

Pakistan Meteorological Department

Drought Bulletin of Pakistan



April-June 2019

National Drought Monitoring Centre

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Drought Bulletin

April – June, 2019

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Quarterly Drought Bulletin

April – June, 2019

By

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1. Introduction

Pakistan has a long latitudinal extent and the rainfall variability during different seasons is considerably high. The climate of the country in its lower southern half is arid and hyper-arid while the northern half of country lies between semi arid to very humid. Some regions of the country in each seasons, remain drastically dry and area always vulnerable to drought. If subsequent seasons fail to generate significant precipitation, the drought conditions then are sure to take the vulnerable regions in the grip. All the provinces of Pakistan have a history of facing major droughts in the past.

Drought differs from other natural disaster (e.g. flood, tropical cyclones, tornadoes and earthquakes etc) in the sense that the effects of drought often accumulate slowly over a considerable period of time and may linger for years even after the termination of the event. Because of this drought is often referred to as a “Creeping Phenomena”. Drought impacts are less obvious and are spread over large geographical areas than are the damages that results from other natural hazards. Consequently drought affects more people than any other environmental hazard.

Unfortunately, no organizations dealing with the drought issues exist in Pakistan and the responses to drought for the distressed economic and social sector, whenever such situation arose, were taken on emergency and on adhoc basis. It is thus inevitable need of the time and Pakistan Meteorological Department (PMD) took an initiative to establish National Drought/Environment monitoring and Early Warning Centre (NDMC) in 2004-05 after the worst drought during 1999-2001 in Pakistan. The main objective is to monitor drought situation in the country and issue advisory before time. Its national centre is in Islamabad while four Regional Drought Monitoring Centers (RDMC’s) are in Lahore, Karachi, Peshawar and Quetta. These four RDMC’s cover those regions which come under their jurisdiction. These centers serve as a hub for the monitoring,

collection, consolidation and analysis of drought related data from all the possible sources in the country. In order to strengthen the network, 50 Automatic weather stations (AWS) have been installed in different regions, particularly the drought prone areas of the country. The data of eleven meteorological parameters i.e. air temperature, humidity, wind speed, wind direction, dew point, sea level pressure, station level pressure, solar radiations, soil moisture at standard depths (5, 10, 20, 50 ,100)cm and snow level are transmitted through satellite and GPRS technology after 3 hours. So, it has now become easy to access the data of remote areas of the country. NDMC has installed 335 Ordinary Raingages at districts level in four provinces as shown in figure-1.

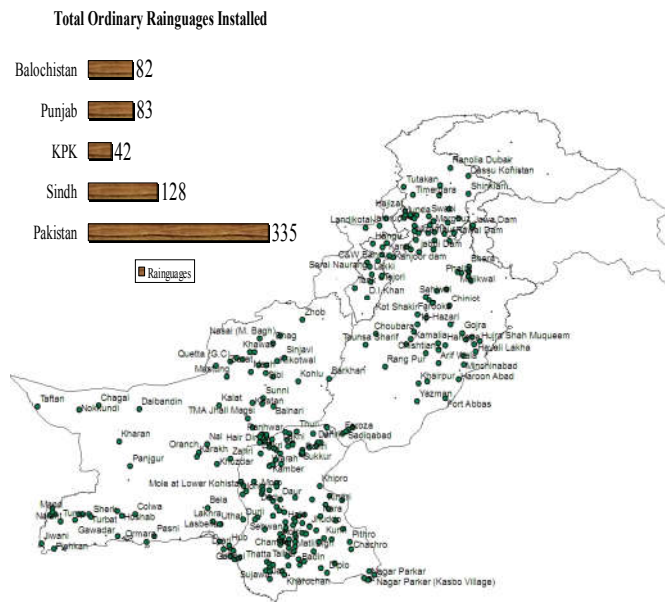


Figure-1 Rain-gauges Network of Pakistan by NDMC

NDMC is monitoring the water level situation of small dams also in Barani areas of the country. NDMC using different indices like Standardized Precipitation Index (SPI), Normalized difference Vegetation Index (NDVI), Cumulative Precipitation Anomaly (CPA), Rainfall Anomaly Index (RAI), Percent of normal, Probability of occurrence, Percentage departure and soil moisture analysis etc to monitor drought. NDMC issues weekly, fortnightly, monthly, quarterly drought bulletins of the country. Negotiations are underway with NGO's and National Disaster Management Authority (NDMA) for utilization of drought advisories / bulletins to end users.

2. Historical Background

The Indian sub-continent is predominantly characterized by a tropical monsoon climate and entire regime is distinguished mainly by the differences in rainfall both in quantity and distribution. The most important feature is the regional and temporal alteration of atmospheric flow patterns

associated with monsoon. There are two rainfall systems operating in the region (a) Southwest or Summer monsoon and (b) Northeast or the Winter monsoon.

Fortunately Pakistan also falls in this region which receive heavy amount of rainfall in summer due to SW monsoon and in winter due to western disturbances. The summer monsoon accounts for 70 to 80% of the annual rainfall over major parts of South Asia (IMD, 2009). In Pakistan, summer monsoon accounts 60 to 70% of the annual rainfall during July to September (Chaudhry, 1992). There is a large variability in the monsoon rainfall on both space and time scales.

Droughts in Pakistan region are mainly due to failure of rains from southwest monsoon. Also there seems to be some association between El Nino and La Nina events and weak monsoons. Pakistan frequently experiences droughts in southern parts of country. The study conducted at National Drought Monitoring Centre (NDMC) of PMD revealed that the province of Sindh and Balochistan are the more vulnerable to drought. The long term data analysis of past sixty years (1951-2010) different intensity (mild to extreme) of drought were experienced in the country i.e. 31 in Sindh, 23 in Balochistan, 22 in Punjab and 18 in Khyber Pakhtunkhwa. The longest episode of drought was experienced during 1999-2001. The Punjab province experienced the worst droughts in 1899, 1920 and 1935, 1969, 1987-88, 2000-01, Khyber Pakhtunkhwa (KPK) experienced the worst droughts in 1902 and 1951-1952, 1970-71, 1987-88, 1999-2001, Sindh had its worst droughts in 1871, 1881, 1899, 1931, 1947, 1951-52, 1958, 1966, 1969, 1972-74, 1987-88, 1999-2001 and 2003-04 while Balochistan had 1952, 1963-64, 1965, 1968, 1970-71, 1983-84, 1987-88, 1999-2002, 2004 and 2006. Over more than hundred year's period between 1871-1988, 11 out of 21 drought years were El Nino years.

Due to climate change, some years we receive more rains in wet spell and in dry spell we receive less rain. Due to less rain we have drought and heavy rain we have floods (flash flood, urban flood, costal flood and river flood).

3. Rainfall Distribution (April-June) 2019

During the second quarter of the year (April-June) 2019, Above normal (21.94 %) precipitation was observed over Pakistan. During the quarter high temporal and spatial variability in precipitation was observed. Normally May and June are the hottest months in the country whereas northern areas and south western parts received very less amount of rainfall. However, some convection rainfall lessened the moisture stress in the country along with some gusty winds. The evaporation rate remained very high during this quarter. But during this quarter, amount of rainfall was above normal as predicted by the Pakistan Meteorological department in seasonal forecast.

During April 2019, well above normal (37.7%) received in Pakistan. Similarly, it was very much above normal (208.2%) in Balochistan, in Punjab (43.5%), in Sindh (16.2%) whereas it was near normal in Khyber Pakhtunkhwa (-3.8%) and well below normal in Gilgit-Baltistan and Azad Jammu Kashmir (-66.5%). Like April, well above normal (35.9%) rainfall received in country during May, 2019. The provinces of Balochistan received very much above normal rainfall (123.1%). Similarly, it was above normal in Punjab (47.7%), Sindh (35.3) and Khyber Pakhtunkhwa (22.2%) and well below normal in Gilgit-Baltistan and Azad Jammu and Kashmir (-45.3%).

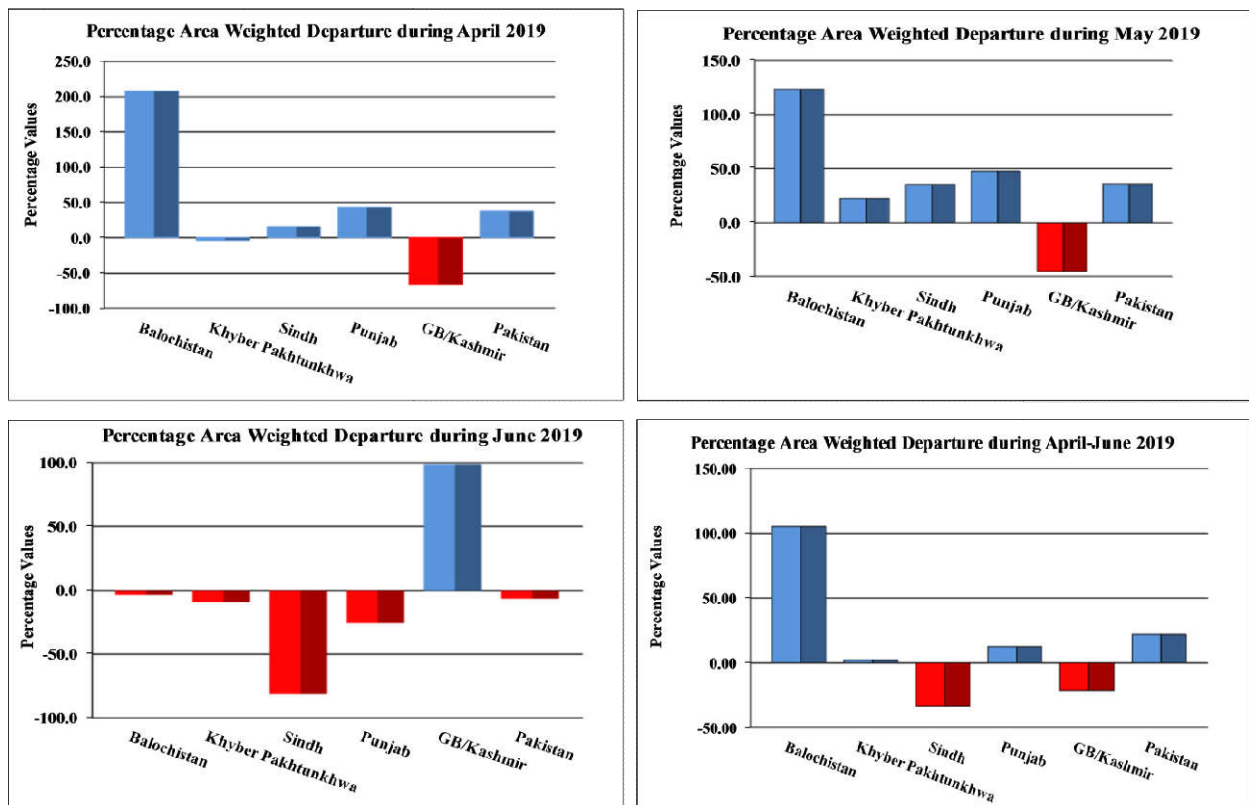


Figure-2 percentage departure of rainfall during (April-June) 2019

During June 2019, amount of rainfall was near normal (-6.5%) in country. However, rainfall was well above normal in Gilgit-Baltistan and Azad Jammu and Kashmir (99.1%). The province of Sindh received rainfall well below normal (-81.3%) and Punjab received below normal rainfall (-25.9%) whereas it was near normal in the province of Khyber Pakhtunkhwa (-9.2%) and Balochistan (-3.8%). The figure no2 shows the percentage area weighed departure rainfall occurred during (April-June) 2019 for whole region of Pakistan in which the country received above normal (21.94%) rainfall during this quarter. Viewing the rainfall distribution on province basis, highly above-normal rainfall was received over Balochistan (105.07%) and normal to near

normal over Khyber Pakhtunkhwa (2.13%), Punjab (12.6%) while it was below normal in Sindh (-33.37%) and Gilgit-Baltistan and Azad Jammu & Kashmir (-21.54%) as shown in figure-2. Indian Ocean Dipole (IOD) is in positive phase where as weak El-nino conditions are prevailing. Spatial distribution of monthly and quarterly rainfall is shown below in figure-3.

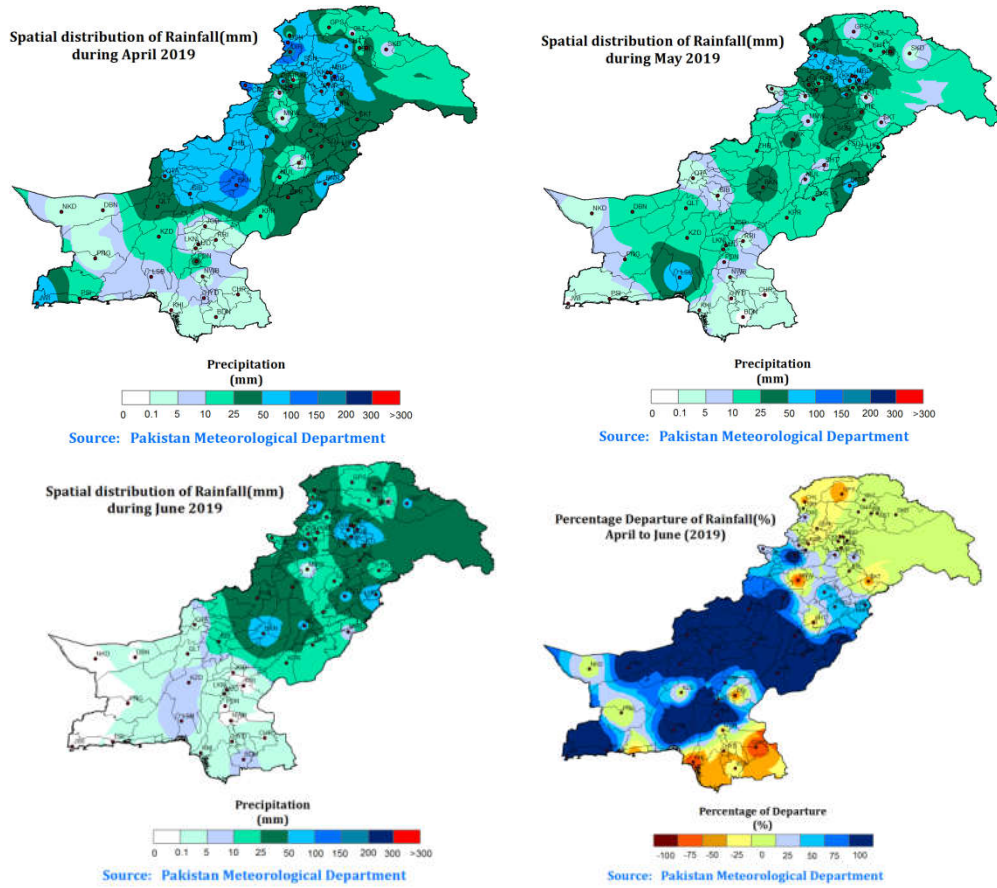


Figure-3 spatial distribution of rainfall during (April-June) 2019 of Pakistan

- **Maximum length of dry Spell**

The dry spell is defined as when the amount of rainfall is less than 1.0mm over an area.

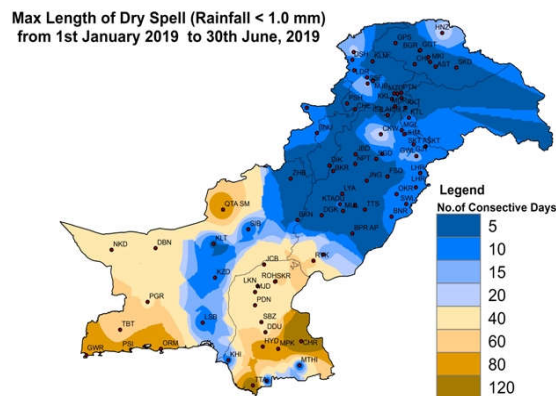


Figure-3b spatial distribution of maximum length of dry spell

- **Monthly Highest Rainfall**

- i. **April, 2019**

4-5 wide spread rain spells were received in Punjab, Sindh and Balochistan. In Punjab, Murree received rainfall of 92 mm, Islamabad 91 mm, Gujranwala 85 mm, Bahawalnagar 62 mm, Lahore 55 mm, Mandi Bahauddin 53 mm, Jhelum 52 mm, Dera Ghazi Khan 50 mm while rest of Punjab received less than 50 mm of rainfall. In Khyber Pakhtunkhwa maximum cumulative rainfall was 190 mm in Dir, 182 mm in MirKhani, 171 mm in Kalam, 146 mm in Malam Jabba, 116 mm in Parachinar, 69 mm in Bannu, 66 mm in Abbottabad, 63 mm in Chitral and D. I. Khan, 58 mm in Peshawar while rest of Khyber Pakhtunkhwa received less than 50 mm of rainfall. In Balochistan, Barkhan received rainfall of 138 mm, Jiwani 94 mm, Sibbi 72 mm, Zhob 68 mm, Quetta 50 mm while rest of Balochistan received less than 50 mm of rainfall.

- ii. **May 2019**

3-4 country wide rain spells were observed with above normal rainfall in most of agricultural plains of the country. In Punjab, Murree received rainfall of 104 mm, Dera Ghazi Khan 71 mm, Kamra 65 mm, Mangla 63 mm, Bahawalnagar and Joharabad 56 mm, Islamabad 52 mm while rest of Punjab received less than 50 mm of rainfall. In Khyber Pakhtunkhwa maximum cumulative rainfall was 128 mm in Malam Jabba, 107 mm in Parachinar, 102 mm in Kohat, 89 mm in Kakul, 84 mm in Dir, 81 mm in Kalam, 55 mm in Cherat while rest of Khyber Pakhtunkhwa received less than 50 mm of rainfall. In Sindh, Larkana received 15 mm of rainfall and Jacobabad 14 mm. While rest of Sindh received less than 10 mm of rainfall. In Balochistan, Lasbela received rainfall of 74 mm, Barkhan 34 mm, Zhob 23 mm, Dalbandin and Kalat 21 mm while rest of Balochistan received less than 15 mm of rainfall.

- iii. **June, 2019**

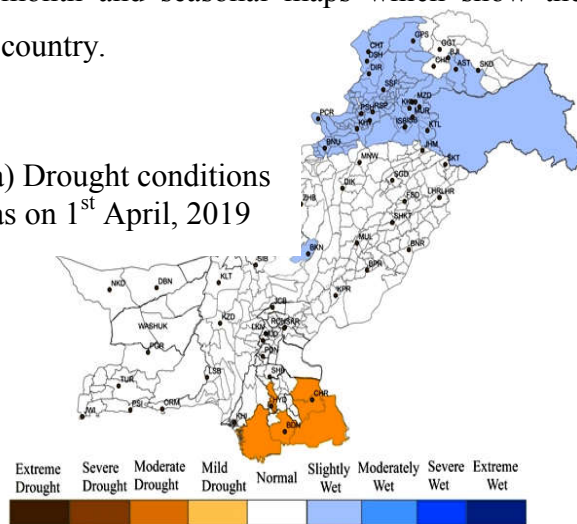
4-5 country wide rain spells were observed above Normal rainfall over lower Khyber Paktunkhawa, many parts of Punjab & GB and Kashmir; while below normal at most parts Sindh and Balochistan. During the month of June, rainfall across the country contributed well to the water availability in the reservoirs. Light to Moderate rainfall events were reported across Pakistan. Highest accumulated monthly rainfall was recorded at Chakothei (153mm), Bandi Abbaspur (148mm), Tandali (121mm), Astore (112mm), Muzaffarabad (106mm), Haraman (94mm), Kakul (94mm), Hajira (93mm), Dir (91mm), Garhi Dupkata (84mm), Murree (84mm) and Brarkot (82mm).

4. Drought products

i. Standardized Precipitation Index (SPI)

The Standardized Precipitation Index (SPI) was developed for the purpose of defining and monitoring drought (McKee *et al.*, 1993). The SPI calculation for any location is based on a series of accumulated precipitation for a fixed time scale of interest (i.e. 1, 3, 6, 9, 12, months). Positive SPI values indicate greater than median precipitation, and negative values indicate less than median precipitation. Because the SPI is normalized, wetter and drier climates can be represented in the same way, and wet periods can also be monitored using the SPI. Here we are including one month and seasonal maps which show the drought conditions of the monsoon season in the country.

a) Drought conditions as on 1st April, 2019



b) Drought conditions as on 30th June, 2019

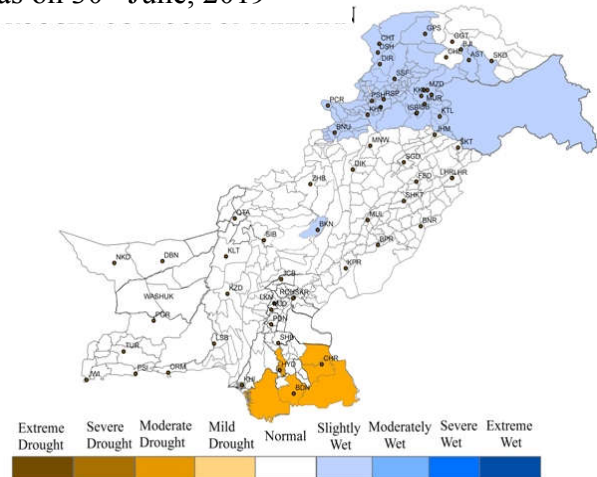


Figure-4 Drought conditions of Pakistan

Due to deficient rainfall, mild to moderate drought conditions emerged in lower Sindh. Appreciable amounts of rainfall has been recorded over agricultural plains of the country, therefore the water requirement is satisfactory.

ii. Cumulative Precipitation Anomaly (CPA)

Westerly rain bearing systems remained active over Pakistan with the decreasing frequency of occurrence as compared to the peak winter months. The northern parts of the country will be mainly influenced by these weather systems and frequency of precipitation days would be greater in these areas as compared to other parts of the country. Some precipitation associated with thunderstorm/ hailstorm is also expected due to local weather developments in the northern parts.

During April to June 2019, it was observed that Cumulative Precipitation Anomaly was positive in southern west Balochistan, southern Sindh and upper KP regions. Even the day time temperature

and evapotranspiration were higher as compared to the previous quarter yet the conditions are satisfactory and no moisture stress has been observed especially in lower and central regions of the country. While the barani areas of Khyber Pakhtunkhwa, Gilgit Baltistan, Kashmir, Potohar regions and some parts of southwestern coast of Balochistan were under moisture stress.

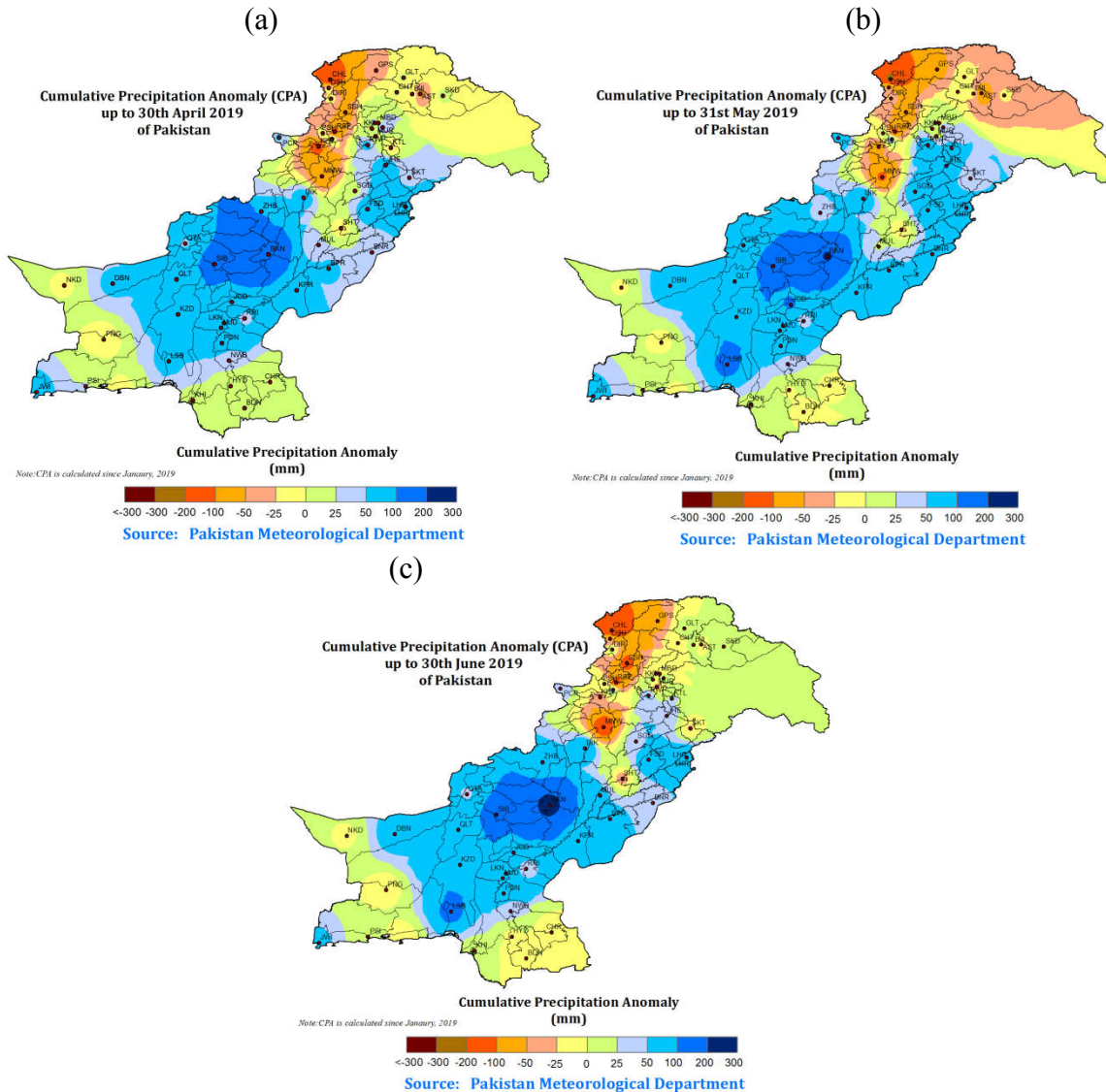


Figure-5 Cumulative precipitation anomaly during (April-June) 2019 of Pakistan

iii. Soil Moisture Anomaly (SMA)

No significant moisture stress was observed in most parts the country. However central & western regions of Balochistan and southeastern Sindh have shown some stress due to low amount of rainfall in these areas as shown in figure-6. However, Soil moisture conditions through out the country is satisfactory. It was predicted that rainfall will be above normal in April-June 2019 due to which soil moisture stress may be lessen especially in the southern parts of the country. It is

predicted that the slightly below normal monsoon rainfall 2019 is expected in the southern half of the country that may arise the stress conditon.

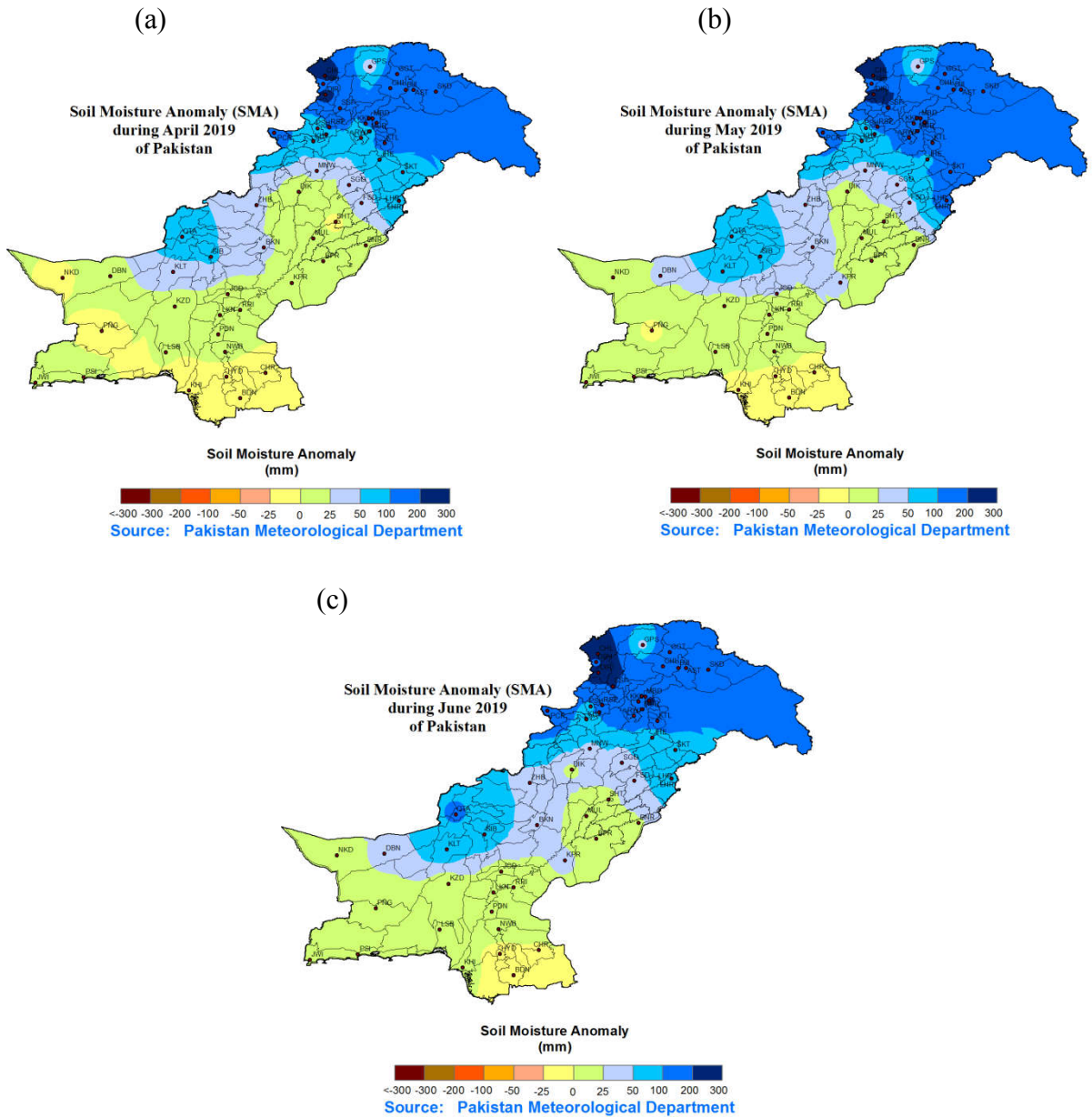


Figure-6 soil moisture anomaly during (April-June) 2019 of Pakistan

iv. Water Level of Reservoirs

Pakistan has two main reservoirs of water in the form of dams i.e. Tarbela and Mangla. The dead level of Tarbela is 1378 feet while maximum conservation level is 1550 feet; whereas Mangla has dead level of 1040 feet and maximum conservation level of 1242 feet. Pre-monsoon rains, along with the snow melting play an important role to water levels of dams. In addition, small dams in various parts of the country were also filled that would help to boost agriculture and improve

socio-economic activities in the country. However, the dams situation is satisfactory in major as well as small reservoirs in the country. Percentage of average water level during April to June 2019 was calculated for both dams are shown below in figure -7;

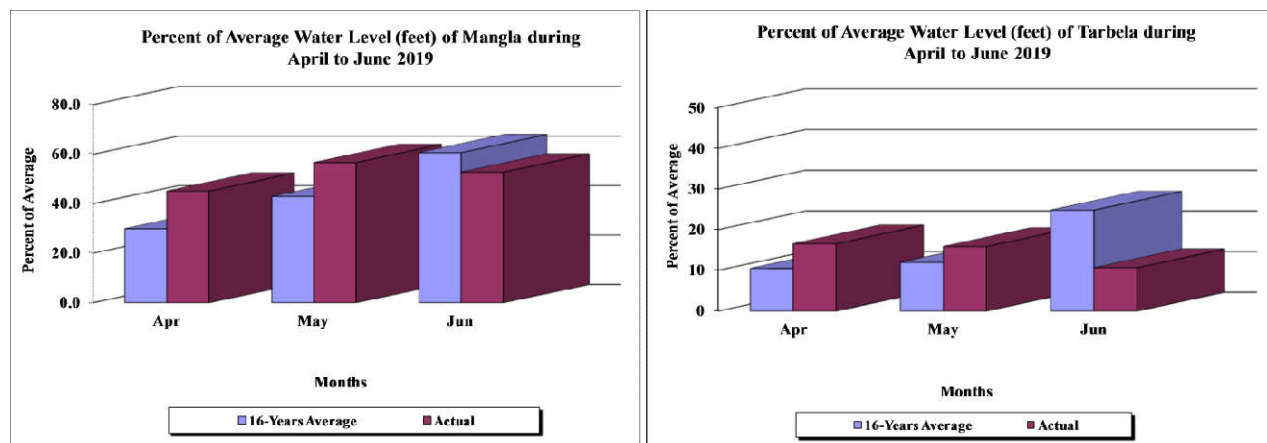


Figure-7 percent of water level of Tarbela and Mangla during (April-June) 2019

5. Agriculture

Agriculture is main livelihood of about 70% population of the country. Due to direct relationship between agriculture and water scarcity/drought, drought mapping data is of vital importance. Efforts are being made to inform farmers of drought information in a timely fashion for better utilization of data.

5.1 Crop Condition:April-2019

The rabi season at the end of April, was half way through in Punjab, Upper Sindh, Balochistan and Southern KP. The harvesting overed in most parts of these areas by mid-May. The harvesting in Peshawar valley and northern areas generally extends upto June and beyond.

- Wheat Crop

Wide spread rains and mild temperatures without any heat wave during March and April delayed wheat harvesting by 10 to 15 days particularly in Punjab. Wheat harvesting and threshing was at peak during last fortnight of April particularly in central and southern parts of Punjab. Following were key features of wheat crop 2018-19:

- Increase in area of wheat in barani tracts of the country mainly due to timely and effective rains
- Decrease in area in multi crop districts (lower Sindh, maize growing) particularly in central and few districts of southern Punjab
- Higher prevalence of rust diseases due to wide spread and frequent rains

- Decrease in the offtake of Nitrogen (-4.2 %), Phosphorous(-13.8 %) and Potash (-13.0 %) during October to February
- Increase in the prices of nitrogenous and phosphorous fertilizers
- Decrease in irrigation water supply particularly at the time of sowing
- Significant damage to wheat production due to rains / hailstorm (15-17 April, 2019)

- **Maize crop**

Two crops of Maize are grown in Pakistan viz. autumn crop during June to August and spring crop during February to March. Spring maize was at silking stage during April in major growing districts of Punjab. These districts include Sahiwal, Okara, Pakpattan, Chiniot, Sialkot and Kasur. The crop is gaining popularity in adjoining districts of Khanewal, Vehari, Multan and Jhang. The abundant rainfall during early period proved highly beneficial for the crop. The crop will be harvested in June.

5.2 Crop Situation: May, 2019

The spring maize crop is at cobbing stage after completing tasseling and silking stages and would be harvested in early June. The February-March sown sugarcane crop is at suckering stage and the September sown crop is at prime stage of rapid growth. Early sown cotton in Punjab and Sindh is at flowering stage. However major sowing of the cotton area was carried during April-May in Sindh. The large areas of cotton were sown during May and the operation will continue further during early June. The major activity of the Rabi season during early May was harvesting of wheat crop.

- **Spring Maize Crop**

Spring maize crop is mainly grown in Punjab. There are two cropping seasons of maize crop viz. autumn and spring. Spring maize crop is sown in February-March and harvested up-to June. The main growing districts include Okara, Pakpattan, Sahiwal, Faisalabad, Chiniot, Kasur, Jhelum and others. The crop completed tasseling and silking stages in April-early May. The crop was at grain filling and maturity stage towards the end of May. The crop is at grain formation stage and will be harvested in early June.

- **Cotton Crop**

Cotton crop is at sowing and flowering stage depending upon sowing time, area and varietal characteristics. Late wheat harvesting particularly in southern Punjab, has caused one to two weeks

delay in cotton sowing operations from the normal time frame. The optimal sowing time for cotton in Sindh is from April to mid-May; while in Punjab, it is from May to mid-June. The field information indicate that about 8-10 percent of the cotton crop is sown early during the months of February and March in both these provinces. However the farmers draw out the sowing timelines on either side, both early and late to match the thinly spread irrigation water supply. The sowing of early cotton starts in February in Punjab. This situation has been corroborated to combat the attack of cotton leaf curl virus. The main crop is sown in March-May in Sindh and May-June in Punjab.

- **Sugarcane Crop**

Sugarcane crop is at vegetative growth stage. Crop growth is generally satisfactory. Crop yield is expected to be better than last year mainly due to better irrigation water supplies as compared to last year. In Sindh, 75 percent of sugarcane crop area was sown in September 2018 while the rest of the area was sown during February and March 2019. In most parts of Punjab and KP sugarcane was sown during February and March, 2019. Crop is at healthy growth stage in most parts of the country due to sufficient water availability.

- **Rice Crop**

Coarse rice transplantation is in progress. IRRI and Basmati varieties however were at nursery sowing stage after 10th May and normally transplanted during June / July. The rice crop is still at nursery stage in most parts of the country. By end of May, Basmati rice in North eastern region of Punjab was at nursery plantation stage and is required to be sown after 20th May by a legislation aiming at breaking life cycle of rice borer by eliminating the host plants.

5.3 Crop Situation: June, 2019

The growth of Kharif season crops i.e sugarcane and cotton are progressing during the month of June. Sugarcane crop is at early growth stage. The cotton crop is at boll formation stage in Sindh and in some limited areas of Punjab, where crop was sown during February & March. The Cotton crop in major areas of Punjab is however at flowering stage.

Farmers in Khanewal and Vehari substituted part of the area by planting spring maize crop and in Muzaffargarh, the short duration Mungbean crop was sown in areas stretching along the River Chenab to assure resilience in any likelihood of flooding

Kharif Crops

- **Maize Crop**

Spring maize crop is mainly grown in Punjab. There are two cropping seasons of maize viz. autumn and spring. The main growing districts are Okara, Pakpattan, Sahiwal, Faisalabad, Chiniot, Kasur and Jhelum. This crop is sown in February-March and harvested by June.

Harvesting of spring maize in Sahiwal division took place during June and almost completed except the late sown maize during April, which will be harvested in first decade of July.

- **Cotton Crop**

Cotton crop is a perennial plant with an indeterminate growth habit which has no distinct stage between vegetative and its reproductive stage. This characteristic makes cotton picking a multi-stage picking phenomenon. It has a very dynamic growth response to environment and management. Site-specific management strategies need to be taken into consideration to optimize yields. Furthermore, management strategies should be flexible to allow for changing environmental conditions. Cotton has one of complex insect pest and disease problem in main growing areas of Punjab and Sindh. Most common are CLCV, bollworms, dusky cotton bug, whitefly thrips, armyworm, jassids and others.

- Cotton in Sindh is promising this year and has reached the blooming stage. A few Ginning factories have started operation by mid of June based on small scale cotton picking. It is expected that cotton production will be on higher side, if crop acreage and crop growth is not affected by rains/river floods later in the season.

5 District wise impact of drought

Due to normal seasonal rainfall and above normal rainfall in drought prone areas of country, no serious negative impacts of drought have been reported from any part of the country. Furthermore, the above normal rainfall provided a significant relief to drought prone areas of Sindh and Balochistan and drought conditions have been eliminated and returned to normal. In this regard, NDMC issued back to normal alert on 11th April, 2019 as follows;

- **Back to Normal**

- 1. **Drought situation**

Above normal rainfall was recorded over most of the area of the country especially the drought prone districts of Sindh and Balochistan during January to March, 2019. Major rainfall deficit was experienced over the provinces of Gilgit-Baltistan and Azad Jammu Kashmir (-31.5%), Khyber Pakhtunkhwa (-18.9%). The country received well above normal rainfall (64.0%), i.e. Sindh (262.6%), Punjab (113.6%) and Balochistan (31.8%), during the winter rainy season (Jan-Mar), 2019. The area weighted rainfall departure (%) detail is as under table-1;

Table 1 Area weighted rainfall departure (%) of Pakistan

Area Weighted Rainfall of Pakistan during January-March (2019)												
Provinces	January			February			March			January-March		
	Actual (mm)	Normal (mm)	Departure (%)	Actual (mm)	Normal (mm)	Departure (%)	Actual (mm)	Normal (mm)	Departure (%)	Actual (mm)	Normal (mm)	Departure (%)
Balochistan	5.2	6.0	-12.6	0.7	7.5	-90.9	22.8	8.3	175.4	28.7	21.8	31.8
Khyber Pakhtunkhwa	6.5	4.2	53.4	1.9	6.4	-71.1	7.8	9.2	-15.6	16.1	19.9	-18.9
Sindh	3.0	0.6	425.4	3.7	1.1	241.8	2.4	0.8	179.4	9.1	2.5	262.6
Punjab	5.4	2.4	129.5	11.5	3.5	226.2	3.5	3.6	-5.3	20.4	9.5	113.6
Gilgit-Baltistan & AJK	3.1	2.7	13.0	0.6	3.2	-80.6	3.4	4.3	-22.4	7.0	10.3	-31.5
Pakistan	23.2	15.8	46.4	40.7	21.8	86.7	41.0	26.3	55.7	104.9	64.0	64.0

Normal period (1981-2010)

Keeping in view the observed winter rainfall situation in drought prone districts of Pakistan, current drought conditions have returned back to normal over whole Balochistan and Sindh province except Badin, Hyderabad, Sajwal, Sanghar, Umarmkot, Thatta and Tharparkar where moderate drought is prevailing.

- 6 **Government reactions to drought**

Due to above normal rainfall, drought conditions subsided and returned to normal in the country. The water availability in major reservoirs is sufficient due to above normal snowfall in the catchments areas, water situation in the dams is improving day by day. NDMC is continuously monitoring the drought situation as it may arise again after the monsoon season as below normal rainfall is predicted in southern half of country. It is therefore advised to all stakeholders to adopt an immediate water management strategy to avoid negative impacts of deficit rainfall on agriculture sector and keep themselves regularly updated on weekly, fortnightly and monthly basis at PMD website <http://www.pmd.gov.pk/ndmc/index.htm>.

7 Recommendations

Natural disaster could not be stopped. Each disaster gives us a lesson to do better planning, management and taking some precautionary measures to minimize its impacts in future. Following are some recommendations to cope with droughts in Pakistan

- Pakistan dam's water storage capacity is much less than the neighbouring countries like India. Therefore it is need of the hour to build large and small dams for storage of water which should be used during scarcity of rainfall to avoid drought conditions.

8 Acknowledgement

National drought monitoring centre, Pakistan Meteorological Department, Islamabad acknowledges SUPARCO and district office agricultural departments for sharing the information.

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