Monthly Weather Report

May 2019

Director General

Pakistan Meteorological Department

Prepared by: National Weather Forecasting Center
Islamabad

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SUMMARY

1. In May 2019 area weighted rainfall of the country remained above normal +39 %.
2. On regional basis rainfall was above normal in Balochistan +176%, Punjab +79%, Khyber Pakhtunkhwa +14%, and below normal in Gilgit Baltistan -66%, Sindh -21% and Azad Jammu and Kashmir -17%.
3. Highest accumulated precipitation during the whole month was recorded in Kotli, Azad Jammu and Kashmir, 131 mm.
4. Highest amount of rainfall during 24 hours was recoded in Chaklala, Rawalpindi 58.5 mm.
5. Highest Maximum Temperature was recorded in Jacobabad and Larkana, 50.0℃.

INTRODUCTION

May is the first summer month of the country. During this month mean minimum temperature varies from 7.8°C in Astore to 28.0°C in Sibbi. While mean maximum temperature varies from 20.2°C in Astore to 44.2°C in Nawabshah, Shaheed Benazirabad. Normal area weighted rainfall in May for Pakistan is 14.9 mm. For Khyber Pakhtunkhwa 44.3 mm, Punjab 15.6 mm, Balochistan 6.0 mm, Sindh 2.9 mm, Azad Jammu and Kashmir it is 30.4 mm and Gilgit Baltistan 32.2 mm. In May 2019 area weighted rainfall of Pakistan remained above normal +39%. On regional basis rainfall was above normal in Balochistan +176%, Punjab +79%, Khyber Pakhtunkhwa +14%, and below normal in Gilgit Baltistan -66%, Sindh -21% and Azad Jammu and Kashmir -17%. In this month highest maximum temperature was recorded in in Jacobabad and Larkana (50.0°C). Highest accumulated precipitation during the whole month was recorded in Kotli, Azad Jammu and Kashmir, 131 mm. While highest amount of rainfall during 24 hours was recoded in Chaklala, Rawalpindi 58.5 mm. Pakistan experienced two major rainfall spells during this month. Their detail is appended below.

FIRST SPELL

First rainfall spell in May was during 1st to 4th May. Synoptic situation during this day as obtained by NCEP/NCAR reanalysis dataset (Kalnay 1996) is shown in figure 1. A circulation is present on the lower level while a shallow westerly wave is also affecting upper and central parts of the country.

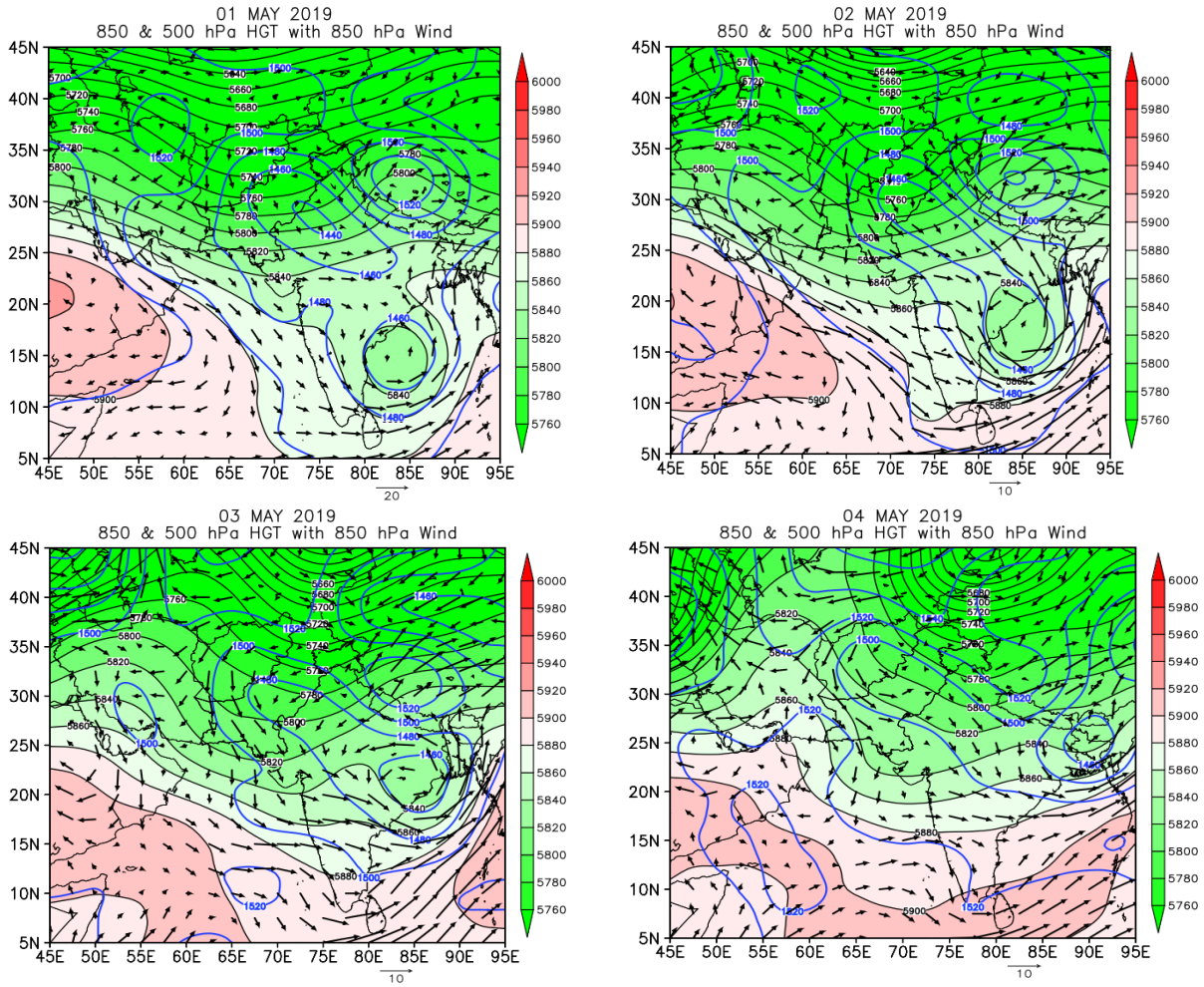

Figure 1 Synoptic situation 1st to 4th May 2019. Shaded portion represents the geopotential height pattern at 500 hPa, solid line represents the geopotential height pattern at 850 hPa, while arrows indicate 850 hPa winds.

Rainfall distribution during the first spell is shown in figure 2. This spell produced rainfall in upper and central parts of the country. Most of the southern parts of the country remained dry during this spell.

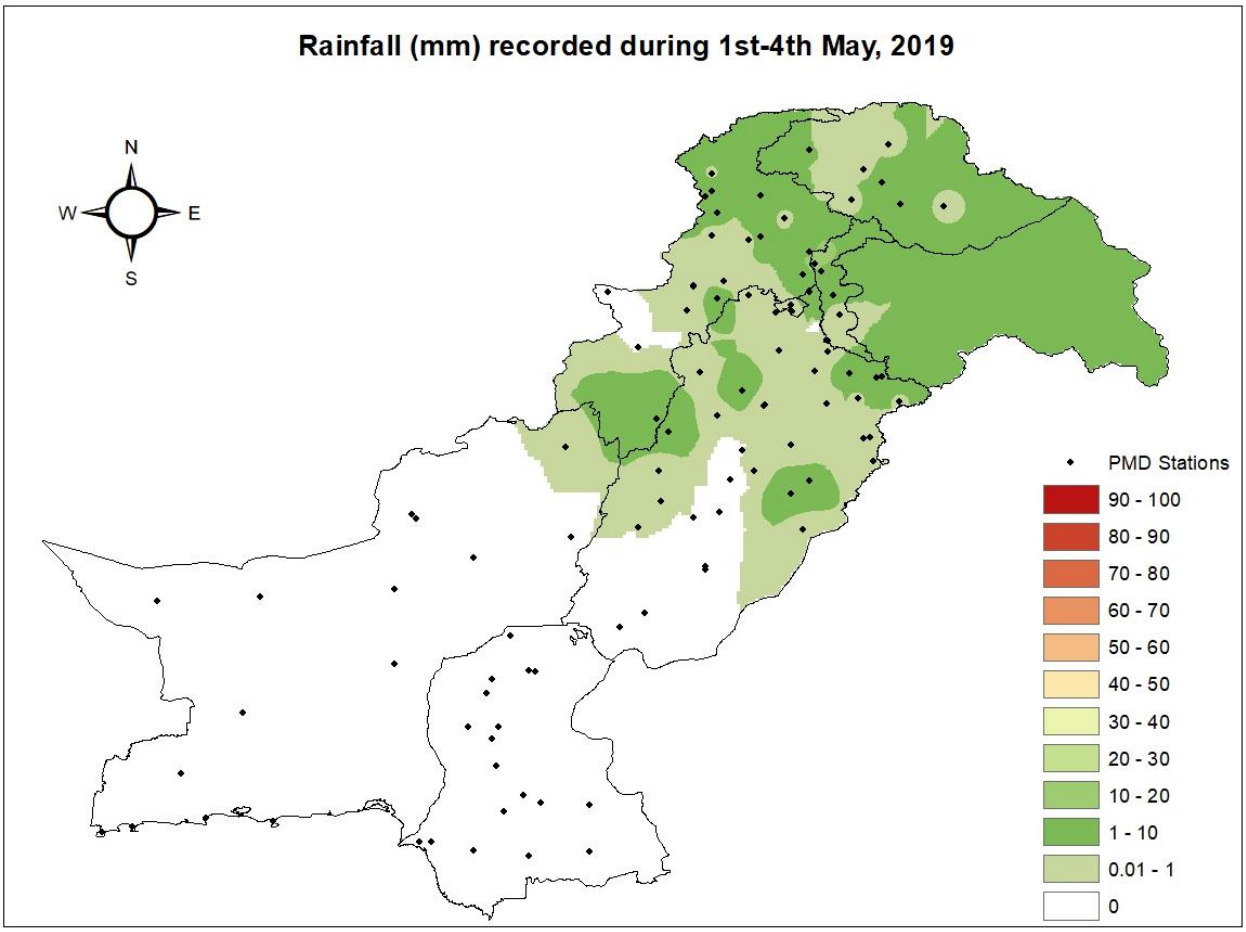

Figure 2 Rainfall (mm) distribution on 1st to 4th May 2019.

SECOND SPELL

Second wet spell of the month was during 9th to 12th May. The synoptic situation on these days is shown in figure 3. A westerly wave is seen affecting upper and central parts of the country. While at lower level a southwesterly flow was present.

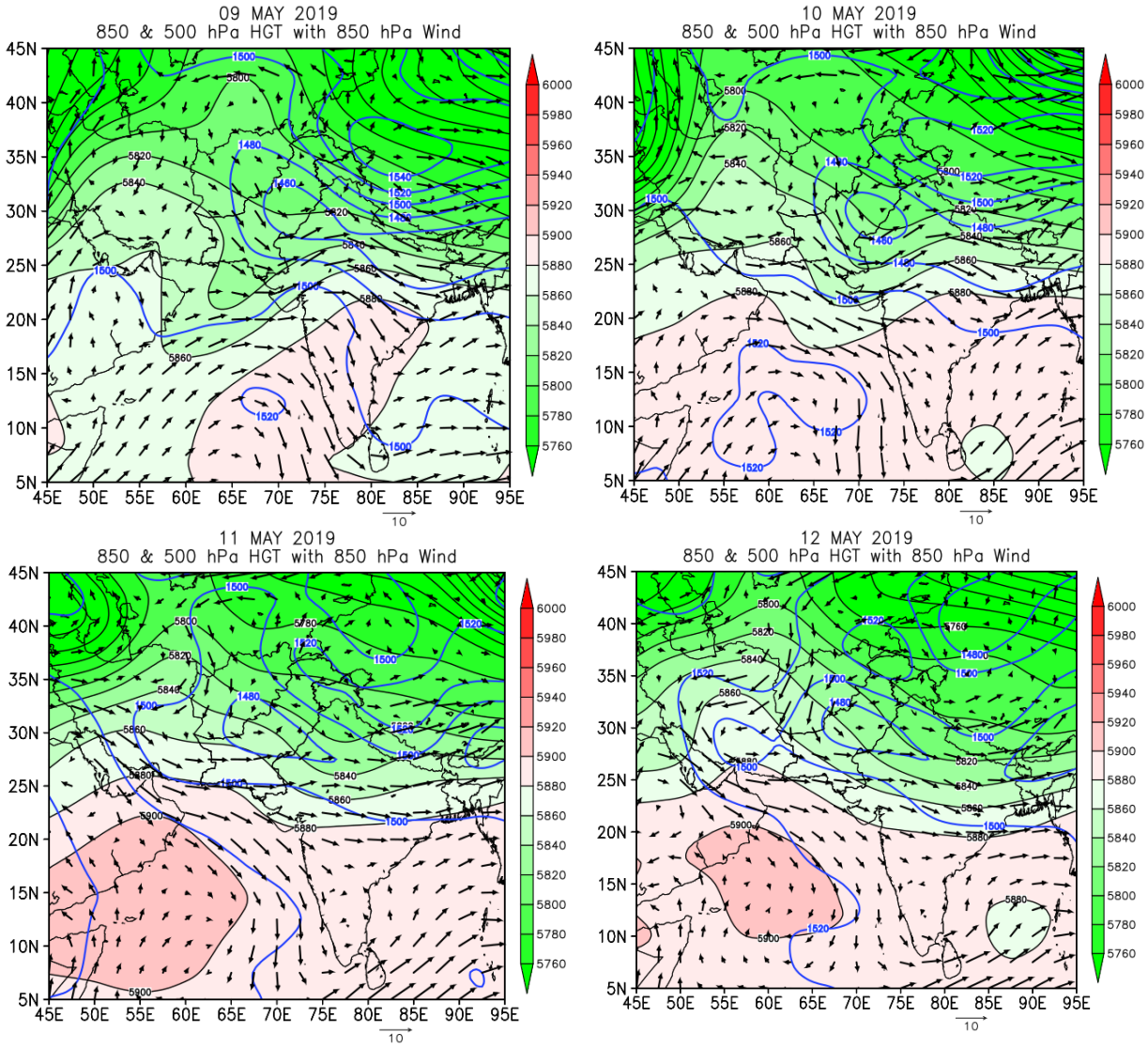

Figure 3 Synoptic situation from 9th to 12th May 2019. Shaded portion represents the geopotential height pattern at 500 hPa, solid line represents the geopotential height pattern at 850 hPa, while arrows indicate 850 hPa winds.

Spatial distribution of rainfall from 9th to 12th May 2019 is shown in figure 4. It shows northern, western, central parts of the country along with coastal areas of Sindh received rainfall

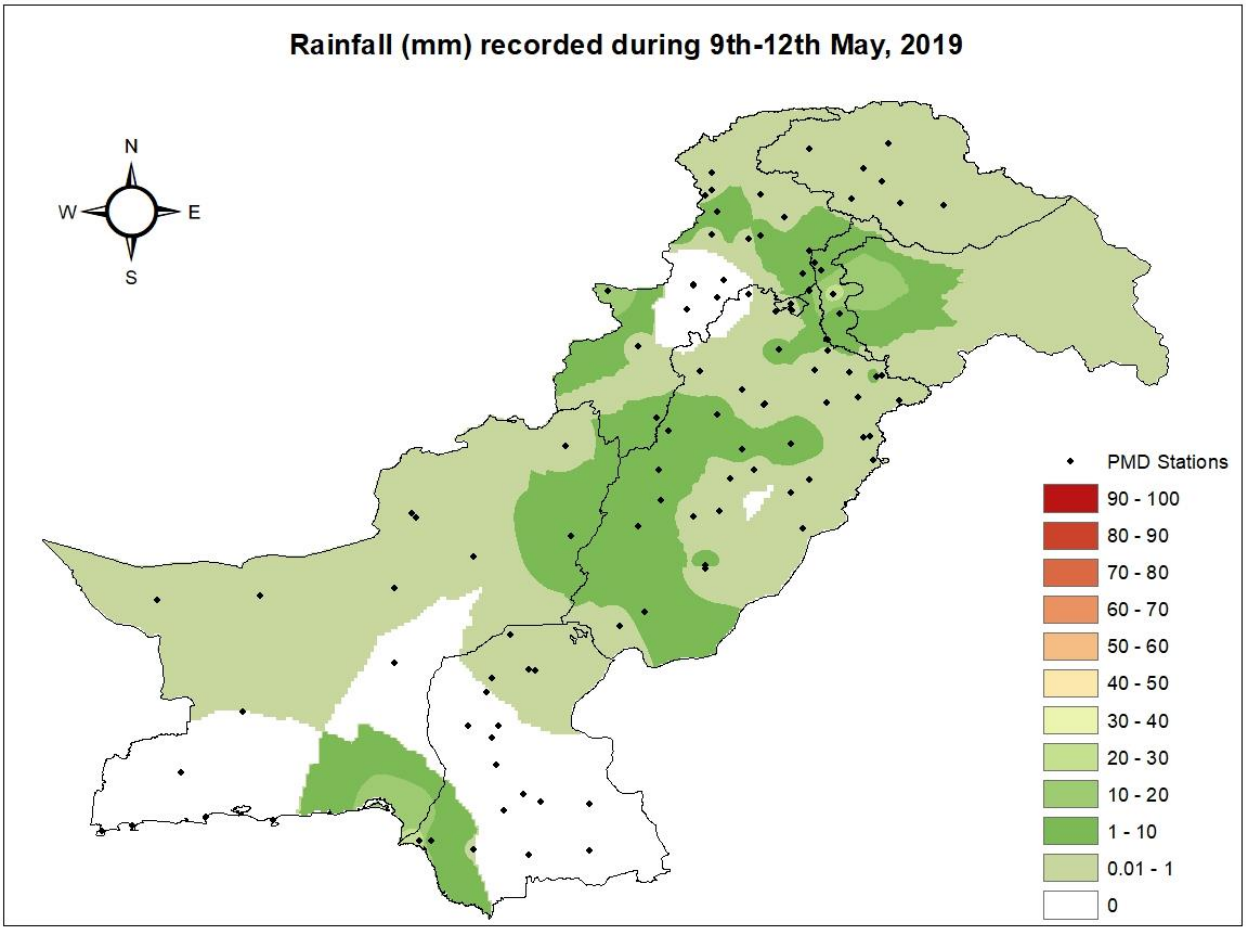

Figure 4 Rainfall (mm) distribution during 9th to 12th May 2019.

THIRD SPELL

Third wet spell of May was during 14th to 20th. The synoptic situation during 15th to 18th May is shown in figure 5. A cyclonic circulation at lower level is seen gripping most of the central parts of the country Strong southwesterly flow is seen transporting moisture from the Arabian Sea to upper parts of the country during the period.

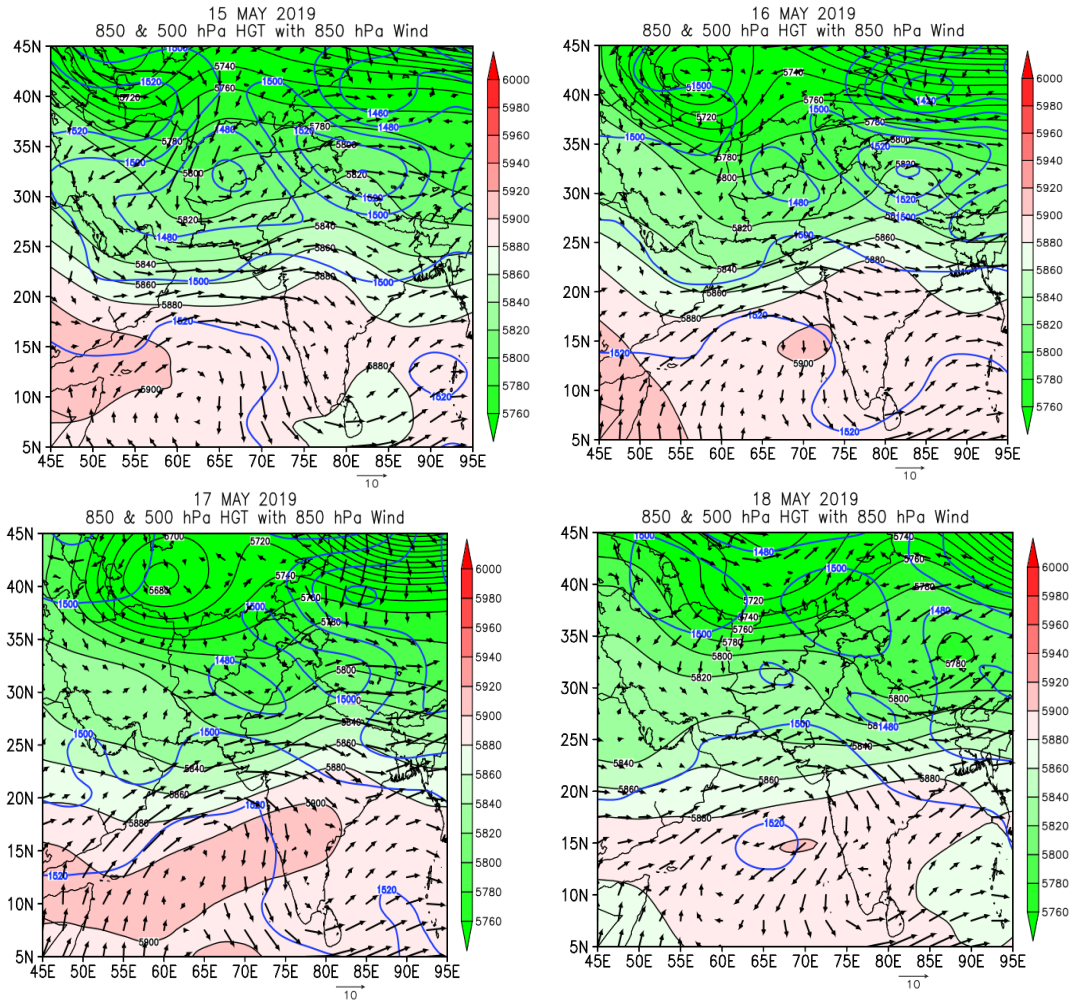

Figure 5 Synoptic situation from 15th to 18th May 2019. Shaded portion represents the geopotential height pattern at 500 hPa, solid line represents the geopotential height pattern at 850 hPa, while arrows indicate 850 hPa winds.

Figure 6 represents the spatial distribution of rainfall during the spell. In this spell most parts of the country except for southeastern Sindh received rainfall. A center of maximum rainfall is present over Parachinar.

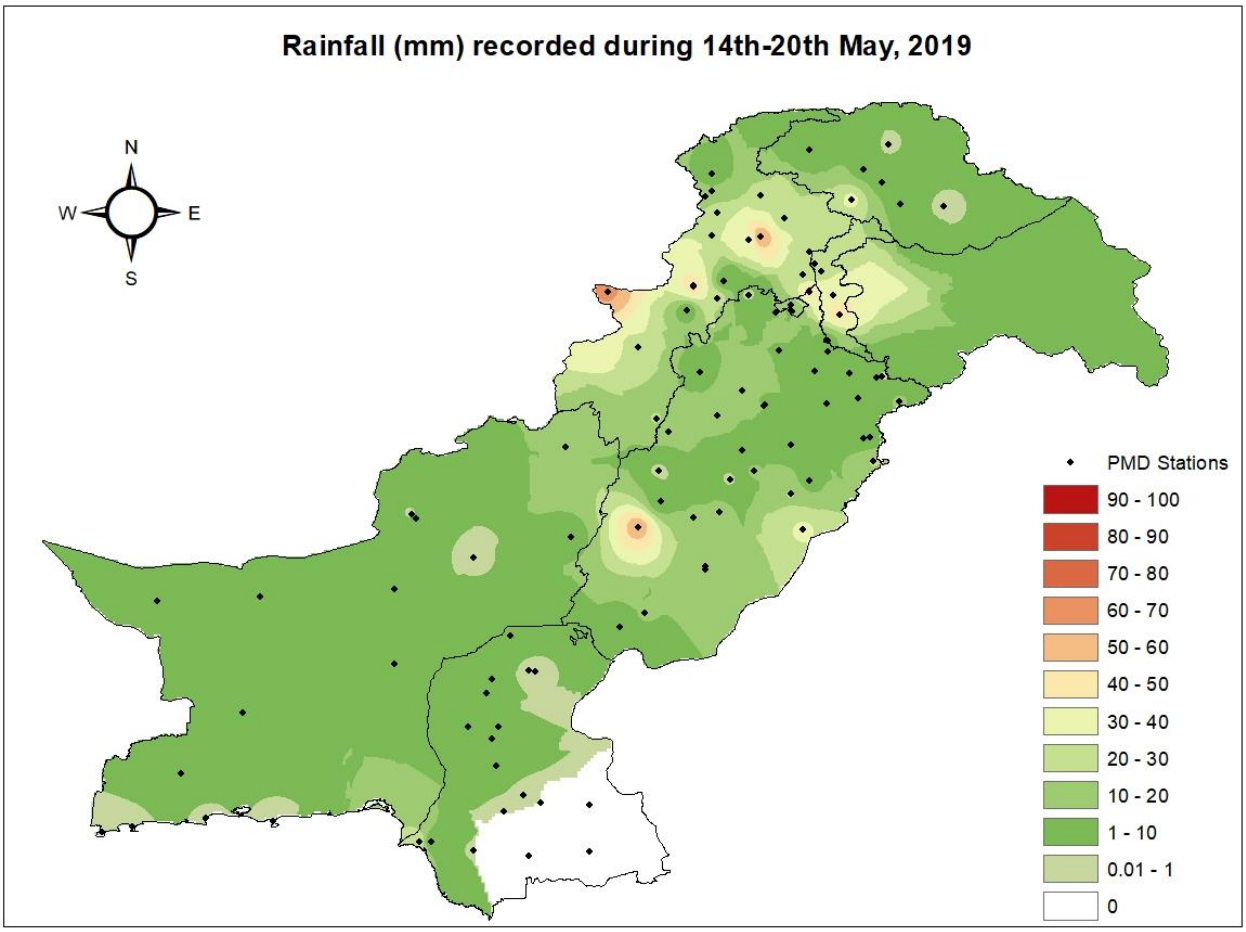

Figure 6 Rainfall (mm) distribution during 14th to 20th May 2019.

FOURTH SPELL

Third wet spell of May was during 23rd to 25th. The synoptic situation during these days is shown in figure 7. Most parts of the country remained in the grip of a strong westerly wave. A closed circulation was also present at lower level.

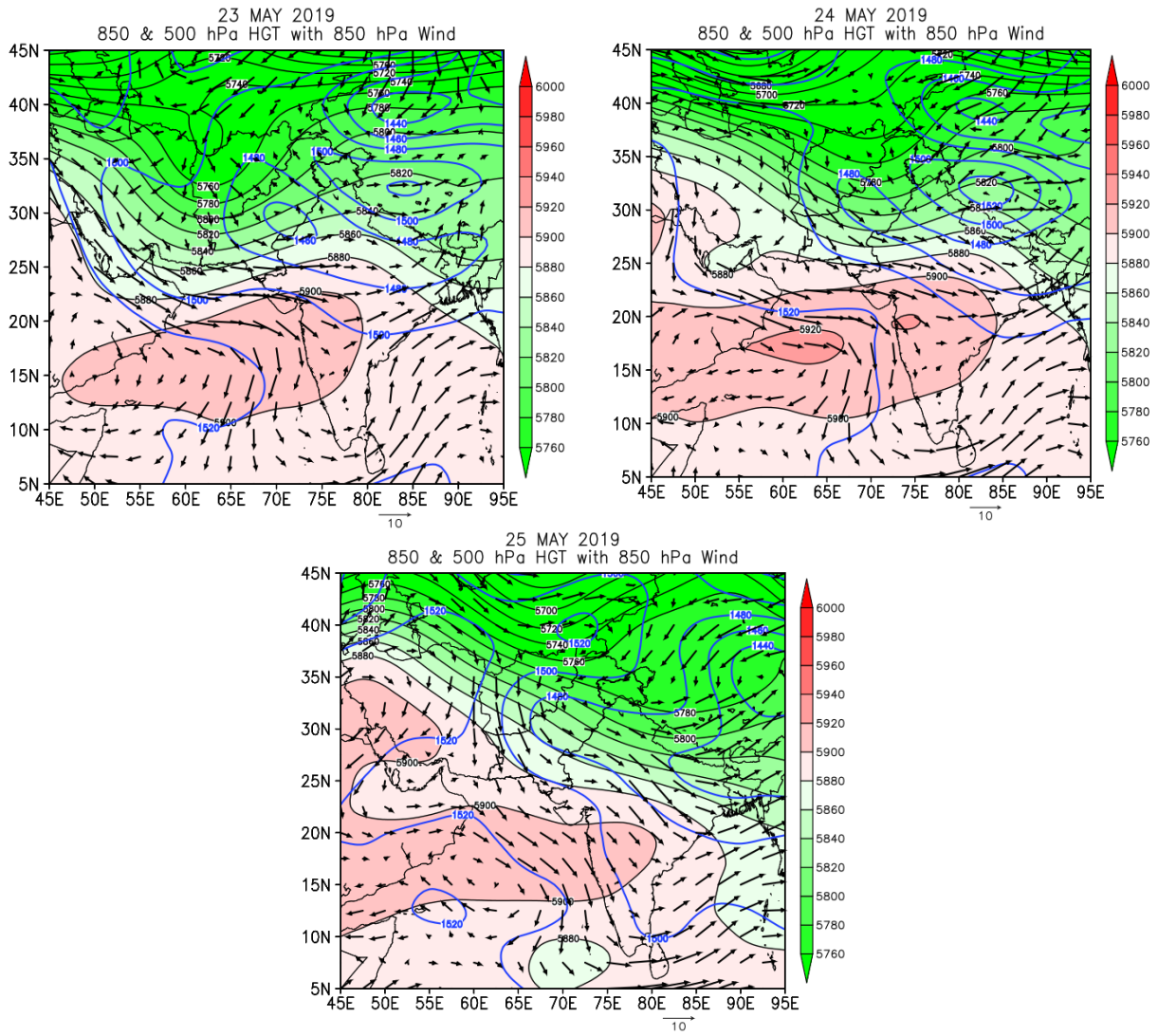

Figure 7 Synoptic situation from 23rd to 25th May 2019. Shaded portion represents the geopotential height pattern at 500 hPa, solid line represents the geopotential height pattern at 850 hPa, while arrows indicate 850 hPa winds.

Figure 8 represents the spatial distribution of rainfall during the period. In this spell most of the upper and central parts of the country received rainfall southeast parts of Sindh and southwest parts of Balochistan remained dry during this spell.

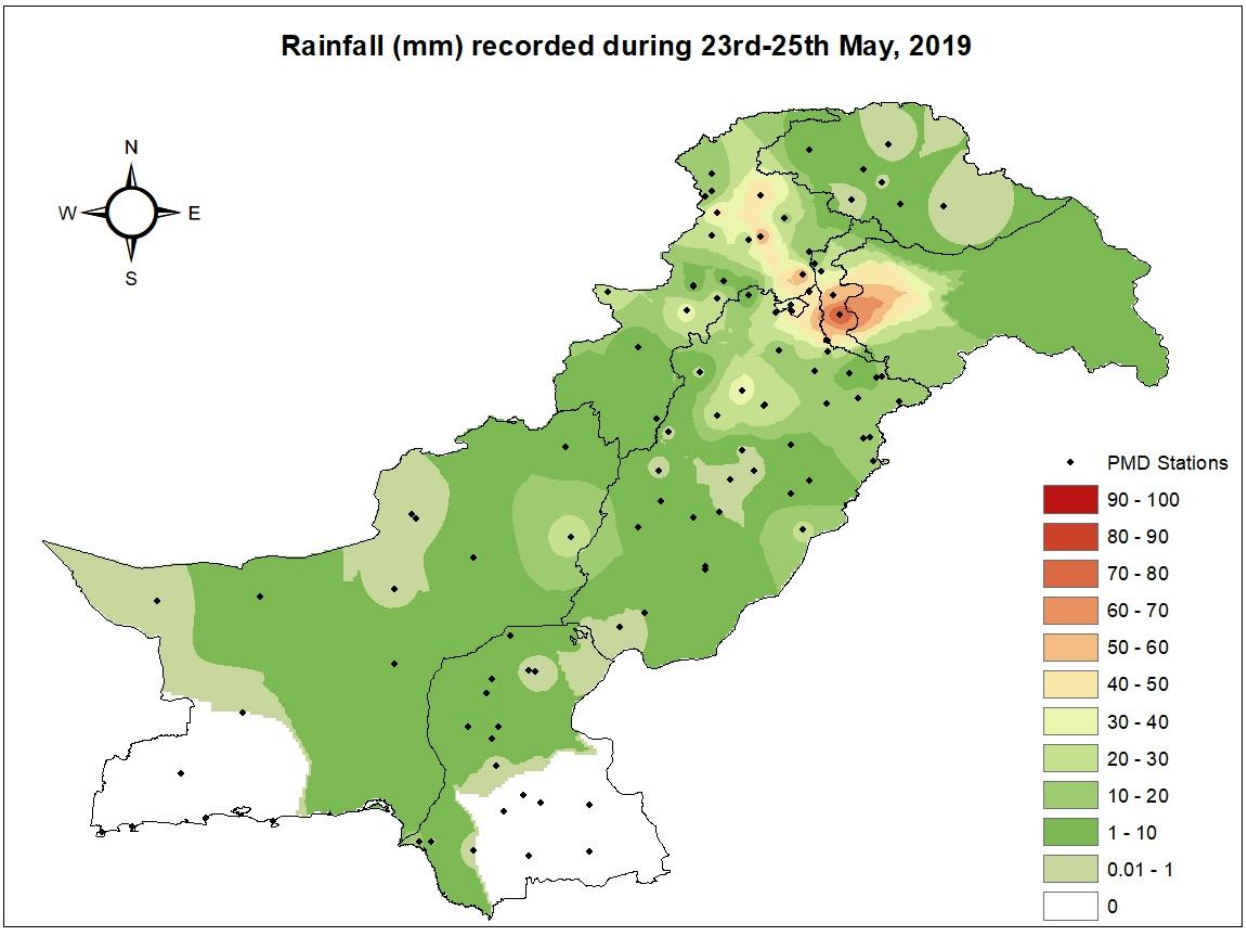

Figure 8 Rainfall (mm) distribution during 23rd to 25th May 2019.

ACCUMULATIVE RAINFALL

In May most parts of the country except for southeastern parts of Sindh received rainfall. Figure 9 represents the spatial distribution of rainfall during the month of May. The center of maximum rainfall is in Azad Jammu and Kashmir. Details of rainfall are appended in annexure I.

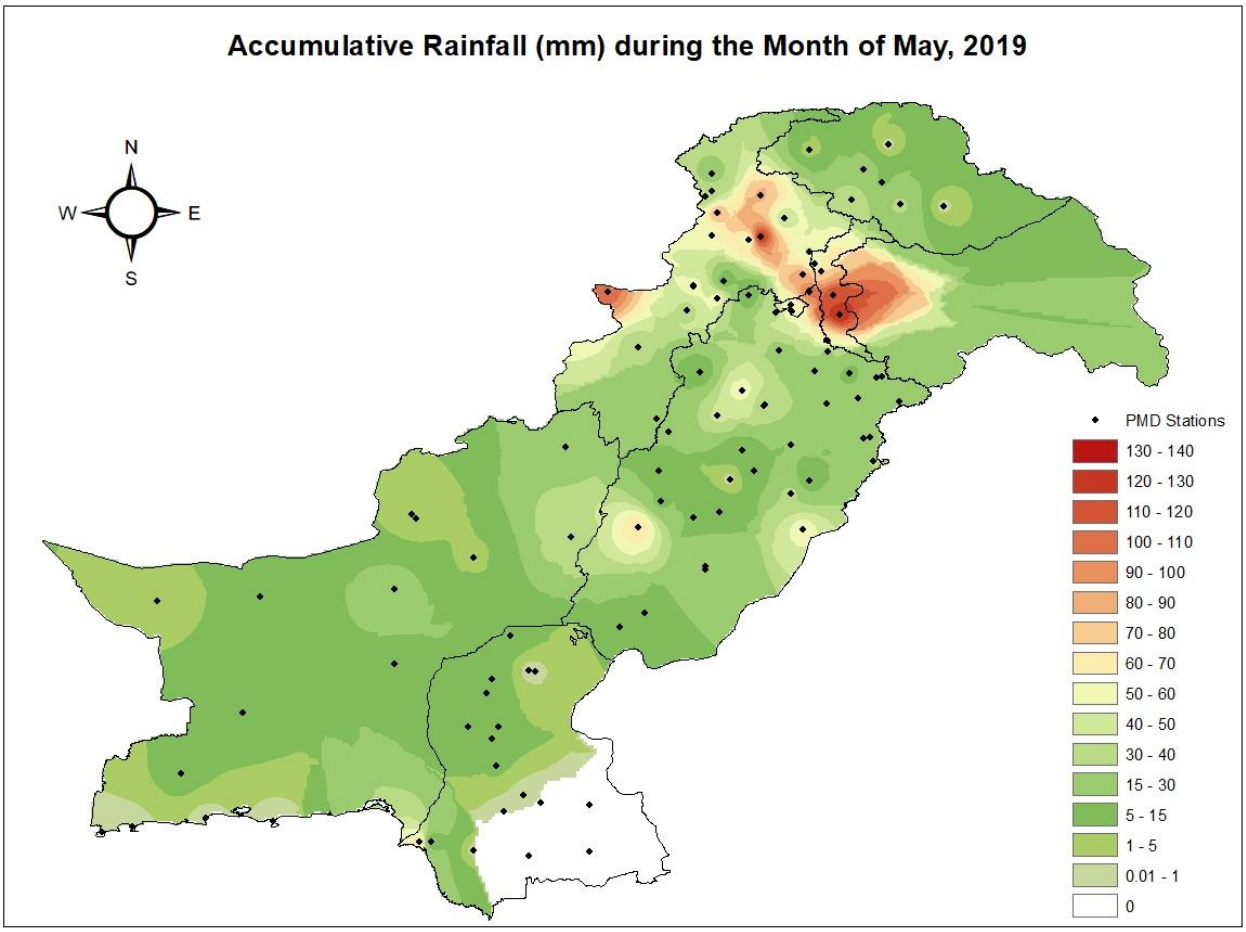

Figure 9 Rainfall (mm) distribution during May 2019.

RAINFALL DEPARTURE

During this month area weighted rainfall of the country remained above normal +39%. On regional basis rainfall remained above normal in Balochistan +176%, Punjab +79%, Khyber Pakhtunkhwa +14%, and was below normal in Gilgit Baltistan -66%, Sindh -21% and Azad Jammu and Kashmir -17%. (CDPC 2019) represented in figure 10. Figure 11 shows the spatial distribution of rainfall departure in the month of May with respect to the base period of 1961-2010. It shows deficient rainfall in parts of Gilgit Baltistan and Sindh while above normal rainfall in parts of Northwestern Khyber Pakhtunkhwa and Azad Jammu and Kashmir.

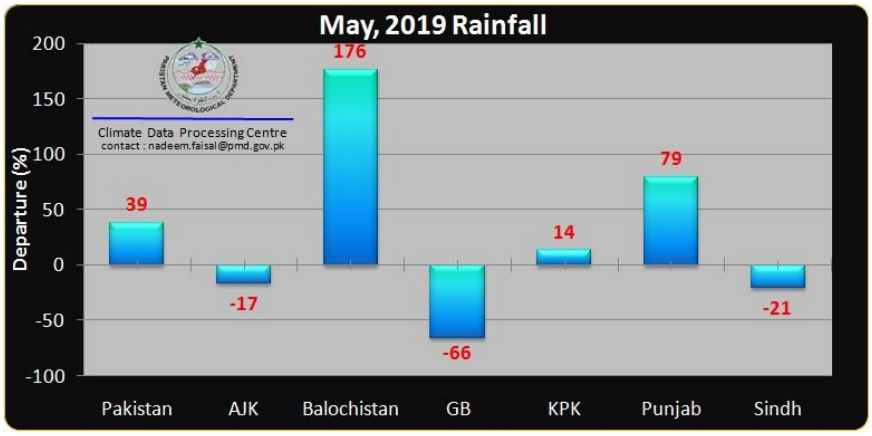

Figure 10 Rainfall departure in May 2019

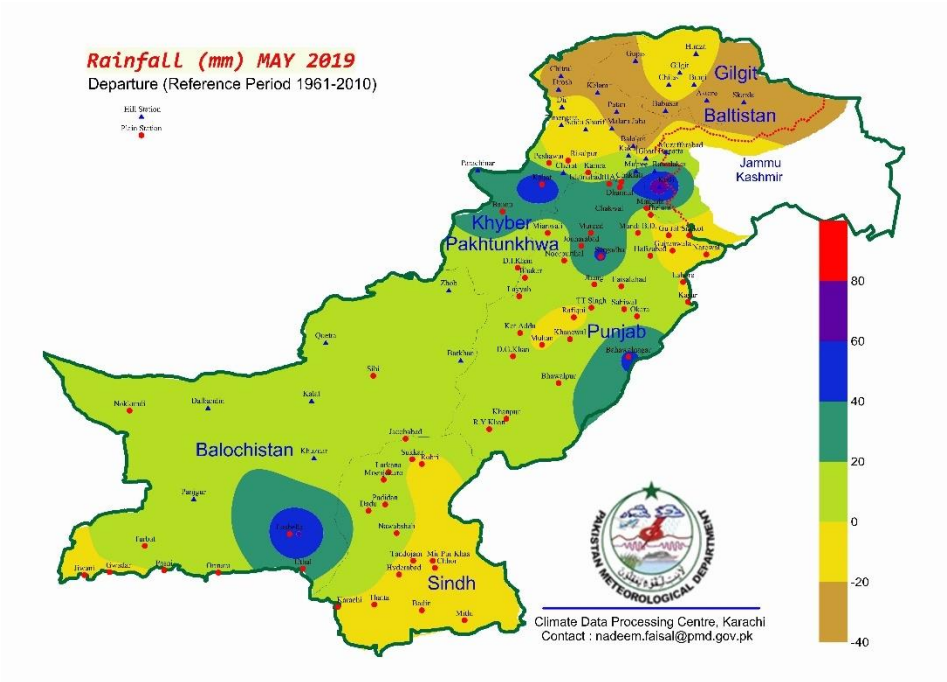

Figure 11 Spatial distribution of rainfall (mm) departure in May 2019

FORECAST VALIDATION

An attempt is made to substantiate the accuracy of precipitation forecasts issued in May. 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	87.1
Second Spell	90.3
Third Spell	90.3
Fourth Spell	93.5
Average	90

TEMPERATURE

During the month of May below normal maximum temperatures were recorded in Pakistan. Maximum temperatures in Gilgit Baltistan and Azad Jammu Kashmir remined close to normal. Sindh recorded well below normal maximum temperatures while in Balochistan, Punjab and Khyber Pakhtunkhwa maximum temperatures remained slightly below normal. Figure 12 represents the comparison of May 2019 and mean maximum temperatures over the country. Spatial distribution of anomaly of mean temperature is shown in figure 13. It Indicates that most parts of the country remained cooler than normal in the month of May While some parts of Sindh and Azad Jammu and Kashmir were warmer than normal.

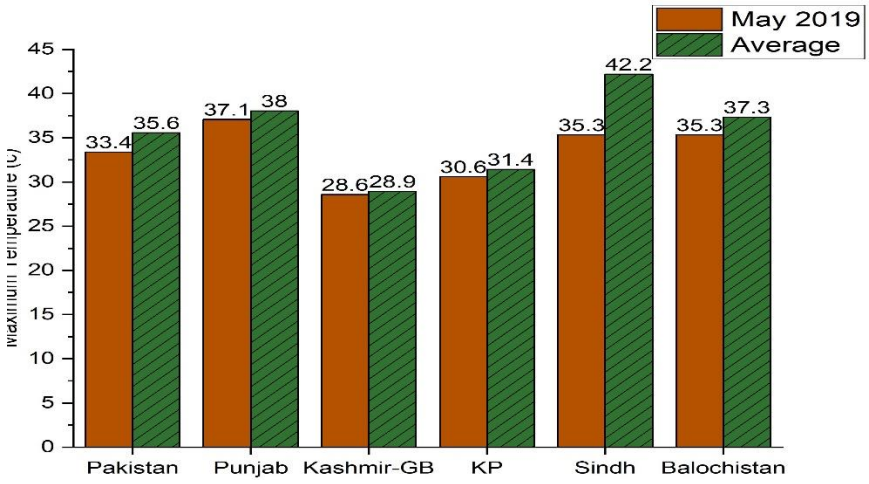

Figure 12 Temperature comparison between normal and May 2019 maximum temperatures.

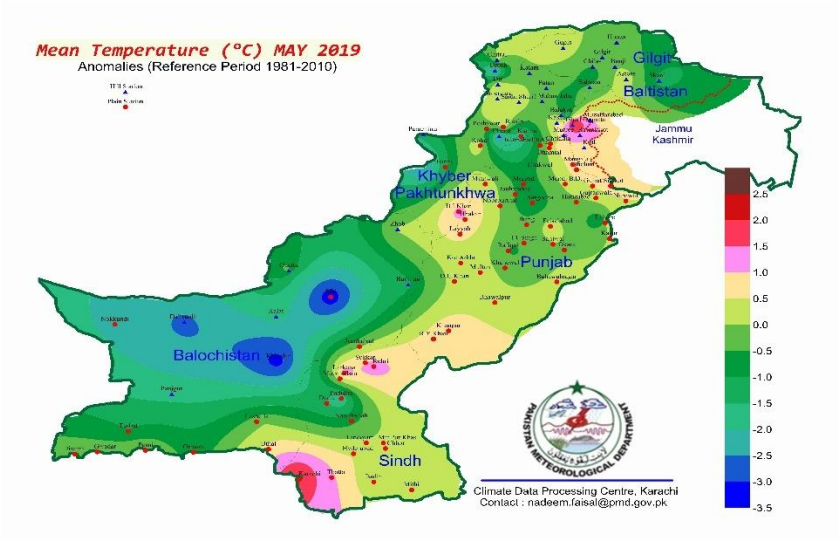

Figure 13 Temperature anomaly in May w.r.t 1981-2010

DROUGHT CONDITION

According to the latest drought analysis done by National Drought Monitoring Center of PMD, Wet conditions prevailed over some places in the northern parts of the country. During the month of May, the rains in the agricultural plains of Khyber Pakhtunkhwa and Punjab gave relief to the crops. Some districts in Sindh are under Moderate drought conditions due to no or very less precipitation and persistent dry conditions over there. Drought analysis results using different indices is represented in figure 14.

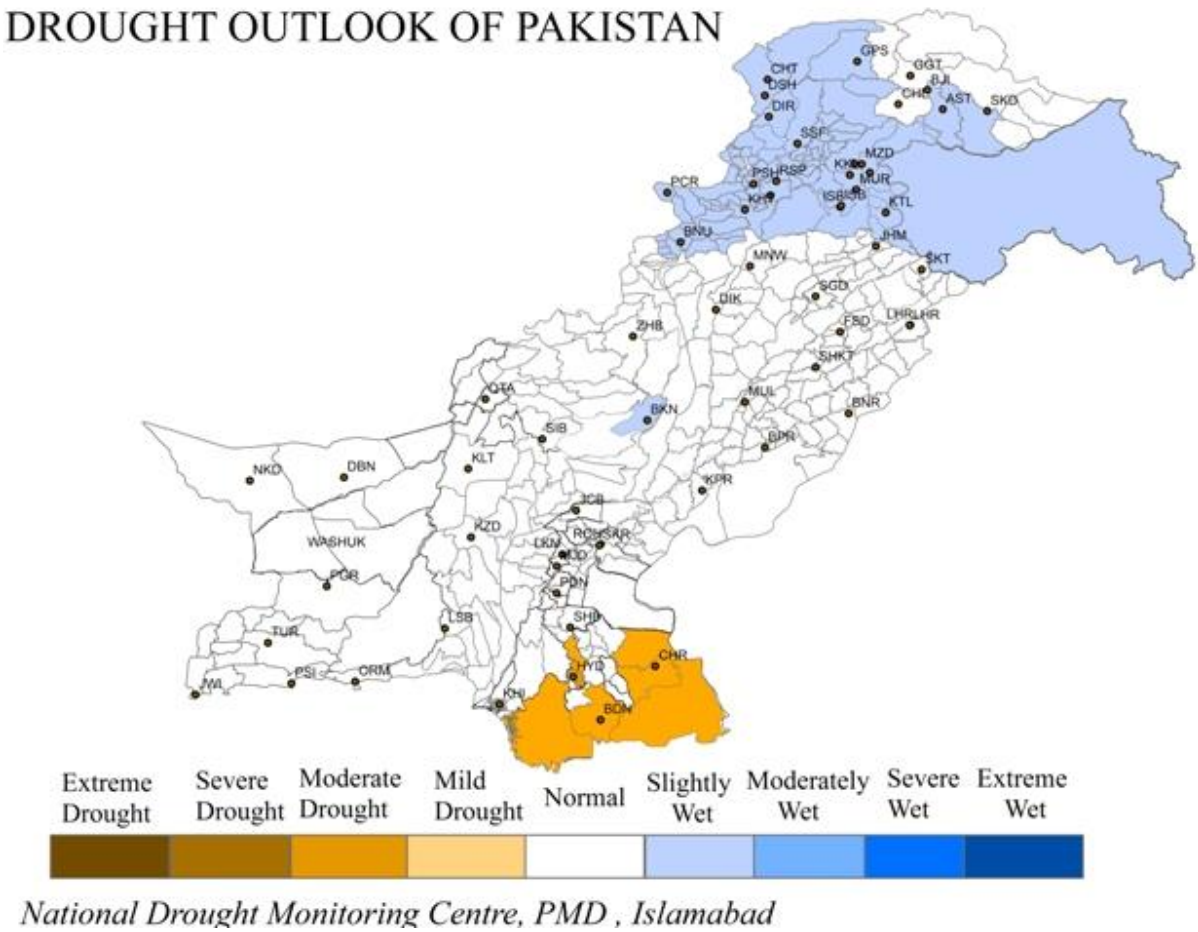

Figure 14 Drought outlook during the month of May.

ACKNOWLEDGMENT

This work is the combined effort of all the forecasting team. Special thanks to Mr. Farooq Dar, Ms. Ruqiya Mehmood and Mr. Muhammad Safdar, National Weather Forecasting Center (NWFC), Islamabad. Mr. Nadeem Faisal, Climate Data Processing Center (CDPC), Karachi. Mr. Ibrar Qureshi, Flood Forecasting Division (FFD), Lahore. Mr. Nassir Yaseen, National Drought Monitoring Centre (NDMC), Islamabad

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ANNEX I

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

Punjab			
Stations	**May-19**	**Normal**	**Deviation**
Murree	104.9	83.4	21.5
Islamabad, Old Airport	74.2	**	**
DG. Khan	70.8	**	**
Sargodha City	70.0	**	**
Attock	65.0	**	**
Mangla	62.8	**	**
Bahawalnagar	56.0	13.2	42.8
Joharabad	55.6	**	**
Islamabad, Zeropoint	52.0	38.2	13.8
Shorkot	49.3	**	**
Noorpur Thal	41.0	**	**
Islamabad, New Airport	35.7	**	**
Kasur	31.0	**	**
Jhelum	27.5	29.6	-2.1
Chakwal	26.2	**	**
Sahiwal	26.0	**	**
Mandibahauddin	25.6	**	**
Hafizabad	24.9	**	**
Lahore, City	23.1	22.4	0.7
Mianwali	23.0	**	**
Bahawalpur, City	22.3	7.1	15.2
Narowal	21.9	**	**
Gujranwala	20.1	**	**
Sialkot Airport	17.8	**	**
Faisalabad	15.6	14.9	0.7
Bahawalpur, Airport	15.6	**	**
Bhakkar	14.3	**	**
Lahore, Airport	14.0	23.4	-9.4
Khanpur	13.6	4.5	9.1
Khanewal	13.0	**	**
Kot Addu	12.0	**	**
T.T. Singh	11.2	**	**
Sialkot Cantt	9.1	26.8	-17.8

Multan	8.9	**	**
Gujrat	8.4	**	**
Sargodha, Airport	7.0	**	**
Okara	7.0	**	**
Jhang	5.8	**	**
Rahim Yar Khan	5.4	**	**
Layyah	5.0	**	**
Gilgit Baltistan & Azad Kashmir			
Stations	**May-19**	**Normal**	**Deviation**
Kotli	131.0	44.7	86.3
Rawalakot	117.6	**	**
Garidopatta	71.0	77.3	-6.3
Bagrote	63.8	**	**
Muzaffarabad	55.6	80.3	-24.7
Astore	31.8	62.5	-30.7
Gilgit	17.8	25.2	-7.5
Bunji	13.7	26.9	-13.2
Chilas	10.2	30.6	-20.4
Gupis	6.0	28.1	**
Skardu	0.1	26.7	-26.6
Hunza	0.0	**	**
Khyber Pakhtunkhwa			
Stations	**May-19**	**Normal**	**Deviation**
Malam Jabba	128.5	**	**
Parachinar	107.0	72.0	35.0
Kohat	102.0	**	**
Abbotabad	89.2	70.2	19.0
Dir	84.0	90.5	-6.5
Kalam	81.0	**	**
Cherat	55.0	28.4	26.6
Lower Dir	55.0	**	**
Saidu Sharif	51.5	63.1	-11.6
Balakot	44.0	76.3	-32.3

Pattan	40.0	**	**
Peshawar City	35.5	**	**
Drosh	33.1	59.7	-26.6
Bannu	32.9	8.2	24.7
Peshawar A/P	30.0	**	**
Mirkhani	30.0	**	**
DI. Khan	29.0	14.2	14.8
Chitral	24.0	42.5	-18.5
Risalpur	14.0	**	**
Sindh			
Stations	**May-19**	**Normal**	**Deviation**
Larkana	15.0	2.5	12.5
Jacobabad	14.0	3.5	10.5
Padidan	8.0	1.3	6.7
Dadu	7.0	**	**
Mohenjo-Daro	6.0	2.2	3.8
Shaheed Benazirabad	4.4	5.5	-1.1
Sukkur	0.0	5.0	**
Rohri	0.0	4.3	-4.3
Badin	0.0	6.2	-6.2
Chhor	0.0	5.8	-5.8
Hyderabad	0.0	2.8	-2.8
Karachi, Airport	0.0	0.1	-0.1
Mithi	0.0	**	**
Thatta	0.0	**	**
Mirpur Khas	0.0	**	**
Tando Jam	0.0	**	**
Balochistan			
Stations	**May-19**	**Normal**	**Deviation**
Lasbela	74.0	18.0	56.0
Barkhan	34.0	27.3	6.7
Zhob	23.0	17.3	5.7
Dalbandin	21.3	1.5	19.8
Kalat	21.1	4.2	16.9

Khuzdar	13.3	14.7	-1.4
Panjgur	10.0	2.9	7.1
Quetta, Airport	9.1	**	**
Turbat	8.4	2.9	5.5
Sibbi	4.0	5.4	-1.4
Nokkundi	2.0	0.1	1.9
Quetta City	0.1	**	**
Pasni	0.0	0.6	-0.6
Gwadar	0.0	**	**
Jiwani	0.0	0.2	-0.2
Ormara	0.0	0.1	-0.1