Al-Mustansiriyah Journal of Science
ISSN: 1814-635X (print), ISSN:2521-3520 (online) Volume 31, Issue 1, 2020 DOI: http://doi.org/10.23851/mjs.v31i1.229

Research Article Open Access

Determined Seasonal Variation of Polar Jet Streams over Baghdad City for period 2012-2014

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ArticleInfo

Received
22/08/2017
Accepted
03/11/2019

Published
01/03/2020

ABSTRACT

Analysis of the jet stream is diagnostic over Baghdad for period studies 2012 to 2014 using Radiosonde data and synoptic charts. The source of data is the Iraq Meteorological Organization and Seismology (IMOS). The most frequent occurrences of a jet stream are in April and July at 500 hPa equal to 13 times, at 300 hPa the highest frequency of the jet stream is in May equal to 14 times. This study showed that the incidence of jet streams became fluctuating, increasing and decreasing, as the least occurrences were in 2012 and gradually increased in 2014, when the highest incidence of jet streams was recorded in 2014. The most prominent results of the current jet current determination used by the synoptic maps through the fulfillment of all conditions or the fulfillment of part of the conditions. In the event that all conditions are met due to the expansion of the Hadley cell when it hits the middle condition. The results were produced if some conditions were met and in most study cases that the jet stream formed over Europe and continues to move until it reaches the Mediterranean Sea, then there will be a crossroads either over Turkey and it will be strong and in the case of growth or heading towards Iraq, in this case, it will be weak and in Decay condition.

KEYWORDS: Seasonal variation, Jet stream, Climate variation.

الخلاصة

تحليل التيار النفاث هو تشخيصي فوق بغداد لدراسات الفترة من ٢٠١٢ إلى ٢٠١٤ باستخدام بيانات الراديوسوند والخرائط السينوبتيكية. مصدر البيانات هو الهيئة الانواء الجوية والرصد الزلازلي (IMOS). إن أكثر الحوادث تكرارًا لتيار نفاث هي في شهري أبريل ويوليو بمعدل ٥٠٠ hPa تساوي ١٣ مرة، وعند ٣٠٠ hPa يكون أعلى تردد للتيار النفاث في مايو يساوي ١٤ مرة. أظهرت هذه الدراسة أن معدل تيارات الطائرات النفاثة أصبح متقلباً، حيث يزداد ويتناقص ، حيث كانت أقل الحوادث في عام ٢٠١٢ وزادت تدريجيًا في عام ٢٠١٤، عندما تم تسجيل أعلى معدل للتيارات النفاثة في عام ٢٠١٤. وأبرز نتائج التيار النفاث الحالي تحديد المستخدمة من قبل خرائط السينوبتيكية من خلال تحقيق جميع الشروط أو الوفاء بجزء من الشروط. في حالة استيفاء جميع الشروط بسبب توسع خلية هادلي عندما تصل إلى الحالة الوسطى. تم إنتاج النتائج إذا تم استيفاء بعض الشروط وفي معظم حالات الدراسة التي تشكل فيها التيار النفاث فوق أوروبا ويستمر التحرك حتى يصل إلى البحر الأبيض المتوسط ، سيكون هناك تقاطع طرق إما فوق تركيا وسيكون قوياً وفي حالة النمو أو التوجه نحو العراق، في هذه الحالة، سيكون ضعيفًا وفي حالة الاضمحلال.

INTRODUCTION

The characteristics of the jet stream are of great importance to many fields such as air navigation and air pollution and to know the weather daily. Hence, Jet streams act as an invisible director of the atmosphere and are largely responsible for changes in the weather across the globe. A jet stream is essentially an atmospheric highway located at the level where jets cruise. Winds in this high-speed river of air often reach 250 mph. the study tries to understand the changing seasonal and spatial speed, direction and height of power jet stream over Baghdad. Concerning frequencies for the stream jet over Baghdad; the jet stream repeated in summer more than in winter even though it is stronger in winter. The same applies for spring and autumn when the jet stream more frequent in spring [1].

Jet stream is part of the movement of wind that occurs in the upper atmosphere, change jet stream in their properties in the summer and winter also change their movement towards the pole and line equator. As well as the change from hand movement wave (amplitude) and the number of wavelength, repeat wave. Acting as a wave of the jet stream flowing through and its

movement from the West toward East. In general, characterized by jet streams that have a width estimated about 100km thick 1.5km almost as much different length, where an average of up to about 4800 km and speed (100 km/hour) it reach to (500 km/hour) in the position [2].

THE GENERAL CIRCULATION MODEL

The study is concerned with the general movement of the wind as model year general patterns of the elements of air and then the difference or variation in these factors. That the primary role of these patterns is to know and determine the overall shape of each region of the world and determine the difference or variation in these patterns, especially if it addressed variation in the field of energy, which is the main driver for these models. You can divide patterns general movement to the first two main sections which meant the general movement, especially rates to wind patterns and pressure, and the second is the swirls and movement is considered out of the ordinary for this pattern model as shown in Figure 1 [3].

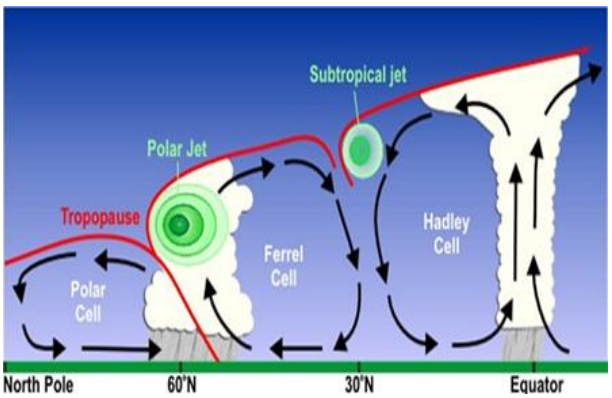

Figure 1. General movement of the winds cells Hadley and Feral and Rossby with jet stream[3].

In both cases the paint through the use of contour lines that are curves quarterly or semi-quarterly lines equal to the pressure or wind or other weather factors, and determine the spacing lines and convergence with indicators to determine the type of weather pattern and it gives an idea of the strength or the decay of air masses through swirls of similarities geostrophic movement.

Types of Jet Stream

1. Polar jet stream: Is the most frequent cases within the Middle district East and often what is happening within a layer of 500hPa be a western winds formed in top winds of Feral cell spacing area with winds in the polar cell and up to speed 500 (Km/hour) as shown in Figure 2. The polar jet stream appeared during the study that we conducted, more than all of jet stream tropical and the jet stream subtropical shows through the results that we got from analysis of maps of previous years and there are instances of the polar jet stream, first check all conditions (low temperature, low air pressure, increasing humidity, the increase in height) second check half conditions third check one condition [4].

Figure 2. The polar and subtropical jet streams [5].

2. Subtropical jet stream: It consists of a fast-westerly wind, it is located at a latitude of 25 and formed by the upper wind convergence of the Hadley cell with the wind Feral top of the cell and reach a speed of 250 km/hour and change his location rate in winter and summer has a significant impact on the weather .In some cases, the jet stream exists subtropical in the instability of the depressions region and this works to increase instability in the layers of the atmosphere and works on heavy rain and strong sometimes in the Winter it had control on the northern regions of Africa and North of the Arabian Peninsula, where it appears that the rush of the upper on a particular area and the depressions are in the low introduction top.
3. Tropical jet stream: It consists at latitude 15 in the summer in the northern half of the land and tropical jet stream which is weak compared to other jet currents, reaches a maximum speed of 180 km/hour. Moving from West to East and is caused by easterly winds. On the contrary, both the polar and semi-tropical let's turn around the earth, but it stabled in East Asia and Africa, and only in summer [6].

The Annual and Seasonal Global Trends Jet Stream

Using the characteristics of the jet stream, simple numerical scales for the whole world (or regions of interest) which can be obtained globally. Medium height and wind speed and altitude jet streams three (SHP, NH, SHT) for the period (1979-2001) from each of ERA-40 data set NCEP since the time evolution of annual and seasonal levels, ERA-40 the reanalysis NCEP almost identical. In terms of the latter contribution to material assistance [7]. Since all three jet streams moved toward pole during the period (1979-2001). Rates ranged between (0.11- 0.06) degrees / knots in SHT, (0.10 - 0.07) degrees / knots in SHP, (0.17 - 0.19) degrees / knots in NH jet stream.

Dynamic of Jet stream

The Global Forecasting System (GFS) graph (WIND SPEED) and the direction of flow on level (300hPa) in other words, the high and not far under tropopause. The most obvious immediate attention of the jet stream does not always work in a straight line between West eastward despite the fact that this trend is the prevailing wind direction in half Northern Hemisphere [8]. Instead curves North and South in a series of wavelengths including waves which are high-pressure and low-pressure basins, known as long waves or Rossby waves, which exist at the present time along the front essential element in the composition is disturbance of the upper part of the atmosphere. These waves have a strong influence on the weather with the jet stream. There are several factors important that are with respect to the polar and its impact on the weather, and be of importance weather systems moving along fairly quickly. This led to the change of weather. It can be Rossby waves to slow down in the East. To form what is known as the name of the air masses when it formed whatever the weather during the winter [8].

Charts of jet stream

In the Far to the wind and altitude, if in some other countries, the level of charts are drawing in the wind (30000, 40000, 50000) mile maximum limit the wind and altitude if in some other countries, the level of (25000, 55000) mile at first glance seem easy to identify the jet stream sites from these charts and it manages many stations and prevent the reporting maximum limit winds of between (25000, 55000). Isotach and the jet stream could lead to a careful analysis of whether the jet stream maps used alone. So were the current charts. Jet provides information to the wind in the high level (200, 300) hpa show three types of jet streams on these charts or maps. Analyses showed that the weak current passes to the South in the middle of the period and after the North Stream shows again and when the force is weak in the South of the jet stream. The requirements for determination of tropopause are during the graphs where the tropopause is continuous down and the upper part of it is predominant. The jet stream between tropopause interferes and through section accidental high winds when the limit does not but maybe it's because to the absence of reports of winds in this region, and therefore cannot be configured or the emergence of jet stream in this region. Total jet stream through the maps be in Southwestern part run. Then powerful jet streams will begin to weaken to some extent with the maximum wind speed, which gradually decreases the value of more than from 175kt to 120kt [9].

Radiosonde Data

Radiosonde: is a tool for measuring distance in the atmosphere usually called balloon weather, which measures various atmospheric information and transmits them via reception earth. Radiosonde calculates variables such as height, pressure, temperature, relative humidity and wind (wind speed and direction alike), and readings of cosmic rays at high altitude and geographic location (longitude and width) it is known that radiosonde measures concentrations of ozone. Radiosonde works on radio frequency of 403 MHz or 1680 MHz [10]. Radiosonde follows when climbs the site works to give the wind speed and direction the information is called (wind radar), and most radiosonde radar reflectors technically called radiosonde that are dropped from the plane and falling rather than carried by a balloon called wireless probes are the main source of meteorological data hundreds called all over the world every day.

RESULT AND DISCUSSIONS

Synoptic Charts

The source of these charts is Iraq Meteorology Organization and Seismology by photographing maps with a digital camera and identified the days when the jet stream has occurred and filmed the day before the event and the day after the event to be sure. The maps of the two levels 500hPa, 300hPa studied each level and characteristics of each layer were current occurrence of jet stream.

Frequency of jet streams in 500hPa

Frequency of jet stream means summation of jet stream events during three year (2012, 2013, 2014) for each month. For examples how many jet stream bit or happen in during January in the period of study represented by number frequency (N). The maximum frequency for 500hPa appears in both April and July equal to 13 times, while minimum frequency happens in October and December 2 times only. The rest of month between maximum and minimum frequency, except missing date in March is unable to make clear judged about it. Figure 3 showed normal distribution of jet stream.

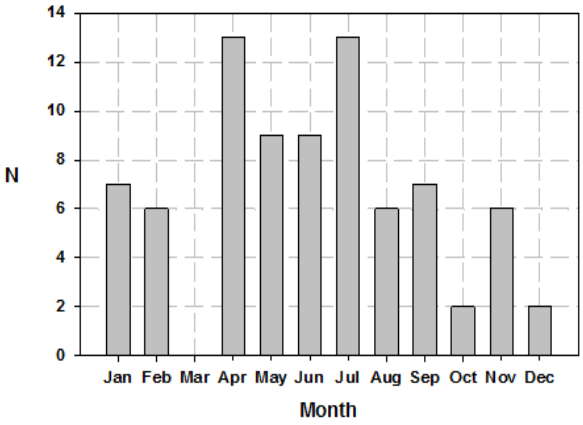

Figure 3. Frequencies of jet stream in 500hPa for years (2012, 2013, 2014).

Frequency of jet streams in 300hPa

The maximum frequency for 300hPa appears in May equal to 14 times, while minimum frequency appears in November equal 2 times, while other months have moderate frequency as shown in Figure 4. Three months are missing date named March, August and October .

The comparison between 500hPa and 300hPa for total frequency is almost set around 55 times may be referring to the missing date in 500hPa pressure level is one month only but in pressure level 300hP are three months. Another reason is according to polar cell be present in 500hPa while the opposite frequency happens in (April and July) in 300hPa happens in (May).

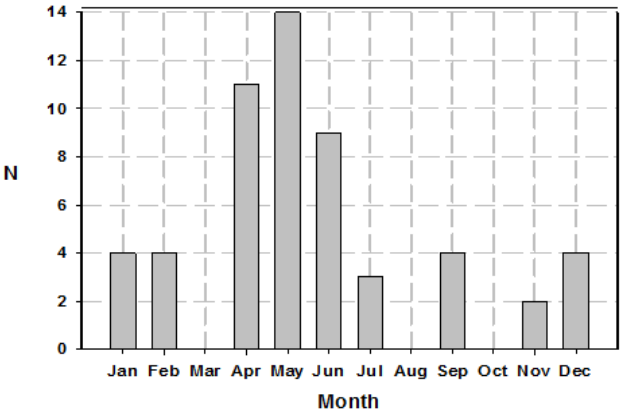

Figure 4. Frequencies of jet stream in 300hPa for years (2012, 2013, 2014).

Verification of Jet Streams Conditions

The main relative jet stream pattern over Iraq came from European region, it is considered as source of jet stream. The genesis of jet streams usually began over Easterly European then move toward Russia and Central Asia, after that sink toward Mediterranean Sea to reach two points way either, goes high over Turkey in this case jet stream growths or low move toward Mediterranean Sea, in this case jet stream decays. The case of developed jet stream over Turkey is more likely than jet streams' happen to by several time. This case referred to the conflict between two Hadley and Feral cells. The main condition the sign to jet stream is as shown figure 5 is decreasing temperature, decreasing air pressure, increasing geopotential and increasing humidity.

This case all conditions Verification and the jet stream hits December, 21, 2014 for 300hPa Strongly effect on the region latitude from South East Mediterranean Sea to Northern Arabian Gulf. This case happened in winter at normal direction always from West to East. Velocities ranging between wind speed about 925- 972 note/h. During the low pressure system isobar lines was closely together and case of growth cyclone with extended amplitude of wave propagation because polar cell is stronger than Hadley cell to reach Middle East. Some pattern was repeated itself in case of the study in October, 4, 2012 500hPa in autumn and July, 7, 2013 500hPa in summer.

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Partial Jet Streams Conditions Verification

The cases of jet streams have partial conditions less than previous cases. Some cases have three conditions verification, some of them has two conditions, and some cases has only one condition.

One example of the cases that have three conditions happened in June, 29th, 2014. The three conditions verifications are decreased low-pressure system, increased in gradient geopotential height and increased in relative humidity. To understand this case, we need to analyze 300hPa geopotential height chart and study weather condition in two days before (June, 27th, and 28th), and one day after (June, 30th) event.

Three conditions are verification in this case are, decreasing air pressure, increasing geopotential and increasing humidity. There was a jet stream effects over central and Southern regions of the country and was moving toward the bottom as a date 27/6/2014 towards the equator from West to East and continued through his movement to take to the mid-latitudes, which is approaching from the center of Northern Iraq for day 28/6/2014 and continued his movement on 29 /6/2014 at boarding frequent twisting movement where view along the (jet stream) in the regions of Europe and a strong it began to climb again toward the pole and have no impact on the central and northern parts of Iraq specifically. Despite the fact that the case of the day (28) over Iraq is that the extension of the (J.S) above Europe, which began from the day (28.29) to stay away from The equator toward the poles, and this extension affects the regions of the country due to the deepening and because of the increase of the decline of low air and this explained the line extension (buckling) and the impact of the movement of all from two cell of Feral and the polar (J.S). Through comparison between the strong jet stream over Europe, the jet stream is born weak original slope clicking through isobar lines that operate on increase of the speed of the jet stream and be strong because it is approaching central offers. We have another example of October (10, 2014) 300hpa as shown in Figures (6, 7, 8, 9):

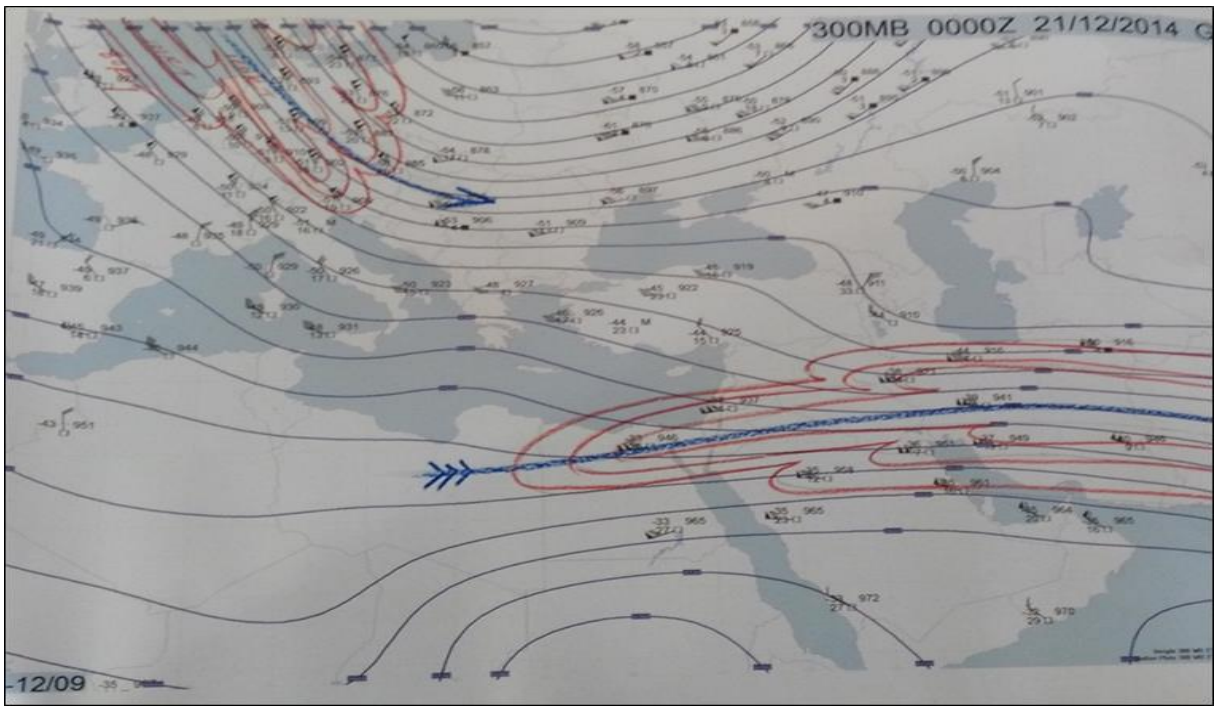

Figure 5. Geopotential height chart for 300hPa for December, 21th, 2014.

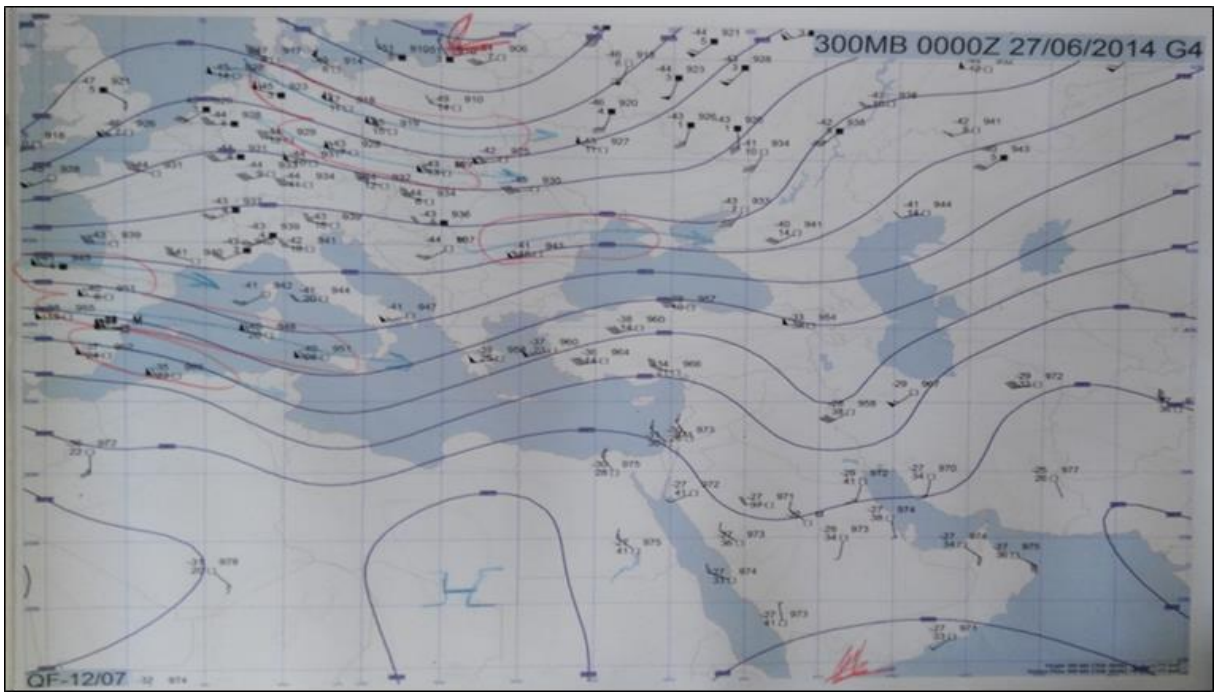

Figure 6. Geopotential height chart for 300hPa for June, 27th, 2014.

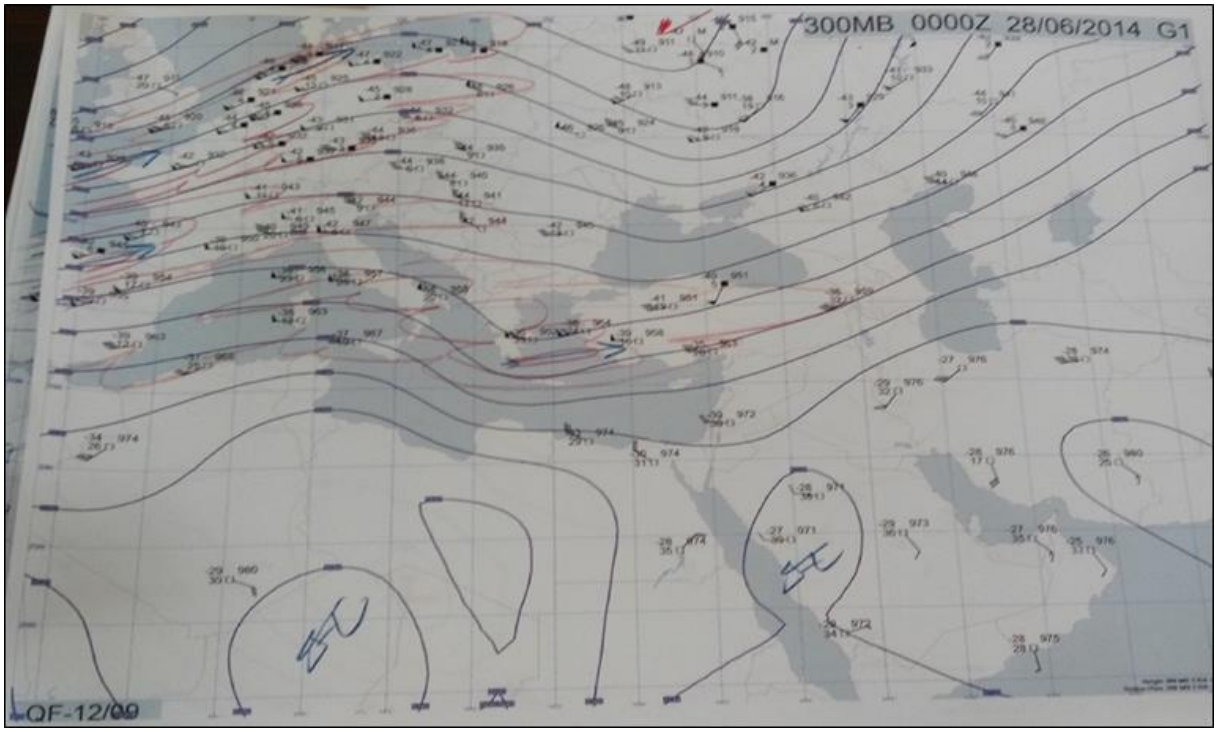

Figure 7. Geopotential height chart for 300hPa for June, 28th, 2014.

Al-Mustansiriyah Journal of Science
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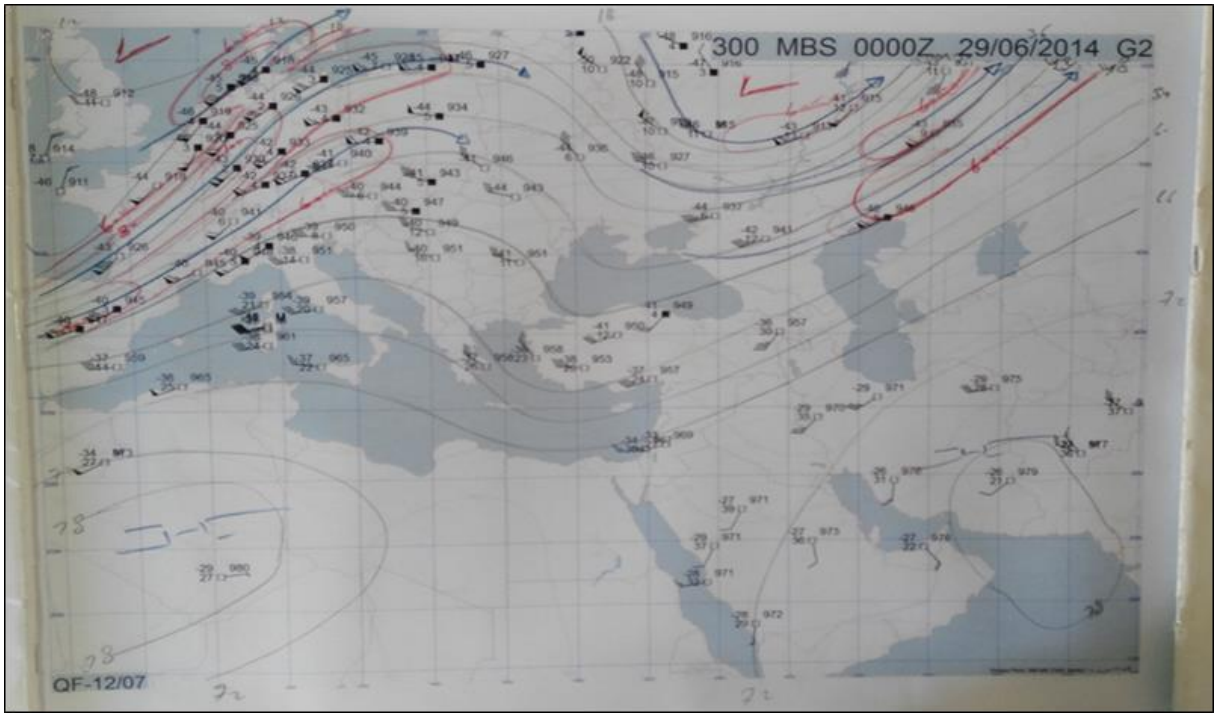

Figure 8. Geopotential height chart for 300hPa for June, 29th,, 2014.

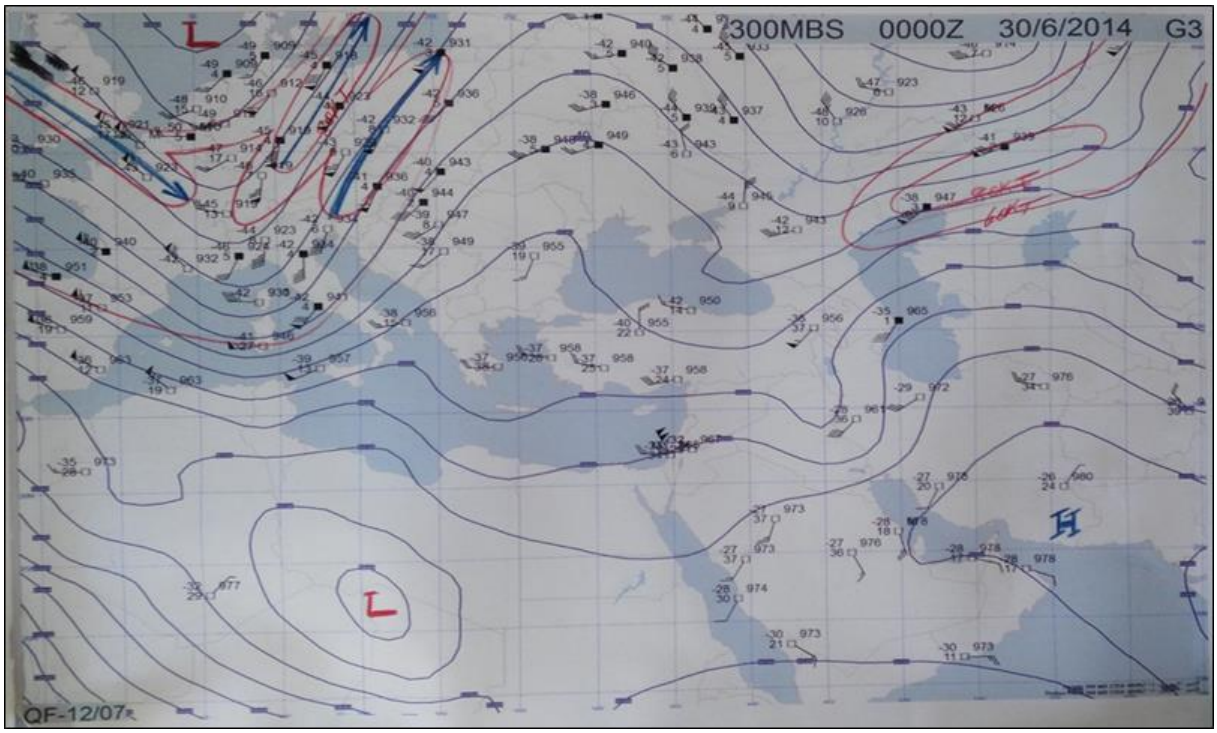

Figure 9. Geopotential height chart for 300hPa for June, 30th, 2014.

CONCLUSIONS

1. Cases jet stream occurs in the summer during is more than cases of jet streams in winter during three years (2012, 2013, 2014).
2. Temperature significant effect on the jet stream if the temperature is the increase will be accursing of the jet stream directly, but if the temperature is decreased in the case jet streams became waves.
3. Depends on maps it's more important than radiosonde data.
4. Frequencies in (2014), ranging between (8-13) visits while ranging between (5-6) through (2013), (1-2) through (2012) and noted that frequencies despite plentiful in the autumn, but it is weak and be stronger during the spring.
5. Maximum frequency of jet stream happened in April and July in 500hpa that equal 13 times, while minimum frequency happened in October and December that equal 2 times.
6. Maximum frequency of jet stream happened in May equal 14 times in 300hpa, while minimum frequency happened in November that equal 2 times.
7. The result of identifying the jet stream current used by synoptic charts through realized verification for all conditions are verification by expanded of Hadley cell to hit Middle East.
8. The result of partial conditions verification carried out the most cases studied of jet streams generated over Europe then have cross way over Mediterranean either flow current over Turkey in this case was strong and growth or toward over Iraq was weak and decay.

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