study area, through which the jet stream passes, was about -49 C0, while in the Baghdad city -40 C0, which was five degrees Celsius warmer compared to the previous day. As for the wind speed in the study area, it was slightly turbulent.

Passing of jet stream in the 31st of January, the study area was relatively calm, as there was no disturbance in temperature or pressure in general, as the pressure was about 926, while the temperature was -51 C0. However, in the Baghdad city, there was no change in pressure or temperature compared to the previous day. The pressure was about 924 hPa, while the temperature was -40 C0, as shown in the figure (2-f).

On the first day of February in Figure (2-g), a polar jet stream activity was observed from the northwest, heading towards the southeast, specifically over the study area, and its behavior was turbulent, as the pressure extracted from nearby stations was measured and it was approximately between 880 and 920 hPa, while the temperature was -50. C0. In the study area, the pressure was about 923 C0 and the temperature was -48 C0. This shows the extent of the impact of the jet stream on the study area. In the Baghdad city, the pressure was about 907 hPa, and the temperature was about -42 C0, and the winds were very turbulent for Baghdad city.

On the second day of February, it notices that the extension and intensity of the jet stream towards the south, meaning that it extends from the northwest, covering a wide area of Europe, until it completes its extension and heads towards the south of the map towards the study area. The pressure in the study area was about 921 hPaat a temperature of - 48C0, and the wind speed was very strong in the region, exceeding 80 m/s. In Baghdad, the pressure was about 912 hPa, while the temperature was -45 C0, as shown in the figure (2-h).

On the third day of February, as shown in Figure (2-i), the effect of the polar jet stream on the study area was less than the previous day, as the pressure was about 933 hPa, while the temperature was two degrees warmer, at -46 C0, and the wind rate was less intense by 65 m/ In the Baghdad city, the pressure was about 910 hPaand the temperature was -45 C0, meaning there was no disturbance.

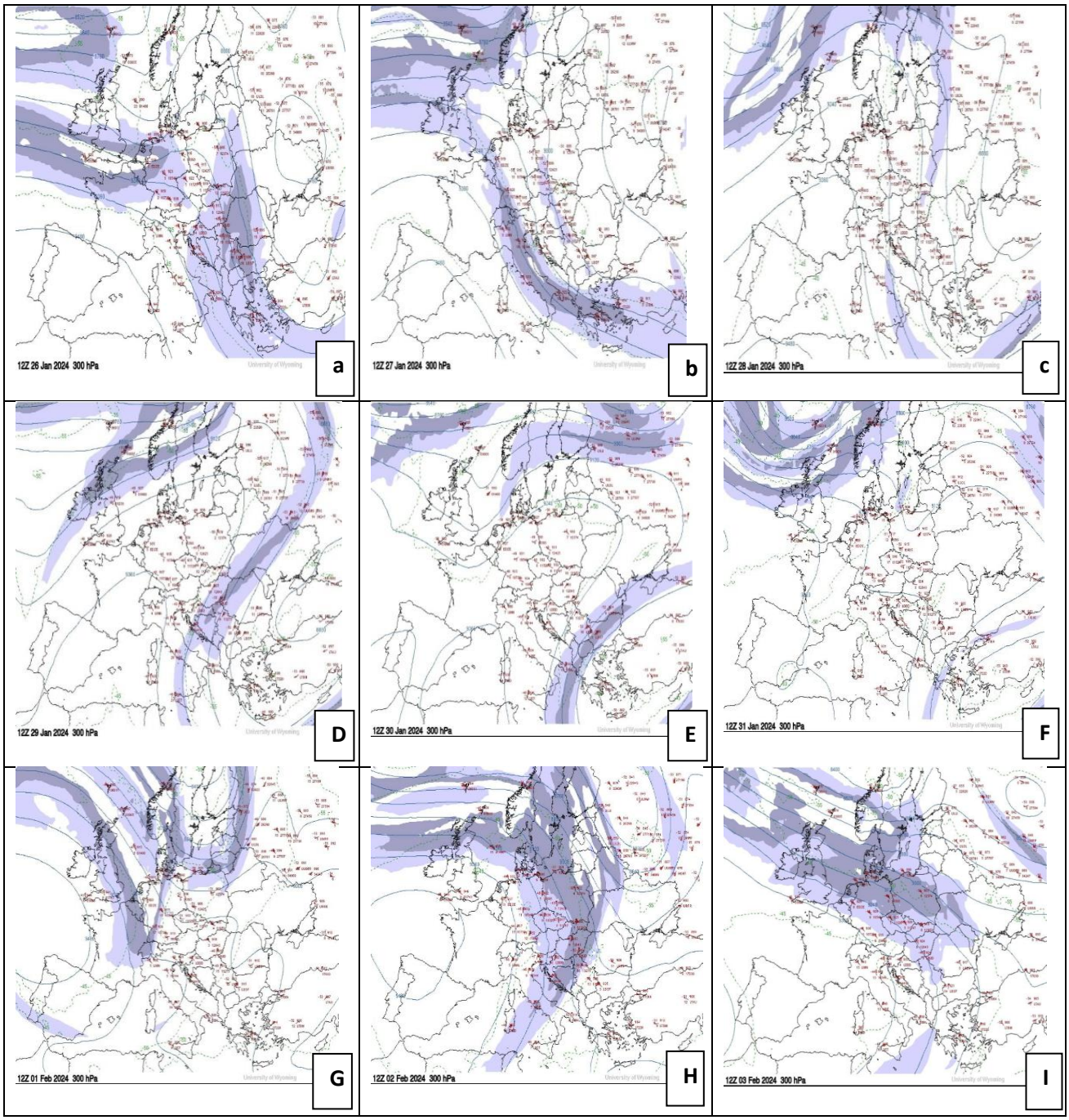


Figure (2): Synoptic maps of polar jet stream activity from 26/1/2024 to 3/2/2024 mentioned from (A) to (I).

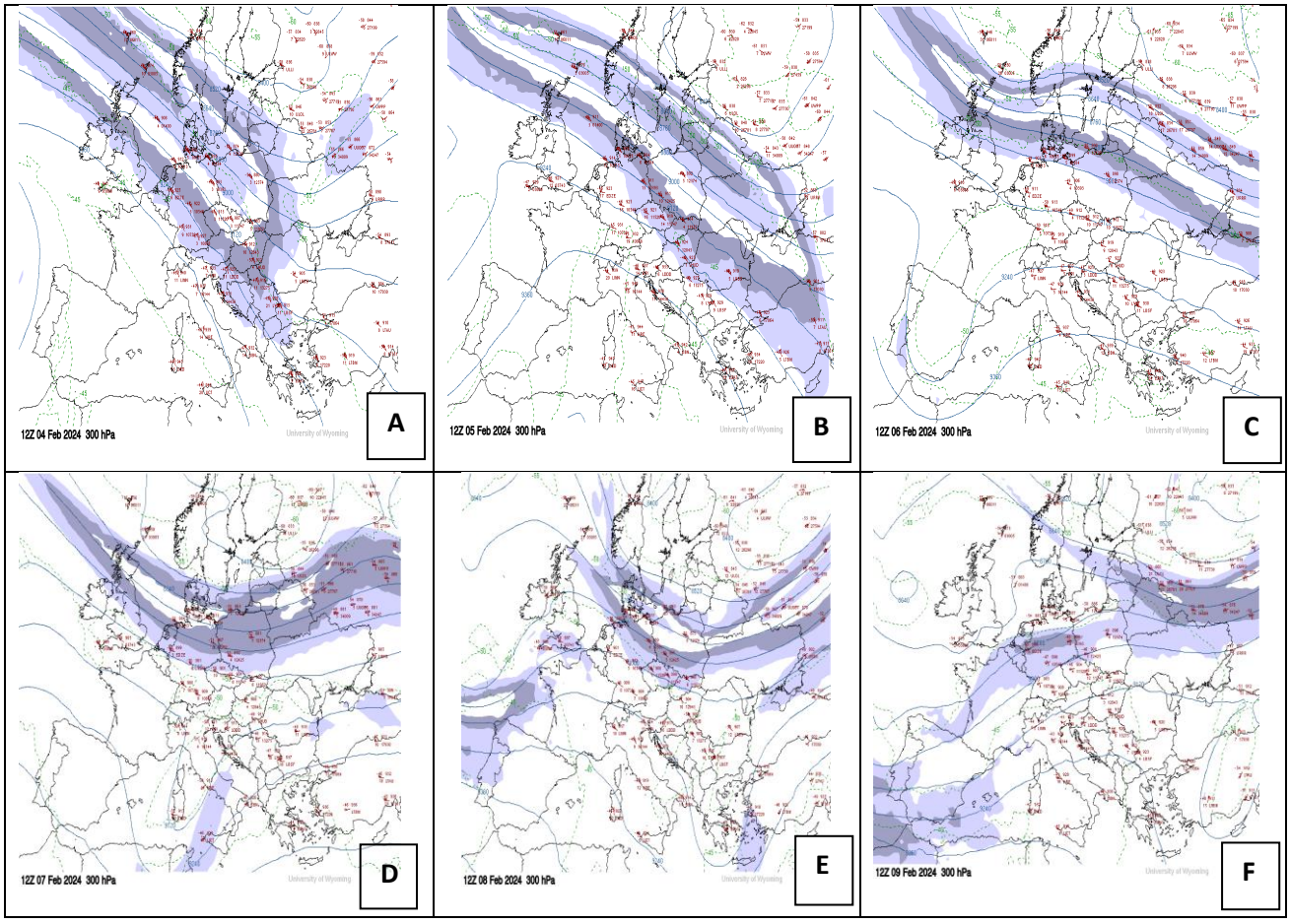
When the jet stream continuing to follow the synoptic path across the maps, it becomes clear in Figure (3-a) on the 4th of February the extension of the polar jet stream, as it is straight from the northwest to the southeast over the study area, and the pressure there was about 925 hPa, while the temperature was -47 C0. In the Baghdad city, the pressure was about 912 hPaand the temperature was about -45 C0, meaning that the polar jet stream does not affect the study area due to its distance from it, thus the pressure and temperature were stable for the study area and the Baghdad city.

On the 5th of February, meaning the day before the event, the extension of the polar jet stream was the same as the previous day, when the pressure in the study area was 933 hPaand the temperature was -46 C0. In the Baghdad city, the pressure was about 924 hPa, while the temperature was -45 C0, as well as on the 6th of February, which was the day of the event, when the pressure in the study area was about 925 hPa, while

the temperature was about -46 C0. On the next day, the influence of the polar jet stream and its extension on the Baghdad city appears, as the pressure there was 822 hPa, where the isobars lines converge clearly, while the temperature was about -54 C0, which is very cold, and in contrast to the previous days, the temperature remained almost constant in the city. Baghdad, turbulent wind speeds exceeded 50 m/s, and this will cause severe turbulence in the atmosphere from strong precipitation and a volatile atmosphere, as is clear from the figure (3- b and c).

But on the 7th of February, the day after the event, notice that the polar jet stream is heading eastward from the synoptic map over the chosen study area, and the pressure there was about 911, while the temperature was very low due to the proximity of the jet stream to the study area, where it was about -51 C0, but on the same day in the Baghdad city, the pressure was about 936 hPa, while the temperature was about -44 C0, so the weather in Baghdad was normal and there was no disturbance, which is clear in the figure (3-d)

As for the 8th of February, two days after the day of the event in Baghdad, the extension of the polar jet stream in Europe, specifically over the chosen study area, which is located on the same longitude as the Baghdad city, extended from the middle over the area and in a straight line heading towards the east, and the pressure in the study area was about 911hPa. The temperature was -49 C0, and in the Baghdad city the pressure was about 936 hPa, and the temperature was about -45 C0. Therefore, the weather in the Baghdad city was the same as the previous day, and there was no disturbance in the temperature or pressure. Likewise, on the 9th of February, we notice that the activity of the polar jet stream begins to decline, heading towards the east, as shown in the synoptic map below. The pressure in the study area was about 917 hPa, while the temperature was -44 C0, while in the Baghdad city the pressure was about 936. hPaand the temperature is -45 C0 as the previous day, which is shown in the figures (3-e and f)



Analyzing synoptic variables within the subtropical jet stream.

The maps below show the activity of the subtropical jet from the date (26/1/2024) to the date (9/2/2024) and the extent of its impact on Iraq, specifically Baghdad Governorate. The maps below show that the subtropical jet stream passes through Iraq in its first days after that. The activity of the subtropical jet stream around Iraq is either in the study area or in a place close to it

Observing the figure (4-a) on the 26th of January revealed the activity of the subtropical jet stream, and it is clear that the jet stream extends from the northwest, heading towards the east, passing through Iraq and Baghdad, where the pressure in the study area, which is located above the subtropical jet stream, was about 896 hPa with a sharp drop in temperature by -48 C0, and this shows the intensity of the jet stream. As for the Baghdad city, the pressure was about 926 hPa and the temperature was about -43 C0.

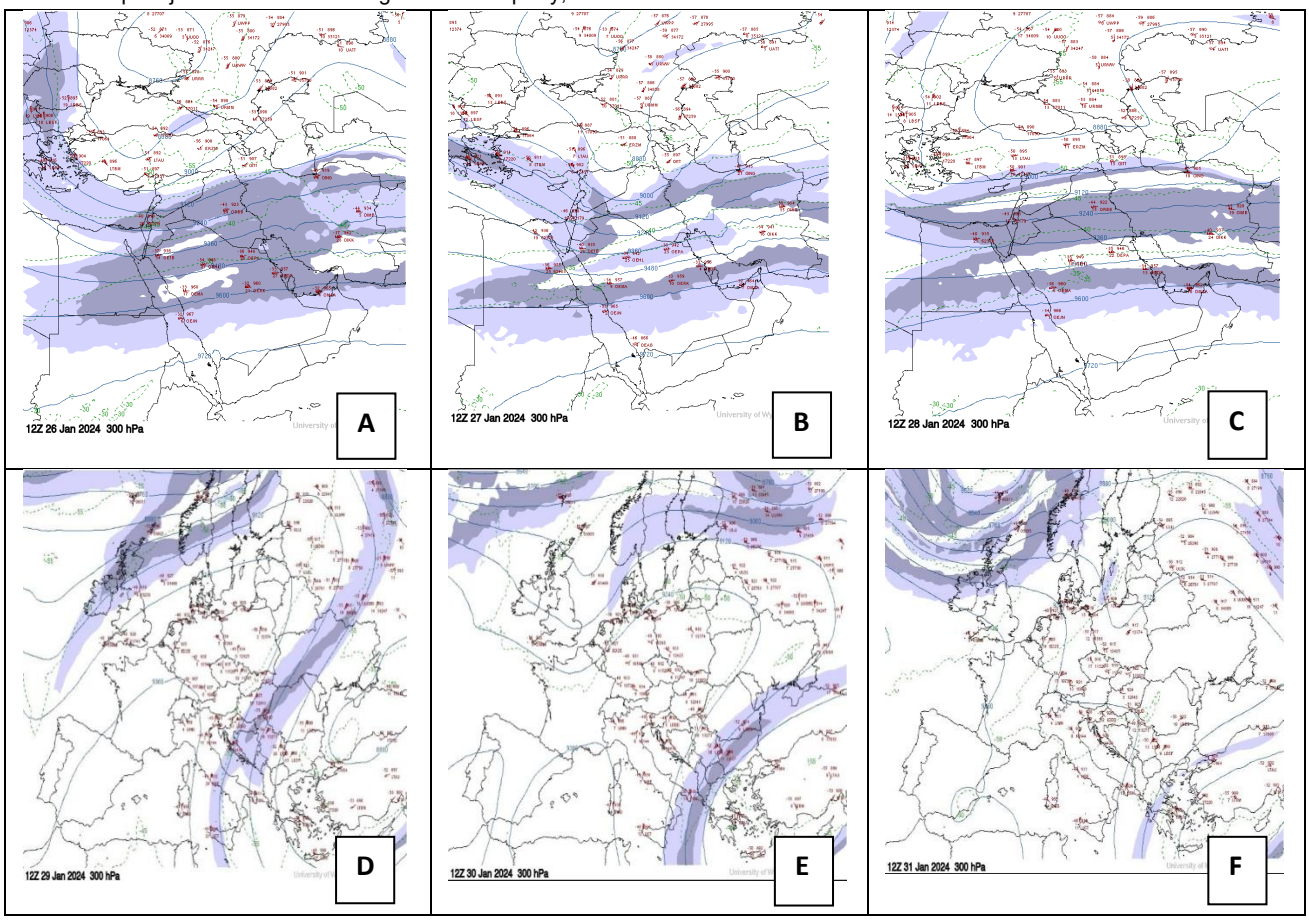
the 27th of January, shows that the subtropical jet stream moved towards the east, where the pressure in the study area was about 880 hPa, while the temperature was -58 C0. This explains the nature of the subtropical jet stream, as the pressure in it ranges between 800 and 930 milliliters, as the subtropical jet stream is always active in the winter in the tropical regions, unlike the polar jet stream, which is very oscillatory, as shown in the figure (4-b).

On the 28th of January, the pressure in the study area was about 884 hPa, while the temperature was very low, about -58 C0, while in the Baghdad city at the same time, the pressure was about 922 hPaand the temperature was about -44 C0, and the map It shows the subtropical jet stream extending from west to east in a straight line, passing through Iraq Likewise, the 29th of January shows the tropical jet stream and its extension from the southwest almost to the east, and we notice the area of the jet stream's decay at Iraq, despite its passage through Iraq. The pressure in Iraq, specifically Baghdad, was about 912 hPa, and the temperature returned to about -44 C0, as for the study area, which is located above the subtropical jet stream, had a pressure of about 893 hPa and a temperature of -58 C0. The high pressure in the area was due to the distance of the subtropical jet stream from the study area, and of course with the constant temperature, as shown in the figures (4-c and d).

Also on the 30th of January, the extension of the subtropical jet stream was passing through the middle and south of Iraq, and the pressure in Iraq, specifically Baghdad, was about 924 hPa, while the temperature was about -40. In the study area over Iraq, the pressure was about 912 hPawith temperature. About -50 C0, where the pressure and temperature were somewhat stable due to the distance of the subtropical jet stream from the study area and certainly its proximity to Iraq, as shown in the figures (4-e and f)

On the 31st day of January, it was shown that the extension of the subtropical jet stream was affecting northern Iraq only, and certainly not with great force, as we notice its decline. The pressure in the Baghdad city was about 924 hPa, with temperatures stable at about -40 C0, while in the study pressure is about 907 hPaand the temperature is about -54 C0 due to the decline of the subtropical jet stream and its distance from the study area. Also, the first day of February shows that the extension of the subtropical jet stream passes through the middle of Iraq, but its intensity was at its beginning in the southwest of Synoptic map, the pressure was about 907 hPaand the temperature was 42 C0, and since the jet stream was passing through the Baghdad city, the wind speeds were very strong as it crossed 105 m/s. As for the study area, which is located above Iraq at the same longitude, the pressure was about 900 hPaand the temperature was -54 C0 and the wind speed was 30 m/s. The weather in the area was relatively calm due to the distance of the subtropical jet stream from it, which is clear in the figures (4- g and h)

As for the second day of February in the figure (4-i), the extension of the subtropical jet stream was the same as on the previous day, with a slight difference in intensity, as the pressure in the Baghdad city was about 912 hPa, while the temperature was -45 C0, and the wind speed was less than today. The previous one was approximately 80 m/s because the intensity of the subtropical jet stream was less than the previous day, and this is shown in the map below. In the study area, the pressure was about 888 hPa, with a temperature of about -52 C0, and the wind speed was about 50 m/s, as shown in the maps.



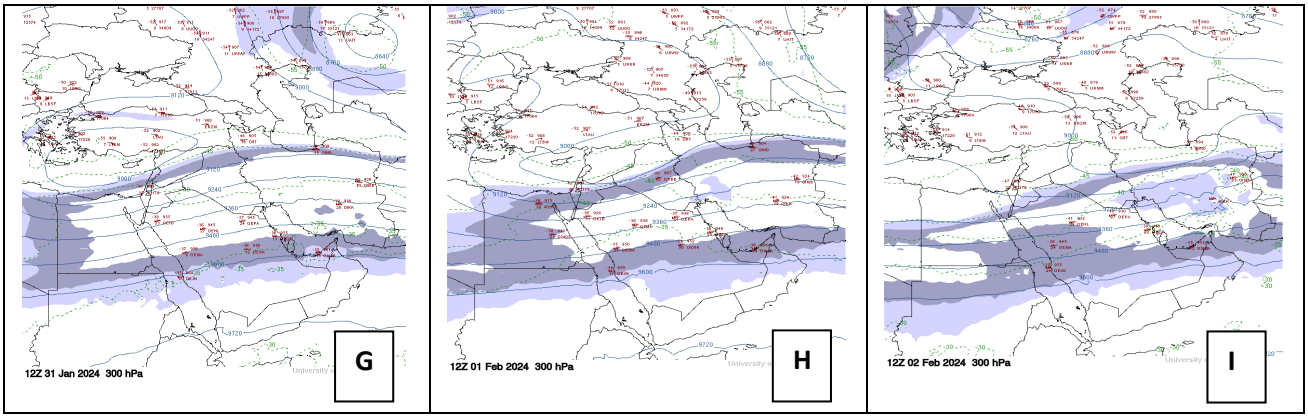


Figure (4): Synoptic maps of subtropical jet stream activity from 26/1/2024 to 2/2/2024mentioned from (A) to (I).

When tracking the continuation of the path of the subtropical jet, it was found that on the third day of February, the subtropical jet stream extended from the southwest to the southeast in a straight line and passed through the south of Iraq, where its intensity was very low, as for the Baghdad city, which was far from the influence of In the subtropical jet stream, the pressure was about 910 hPa, while the temperature was about -45 C0. In the study area, which is located over Iraq, as it mentioned previously, the pressure was about 870 hPaand the temperature was about -56 C0, and the 4th of February, the subtropical jet stream was active and extended in the middle and south of Iraq, but its intensity was relatively low. The pressure in the Baghdad city was about 912 hPaand the temperature was -45 C0. In the study area, the pressure was about 877 hPa, and for the temperature 54- C0, which shown in (5-a)

After that on the 5th of February, the extension of the subtropical jet stream was passing through southern Iraq with little intensity, as the pressure in the Baghdad city was about 924 hPa, while the temperature was relatively constant at -45 C0, and in the study area the pressure was about 854 hPa. The temperature is about -57 C0,also, February 6 was the day of the event, as the extension of the subtropical jet stream had a severe impact on the Baghdad city, as it passed through the study area over Iraq, specifically Baghdad. The pressure in the study area was about 849 hPaand the temperature was about -53 C0, and it was fast. The wind was about 80 m/s, while in the Baghdad city the pressure was about 822 hPa, where there was a severe drop in pressure and the temperature was about -54 C0, which was the coldest temperature in the Baghdad city this year, and the wind speeds were very turbulent with an increase in humidity, this is clear through the figures (5-b and c)

Next on the 7th of February, the day after the event, the jet stream activity was directly over the study area, and its extension passed through the study area, where the pressure was about 907 hPa and the temperature was about -46 C0, while in the Baghdad city, the pressure was about 936 hPa. The temperature was about -44 C0, and the atmosphere was generally calm due to the distance of the jet stream from Iraq, on figure (5-d)

But at last days, February 8, the subtropical jet stream was extending from west to east, passing through the study area. The pressure in the study area was about 886 hPa, the temperature was about -52 C0, and the wind speed exceeded 90 m/s. However, in the Baghdad city, the pressure was about 936 hPa, the temperature is 45 C0, and the weather is relatively calm, as is clear in the map below until it reaches the 9th of February, when the subtropical jet stream, as on the previous day, extends from west to east, passing through the study area, and there is no noticeable change from the previous day, as the pressure in the study area was about 887 hPaand the temperature was about -52 C0, while the wind speed was more than 100 m/s. In the Baghdad city, the pressure was about 936 hPa, while the temperature was 45 - constant, as in the previous days, as shown in figure (5-e and f)

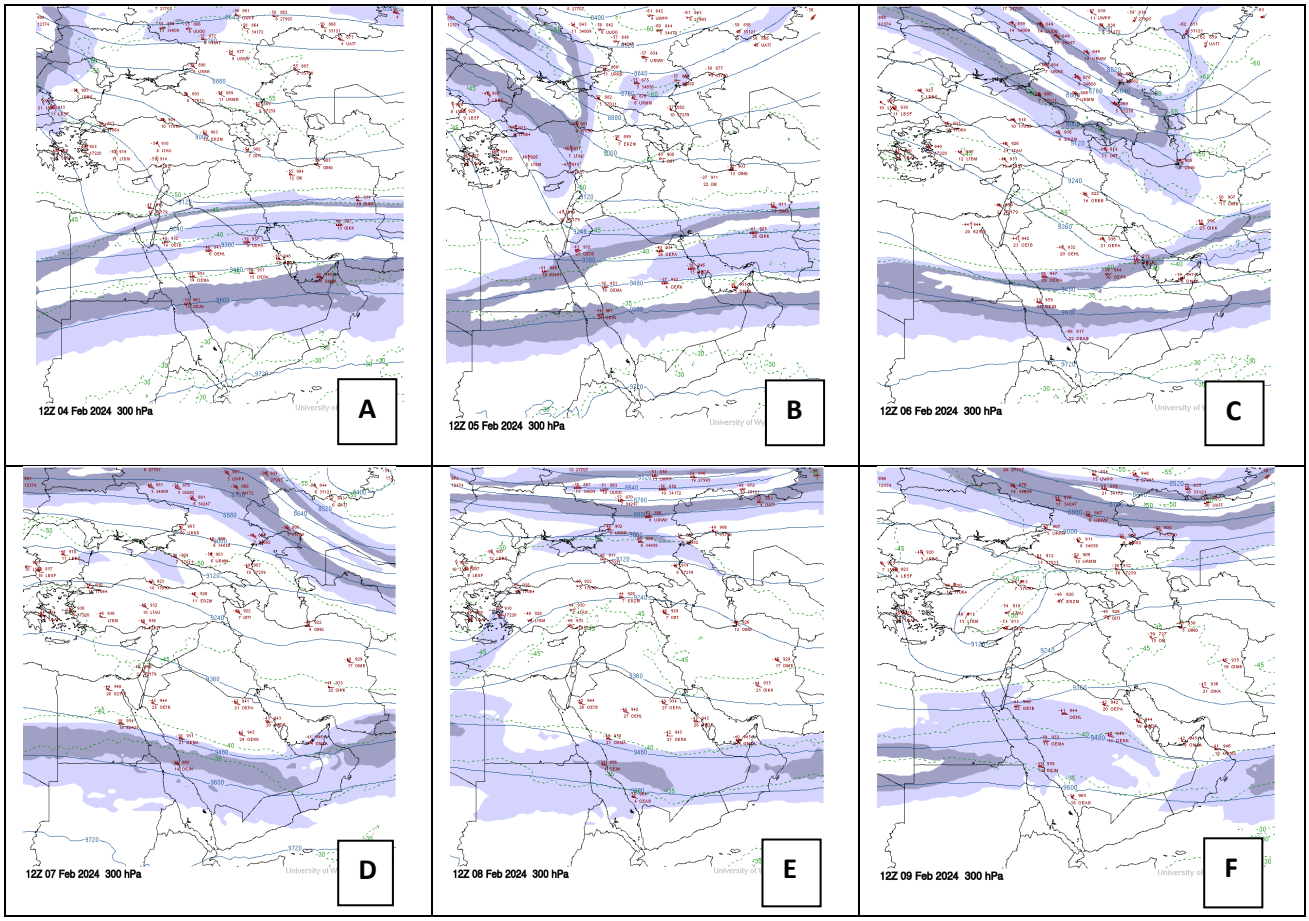


Figure (5): Synoptic maps of subtropical jet stream activity from 4/2/2024 to 9/2/2024mentioned from (A) to (F).

Statistical Analysis

After extracting the values of some of the hPa variables from the maps above, they were placed in special tables to show the relationship of the polar jet stream with the subtropical jet stream in terms of pressure and temperature values. Tables were extracted to determine the extent of the relationship in temperatures between the polar jet stream and the subtropical jet stream, as well as Explaining the extent of the relationship in pressure values between the two jet streams and then investigating the extent of the impact of changing these values at the level of 300 hPa over Iraq in terms of pressure and temperature at the same time periods. For the passage of the two jet streams, using the (Sigma plot) program for drawing diagrams. The results in the diagram figure (6) and table (1) show the difference in temperatures for the subtropical jet stream and the Baghdad city and the nature of the relationship between them, as the diagram shows that the temperature is on the y-axis and the days are on the x-axis. The black curve shows the temperature of the subtropical jet stream, and the dotted curve shows the temperature of the Baghdad city. Therefore, it has been shown that there is a correspondence between the temperatures over the Baghdad city at the level of 300 hPa and the temperatures of the subtropical jet stream clearly, as on the first day the temperature of the subtropical jet stream was -49 C0, while on the same day in Baghdad, the temperature was -43 C0, but the next day the temperature of the subtropical jet stream became much colder than the previous day by -58 C0, while in the Baghdad city the temperature was colder than the previous day by -45 C0, and so on for the third and fourth days. As for the fifth day, and notice an increase in temperatures which about -50 C0, while in the Baghdad city, the temperature increased and became -40 C0, warmer than the previous days. The chart and table show that the nature of the relationship between the temperature in the subtropical jet stream and the temperature of the Baghdad city, also a direct relationship where found, that is mean an increase with an increase and vice versa, and this is due to the proximity of the subtropical jet stream to Iraq and its severe impact on it.

Table (1): temperature values at 300 hPalevel for the Baghdad city and the subtropical jet stream.

Days	Subtropical Temperature	Baghdad Temperature
1	-49	-43
2	-58	-45
3	-58	-44
4	-58	-45
5	-50	-40
6	-54	-40
7	-54	-42
8	-52	-45
9	-56	-45

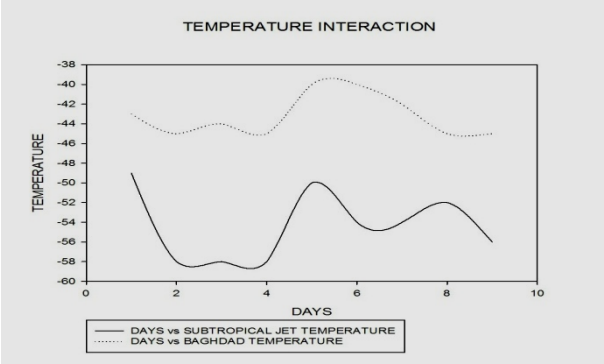


Figure (6): temperature values fluctuations at 300 hPalevel for the Baghdad city and the subtropical jet stream.

When examining the extent of correlation between the values of the polar jet stream and the level of 300 hPaover the Baghdad city, it turns out that the figure (7) and table (2) have

shown that there is a difference in the effect of up to 24 hours, which is clear from the table and the chart that show the difference in temperatures of the polar jet stream and the Baghdad city and the nature of the relationship between them, and the chart shows that the temperature of the polar jet stream was -48 C0, while on the same day in Baghdad the temperature was45 C0, but the next day the temperature of the polar jet stream became warmer than the previous day by -46 C0, but in the Baghdad city the temperature was constant as on the previous day at -45 C0, and so on the third and fourth days the temperatures were different. In the polar jet stream, the difference was a C0increase or decrease, and in the Baghdad city it was constant. On the fifth day, the temperature of the polar jet stream was about -47 C0, and the temperature in the Baghdad city was much colder by -54 C0. On the sixth day, the temperature of the jet stream was, and the polar temperature reached -51 C0, and the temperature in the Baghdad city returned to stability at -45 C0, and so on for the rest of the days, there was stability in the temperature of Baghdad and a difference in the pole.

Table (2): temperature values at 300 hPalevel for the Baghdad city and the polar jet stream.

Days	Polar Temperature	Baghdad Temperature
1	-48	-45
2	-46	-45
3	-47	-45
4	-46	-45
5	-47	-54
6	-51	-44
7	-49	-45
8	-44	-45
9	-44	-45

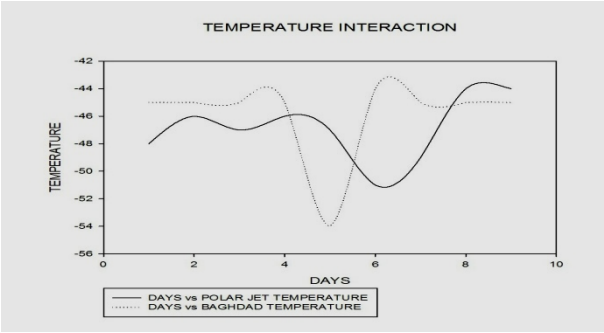


Figure (7): temperature values fluctuations at 300 hPa level for the Baghdad city and the polar jet stream.

As for the pressure values at the level of 300 hPa, on the first day the pressure of the subtropical jet stream was 896 hPa, while in the Baghdad city it was about 923 hPa. On the next day, the pressure of the subtropical jet stream decreased to 880 hPa, and in the Baghdad city it decreased. Likewise, to 910 hPa, and this is the case with the third and fourth days. On the fifth day, the pressure of the jet stream increased to 912 hPa, and with the increase in pressure in the Baghdad city on the same day to 924 hPa, as for the remaining days, the relationship returned to be direct between them, increasing with an increase, and vice versa, and it is explained. In the figure (8) and table (3)

Table (3): pressure values at 300 hPalevel for the Baghdad city and the sub-tropical jet stream.

Days	SubtropicalPressure	BaghdadPressure
1	896	923
2	880	910
3	884	922
4	893	912
5	912	924
6	907	924
7	900	907
8	888	912
9	870	910

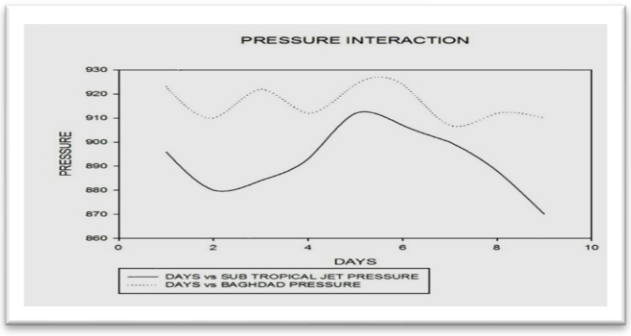


Figure (8): pressure values fluctuations at 300 hPa level for the Baghdad city and the sub-tropical jet stream.

The same was true on the first day, through the figure and table (4) and figure (9) of the pressure values. It was found that there was a very weak relationship, as the pressure of the polar jet stream was about 921 hPa, while in the Baghdad city the pressure was 912 hPa, and on the second day the pressure of the polar jet stream is 933 hPa. And notice an increase in pressure, in contrast to the Baghdad city, where there a decrease in pressure there to 910 hPa, this is the case for the third and fourth days. On the fifth day, we notice a decrease in the pressure of the polar jet stream to 925 hPafrom the previous day. As for the city Baghdad the pressure dropped strongly and reached 822 hPa, and this was the day of the event. For the rest of the days, the pressure returned to its normal state and the relationship between the polar jet stream and the Baghdad city was restored.

Table (4): Pressure values at 300 hPa level for the Baghdad city and the polar jet stream.

Days	PolarPressure	BaghdadPressure
1	921	912
2	933	910
3	925	912
4	933	924
5	925	822
6	911	936
7	911	936
8	917	936
9	915	924

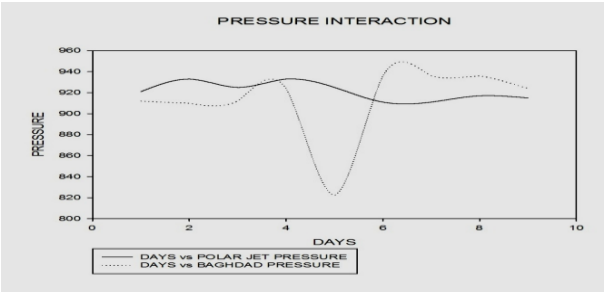


Figure (9): Pressure values fluctuations at 300 hPalevel for the Baghdad city and the polar jet stream.

But with regard to the correlation between the pressure values in the subtropical jet stream with the pressure in the polar jet stream, it has been shown through the figure (10) and table (5) that there is harmony with a slight direct relationship that begins to increase and decrease in a direct manner, but there is a mismatch, especially on the day the jet stream arrives at the study area, this is also the case for the harmony in temperature values between the polar and subtropical jet stream, and there is a harmonious oscillation between them, especially before and after the jet stream passes over the study area, which is clear through the figure (11) and the table (6).

Table (5): Pressure values at 300 hPa level for polar jet stream and subtropical jet stream.

Days	PolarPressure	SubtropicalPressure
1	927	896
2	909	880
3	921	884
4	929	893
5	932	912
6	926	907
7	923	900
8	921	888
9	933	870
10	925	877
11	933	854
12	925	849
13	911	906
14	911	886
15	917	887
16	915	904
17	927	896

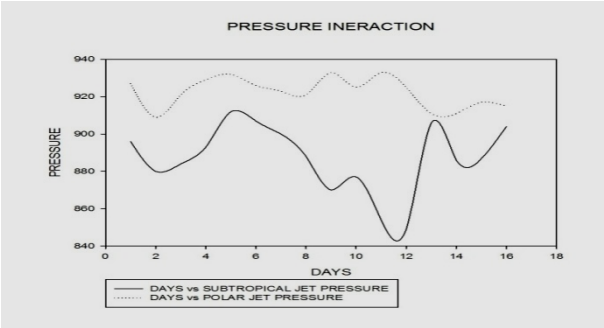


Figure (10): Pressure variation for both polar and subtropical jet streams.

Table (6): temperature values at 300 hPa level for polar jet stream and subtropical jet stream.

Days	PolarTemperature	SubtropicalTemperature
1	-46	-49
2	-54	-58
3	-53	-58
4	-49	-58
5	-49	-50
6	-51	-54
7	-48	-54
8	-48	-52
9	-46	-56
10	-47	-54
11	-46	-57
12	-47	-53
13	-51	-46
14	-49	-52
15	-44	-52
16	-44	-48
17	-46	-49

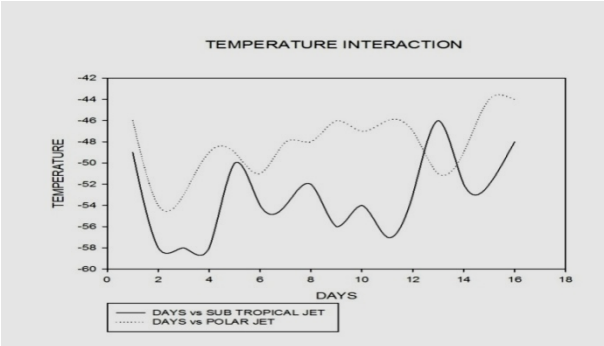


Figure (11): Temperature variation for both polar and subtropical jet streams.

Conclusions

The activity of the subtropical jet stream is synchronous with the polar jet stream, but with a difference of some time, this may be due to the partial polar jet stream feeding to the sub-tropical jet stream. The polar jet stream has a longer impact on the region in terms of time period compared to the subtropical jet stream, and it also has lower temperature rates in comparison, but the subtropical jet stream has a faster impact on the 300 hPa layer over Iraq compared to the polar jet stream, despite its limitation, and this may be due to its proximity to the region. As for the polar jet stream, there is little harmony in terms of pressure and temperature with those variables at the level of 300 hPa above the Baghdad city, with some temporal creep due to the change in values between the polar jet stream and n the values of those variables at the level of 300 hPa. The study also concludes that the pressure values at the level of 300 hPa, the fluctuation is high in terms of going up and down over the Baghdad city at the same pressure level, but it is less fluctuating over the period of passage of the subtropical jet stream at its level. this is also the case for the polar jet stream in which the values are the pressure fluctuates little compared to its level over the Baghdad city. Finally, there is a consistency in the change in pressure and temperature values between the polar and subtropical jet stream to a large extent, as it can be said that the pressure and temperature values increase and decrease at the same period, but with a not very large time difference over the duration of the study.

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