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Change in the Length of Life of Subarctic Jet Currents Over Iraq and their Impact on Drought

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Abstract

This article investigates the duration of subpolar jet stream persistence over Iraq and its impact on drought conditions. The research involves the analysis of synoptic weather maps at the 300-millibar level during the 0z nighttime observation for the years 1980–2024, focusing on the months of October, January, and April. The article calculates the temporal changes in jet stream persistence and analyses rainfall amounts during the same period and months to determine trends—whether increasing or decreasing. Furthermore, it explores the correlation between the duration of jet stream persistence and rainfall amounts to assess whether the relationship is positive (increasing) or negative (decreasing).

Keywords: *Subpolar Jet Streams, Duration of Persistence, Drought.*

Introduction

The article of subpolar jet streams is a vital area in climatology due to their significant influence on precipitation, which in turn affects various aspects of life. Recently, interest in this field has intensified owing to climate change, which has introduced new climatic patterns and altered the direction and speed of jet streams.

Questions

The article seeks to answer the following questions:

1. Has there been a change in the duration of subpolar jet stream persistence over Iraq?

2. Has the change in the duration of subpolar jet stream persistence over Iraq affected precipitation levels and intensified drought conditions?

Hypothesis

1. There has been a change in the duration of subpolar jet stream persistence over Iraq.

2. This change has influenced precipitation levels and contributed to increased drought severity.

Objective

1. To analyse the duration of subpolar jet stream persistence over Iraq.

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2. To analyse rainfall amounts over Iraq and determine the correlation with the duration of jet stream persistence.

Importance

The significance of this article lies in its contribution to the understanding of a critical aspect of global climatology subpolar jet streams. By examining the duration of their persistence and identifying trends whether increasing or decreasing the article provides insights into changes in precipitation patterns over Iraq. Furthermore, it highlights the relationship between jet stream behaviour and rainfall, offering a better understanding of drought dynamics in the region.

Justification

This article addresses the duration of subpolar jet stream persistence over Iraq due to the significant role these jet streams play in the country's precipitation patterns. Additionally, the lack of previous studies that explore this subject in such detail further justifies the article.

Scope

Spatial Scope: The article is geographically limited to the territory of Iraq, located in the southwestern part of Asia between latitudes 29°05′ and 37°23′ North, and longitudes 38°45′ and 48°45′ East.

Temporal Scope: The temporal dimension of the article spans the years from 1980 to 2024.

Thematic Scope: The article focuses on analysing the duration of subpolar jet stream persistence over Iraq and assessing its impact on drought conditions. Iraq is divided into three regions for the purpose of analysis:

- The northern region, located north of latitude 35°N.
- The central region, situated between latitudes 32°N and 35°N.
- The southern region, located south of latitude 32°N.

Methodology

1. Collecting daily synoptic weather maps from the 0z nighttime observation at the 300-millibar level for subpolar jet streams. A total of 11,880 daily weather maps were obtained from the NOAA website, analysed, and recorded in tabular form as a time series.

2. Calculating the longest duration of subpolar jet stream persistence for each month during the period 1980–2024.

3. Measuring rainfall amounts for the same time period (1980–2024).

4. Determining the correlation between the longest duration of subpolar jet stream persistence and rainfall amounts.

Discussion

The term "duration of persistence" refers to the longest continuous period during a given month in which the subpolar jet stream remains present.

1. Longest Duration of Subpolar Jet Stream Persistence over Iraq (1980–2024): [This section appears to introduce an analysis or data presentation, which can be expanded further if you provide more content or specific figures.]

Northern Region:

a. October:

Table (1) and Figure (1) illustrate that the average of the time series for the longest duration of subpolar jet stream persistence over the northern region during October is 4.59 days.

Year	Longest Stay	Year	Longest Stay	Year	Longest Stay
1980	8	1995	8	2010	5
1981	0	1996	5	2011	4
1982	5	1997	2	2012	3
1983	11	1998	5	2013	4
1984	5	1999	4	2014	3
1985	7	2000	6	2015	2
1986	6	2001	8	2016	3
1987	6	2002	0	2017	6
1988	6	2003	3	2018	2
1989	11	2004	4	2019	5
1990	6	2005	7	2020	3
1991	3	2006	3	2021	5
1992	3	2007	4	2022	4
1993	2	2008	3	2023	4
1994	2	2009	6		
Average:			4.59		
Coefficient of Change:			-0.05		

Table (1): Longest Duration (in Days) of Subpolar Jet Stream Persistence over the Northern Region (0Z Observation) during October (1980–2024)

Source: Developed by the articleer based on analysis of 300-millibar weather maps available at NOAA ESRL PSD.

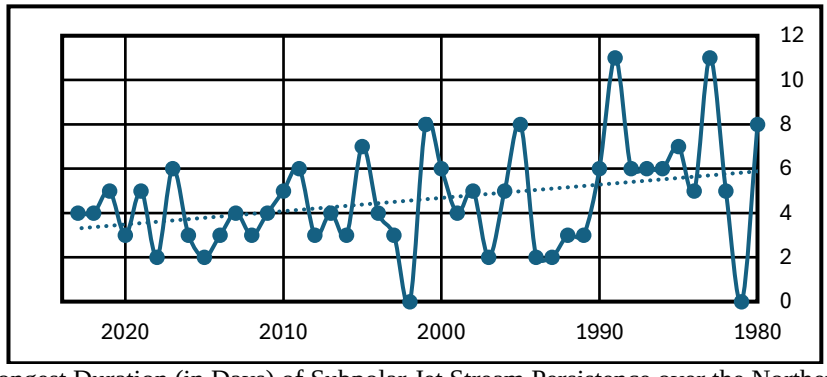

Figure (1): Longest Duration (in Days) of Subpolar Jet Stream Persistence over the Northern Region (0Z Observation) during October (1980–2024)

***Source**: Compiled by the Author based on Table (1).*

a. October (continued):

According to Table (1), the longest recorded duration of subpolar jet stream persistence over the northern region in October during the period 1980–2024 occurred in the years 1983 and 1989, with a duration of 11 days. In contrast, the shortest duration, indicating no persistence at all (0 days), was recorded in the years 1981 and 2002. The coefficient of change for this period was -0.05, indicating a decreasing trend in the jet stream's persistence during October.

b. January:

As shown in Table (2) and Figure (2), the average of the time series for the longest duration of subpolar jet stream persistence over the northern region during January is 9.36 days. The maximum duration was recorded in the year 1995, reaching 18 days, while the minimum duration was 5 days, observed in the years 1984, 2008, 2012, and 2023. The coefficient of change for this period is -0.02, indicating a slight downward trend in persistence over time.

Table (2): Longest Duration (in Days) of Subpolar Jet Stream Persistence over the Northern Region (0Z Observation) during January (1980–2024).

Year	**Longest Duration**	**Year**	**Longest Duration**	**Year**	**Longest Duration**
1981	14	1996	7	2011	6
1982	12	1997	6	2012	5
1983	9	1998	6	2013	11
1984	5	1999	6	2014	13
1985	16	2000	7	2015	9
1986	10	2001	9	2016	9
1987	5	2002	9	2017	10
1988	8	2003	6	2018	10
1989	11	2004	13	2019	10
1990	11	2005	10	2020	10
1991	9	2006	10	2021	9
1992	6	2007	11	2022	12
1993	15	2008	5	2023	5
1994	10	2009	8	2024	8
1995	18				
Average	**9.36**				
Coefficient of Change	**-0.02**				

Table (2): Longest Duration (in Days) of Subpolar Jet Stream Persistence over the Northern Region (0Z Observation) during January (1980–2024).

Source: Compiled by the Author based on the analysis of 300-millibar weather maps published on the website http://www.esrl.noaa.gov/psd/data/composites/.

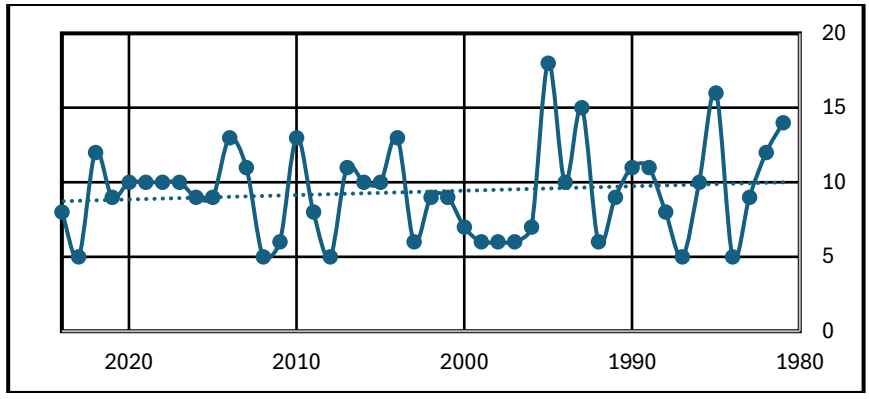

Figure (2): Longest Duration (in Days) of Subpolar Jet Stream Persistence over the Northern Region (0Z Observation) during January (1980–2024)

Source: *Compiled by the Author based on Table (2).*

c. April:

As shown in Table (3) and Figure (3), the average of the time series for the longest duration of subpolar jet stream persistence over the northern region in April is 6.77 days. The maximum duration was recorded in 1984, lasting 14 days, while the minimum was 0 days, recorded in 1989. The coefficient of change is -0.06, indicating a declining trend in persistence over the article period.

Year	**Longest Duration**	**Year**	**Longest Duration**	**Year**	**Longest Duration**
1981	12	1996	8	2011	7
1982	7	1997	10	2012	4
1983	7	1998	8	2013	10
1984	14	1999	6	2014	9
1985	7	2000	7	2015	9
1986	5	2001	9	2016	3
1987	7	2002	7	2017	7
1988	4	2003	6	2018	3
1989	0	2004	9	2019	11
1990	9	2005	10	2020	6
1991	13	2006	4	2021	6
1992	9	2007	5	2022	2
1993	4	2008	5	2023	3
1994	4	2009	6	2024	4
1995	8	2010	4		
Average	**6.77**				
Coefficient of Change	**-0.06**				

Table (3): Longest Duration (in Days) of Subpolar Jet Stream Persistence over the Northern Region (0Z

Observation) during April (1980–2024)

Source: *Compiled by the Author based on the analysis of 300-millibar weather maps published on the website http://www.esrl.noaa.gov/psd/data/composites/.*

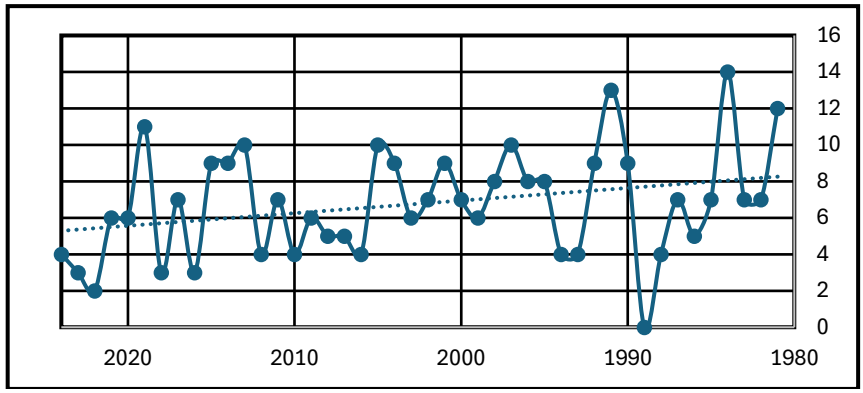

Figure (3): Longest Duration (in Days) of Subpolar Jet Stream Persistence over the Northern Region (0Z Observation) during April (1980–2024)

Source: Compiled by the Author based on Table (3).

Central Region

a. October:

As shown in Table (4) and Figure (4), the average of the time series for the longest duration of subpolar jet stream persistence over the central region in October is 4.45 days. The longest durations were recorded in the years 1983 and 1989, each with 11 days, while the shortest duration, 0 days, occurred in 1981 and 2002. The coefficient of change is -0.05, indicating a declining trend over the article period.

Year	Longest Duration	Year	Longest Duration	Year	Longest Duration
1980	7	1995	8	2010	4
1981	0	1996	5	2011	7
1982	4	1997	2	2012	4
1983	11	1998	5	2013	10
1984	5	1999	4	2014	9
1985	6	2000	6	2015	9
1986	6	2001	8	2016	3
1987	5	2002	0	2017	7
1988	6	2003	3	2018	3
1989	11	2004	4	2019	11
1990	6	2005	7	2020	6
1991	3	2006	3	2021	6
1992	3	2007	4	2022	2
1993	2	2008	3	2023	3
1994	2	2009	6	2024	4

Average	**4.45**
Standard Deviation	-0.05

Table (4): Longest Duration (in Days) of Subpolar Jet Stream Persistence over the Central Region (0Z Observation) during October (1980–2024).

Source: Compiled by the Author based on the analysis of 300-millibar weather maps published on the website http://www.esrl.noaa.gov/psd/data/composites/

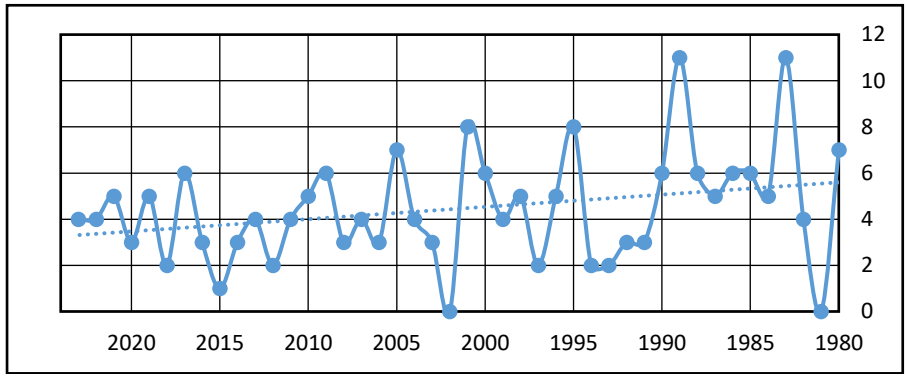

Figure (4): Longest Duration (in Days) of Subpolar Jet Stream Persistence over the Central Region (0Z Observation) during October (1980–2024)

Source: *Compiled by the Author based on Table (4).*

b. January:

As shown in Table (5) and Figure (5), the average of the time series for the longest duration of subpolar jet stream persistence over the central region in January is 9 days. The longest duration was recorded in 1995, with 18 days, while the shortest duration was 5 days, observed in the years 1984, 1997, 2008, 2012, and 2023. The coefficient of change is -0.02, indicating a declining trend in persistence over the article period.

Year	Duration	Year	Duration	Year	Duration
1981	14	1996	7	2011	6
1982	12	1997	5	2012	5
1983	9	1998	6	2013	11
1984	5	1999	6	2014	11
1985	15	2000	7	2015	9
1986	10	2001	9	2016	6
1987	5	2002	8	2017	10
1988	8	2003	6	2018	10
1989	11	2004	13	2019	10
1990	11	2005	10	2020	10
1991	9	2006	10	2021	9
1992	6	2007	11	2022	11

1993	12	2008	5	2023	5
1994	6	2009	8	2024	8
1995	18	2010	13		
Average	9				
Rate of Change	-0.02				

Table (5): Longest Duration (in Days) of Subpolar Jet Stream Persistence over the Central Region (0Z Observation) during January (1980–2024)

Source: Compiled by the Author based on the analysis of 300-millibar weather maps published on the website http://www.esrl.noaa.gov/psd/data/composites/

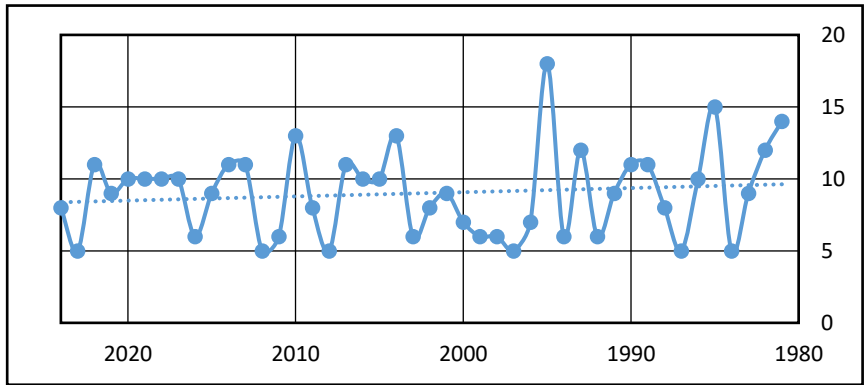

Figure (5): Longest Duration (in Days) of Subpolar Jet Stream Persistence over the Central Region (0Z Observation) during January (1980–2024)

Source: Compiled by the Author based on Table (5).

c. April:

As shown in Table (6) and Figure (6), the average of the time series for the longest duration of subpolar jet stream persistence over the central region in April is 6.47 days. The longest duration of persistence occurred in 1984, with 14 days, while the shortest duration was 0 days, observed in 1989. The coefficient of change is -0.07, indicating a declining trend in persistence over the article period.

Year	Duration	Year	Duration	Year	Duration
1981	12	1996	8	2011	7
1982	7	1997	10	2012	2
1983	7	1998	8	2013	10
1984	14	1999	6	2014	9
1985	7	2000	7	2015	9
1986	3	2001	9	2016	2
1987	7	2002	7	2017	7
1988	4	2003	6	2018	3
1989	0	2004	9	2019	11

1990	9	2005	10	2020	6
1991	13	2006	3	2021	5
1992	6	2007	5	2022	2
1993	3	2008	5	2023	2
1994	4	2009	6	2024	3
1995	8	2010	4		
Average	6.47				
Rate of Change	-0.07				

Table (6): Longest Duration (in Days) of Subpolar Jet Stream Persistence over the Central Region (0Z Observation) during April (1980–2024)

Source: Compiled by the Author based on the analysis of 300-millibar weather maps published on the website http://www.esrl.noaa.gov/psd/data/composites/

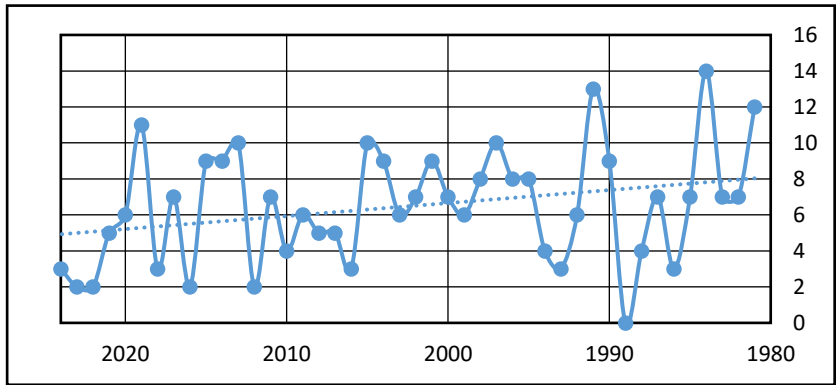

Figure (6): Longest Duration (in Days) of Subpolar Jet Stream Persistence over the Central Region (0Z Observation) during April (1980–2024)

Source: Compiled by the Author based on Table (6).

Southern Region

a. October:

As shown in Table (7) and Figure (7), the average of the time series for the longest duration of subpolar jet stream persistence over the southern region in October is 3.56 days. The longest duration was observed in 1989, with a continuous 10-day period. This duration was not repeated in the years 1981, 1992, 2002, and 2015. The coefficient of change is -0.03, indicating a declining trend in persistence over the article period.

Year	Duration	Year	Duration	Year	Duration
1980	3	1995	6	2010	5
1981	0	1996	5	2011	3
1982	4	1997	2	2012	2
1983	6	1998	3	2013	3
1984	5	1999	3	2014	2

1985	6	2000	6	2015	0
1986	5	2001	6	2016	2
1987	4	2002	0	2017	4
1988	3	2003	3	2018	1
1989	10	2004	2	2019	5
1990	6	2005	7	2020	3
1991	3	2006	3	2021	5
1992	0	2007	4	2022	4
1993	2	2008	2	2023	2
1994	2	2009	5		
Average	3.56				
Rate of Change	-0.03				

Table (7): Longest Duration (in Days) of Subpolar Jet Stream Persistence over the Southern Region (0Z Observation) during October (1980–2024)

Source: Compiled by the Author based on the analysis of 300-millibar weather maps published on the website http://www.esrl.noaa.gov/psd/data/composites/

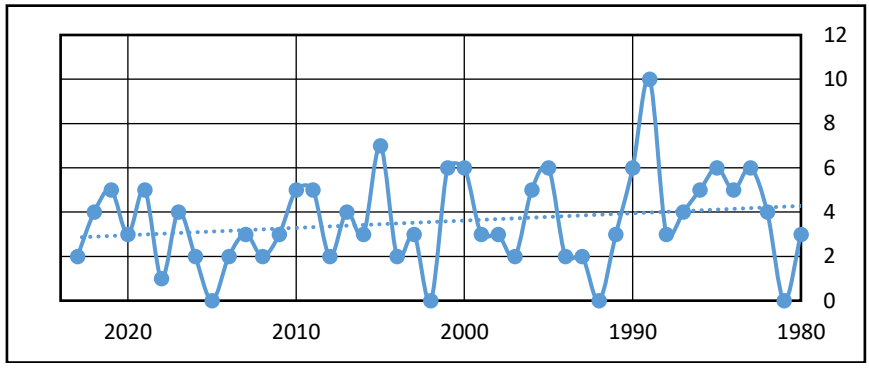

Figure (7): Longest Duration (in Days) of Subpolar Jet Stream Persistence over the Southern Region (0Z Observation) during October (1980–2024)

Source: Compiled by the Author based on Table (7).

b. January:

As shown in Table (8) and Figure (8), the average of the time series for the longest duration of subpolar jet stream persistence over the southern region in January is 8.88 days. The longest duration occurred in 1995, lasting 18 days, while the shortest duration was 5 days, observed in the years 1984, 1987, 1992, 1997, 2008, 2012, and 2023. The coefficient of change is -0.01, indicating a declining trend in persistence.

Year	Duration	Year	Duration	Year	Duration
1981	12	1996	7	2011	6
1982	12	1997	5	2012	5

1983	9	1998	6	2013	11
1984	5	1999	6	2014	11
1985	14	2000	7	2015	9
1986	10	2001	9	2016	6
1987	5	2002	8	2017	10
1988	8	2003	6	2018	10
1989	11	2004	13	2019	10
1990	11	2005	10	2020	10
1991	9	2006	10	2021	9
1992	5	2007	11	2022	11
1993	12	2008	5	2023	5
1994	6	2009	8	2024	8
1995	18	2010	12		
Average	8.88				
Rate of Change	-0.01				

Table (8): Longest Duration (in Days) of Subpolar Jet Stream Persistence over the Southern Region (0Z Observation) during January (1980–2024)

Source: Compiled by the Author based on the analysis of 300-millibar weather maps published on the website http://www.esrl.noaa.gov/psd/data/composites/

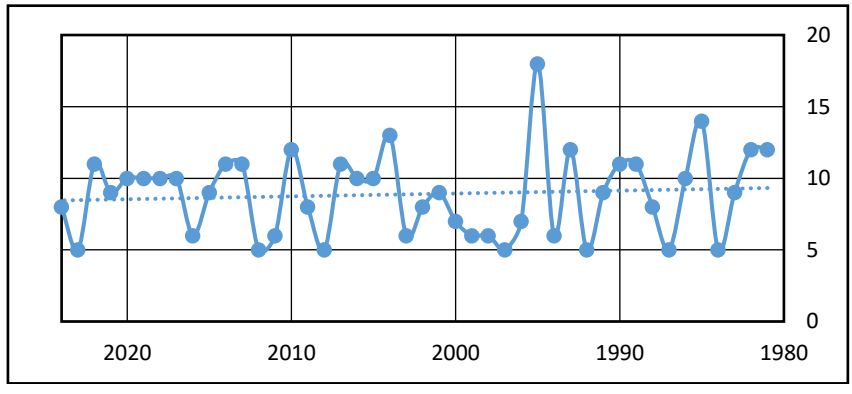

Figure (8): Longest Duration (in Days) of Subpolar Jet Stream Persistence over the Southern Region (0Z Observation) during January (1980–2024)

Source: Compiled by the Author based on Table (8).

c. April:

As shown in Table (9) and Figure (9), the average of the time series for the longest duration of subpolar jet stream persistence over the southern region in April is 6.02 days. The longest duration occurred in the years 1981 and 1991, lasting 12 days. This duration was not repeated in 1989. The coefficient of change is -0.05, indicating a declining trend in persistence.

Year	Duration	Year	Duration	Year	Duration

1981	12	1996	8	2011	7
1982	4	1997	10	2012	2
1983	7	1998	7	2013	8
1984	11	1999	6	2014	8
1985	6	2000	7	2015	9
1986	3	2001	9	2016	2
1987	6	2002	7	2017	6
1988	4	2003	4	2018	3
1989	0	2004	8	2019	9
1990	9	2005	10	2020	6
1991	12	2006	3	2021	5
1992	6	2007	5	2022	2
1993	3	2008	5	2023	2
1994	3	2009	6	2024	3
1995	8	2010	4		
Average	6.02				
Rate of Change	-0.05				

Table (9): Longest Duration (in Days) of Subpolar Jet Stream Persistence over the Southern Region (0Z Observation) during April (1980–2024)

Source: Compiled by the Author based on the analysis of 300-millibar weather maps published on the website http://www.esrl.noaa.gov/psd/data/composites/

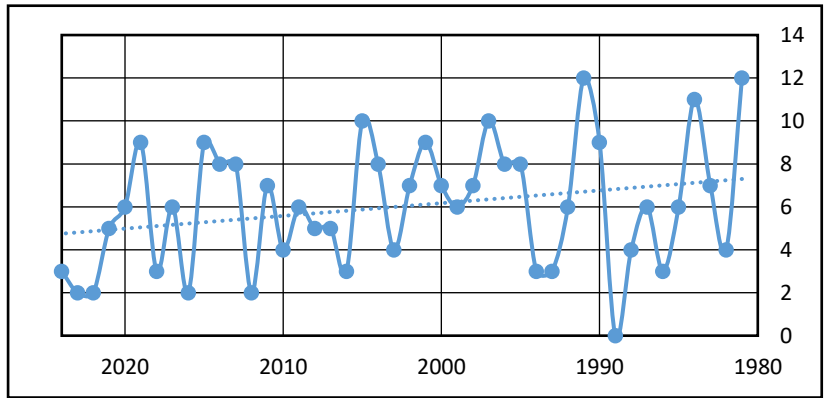

Figure (9): Longest Duration (in Days) of Subpolar Jet Stream Persistence over the Southern Region (0Z Observation) during April (1980–2024)

Source: *Compiled by the Author based on Table (9).*

2. Rainfall Amounts in Iraq for the Period (1980–2024)

a) Northern Region:

The Mosul station was chosen to represent the northern part of Iraq. As shown in Table (10) and Figure (10), during October, the average rainfall for the time series is 14.01 mm, with the highest

rainfall recorded in 1987, reaching 84.7 mm. In 1992, no rainfall was recorded. For January, the average rainfall for the time series is 58.48 mm, with the highest rainfall recorded in 1988 at 198.3 mm, and the lowest rainfall recorded in 2009, with 0.001 mm. For April, the average rainfall for the time series is 38.82 mm, with the highest rainfall recorded in 1993 at 171.4 mm, and the lowest rainfall recorded in 2024, with 0.5 mm. The data also shows a declining trend in rainfall during the mentioned months.

Year	October	January	April
1980	3.1	*	*
1981	26.6	59.4	27.1
1982	15	97	85.8
1983	1	40.5	18.9
1984	18.4	17.8	18.8
1985	3	52.5	52.9
1986	26	31.5	44.1
1987	84.7	18.3	8.4
1988	3.6	198.3	45.2
1989	7.3	14.9	1.3
1990	4	52.4	29.7
1991	0.2	28.5	9
1992	0	97.8	27.2
1993	17.1	49.8	171.4
1994	18.2	76.5	63.7
1995	0.7	37.2	39
1996	6.1	166.9	38.7
1997	38.9	45.6	12.9
1998	0.001	81.8	19.5
1999	10.5	36.8	11.7
2000	12.4	52.6	22.3
2001	2.6	25.9	36.2
2002	9.2	55.4	77.4
2003	11.8	67.1	7.6
2004	3.5	87	76
2005	1.4	94	8.1
2006	34	143.2	92.5
2007	1.1	28	38.9
2008	34.2	21.5	0.8
2009	13.3	0.001	35.7
2010	3.2	56	25.7
2011	2.2	68.3	118.8
2012	10.4	50.8	7.4
2013	0.001	151.8	33.3
2014	74.6	36.9	14.2

2015	22.8	38.1	0.7
2016	0.5	50.4	45.7
2017	0.5	18.7	49.4
2018	28.8	16.9	63.6
2019	10.7	80	130.8
2020	10.7	85.3	50.8
2021	24.8	60.5	25.6
2022	18.9	50.8	20.3
2023	0.5	16.5	0.7
2024	*	14.2	0.5
Average	14.01	58.48	38.82
Rate of Change	-0.03	-0.18	0.05

Table (10): Rainfall Amounts (in mm) over the Northern Region for the Months of October, January, and April (1980–2024)

Source: Compiled by the Author based on data from the General Authority for Meteorology and Seismological Monitoring, Climate Department, Baghdad, 2024 (unpublished data).

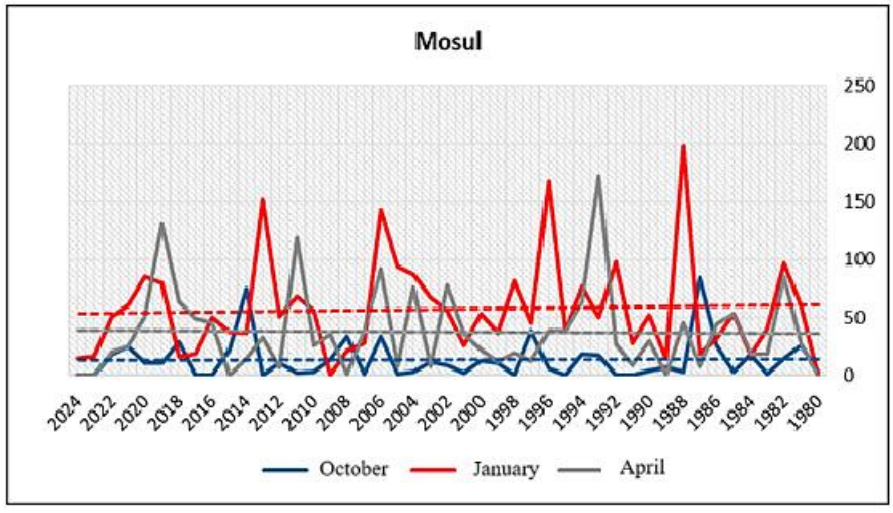

Figure (10): Rainfall Amounts (in mm) over the Northern Region for the Months of October, January, and April (1980–2024)

Source: Compiled by the Author based on Table (10).

b) **Central Region:**

The Baghdad station was chosen to represent the central region of Iraq. As shown in Table (11) and Figure (11), during October, the average rainfall for the time series is 6.02 mm, with the highest rainfall recorded in 2015 at 84.9 mm. In 1983, 1992, 1998, 2017, and 2020, no rainfall was recorded. For January, the average rainfall for the time series is 23.15 mm, with the highest rainfall recorded in 1993 at 102.9 mm, and 1987 saw no recorded rainfall. For April, the average rainfall for the time series is 13.69 mm, with the highest rainfall recorded in 1993 at 59.1 mm, and 2015 had no recorded rainfall.

Year	October	January	April
1980	2.8	*	*
1981	0.001	32.1	6.5
1982	5.5	28.4	23.6
1983	0	13.3	8.6
1984	9.4	49.6	9.2
1985	0	34	0.4
1986	0.2	2.7	45.1
1987	14.1	0	0.9
1988	2.8	36.5	32.4
1989	0.001	32.5	0.6
1990	4.6	17.6	0.9
1991	8.5	21.9	M
1992	0	8.4	1.1
1993	6.1	102.9	59.1
1994	7.3	19.7	7.6
1995	0.001	2.4	15
1996	0.001	40.2	9.1
1997	7.1	8.5	6.4
1998	0	42.4	1.2
1999	0.001	15.7	0.8
2000	4.9	20.7	7.8
2001	0.001	11.9	23.5
2002	3.3	21.4	38.4
2003	M	M	M
2004	M	M	M
2005	0.001	20.4	10.8
2006	11.2	52.7	44.6
2007	0.001	32.2	24
2008	16.6	23.7	0.001
2009	11.6	4.8	11.1
2010	0.001	1.1	10.7
2011	6.1	17.8	31
2012	10.7	3.9	5.4
2013	4	70.8	0.001
2014	4.6	35.8	14.3
2015	84.9	8.2	0
2016	0.001	4.3	11.7

2017	0	9.3	7.5
2018	15.1	0.9	40.8
2019	9.9	49.8	11.4
2020	0	36.1	3.2
2021	1.6	25.6	12.5
2022	0.001	5.8	10.3
2023	0.001	3.9	8.5
2024	*	2.4	5.3
Average	6.02	23.15	13.69
Rate of Change	0.14	-0.2	-0.009

Table (11): Rainfall Amounts (in mm) over the Central Region for the Months of October, January, and April (1980–2024)

Source: Compiled by the Author based on data from the General Authority for Meteorology and Seismological Monitoring, Climate Department, Baghdad, 2024 (unpublished data).

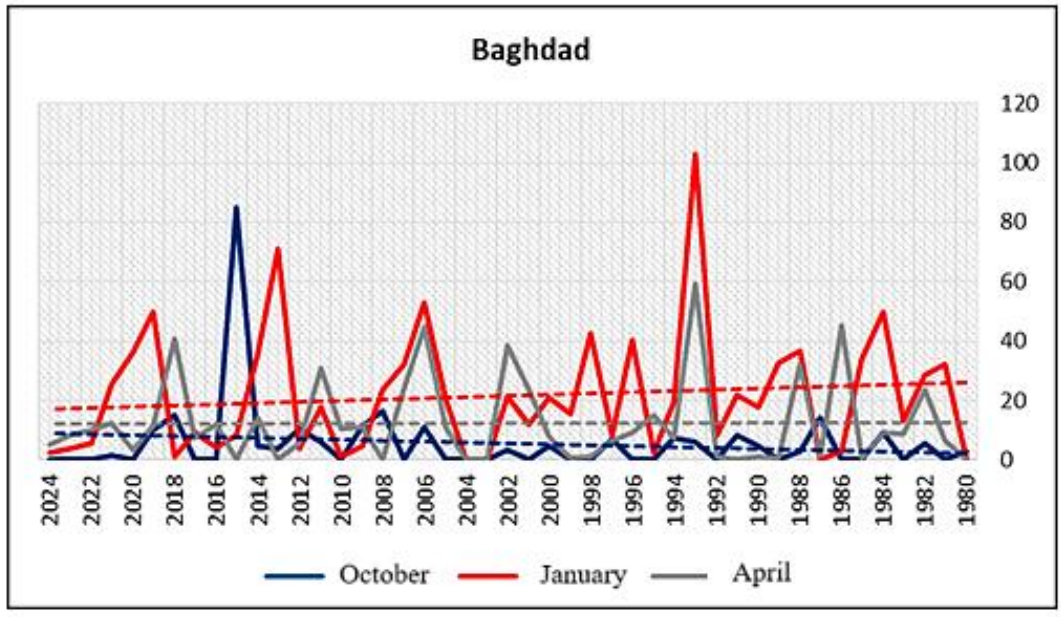

Figure (11): Rainfall Amounts (in mm) over the Central Region for the Months of October, January, and April (1980–2024)

Source: Compiled by the Author based on Table (11).

c) Southern Region:

The Basra station was chosen to represent the southern region of Iraq. As shown in Table (12) and Figure (12), during October, the average rainfall for the time series is 5.22 mm, with the highest rainfall recorded in 1991 at 73.3 mm. In the years 1985, 1986, 1992, 1996, 1998, 2002, 2007, 2010, 2016, 2017, 2019, 2020, 2022, and 2023, no rainfall was recorded. For January, the

average rainfall for the time series is 23.53 mm, with the highest rainfall recorded in 1996 at 67.5 mm, and the lowest rainfall recorded in 1987 at 0.001 mm. For April, the average rainfall for the time series is 11.01 mm, with the highest rainfall recorded in 1986 at 72.1 mm, and the years 2001, 2017, and 2020 saw no recorded rainfall.

Years	October	January	April
1980	0.001	*	*
1981	4.7	29.1	1.2
1982	9.7	47.1	2.1
1983	9	42.4	9.9
1984	0.001	23	0.2
1985	0	35.2	2.4
1986	0	18.6	72.1
1987	15	0.001	3.2
1988	0.001	29.3	11.5
1989	0.4	5	0.001
1990	0.001	8.6	1.8
1991	73.3	45.7	2.7
1992	0	51.1	0.001
1993	6.2	48.4	61.2
1994	41.1	6.9	8.2
1995	0.001	9.9	18.3
1996	0	67.5	58.4
1997	0.9	50.6	28.8
1998	0	47	2.2
1999	0.001	43	0.3
2000	2.9	59.7	0.2
2001	4.5	31.2	0
2002	0	21.5	22
2003	M	M	M
2004	M	M	M
2005	0.001	54.7	2
2006	12.2	58.1	9.4
2007	0	16.3	46.7
2008	3.8	31.6	18
2009	0.9	4.4	4.6
2010	0	10.1	10.3
2011	1	18.5	7.2
2012	0.6	8.8	7

2013	Station closed	6.1	0.001
2014	0	Station closed	Station closed
2015	13.4	2.2	0.001
2016	0	10.8	8.7
2017	0	0.001	0
2018	14.8	0.001	10.9
2019	0	10.9	6.3
2020	0	1.9	0
2021	0.001	2.8	2.5
2022	0	2.9	6.9
2023	0	2.1	2.1
2024	*	2.1	2.4
Average	5.22	23.53	11.01
Rate of Change	-0.18	-0.69	-0.21

Table (12): Rainfall Amounts (in mm) over the Southern Region for the Months of October, January, and April (1980–2024)

Source: Compiled by the Author based on data from the General Authority for Meteorology and Seismological Monitoring, Climate Department, Baghdad, 2024 (unpublished data).

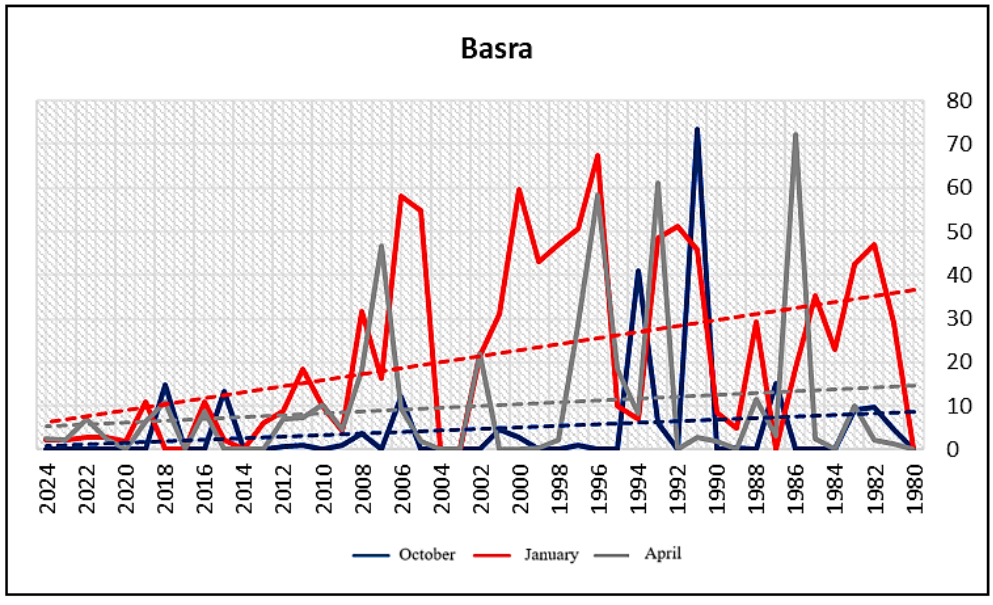

Figure (12): Rainfall Amounts (in mm) over the Southern Region for the Months of October, January, and April (1980–2024)

Source: Compiled by the Author based on Table (12).

Thirdly: Correlation Between the Longest Duration of Polar Jet Stream Persistence and Precipitation Amounts.

Region	October	January	April
North	+68	+55	+53
Central	+65	+53	+50
South	+60	+51	+45

Table (13) That the Correlation Between the Polar Jet Streams and Rainfall Is Positive in All Article Areas.

Source: Compiled by the Author based on the outputs of the SPSS program.

As shown, the correlation was moderately positive in October with values of +68, +65, and +60 for the northern, central, and southern regions, respectively. In January, it was also moderately positive with values of +55, +53, and +51 for the northern, central, and southern regions, respectively. In April, the correlation was moderately positive in the northern and central regions, but weakly positive in the southern region, with values of +53, +50, and +45 for the northern, central, and southern regions, respectively.

Conclusions

1. It was found that the longest duration of polar jet stream persistence has been decreasing in all article areas, with the highest duration recorded in 1995, which reached 18 days across all regions.

2. The rainfall amounts in the northern region have decreased in October and January, while in April, they have increased. In the central region, October recorded an increase, while January and April showed a decrease. In the southern region, there was a decline in rainfall amounts during October, January, and April.

3. The correlation between the longest duration of the polar jet stream and rainfall amounts was positive in all article areas and during all article months. The highest value was in the northern region in October, with +68, while the lowest value was in the southern region in April, with +45.

4. This indicates that the polar jet stream affects the amount of rainfall in Iraq. As the duration of the jet stream's persistence decreases, the amount of rainfall decreases, and conversely, when the jet stream's duration increases, so do the rainfall amounts.

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