Monthly Weather Report

January 2019

Director General

Pakistan Meteorological Department

Prepared by: National Weather Forecasting Center
Islamabad

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SUMMARY

1. In January 2019 area weighted rainfall of the country remained above normal +20%.

2. On regional basis area weighted rainfall was above normal in Khyber Pakhtunkhwa +53%, Punjab +34%, Azad Jammu and Kashmir +33%, Sindh +334%, Gilgit Baltistan +32%, and below normal in Balochistan -33%.

3. Foggy conditions were more prolonged in South Punjab than other parts of the country.

4. On all Pakistan basis near normal average minimum temperatures were recorded.

5. Mountainous areas of Pakistan received good snowfall. Murree received snowfall which was almost equivalent to it's seasonal average.

INTRODUCTION

January is the coldest month in Pakistan with mean minimum temperature varying from -8.2°C in Skardu to 13.8°C in Jiwani. Normal area weighted rainfall in January for Pakistan is 19 mm, For Azad Jammu and Kashmir it is 52.6 mm, Gilgit Baltistan 17.6 mm, Khyber Pakhtunkhwa 45.5 mm, Sindh 2.8 mm, Punjab 15.6 mm and Balochistan 18.1 mm. In January 2019 lowest minimum temperature was recorded in Skardu (-19.6°C) while the highest minimum was recorded in Karachi, Sibbi and Turbat (19.0°C). Highest accumulated precipitation during the whole month was recorded in Malamjaba (256 mm). While highest amount of rainfall during 24 hours was recoded in Islamabad, Golra (82 mm). Five rainy spells entered Pakistan during this month. Their detail is appended below.

FIRST SPELL

Synoptic situation on 1st and 2nd January as obtained by NCEP/NCAR reanalysis dataset (Kalnay 1996) is shown in figure 1. It shows a westerly wave at 500 hPa affecting upper and central parts of the country on 1st with a trough at 850 hPa. Wind patterns indicate that moisture from Caspian Sea converging over the country.

Figure 1 Synoptic situation on 1st and 2nd January 2019. Shaded portion represents the geopotential height pattern at 500 hPa, solid line represents the geopotential height pattern at 850 hPa, while arrows indicate 850 hPa winds.
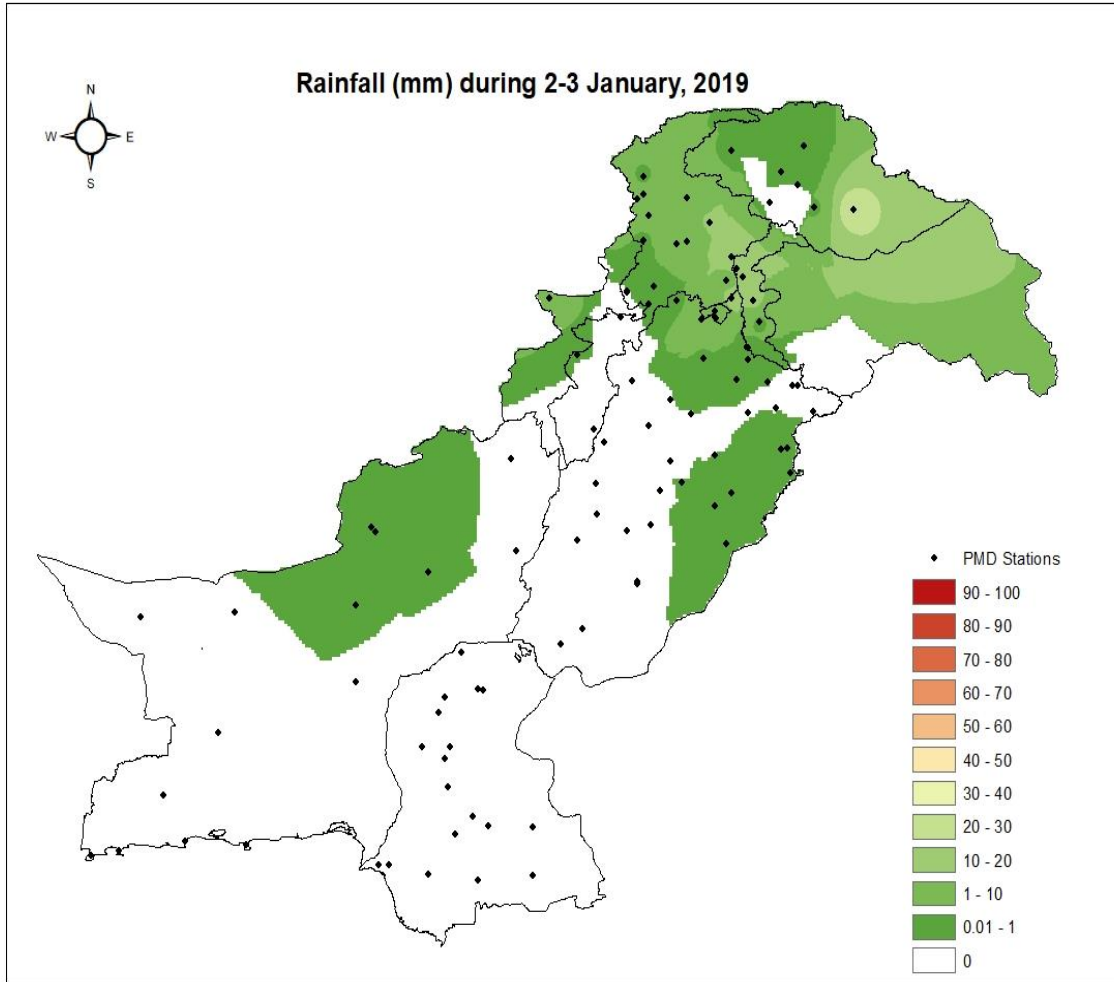
Figure 2 Rainfall (mm) distribution during 2nd and 3rd January 2019.

Rainfall distribution during the first spell is shown in figure 2. Mostly northern, northwestern and northeastern parts received the rainfall. Maximum rainfall was reported from Balakot of 13 mm.

SECOND SPELL

Second wet spell of January was from 5th to 7th January. The synoptic situation in these days is shown in figure 3.

Figure 3 Synoptic situation from 5th to 7th January 2019. Shaded portion represents the geopotential height pattern at 500 hPa, solid line represents the geopotential height pattern at 850 hPa, while arrows indicate 850 hPa winds.

During this period a westerly wave is seen affecting upper and central parts of the country a closed circulation is also present on the eastern parts of the country at 850 hPa.
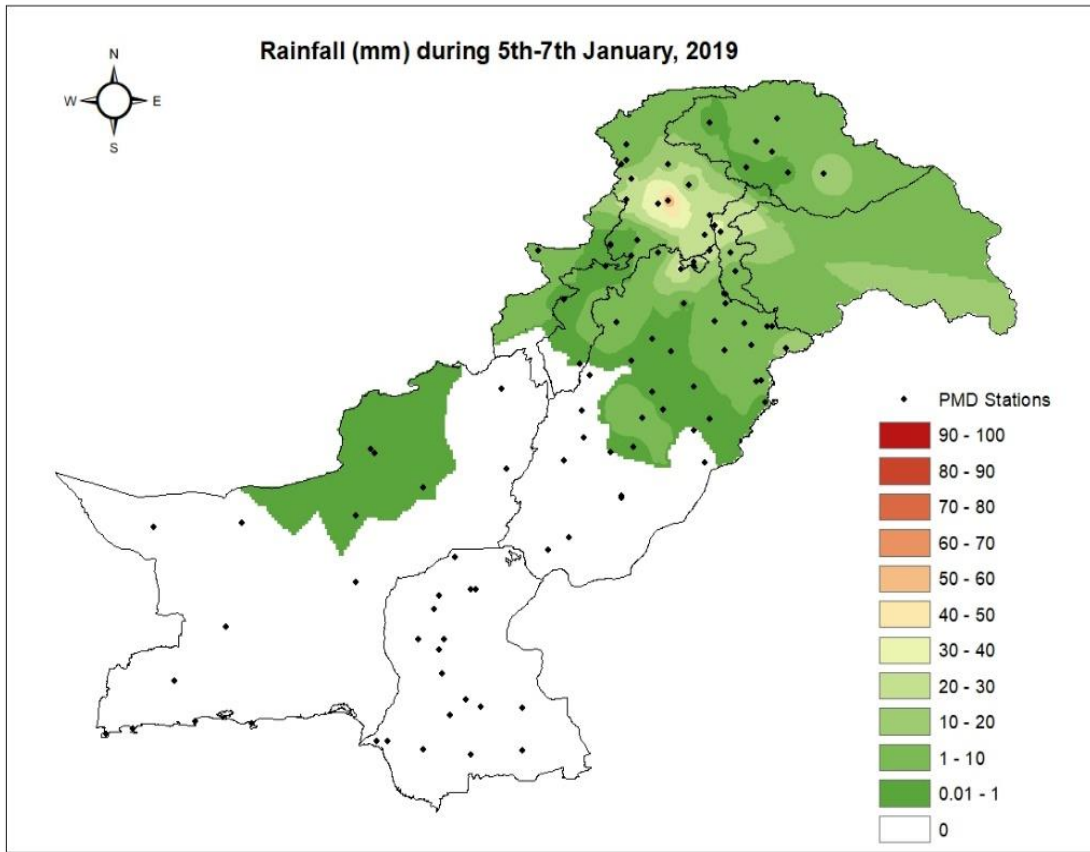
Figure 4 Rainfall (mm) distribution during 5th to 7th January 2019.

Spatial distribution of rainfall from 5th to 7th January is shown in figure 4. Mostly upper and eastern parts of the country received precipitation. Highest rainfall of 49 mm was received at Malamjaba during 24 hours. Mountainous region of the country received good snowfall during the period.

THIRD SPELL

Third wet spell of January was from 11th to 13th. The synoptic situation in these days is shown in figure 5.
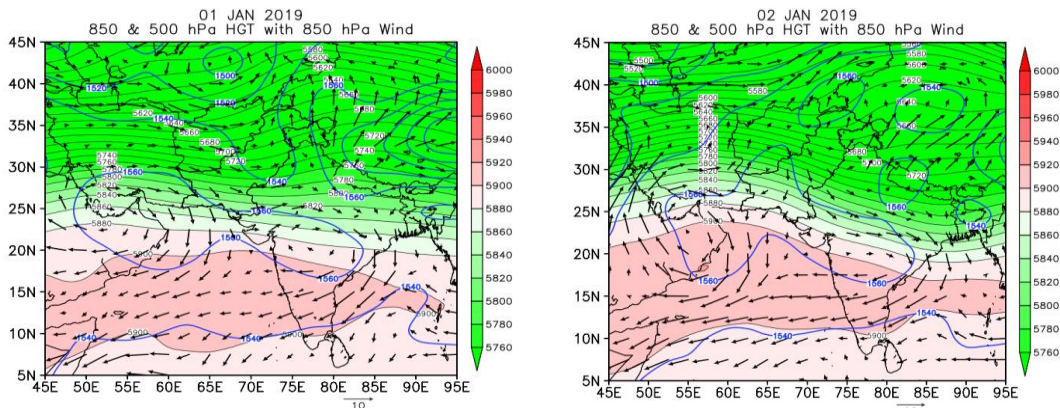

Figure 5 Synoptic situation from 11th to 13th January 2019. Shaded portion represents the geopotential height pattern at 500 hPa, solid line represents the geopotential height pattern at 850 hPa, while arrows indicate 850 hPa winds.

Most parts of the country are under the grip of westerly wave. On 11th and 12th January a closed circulation is also present at 850 hPa, covering eastern and central parts of the country. Due to this rainfall was reported from most parts of the country including Karachi.
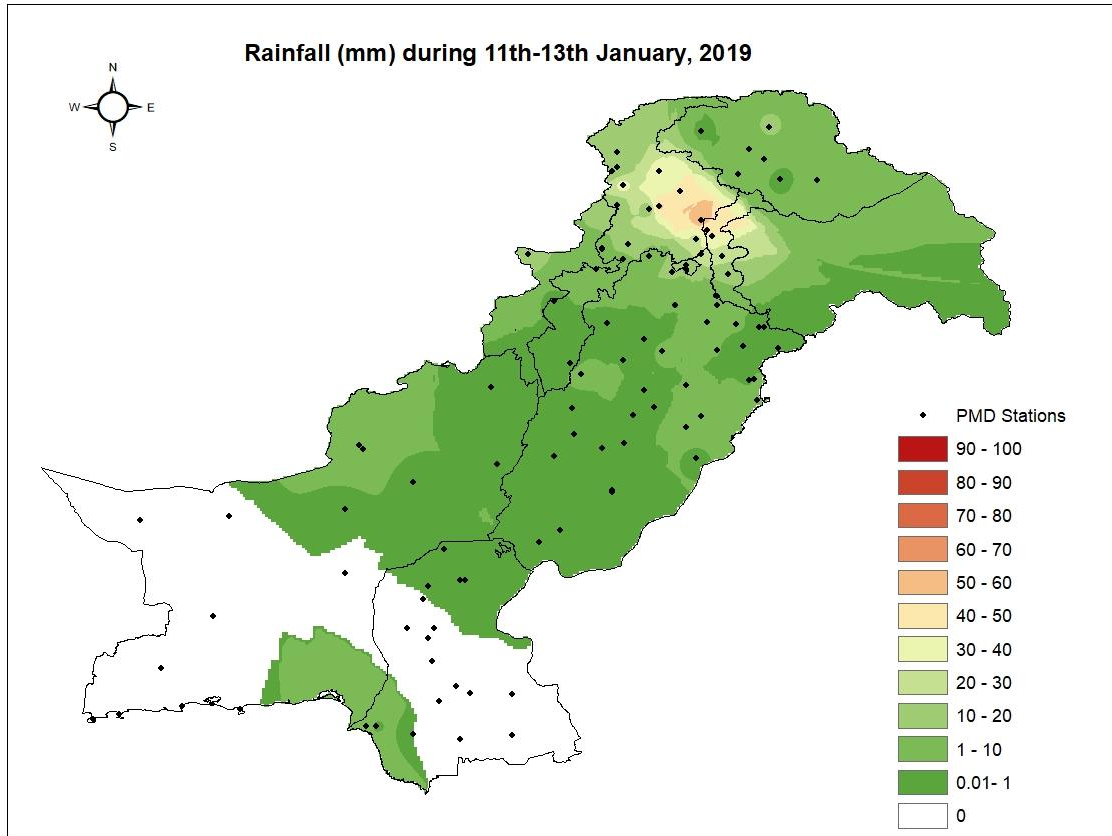
Figure 6 Rainfall (mm) distribution during 11th to 13th January 2019.

Figure 6 represents the spatial distribution of rainfall during the spell. In this spell maximum rainfall of 28 mm was reported, during 24 hours, from Pattan, Azad Jammu and Kashmir.

FOURTH SPELL

Fourth wet spell was from 20th to 24th January. The synoptic situation in these days is shown in figure 7.
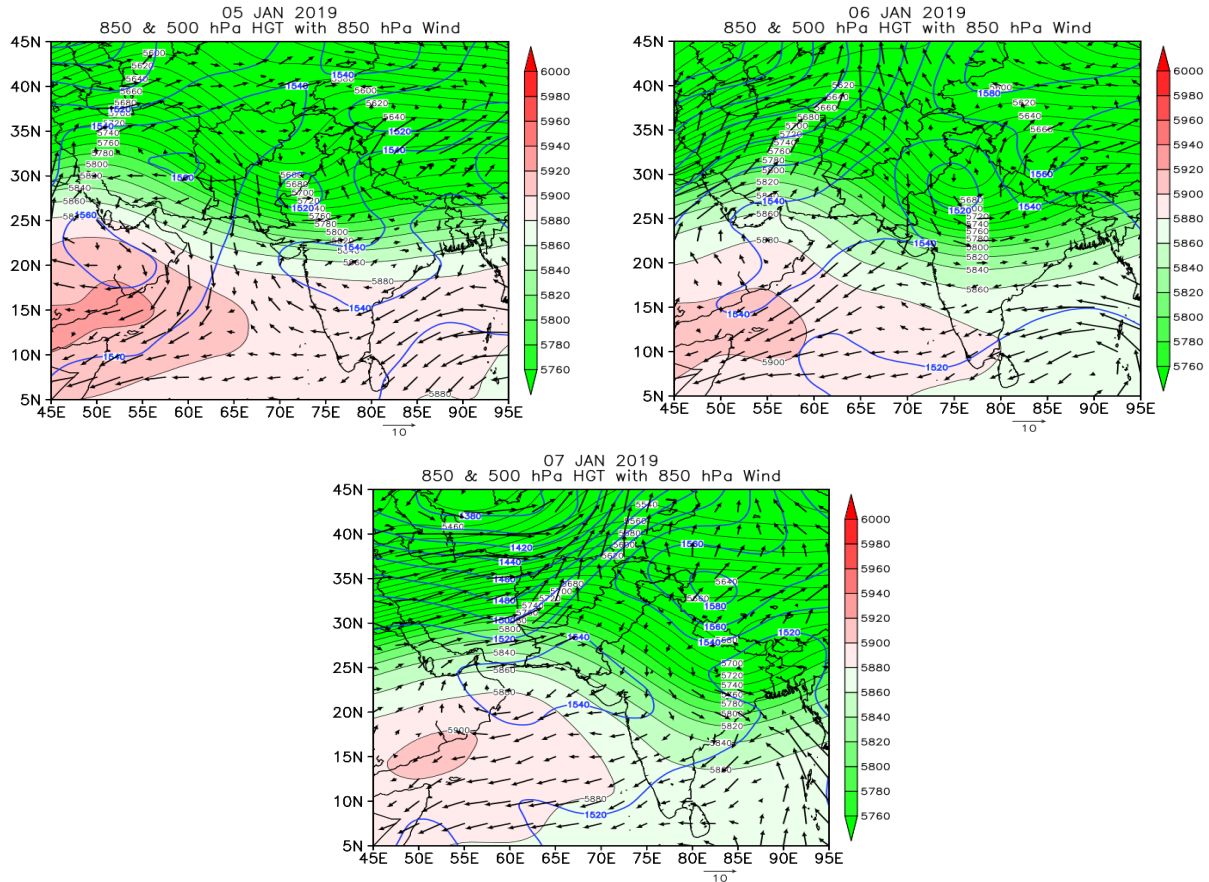

Figure 7 Synoptic situation from 20th to 23rd January 2019. Shaded portion represents the geopotential height pattern at 500 hPa, solid line represents the geopotential height pattern at 850 hPa, while arrows indicate 850 hPa winds.

It indicates that most parts of the country remained in the grip of a westerly wave during 20th to 23rd January. Also 850 hPa wind direction shows that moisture supply was from Arabian Sea. This weather system was at its peak on 21st January this is evident from two closed contours at 850 hPa over central parts of the country. A closed contour can also be seen on 22nd. This weather system gradually weakened after giving rain over most parts of the country. Spatial distribution of rainfall during the spell is shown in figure 8.

It shows that country as a whole received rainfall. Except for extreme west-southwest parts of the country which remained dry during this period. In this spell, Islamabad received maximum rainfall of 69 mm.
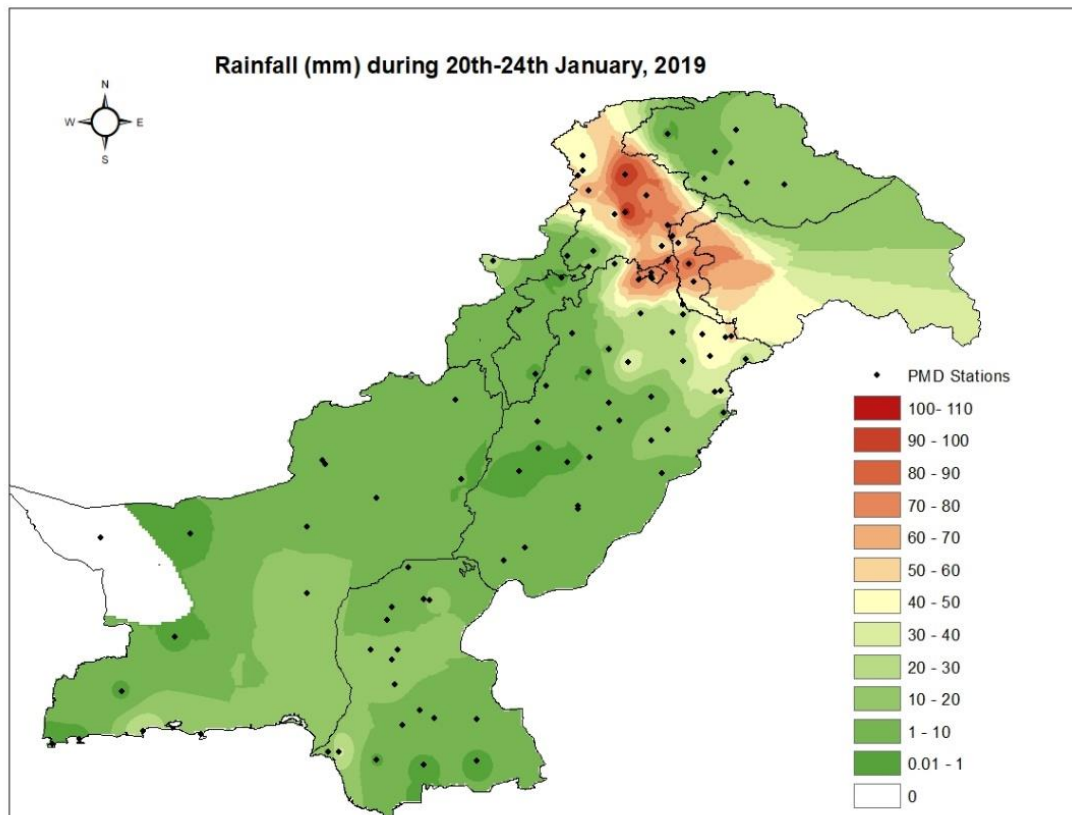
Figure 8 Rainfall (mm) distribution during 20th to 24th January 2019.

FIFTH SPELL

The synoptic situation of the last rainfall spell of January 2019 from 31st January to 1st February is shown in figure 9.
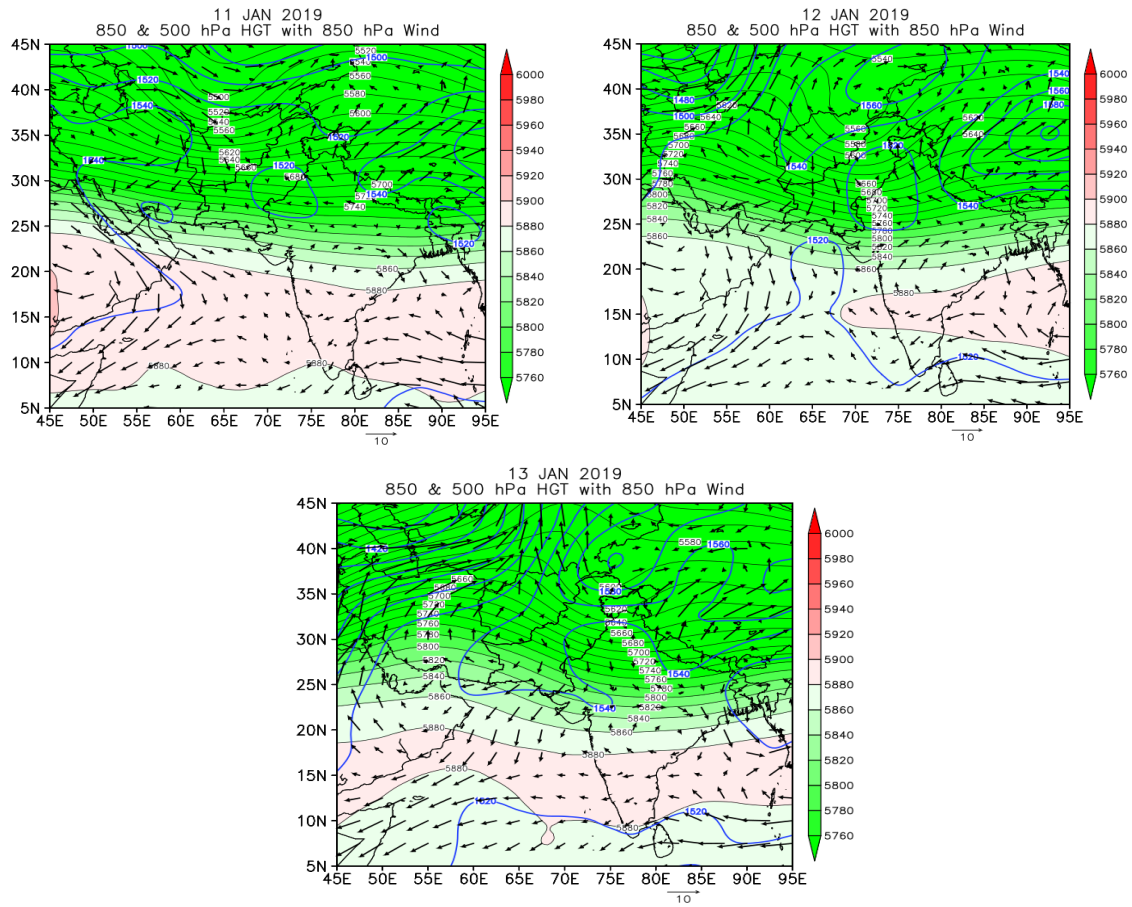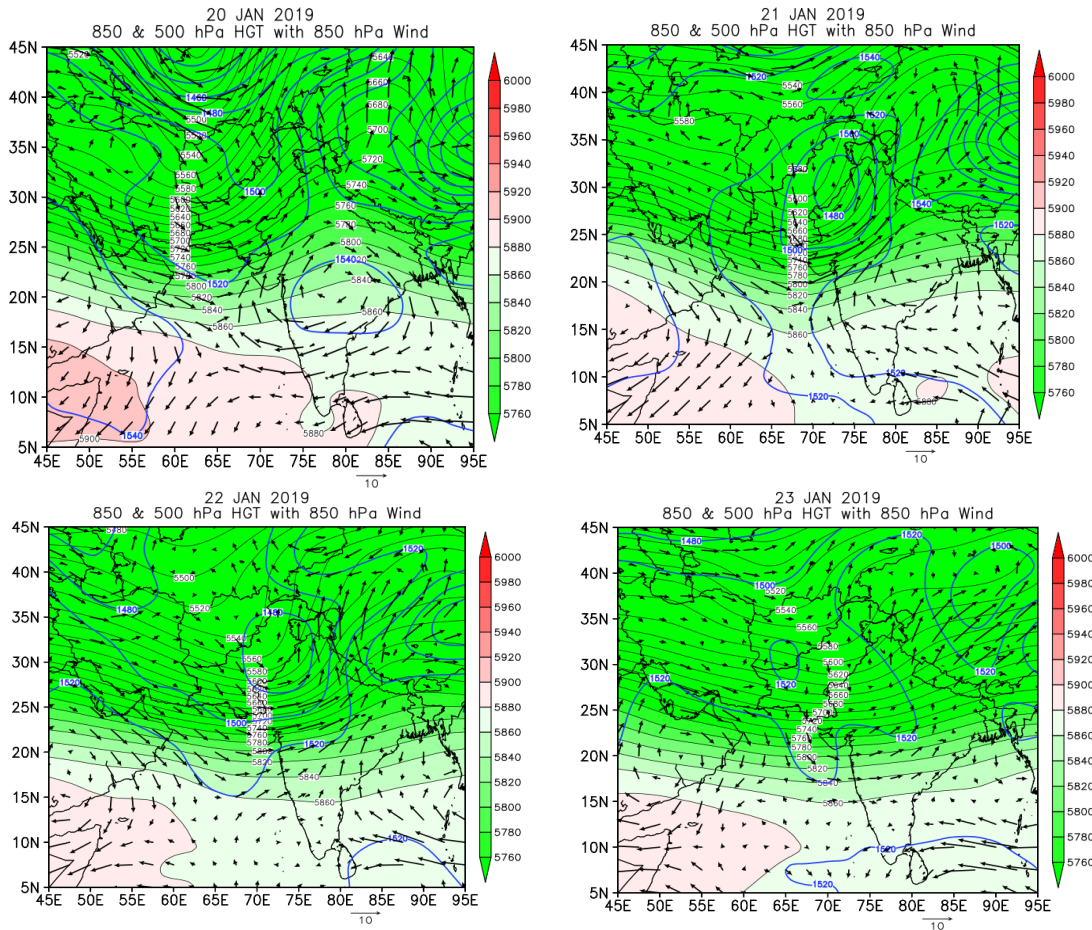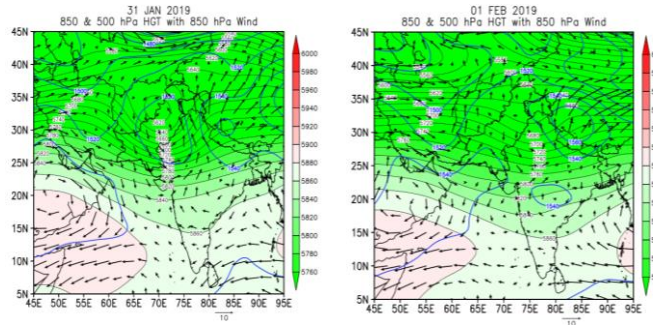

Figure 9 Synoptic situation from 31st January to 1st February. Shaded portion represents the geopotential height pattern at 500 hPa, solid line represents the geopotential height pattern at 850 hPa, while arrows indicate 850 hPa winds.

In this spell like last two wet spells a closed circulation is seen at 850 hPa while a trough of westerly wave is also present at 500 hPa. Moisture is transported from Arabian Sea and converges over upper parts of the country producing scattered rainfall over there. Rainfall distribution over the country is shown in the figure 10.
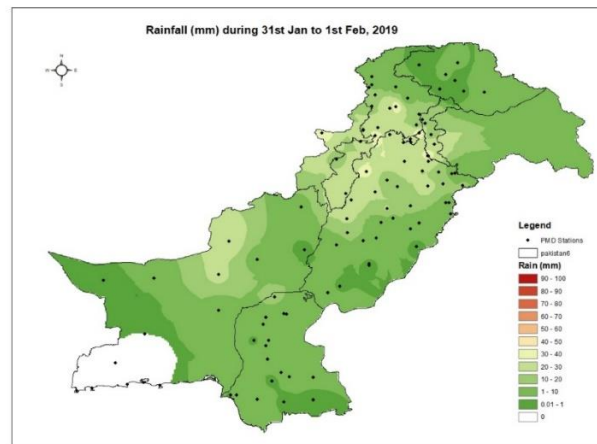
Figure 10 Rainfall (mm) distribution during 31st January to 1st February 2019.

In this spell most parts of the county received rainfall except for south-southwest region which remained mostly dry. Quetta received maximum rainfall of 37 mm during 24 hours.

ACCUMULATIVE RAINFALL

In January country as a whole received widespread rainfall as represented in figure 11. The center of maximum rainfall is near Malamjaba, Khyber Pakhtunkhwa. South southwestern and south southeastern parts received least amount of rainfall. Details of rainfall are appended in annexure I.
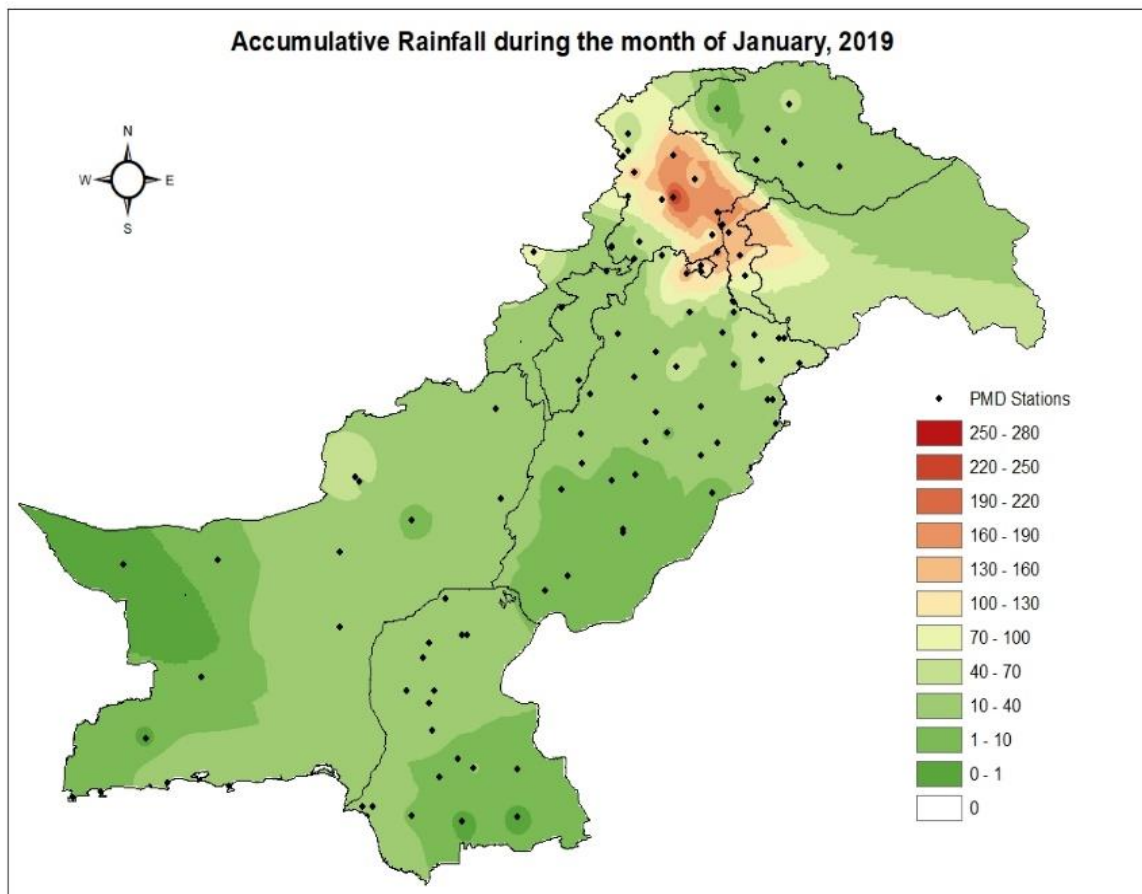
Figure 11 Rainfall (mm) distribution during January 2019.

RAINFALL DEPARTURE

During this month area weighted rainfall of the country remained above normal +20%. On regional basis rainfall was above normal in Khyber Pakhtunkhwa +53%, Punjab +34%, Azad Jammu and Kashmir +33%, Sindh +334%, Gilgit Baltistan +32%, and below normal in Balochistan -33% (CDPC 2019). This is shown in figure 12. While figure 13 represents the spatial distribution of rainfall departure with respect to the base period of 1961-2010. Indicating excess rainfall in northern and southern parts of the country. Extreme northern parts of Gilgit Baltistan, Central parts of the country and parts of southeastern Sindh show near normal rainfall, while south southwestern tip of Balochistan indicate deficient rainfall.
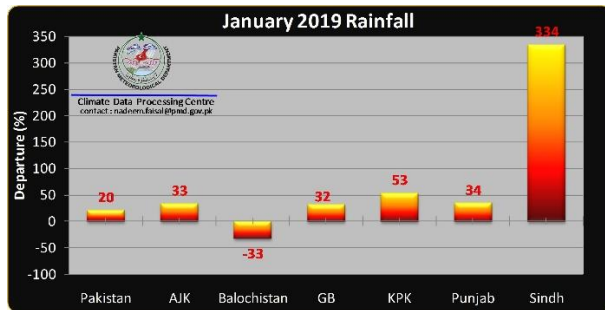
Figure 12 Rainfall departure in January 2019
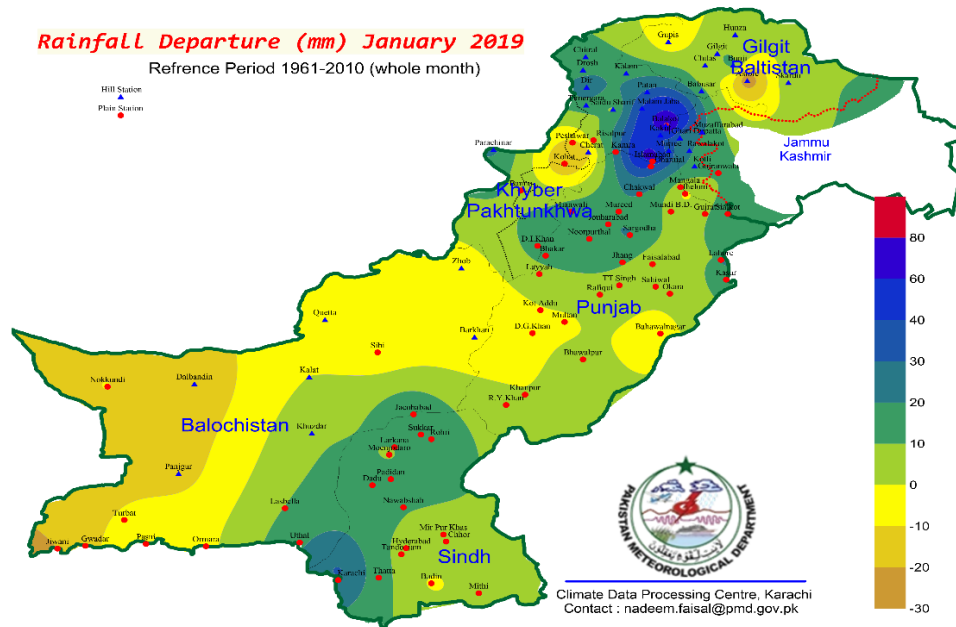
Figure 13 Spatial distribution of rainfall (mm) departure in January 2019

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FORECAST VALIDATION

An attempt is made to substantiate the accuracy of precipitation forecasts issued in January. This is done by using the contingency table 1, for each of the rainy spells. This table is used to find out the level of agreement between forecast and actual observation. The difference between forecast and observation is the error. The lower the errors, the greater the accuracy.

Table 1 Forecast verification contingency table

		Observed		
		Yes	**No**	Total
Forecast	**Yes**	Hits	False Alarms	Forecast Yes
	No	Misses	Correct Negatives	Forecast No
Total		Observed Yes	Observed No	Total

Hits means when the precipitation was forecasted and it occurred. *Miss* is used when the precipitation was not forecasted and it occurred. *False alarm* means when the precipitation was forecasted and it did not occur. *Correct negatives* are when the precipitation was not forecasted and also it did not happen. Accuracy of forecast is calculated by using formula in equation 1. Table 2 describes the accuracy in each of the spells

$$Accuracy = \ Hits + correct \ negatives/Total \quad (1)$$

Table 2 Percentage accuracy of each spell

Rainfall spells	**Percentage accuracy**
First Spell	83
Second Spell	90
Third Spell	90
Fourth Spell	88
Fifth Spell	93

FOG SITUATION

A graph representing number of foggy days is shown in figure 14 (FFD 2019). Bahawalpur recorded maximum twenty-five foggy days in this month. In this month fog was more persistent in south Punjab as compared to other parts of the country as indicated by figure 15. Some stations from upper Sindh also reported fog during the period.

Figure 14 Number of foggy days in January 2019

Figure 15 Spatial distribution of number of foggy days

SNOW

In January good snowfall was reported from the mountainous areas of Pakistan. Murree received almost 4.5 ft of snowfall. While maximum snowfall of almost 7 ft, of the seventeen snow reporting stations of PMD, was reported from Malamjaba and Kalam. Snowfall in feet of some selected stations during 2004-05 to 2017-20018 and Jan 2019 is shown in figure 16.
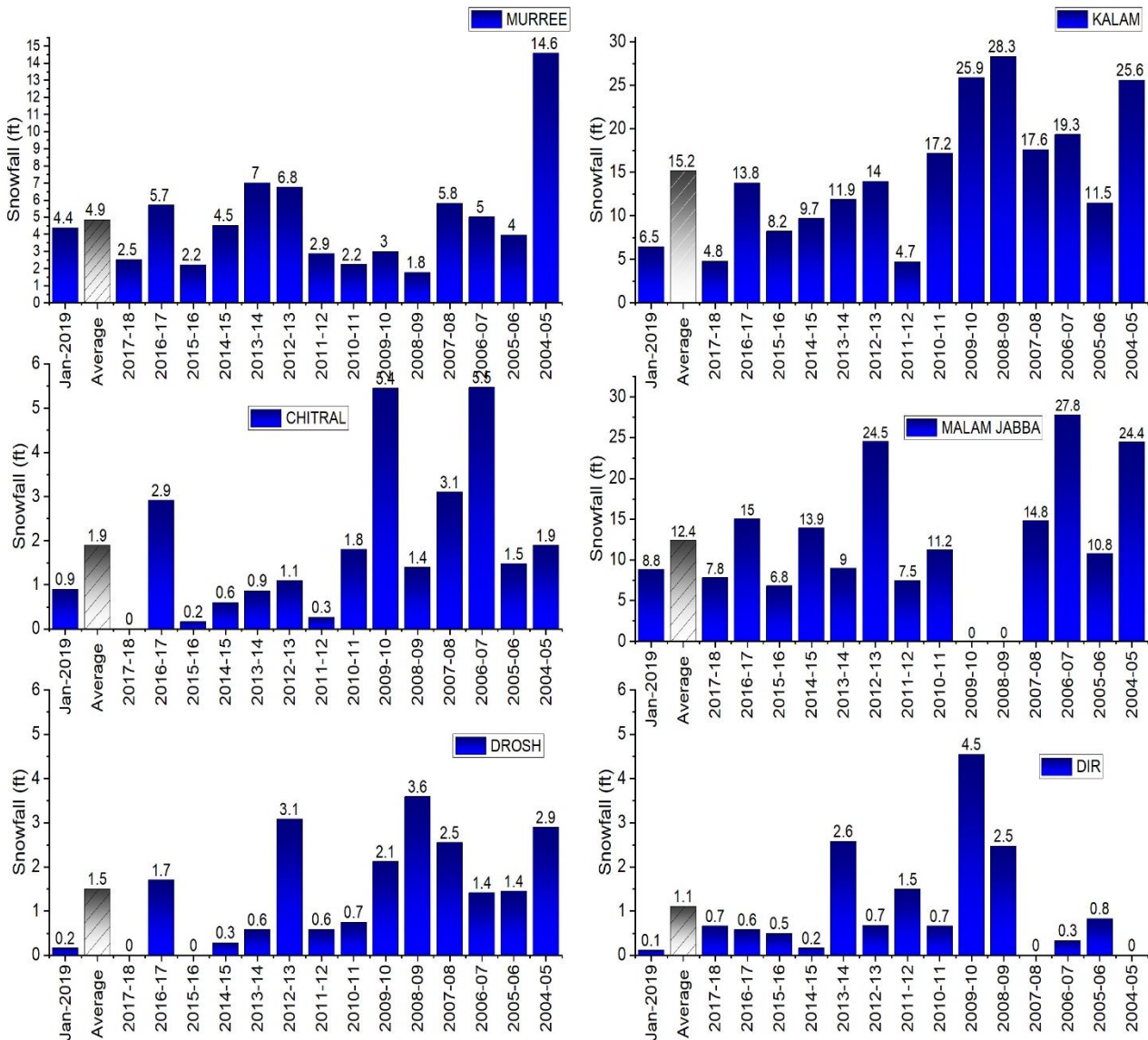
Figure 16 Snowfall (ft) in Jan 2019 and during the winter seasons from 2004-05 to 2017-18

TEMPERATURE

During this month below normal average minimum temperatures were recorded in Gilgit Baltistan, Azad Jammu, Kashmir, Khyber Pakhtunkhwa. While above normal temperatures were recorded in Punjab, Balochistan and Sindh. Overall average minimum temperatures of the country remained close to normal. Figure 17 represents the comparison of January 2019 and normal temperatures of January over the country.
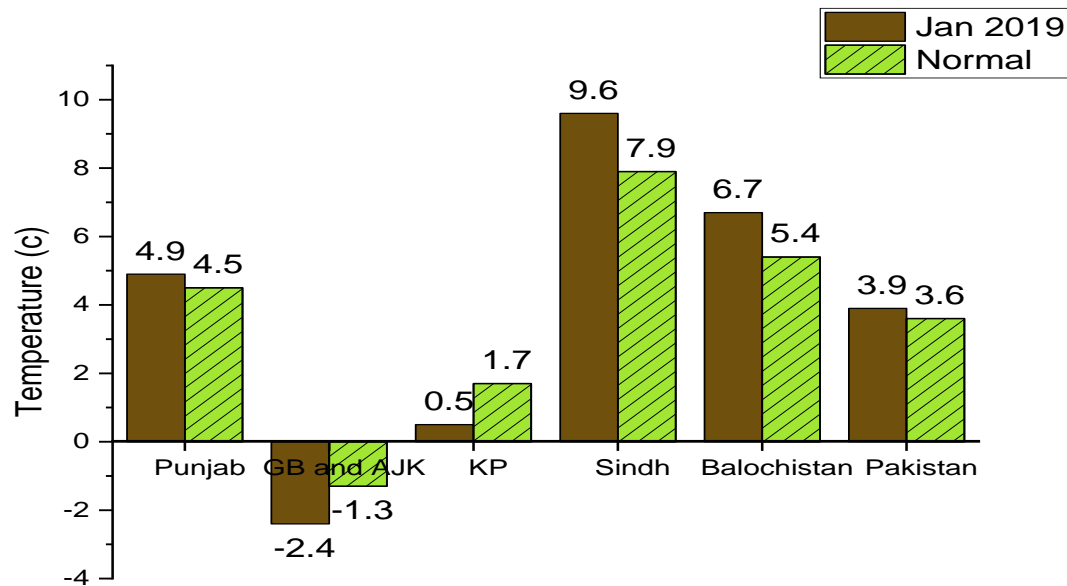
Figure 17 Temperature comparison between normal and Jan 2019 temperatures

DROUGHT CONDITION

According to latest analysis drought conditions have improved in drought prone areas of Sindh and Balochistan. However moderate drought conditions are still prevailing over many parts of Balochistan and Sindh. Figure 18 indicates wet conditions in northern parts of the country, while moderate drought conditions are present in southwestern Balochistan and most parts of Sindh.
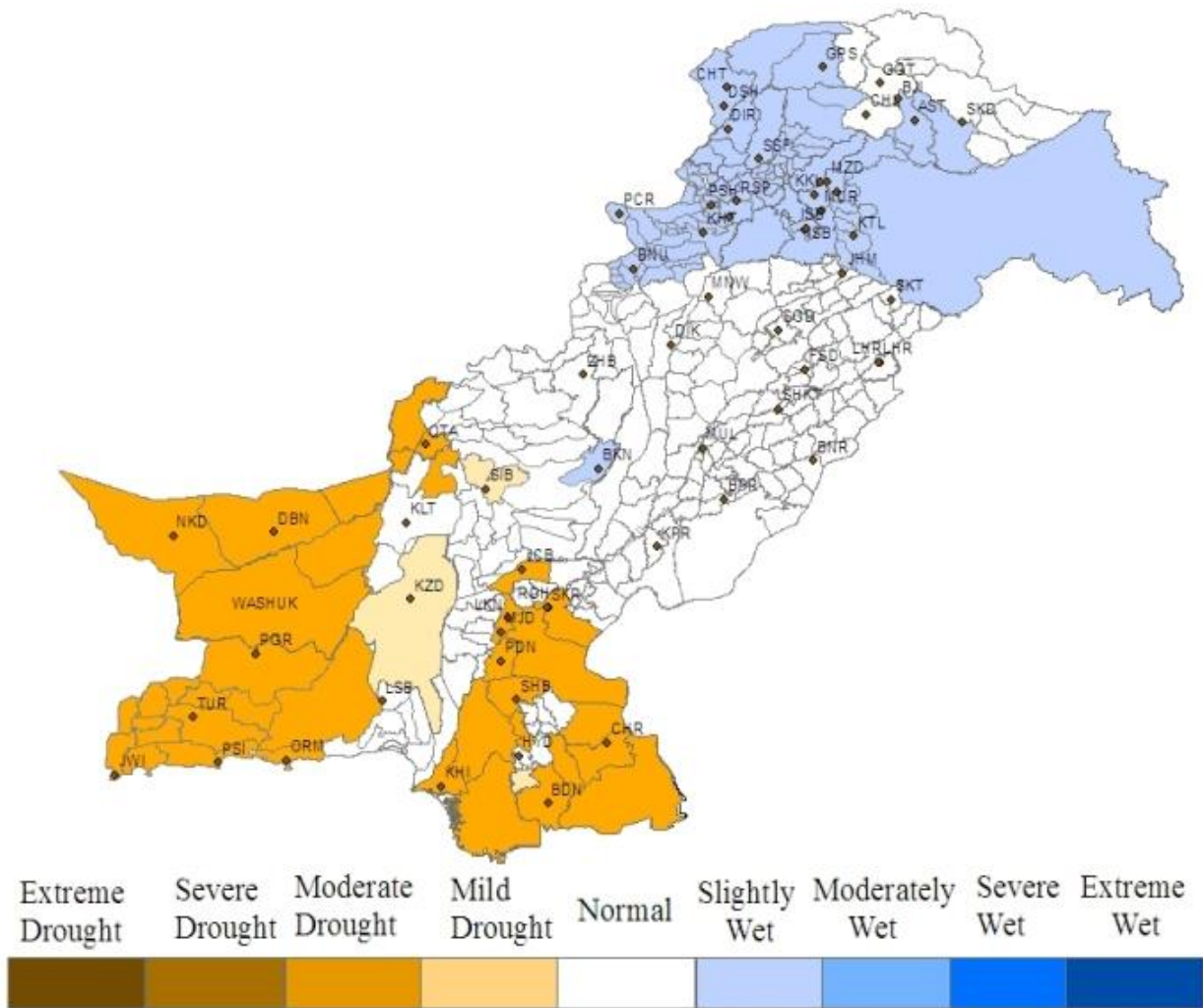
Figure 18 Drought outlook during the month of January

ACKNOWLEDGMENT

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FFD. 2019. "PMD, FFD, Fog Update." 2019. http://www.ffd.pmd.gov.pk/ffd_fog/fog.htm.

Kalnay, E. 1996. "The NCEP/NCAR 40-Year Reanalysis Project." *Bull. Am. Meteorol. Soc.* 77 (3): 437–71. https://doi.org/10.1175/1520-0477(1996)077<0437:TNYRP>2.0.CO;2.

ANNEX I

Accumulative rainfall (mm) in January 2019, and their deviation from the normal rainfall.

		Total Jan-19	Jan Normal	Deviation
Punjab				
1.	Murree	167.01	131.9	35.1
2.	Islamabad, new airport	141.81	**	**
3.	Islamabad, zeropoint	136.01	59	77
4.	Rawalpindi	100.84	56.2	44.6
5.	Sialkot, airport	60.21	**	**
6.	Sialkot cantt	59.73	**	**
7.	Gujranwala	57.01	**	**
8.	Mangla	55.8	**	**
9.	Gujrat	54.3	**	**
10.	Sargodha city	51.72	9.3	**
11.	Attock	48.04	55.1	-7.1
12.	Narowal	42.9	**	**
13.	Lahore, airport	42.32	22.7	19.6
14.	Mianwali	38.54	23.8	14.7
15.	Mandibahauddin	37.21	**	**
16.	Sargodha airport	37.05	18	19.1
17.	Chakwal	36.83	**	**
18.	Hafizabad	35.91	**	**
19.	Jhelum	35.5	40.4	-4.9
20.	Lahore, city	32.63	23.2	9.4
21.	Layyah	29.42	**	**
22.	Okara	25.32	**	**
23.	Bhakkar	25.01	**	**
24.	Jhang	21.91	**	**
25.	Joharabad	18.22	**	**
26.	Sahiwal	18.01	**	**
27.	Noorpur thal	15.6	**	**
28.	Faisalabad	14.64	11.1	3.5
29.	Shorkot	14.15	41.4	-27.3
30.	Kot addu	11.43	**	**
31.	Kasur	9.44	**	**
32.	Bahawalpur, city	9.02	7.4	1.6
33.	Bahawalpur, airport	8.82	**	**
34.	T.T. Singh	8.61	**	**

35.	Rahim Yar Khan	6.01	**	**
36.	Multan	5.82	7.6	-1.8
37.	Khanpur	5.51	5	0.5
38.	Bahawalnagar	5.03	11.4	-6.4
39.	D.G.khan	3.02	**	**
40.	Khanewal	3.02	**	**
Kashmir & Gilgit Baltistan				
41.	Muzaffarabad	174.51	99.3	75.2
42.	Garidopatta	144.22	114.6	29.6
43.	Rawalakot	132.01	**	**
44.	Kotli	93.7	73.9	19.8
45.	Hunza	45.42	**	**
46.	Bagrote	40.73	**	**
47.	Skardu	35.73	31.4	4.3
48.	Bunji	18.25	6.4	11.9
49.	Chilas	14.32	11.3	3
50.	Gilgit	13.22	3.9	9.3
51.	Astore	12.7	43.9	-31.2
52.	Gupis	0.8	8.8	-8
Khyber Pakhtunkhwa				
53.	Malamjabba	256	**	**
54.	Balakot	182.91	91.4	91.5
55.	Kalam	160	**	**
56.	Pattan	150	**	**
57.	Dir	142	112.5	29.5
58.	Abbottabad	110.11	69.8	40.3
59.	Saidu Sharif	93.2	82.6	10.6
60.	Lower Dir	88	**	**
61.	Mirkhani	87	**	**
62.	Parachinar	76	55.9	20.1
63.	Drosh	62.9	49.8	13.1
64.	Chitral	59.1	47	12.1
65.	Risalpur	46.08	45	1.1
66.	Cherat	29.4	47.7	-18.3
67.	D.I.Khan	25.4	10.9	14.5
68.	Bannu	23.01	23.3	-0.3
69.	Peshawar airport	22.09	40.9	-18.8
70.	Peshawar city	18.86	**	**
71.	Kohat	11.02	34.6	-23.6

	Sindh			
72.	Karachi, airport	39.41	8.4	31
73.	Jacobabad	23	3.1	19.9
74.	Padidan	20.01	2.9	17.1
75.	Rohri	19.9	4.1	15.8
76.	Larkana	16.3	3.3	13
77.	Dadu	16	**	**
78.	Sukkur	15.02	3.5	11.5
79.	Shaheed Benazirabad	13	2.5	10.5
80.	Mohenjo-daro	11.01	2.6	8.4
81.	Mirpur Khas	10.5	**	**
82.	Chhor	9	0.8	8.2
83.	Thatta	8	**	**
84.	Hyderabad	6.01	1.4	4.6
85.	Tando Jam	4.6	**	**
86.	Badin	0.03	1.2	-1.2
87.	Mithi	0	**	**
	Balochistan			
88.	Quetta, airport	48.75	55.3	-6.6
89.	Quetta	37.34	**	**
90.	Kalat	33	40.9	-7.9
91.	Khuzdar	28	18.4	9.6
92.	Pasni	28	24.4	3.6
93.	Barkhan	25.01	12.1	12.9
94.	Lasbela	20.01	5.6	14.4
95.	Ormara	13.6	10.4	3.2
96.	Zhob	10	15.1	-5.1
97.	Sibbi	6.01	10.7	-4.7
98.	Jiwani	4	24.2	-20.2
99.	Dalbandin	1	17.3	-16.3
100.	Gawadar	1	**	**
101.	Nokkundi	1	8.7	-7.7
102.	Panjgur	1	13.1	-12.1
103.	Turbat	0	15.5	-15.5