

## ANALYSIS OF WEATHER FORECASTS FOR RAINFALL IN IRAQ

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### **Abstract**

Forecasting rainfall is an important ultimatum to protect human life and property. The analysis reveals that forecasting rainfall is something of a difficulty as a result of sudden changes in air traffic and moving atmospheric depressions that are often difficult to predict because they are subject to many factors that determine their activity and rainfall effects. The research aims to reveal the accuracy of Iraq's rainfall weather forecasts and their conformity with air monitoring station records

### **Introduction**

Rain is an important climatic element; It occupies the first place in terms of importance, especially in the dry and semi-arid areas, because of its obvious effects on human activities. Rain falls in Iraq from October to May. The seasonal distribution of rain has varied as a result of the changes that occurred in the rainy depressions and the different paths, depth and duration Repeating it (Al-Hathal and Al-Jubouri, pp. 47-48); Weather forecasts focus on the possibility of rain, which is of great importance in daily life, especially that rain in Iraq is characterized by heterogeneity in its intensity and quantity during the day (Tariq, 2016, p. 2). The rain weather forecast issued by the Iraqi Meteorological Authority is descriptive rather than quantitative; It is defined as (there is) or (there is no), and this description may not give a real impression and is close to reality, because the potential rain can be estimated based on previous experiences from observing the movement of the air depressions that cause rain. Predicting the rainfall is much easier than predicting the amount of rain that will fall. It is one of the most complex forecasting processes, and it has been found that a large proportion of these forecasts are inaccurate. Precipitation is carried out by analyzing weather maps at the level of (500) millibars; These maps are one of the important means in identifying the characteristics of the upper layers of the atmosphere, as the systems of the upper patterns work on the formation and movement of atmospheric depressions on the surface (Baroud, 1993, p. 38,

1-The rainy situation should be comprehensive and cover most of Iraq's area

2-Adoption of persistent rainwaves (rainwaves) for two or more days .

3-The adoption of rainfall cases on which ritualistic forecasts took place. Three cases were taken, to which air reports indicated the existence of rainfall during the days adopted, and a comparison with the rainfall recorded by these stations and a statement of the number of cases identical to the records from the total cases of each station.

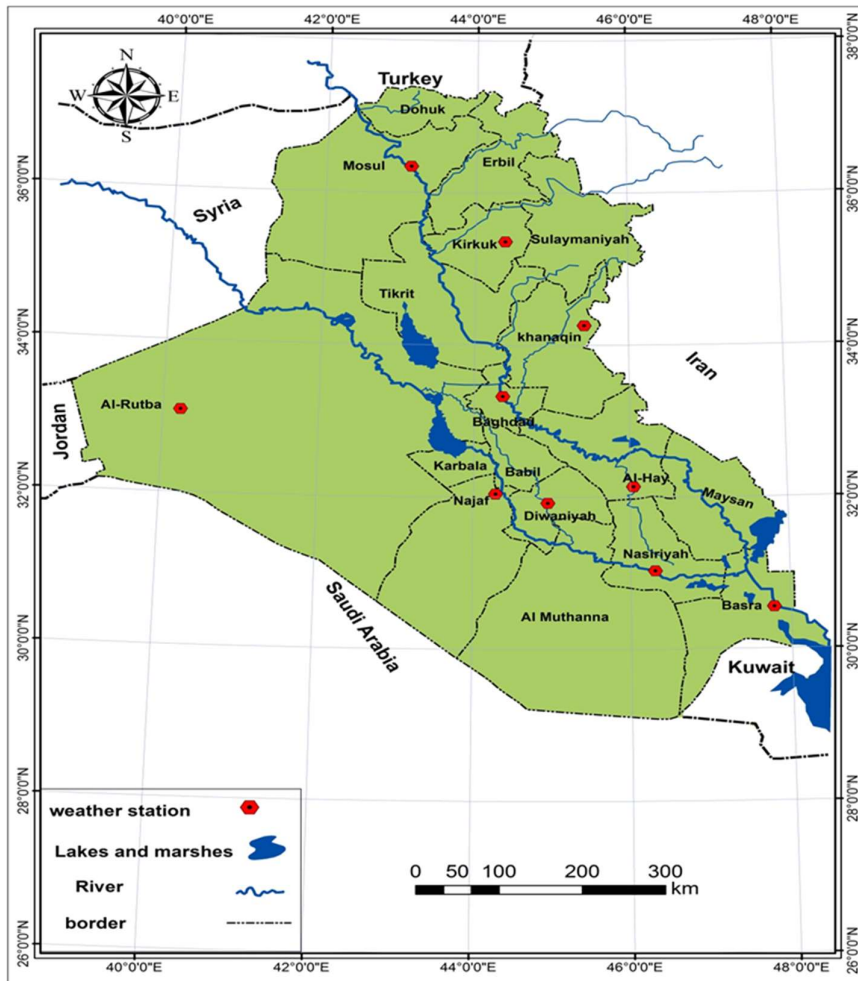
Ten climate stations have been selected throughout Iraq. These stations vary in height and latitude. Table (1) and map (1) are seen for the period (2013-2019).

Table (1) represents the location of the climatic stations included in the study in Iraq.

station	Latitude (North) <sup>o</sup>	Longitude (east) <sup>o</sup>	Height (m)	Station No
Mosul	36 19	43 09	223	608
Kirkuk	35 28	44 4	331	621
khanaqin	34 21	45 23	202	637
baghdad	33 18	44 24	31.7	650
rutba	33 02	40 17	630.8	642
Hay	32 08	46 02	17	665
Najaf	31 57	44 19	53	670
Diwaniyah	31 50	44 10	20	672
Nasiriyah	31 01	46 14	5	676
Basra	30 31	47 47	2	689

Source: Atlas of Iraq's climate (1971- 2000) The General Authority for Meteorology and Seismic Monitoring, Part One, 2012.

Map No. (1) The locations of the stations covered by the study



Source: From the researcher's work based on:

- 1- Arc Gis 10.7.1
- 2- Table (1),
- 3- Atlas of Iraq's climate (1971-2000) The General Authority for Meteorology and Seismic Monitoring, Part One, 2012.

### **Spatial and temporal variability of weather forecasts for rainfall in Iraq**

Weather forecasts vary from month to month and from station to station as a result of sudden changes in air traffic and moving meteorological depressions, which are often difficult to predict because they are subject to many factors that determine their activity and rainfall effects. They may be expected to cause rain in a given area and may not occur as they may pass above these depressions and may be completely rainy.

The accuracy of weather forecasts relating to the rainfall in Iraq varied from one month to the next and from one station to another in order to arrive at accurate results.

#### **1-January**

The month of January records the highest total of rainfall in Iraq, and the number of rainy days increases due to the passage of rainy depressions, which are more powerful and stable. Therefore, the most rainy depressions during this month, which led to the conformity of weather forecasts of rain with the records of monitoring stations during this month. From Table (2), the total number of predictions cases that match the recordings of meteorological stations reached (118) cases, at a rate of (65.6%), and the decrease in the number of cases of predictions that did not match the recordings of meteorological stations for the month of January amounted to (62) cases, at a rate of (34.4%) , It appears from Figure (1) that the matching cases vary between stations; Khanaqin and Baghdad stations recorded the highest number of matching cases, amounting to (16) cases for each station, at a rate of (88.9%), and Kirkuk station recorded the second highest total of (15) cases, at a rate of (83%), while the Mosul station recorded a total of (13) case, At a rate of (72.2%), while (12) cases were recorded in stations (Al-Hay, Najaf, Nasiriyah) at a rate of (66.7%), and the corresponding predictions cases in Al-Diwaniyah station were (11) cases at a rate of (61.1%), and the lowest total of matching prediction cases It was recorded in the station (Al-Rutba and Basra) of (5,6) cases, respectively, at a rate of (27.8- 33.3)%, see Table (2) and Figure (1).

It is clear from Figure (1) that the highest total of non-conforming cases was recorded in Al-Rutba and Basra stations, respectively (13, 12) cases, with a rate ranging between (72.2- 66.7%), while the other stations recorded the lowest matching cases, and the total non-conforming cases varied Among them, the number of non-conforming cases in the stations of Mosul and Kirkuk amounted to (5,3) cases, with a rate ranging between (27.8-16.7%), respectively, and the total non-conforming cases in Khanaqin, Baghdad, and Al-Hay stations reached (2,2,6) cases, with a percentage ranging between ( 11.1- 33.3)%, while the stations (Najaf, Diwaniyah, Nasiriyah) recorded varying cases amounting to (6, 7, 6) cases, respectively, with a percentage ranging between (33.3 - 38.9)%, see Table (2) and Figure (1).

It is noted from Appendix (1) that the accuracy of predictions varies in the cases covered by the study; As the weather forecast indicated that there will be rain on the day (28/1/2014), we found that these forecasts matched with the stations (Mosul, Kirkuk, Khanaqin, Baghdad, Najaf) and the rain intensity in these stations reached (9.3, 14, 0.4, 1.2, 0.001) mm, while the stations (Al-Rutba, Al-Hay, Al-Diwaniyah, Al-Nasiriyah, Basra) did not record rain, the weather forecast also

indicated that there is a comprehensive rain condition for all stations on (28/1/2019) and its forecasts matched with all stations, except for the station Najaf, which did not record any rain, while the other stations recorded rain; It reached in stations (Mosul, Kirkuk) and respectively (40.2, 21) mm, and its density in stations (Khanaqin, Rutba, Baghdad, Al-Hayy) reached (24, 2.8, 0.001, 10) mm, while the stations of (Al-Diwaniyah, Nasiriyah, Basra) (11.1, 3.2, 4) mm, see Appendix (1).

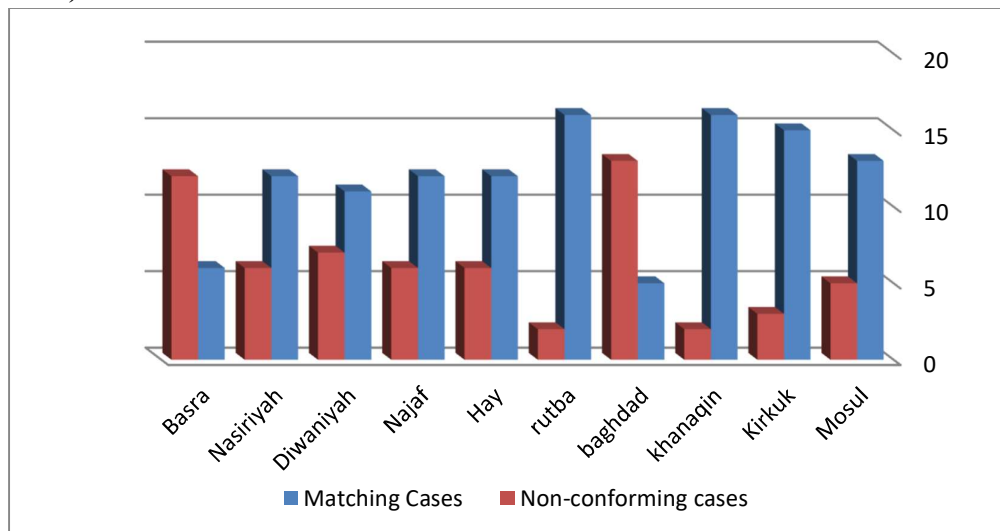
Table (2)Cases of weather forecasts for rain matching and non-conforming to the recordings of meteorological stations in a month January in Iraq for the period (2013-2019)

station	Matching Cases		Non-conforming cases		total	
	number	%	number	%	Cases	%
Mosul	13	72.2	5	27.8	18	100
Kirkuk	15	83.3	3	16.7	18	100
khanaqin	16	88.9	2	11.1	18	100
baghdad	5	27.8	13	72.2	18	100
rutba	16	88.9	2	11.1	18	100
Hay	12	66.7	6	33.3	18	100
Najaf	12	66.7	6	33.3	18	100
Diwaniyah	11	61.1	7	38.9	18	100
Nasiriyah	12	66.7	6	33.3	18	100
Basra	6	33.3	12	66.7	18	100
Total/ rate	118	65.6	62	34.4	180	100

The source is the researcher's work based on the appendix(1).

Figure (3)

Variation in weather forecasts for rain in the month of January in Iraq for the period (2013-2019)



The researcher's work is based on a table(2).

## 2-April

The month of April is considered one of the transitional months that witness cases of atmospheric instability in all regions of Iraq; As the rotation of different pressure systems makes predictions

accurate about the presence of varying rain conditions between stations, the weather fluctuations that the regions of Iraq are exposed to, especially in the transitional seasons, is a complex matter, which leads to a lack of clarity of vision related to the state of the air and thus poor weather estimates of the weather and incorrect weather forecasts in many. From the times, it is clear from Table (3) the general total of weather forecast cases that correspond to the records of meteorological stations (101) cases, at a rate of (48.1%), As for the general total of cases of weather forecasts that do not match the records of meteorological stations, it reached (109), with a percentage of (51.9%).

and it appears from Figure (2) the spatial variation of this total between the meteorological stations, and the highest matching cases were recorded in the two stations (Mosul and Al Hay) with a total of 14,13 cases, respectively, with a rate ranging between (66.7-61.9)% While Nasiriyah station recorded identical cases, a total of (12) cases at a rate of (57.1%), while stations (Kirkuk, Khanaqin and Diwaniyah) all recorded the same number (11) cases for each station at a rate of (52.4%), and Baghdad and Najaf station also recorded The same number for each of them reached (10) cases, with a percentage of (47.6%). ), As for the lowest stations that recorded identical cases, Al-Rutba and Najaf stations amounted to (6, 3) cases, respectively, with a percentage ranging between (28.6-14.3)%, see Table (3) and Figure (2).

Figure (2) shows the spatial variation in the number of weather forecast cases between the regions of Iraq, and the highest number was recorded in the Basra and Al-Rutba stations, amounting to (18,15) cases, respectively, with a rate ranging between (85.7-71.4)%, while the Baghdad and Najaf stations recorded each (11) cases at a rate of (52.4%) for each station. As for Kirkuk, Khanaqin and Al-Diwaniyah stations, each station recorded a total of (10) cases, with a rate of (47.6%) for each station. As for the Nasiriyah and Al-Hay stations, the total number of non-conforming cases, respectively, was (9). , 8) cases with a rate ranging between (42.9-38.1)%, and finally the Mosul station, which recorded the least number of cases of non-conforming predictions, amounted to (7) cases, with a rate of (33.3%). See Table (3) and Figure (2).

It is evident from Appendix (2) that the accuracy of weather forecasts for rain varies between weather stations during this month. As it was expected that all the stations included in the study would record rain on the day (3/5/2013), and from the appendix (2) it became clear that all the recordings of the stations did not record any rain during this day, as well as expected for (14/5/2014) the presence of a case Rainfall includes all regions of Iraq, and through the monitoring records, we find that the stations (Kirkuk, Khanaqin, Baghdad, Al-Hayy) (Najaf and Al-Diwaniyah) recorded rainfall; As the rain intensity in these stations reached (11.6, 3, 12.6, 1.7) mm (0.001, 1.2) mm, respectively, while the stations (Mosul, Rutba, Nasiriyah, Basra) were not covered by rain during this day, and it was expected on the day (10/ 5/2018) the existence of a rainy situation that includes all regions of Iraq, the rain situation was not comprehensive; As the Basra and Rutba stations were not covered by the rainy situation, the rest of the stations recorded totals of rain of different intensity, which amounted to (1.3) mm in Mosul station and (0.4) mm in Kirkuk, while Baghdad station recorded (21.3) mm and Hayy station (0.2) mm, and Najaf station recorded (0.2) mm, Al-Diwaniyah station was the highest density; The total rainfall amounted to (27.4) mm, and the Nasiriyah station recorded a total rainfall of (1.4) mm.

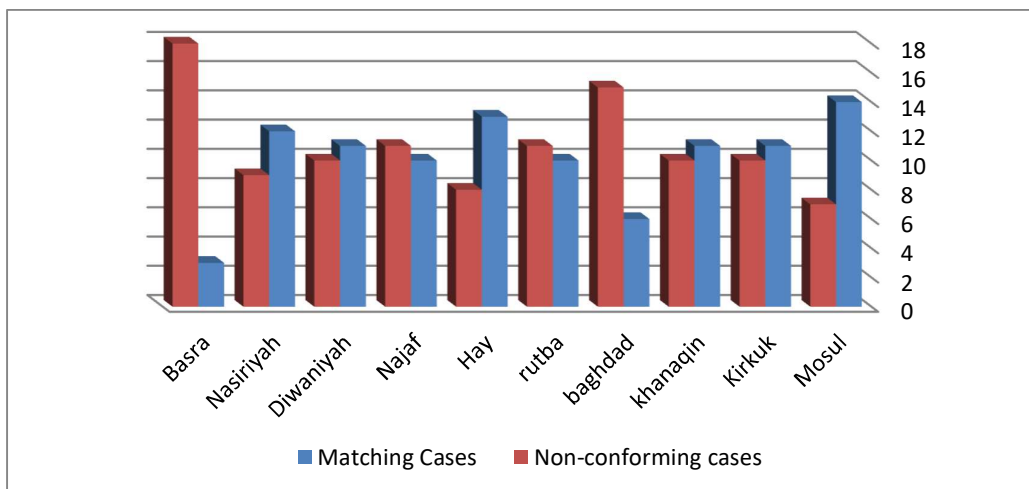
**Table (3)Cases of weather forecasts for rain matching and non-conforming to the recordings of meteorological stations in a month April in Iraq for the period (2013-2019)**

station	Matching Cases		Non-conforming cases		total	
	number	%	number	%	Cases	%
Mosul	14	66.7	7	33.3	21	100
Kirkuk	11	52.4	10	47.6	21	100
khanaqin	11	52.4	10	47.6	21	100
baghdad	6	28.6	15	71.4	21	100
rutba	10	47.6	11	52.4	21	100
Hay	13	61.9	8	38.1	21	100
Najaf	10	47.6	11	52.4	21	100
Diwaniyah	11	52.4	10	47.6	21	100
Nasiriyah	12	57.1	9	42.9	21	100
Basra	3	14.3	18	85.7	21	100
Total/ rate	101	48.1	109	51.9	210	100

The source is the researcher's work based on the appendix(2).

**Figure (2)**

**Variation in weather forecasts for rain in the month April of in Iraq for the period (2013-2019)**



The researcher's work is based on a table(3).

### 3-October

October is the beginning of rain in Iraq; As rainy depressions begin to reach Iraq's airspace, coinciding with the retreat of the seasonal Indian depression, in addition to the progression of cold season systems, which leads to a state of instability. Weather forecasts for rain vary during this month; It is noted from Table (4) that the total number of weather forecasts that match the meteorological records have decreased, amounting to (62) cases, at a rate of 31%. It is noted that the total number of weather forecasts that do not match the records of meteorological stations has increased; It amounted to (138) cases at a rate of (69%), and the weather forecasts varied between the stations covered by the study. The stations (Mosul, Baghdad, Najaf, Nasiriyah) recorded a total of cases (7) cases for each station (35%), the neighborhood station recorded (6)



identical cases (30%), and Khanaqin and Basra stations recorded (5) cases (25%), and the matching cases in Rutba and Nasiriyah stations amounted to (4) cases with a percentage of (20%), see table (4) and figure (3).

The highest non-conforming cases were recorded in Al-Rutba and Al-Diwaniyah stations, which amounted to (16) cases, at a rate of (80%), while Khanaqin and Basra recorded (15) non-conforming cases at a rate of (75%), while the neighborhood station recorded (14) non-conforming cases with a rate of (70%). ), as for the Mosul station, Baghdad, Najaf, and Nasiriyah, it recorded (13) cases at a rate of (65%), while the lowest total of non-conforming weather forecast cases was recorded in Kirkuk station, with a total of (10) cases and a rate of (50%), see the table ( 4) and figure.(3).

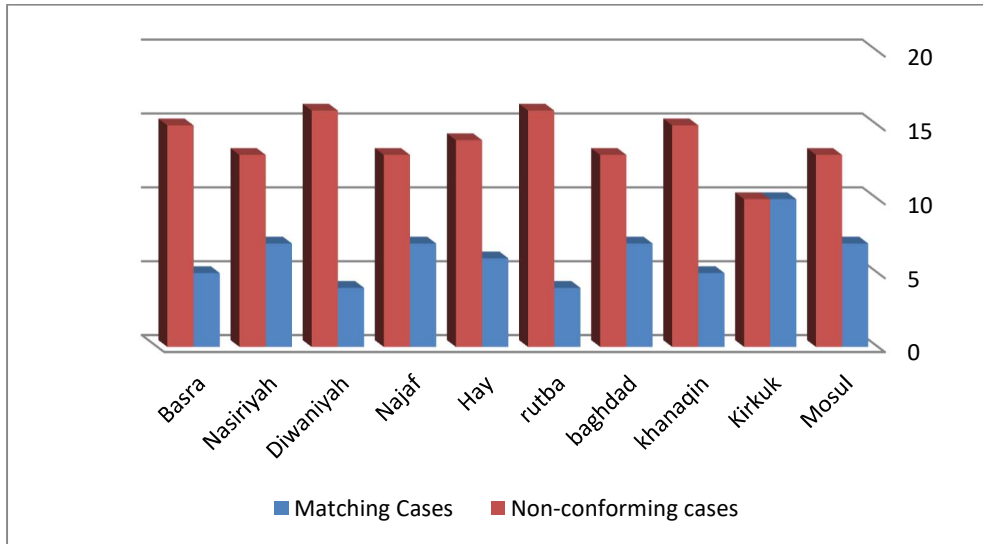
It is noted from Appendix (3) that the accuracy of the weather forecasts for the stations varies during the day when it is expected that there will be rainy cases in certain stations. Comprehensive rain for all stations, and these forecasts matched with stations (Mosul, Kirkuk, Baghdad, Najaf); As the rain intensity reached (13.5, 5.4, 0.5, 0.001) mm, respectively, while the stations (Khanaqin, Al-Rutba, Al-Hayy, Al-Diwaniyah, Al-Nasiriyah, Basra) did not record rain, and it was expected that all the stations covered by the study would record rain on the day (26/ 10/2018) and these forecasts coincided with the stations (Kirkuk, Khanaqin, Al-Hayy, Najaf, Diwaniyah, Nasiriyah, Basra) in which the intensity of rain reached (12.2, 6, 18.6, 1.4, 0.5, 0.001, 6) mm, respectively, see the appendix (3).

**Table (4)Cases of weather forecasts for rain matching and non-conforming to the recordings of meteorological stations in a month October in Iraq for the period (2013-2019)**

station	Matching Cases		Non-conforming cases		total	
	number	%	number	%	Cases	%
Mosul	7	35	13	65	20	100
Kirkuk	10	50	10	50	20	100
khanaqin	5	25	15	75	20	100
baghdad	7	35	13	65	20	100
rutba	4	20	16	80	20	100
Hay	6	30	14	70	20	100
Najaf	7	35	13	65	20	100
Diwaniyah	4	20	16	80	20	100
Nasiriyah	7	35	13	65	20	100
Basra	5	25	15	75	20	100
Total/ rate	62	31	138	69	200	100

The source is the researcher's work based on the appendix(3).

**Figure (3)  
Variation in weather forecasts for rain in the month October of in Iraq for the period (2013-2019)**



The researcher's work is based on a table(4).

### Conclusions

-1 The accuracy of weather forecasts varied over time, and the month of January recorded the highest matching rate, which amounted to (65.5%). As for the month of April, it recorded the second highest rate of accuracy of weather forecasts for rainy cases in the month of April, which amounted to (48.1%), while for the month of October, the percentage of accuracy of weather forecasts for rainy cases reached (31%).

2- It is noted that the accuracy of weather forecasts varies spatially from one station to another. The two stations of Khanaqin and Baghdad recorded the highest rate of accuracy of matching weather forecasts during the month of January, which amounted to (88.9%), while the Mosul station recorded the highest percentage during the month of April, which amounted to (66.7%), while during the month of October, Kirkuk station recorded the highest accuracy rate of (55) %.

### Sources

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-2 Raghad Tariq Mustafa, a study on rain forecasts for the rainy season (2016-2017), the General Authority for Meteorology and Seismic Monitoring, Baghdad, 2016.

-3 Naim Salman Muhammad Baroud, Early Prediction of Annual Rains in Jordan, Master Thesis, College of Graduate Studies - University of Jordan, 1993.

-4 Weather reports and bulletins issued by the Weather Forecasting Department / General Authority for Meteorology, Iraq

5- Republic of Iraq, Ministry of Transport, General Authority for Meteorology and Seismic Monitoring, Climate Department, unpublished data.



### Appendix (1) Rainy cases recorded in January in Iraq for the period (2013-2019)

the year	station the days	Mosul		Kirkuk		khanqin		baghdad		rutba		Hay		Najaf		Diwaniyah		Nasiriyah		Basra	
		forecasting	recordings	forecasting	recordings	forecasting	recordings	forecasting	recordings	forecasting	recordings	forecasting	recordings	forecasting	recordings	forecasting	recordings	forecasting	recordings	forecasting	recordings
		2013																			
2014	17	exist	20	exist	0.8	exist	17.8	exist	17.8	exist	0.8	exist	27.2	exist	22.2	exist	33	exist	28.8	exist	0
	27	exist	20.8	exist	17.6	exist	0	exist	1.8	exist	0.8	exist	6.6	exist	5.3	exist	5.3	exist	6	exist	0
	28	exist	9.3	exist	14	exist	0.4	exist	1.2	exist	0	exist	0	exist	0.001	exist	0	exist	0	exist	0
2015	9	exist	0	exist	6	exist	0.2	exist	4.6	exist	7.3	exist	0.001	exist	0.8	exist	1	exist	0.001	exist	0
	10	exist	0	exist	2	exist	0.9	exist	3.3	exist	0	exist	0.001	exist	0	exist	0	exist	0.001	exist	0.001
	30	exist	6.3	exist	12	exist	30	exist	0.001	exist	0	exist	2.6	exist	0.001	exist	0	exist	0	exist	0
2016	1	exist	6.1	exist	8.9	exist	6.2	exist	0.001	exist	0	exist	0.001	exist	2.8	exist	6.1	exist	6.1	exist	3.1
	22	exist	0	exist	0	exist	0.001	exist	1.3	exist	0	exist	0.4	exist	1.4	exist	1.2	exist	1.2	exist	0
	23	exist	0.7	exist	0	exist	8	exist	1	exist	0	exist	0	exist	0.001	exist	0	exist	0	exist	0.2
2017	15	exist	0	exist	1.8	exist	3	exist	0.001	exist	0	exist	0	exist	0.001	exist	0.001	exist	0.001	exist	0.001
	26	exist	0.2	exist	0	exist	5	exist	8.5	exist	0	exist	1.9	exist	2.6	exist	4.8	exist	4.8	exist	0
	27	exist	0	exist	4.2	exist	6.7	exist	0.2	exist	0	exist	0.001	exist	0	exist	0.001	exist	0.001	exist	0
2018	19	exist	7.8	exist	0.3	exist	4	exist	0	exist	0	exist	0	There is no	0	exist	0	There is no	0	There is no	0
	25	exist	0.3	exist	6.1	exist	3.2	exist	0.001	exist	0	exist	0.001	exist	0	exist	0	There is no	0	There is no	0
	26	exist	0.2	exist	3	exist	0	exist	0	exist	0	exist	0	exist	0.2	exist	0	exist	0	exist	0
2019	16	exist	0.001	exist	2.8	exist	3.9	exist	2	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0
	27	exist	19.1	exist	10.2	exist	23.3	exist	40.5	exist	22	exist	3.8	exist	33.5	exist	0.001	exist	1.3	exist	1.5
	28	exist	40.2	exist	21	exist	24	exist	2.8	exist	0.001	exist	10	exist	0	exist	11.1	exist	3.2	exist	4

### Appendix (2) Rainy cases recorded in April in Iraq for the period (2013-2019)

the year	station the days	Mosul		Kirkuk		khanqin		baghdad		rutba		Hay		Najaf		Diwaniyah		Nasiriyah		Basra	
		forecasting	recordings	forecasting	recordings	forecasting	recordings	forecasting	recordings	forecasting	recordings	forecasting	recordings	forecasting	recordings	forecasting	recordings	forecasting	recordings	forecasting	recordings
		2013	3	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0
2014	4	exist	3.2	exist	0	exist	0	exist	0	exist	0.4	exist	0	exist	0.001	exist	0	exist	0.001	exist	0
	9	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0
	1	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0.001	exist	0.001	exist	5.1	exist	0
2015	13	exist	1.4	exist	4.8	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0.001	exist	0
	14	exist	0	exist	11.6	exist	3	exist	12.6	exist	0	exist	1.7	exist	0.001	exist	1.2	exist	0.0	exist	0
	10	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0.7	exist	1.3	exist	3.8	exist	0.001	exist	0
2016	11	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0.001	exist	0	exist	0	exist	0.8	exist	0.001
	12	exist	16.0	exist	2.1	exist	5.0	exist	7	exist	0	exist	2.8	exist	0.2	exist	1.2	exist	1.2	exist	7.5
	13	exist	0.001	exist	0.0	exist	16.2	exist	0	exist	0	exist	40.8	exist	2.1	exist	0.4	exist	0.4	exist	0.000
2017	2	exist	12.7	exist	5.6	exist	3.3	exist	1.5	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0.000
	12	exist	0.1	exist	0	exist	0	exist	0	exist	0.6	exist	0	exist	0	exist	0	exist	0	exist	0.000
	14	exist	5.9	exist	2.0	exist	1.6	exist	1.9	exist	0	exist	0	There is no	3	There is no	0.001	There is no	0.001	There is no	0.000
2018	9	exist	0.6	exist	0.0	exist	0	exist	0	exist	0.001	exist	0.1	exist	0.0	exist	0.0	exist	0	exist	0.000
	10	exist	1.3	exist	0.4	exist	0.001	exist	21.3	exist	0	exist	0.2	exist	0.2	exist	27.4	exist	1.4	exist	0.000
	11	exist	0.0	exist	0.0	exist	2	exist	0.001	exist	0.001	exist	7.5	exist	0.0	exist	1.0	exist	0.0	exist	0.000
2019	1	exist	2.2	exist	2.2	exist	58	exist	4.9	exist	0	exist	0.4	exist	8.4	exist	12	exist	0	exist	0.000
	5	exist	3.8	exist	3.8	exist	4.6	exist	0.001	exist	8	exist	0.5	exist	0	exist	0	exist	15.1	exist	0.000
	18	exist	7.7	exist	7.7	exist	1	exist	0.001	exist	0.001	exist	4.2	exist	0	exist	0.001	exist	0.001	exist	0.000

### Appendix (3) Rainy cases recorded in October in Iraq for the period (2013-2019)

the year	station the days	Mout								rutha				Hay		Najaf		Dwamiyah		Nasriyah		Basra	
		Mout		Kirkuk		khamajin		baghdad		rutha		Hay		Najaf		Dwamiyah		Nasriyah		Basra			
		forecasting	recordings	forecasting	recordings	forecasting	recordings	forecasting	recordings	forecasting	recordings	forecasting	recordings	forecasting	recordings	forecasting	recordings	forecasting	recordings	forecasting	recordings		
2013	20	exist	0	exist		exist	0.8	exist	0.8	exist	0.8	exist	12	exist	0	exist	0	exist	0	exist	0		
	26	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0.4	exist	0.001	exist	0	exist	0.001	exist	0		
	31	exist	0	exist	1	exist	0	exist	0	exist	0	exist	0	exist	1.9	exist	0.001	exist	0.001	exist	1.6		
2014	11	exist	0	exist	0	exist		exist	1.0	exist	1.0	exist	0	exist	0	exist	0	exist	0	exist	0		
	12	exist	0.001	exist	1	exist	0	exist	0	exist	0	exist	0.001	exist	0.2	exist	0	exist	0	exist	0		
	30	exist	3.6	exist	0	exist	2	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0		
2015	25	exist	13.5	exist	5.4	exist	0	exist	0	exist	0	exist	0	exist	0.001	exist	0	exist	0	exist	0		
	26	exist	0	exist	13.0	exist	0.2	exist	0	exist	0	exist	0	exist	0.1	exist	0.001	exist	0.001	exist	0		
	28	exist	1.9	exist	3.3	exist	38.2	exist		exist		exist	5.5	exist	32.3	exist	3.4	exist	3.8	exist	1.8		
2016	22	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0.0	exist	0	exist	0	exist	0		
	25	exist	0	exist	0.3	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0		
	27	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0		
2017	28	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0		
	29	exist	0	exist	0.8	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0		
	30	exist	0	exist	0.8	exist	0.3	exist	0	exist	0	exist	0	There is no	0	There is no	0	There is no	0	There is no	0		
2018	14	exist	0.5	exist	TR	exist	0.001	exist	0.001	exist	0.001	exist	4.6	exist	0	exist	0.0	exist	0	exist	0.001		
	26	exist	0	exist	12.2	exist	6	exist	0	exist	0	exist	18.6	exist	1.4	exist	0.5	exist	0.001	exist	6.0		
	27	exist	0	exist	0.0	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0.001	exist	4.0		
2019	22	exist	1	exist	0	exist	0	exist	4.2	exist	4.2	exist	0.001	exist	0	exist	0	exist	0	exist	0		
	25	exist	20.6	exist	0	exist	0	exist	2.0	exist	2.0	exist	1.6	exist	3.6	exist	0.001	exist	0.6	exist	0.001		
	26	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0	exist	0.001	exist	4.1	exist	2.3	exist	16.8		

Source: the researcher based on

1-Weather reports and bulletins issued by the Weather Forecasting Section / General Authority for Meteorology, Iraq

2- Republic of Iraq, Ministry of Transport, General Authority for Meteorology and Seismic Monitoring, Climate Department, unpublished data