Pakistan Meteorological Department

Drought Bulletin of Pakistan

January-March 2022

National Drought Monitoring Centre

Pakistan Meteorological Department

Sector H-8/2, Islamabad – 44000,P.O.Box#1214,

Phone # +92-51-9250598, Fax # +92-51-9250368

Website: www.pmd.gov.pk

Drought Bulletin
January – March, 2022

Patron in Chief:Dr. Azmat Hayat Khan (Late), Chief Meteorologist, National Drought Monitoring Centre(NDMC), Islamabad.

Chief Editor: Mr. Jan Muhammad Khan, Director, NDMC, Islamabad.
Editor: Dr. Shahzada Adnan, Meteorologist, NDMC, Islamabad.

Quarterly Drought Bulletin
January – March 2022

By

National Drought/Environment Monitoring & Early Warning Centre,

Pakistan Meteorological Department,

Islamabad

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 the country lies between semi-arid to very humid. Some regions of the country each season, remain drastically dry and are always vulnerable to drought. If subsequent seasons fail to generate significant precipitation, the drought conditions then are sure to take the vulnerable regions in their grip. All the provinces of Pakistan have a history of facing major droughts in the past.

Drought differs from other natural disasters (e.g. floods, tropical cyclones, tornadoes and earthquakes etc) in the sense that the effects of drought often accumulate slowly over a considerable period 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 result 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 an emergency and ad-hoc basis. It is thus an inevitable need of the time and Pakistan Meteorological Department (PMD) took an initiative to establish the 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 the drought situation in the country and issue advisory before time. Its national centre is in Islamabad while four Regional Drought Monitoring Centers (RDMCs) are in Lahore, Karachi, Peshawar and Quetta. These four RDMCs cover those regions which come under their jurisdiction. These centres serve as a hub for

the monitoring, collection, consolidation and analysis of drought-related data from all the possible sources in the country. 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 Rainguages at the districts level in four provinces as shown in figure-1.

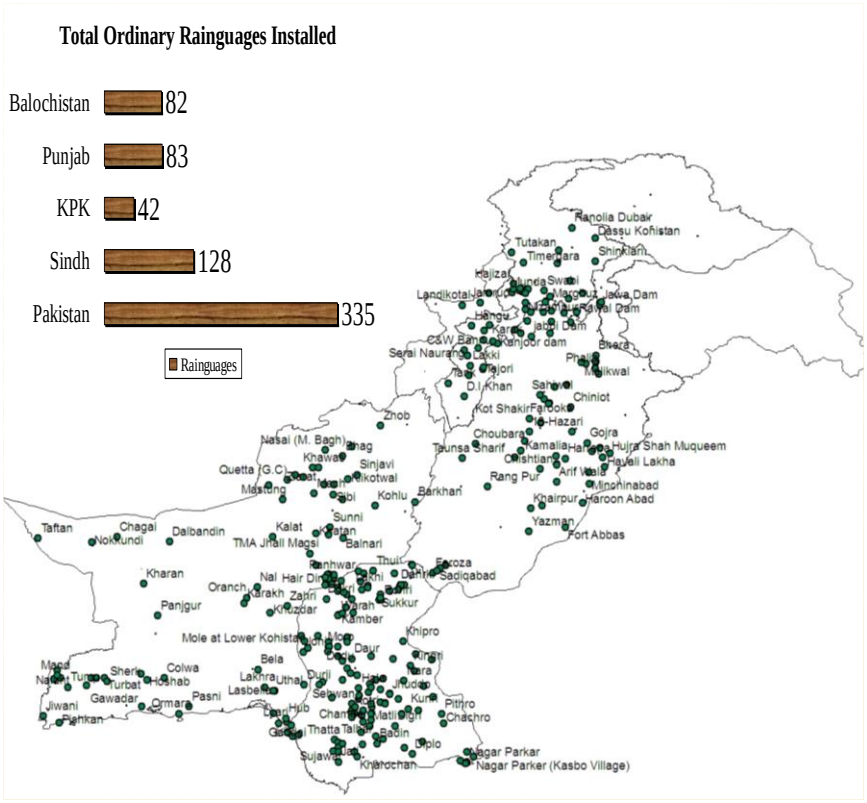


Figure-1 Rain-gauges Network of Pakistan by NDMC

NDMC is monitoring the water level situation of small dams also in Barani areas of the country. NDMC uses 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 a fortnightly drought bulletin of the country. Negotiations are underway with NGOs and the National Disaster Management Authority (NDMA) for the utilization of drought advisories/bulletins to end-users.

2. Historical Background

The Indian sub-continent is predominantly characterized by a tropical monsoon climate and the 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 the monsoon. Two rainfall systems are operating in the region (a) Southwest or summer monsoon and (b) Northeast or the winter monsoon.

Fortunately, Pakistan also falls in this region which receives a 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, the summer monsoon accounts for 60 to 70% of the annual rainfall from July to September (Chaudhry, 1992). There is a large variability in the monsoon rainfall on both space and time scales.

Droughts in the Pakistan region are mainly due to failures of rains from the 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 the country. The study conducted at the National Drought Monitoring Centre (NDMC) of PMD revealed that the province of Sindh and Balochistan are more vulnerable to drought. In the long term data analysis of the past sixty years (1951-2010) different intensities (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 the 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 (KP) 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, 2003-04 and 2018 while Balochistan had 1952,1963-64, 1965, 1968, 1970-71, 1983-84, 1987-88, 1999-2002,2004,2006 and 2018. Over more than a hundred years between 1871-and 1988, 11 out of 21 drought years were El Nino years.

Due to climate change, some years we receive more rain in wet spells and in dry spells we receive less rain. Due to less rain, we have drought and heavy rain we have floods (flash floods, urban floods, coastal floods and riverine floods).

3. Rainfall Distribution (Jan–Mar) 2022

During the first quarter of the year (Jan-Mar) 2022, near to normal (-5.24%), precipitation was observed over Pakistan. During this quarter, high temporal and spatial variable precipitation

has been observed. Normally, January and February are the coldest months in the country. The northern areas and south-western parts received a good amount of rainfall during winter. The rainfall was well above normal (181.83%) during January in the country. The rainfall departure was well above normal in Sindh (690.89%), Punjab (254.73%), Balochistan (178.80%), and Khyber Pakhtunkhwa (115.80%) and GB/Kashmir (102.87%). Unlikely, the rainfall was observed well below normal during February (-71.92%) in Pakistan. The rainfall was well below normal in Sindh (-95.15 %), Balochistan (-89.29%), Khyber Pakhtunkhwa (-67.15%),Punjab (-65.22%), and (-41.23%) in GB/Kashmir. The rainfall was observed well below normal during March (-64.6%)in Pakistan with a decrease (-72.6%) in Punjab, (-68.0%) in Balochistan, (-67.7%) in Khyber Pakhtunkhwa, (-49.6%) in Sindh and (-48.2%) in GB/Kashmir. The figure-2 shows the percentage area weighed departure of rainfall occurred during (Jan-Mar) 2022. The above-normal rainfall of January has subsided the drought-like situation over drought-prone regions of Sindh and Balochistan. Based on the quarterly analysis, rainfall distribution was well below normal over Sindh (-98.76%), Khyber Pakhtunkhwa (-28.20%) and normal to near normal in Gilgit-Baltistan and Kashmir (-6.24%), Balochistan (-5.24%) and Punjab (6.77%), and as shown in figure-2

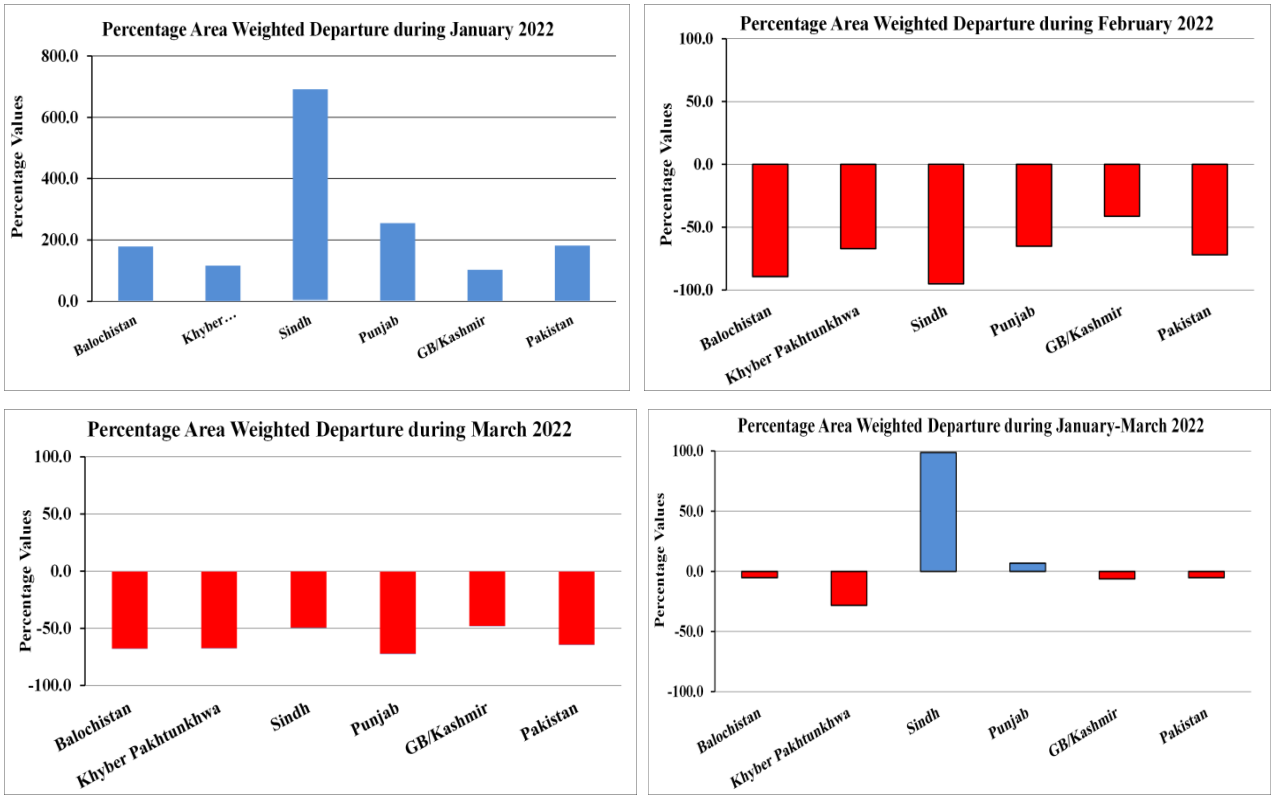


Figure-2 Percentage departure of rainfall during (Jan-Mar) 2022

During the quarter (January-March) rainfall spells were observed throughout the country, especially in Punjab, Sindh and Balochistan. These rains reduced moisture stress on wheat crops in rainfed areas. Above normal rainfall during Januaryand March lessen the moisture and water stress and provided significant relief in drought vulnerable areas of Pakistan. The monthly and seasonal analyses on a regional and country basis are as shown below in figure 3.

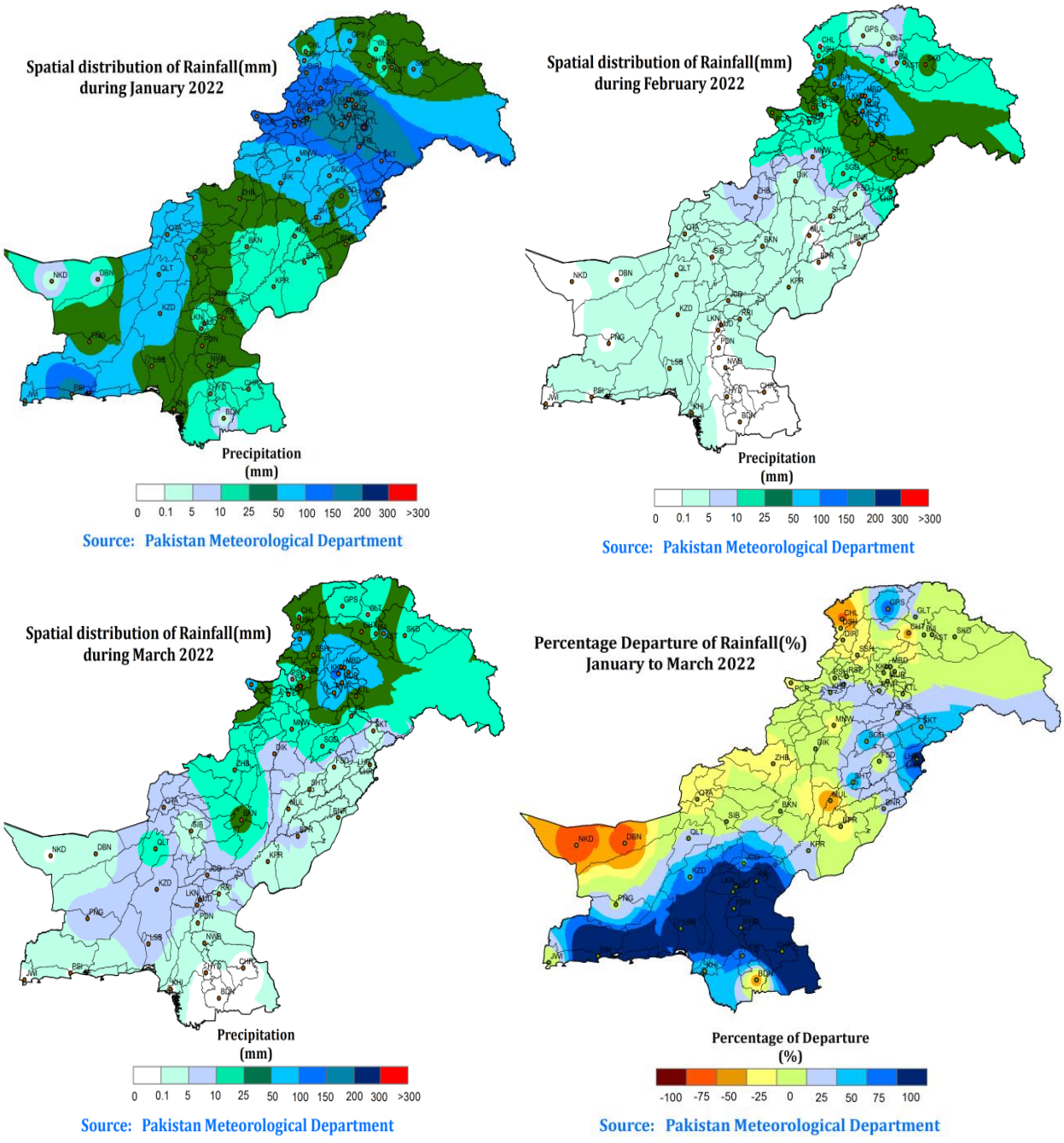


Figure-3 spatial distribution of rainfall during (Jan-Mar) 2022 of Pakistan

- **Rainfall**

During **January 2022**, 4-5 countrywide rain spells were received with light to moderate rainfall along with isolated heavy rainfall.

S. No.	Stations	Rainfall (mm)	S. No.	Stations	Rainfall (mm)
1	Dhulli	260.1	11	Rawalakot	184.9
2	Hajira (AJK)	239.4	12	Muzaffarabad City	184.8
3	Malam Jabba	218.7	13	Chattar Kalas	182.8
4	Bandi Abbaspur (AJK)	205.8	14	Cherat	182.0
5	Kotli	205.6	15	Islamabad (ZP)	174.5
6	Narowal	203.1	16	Sialkot Airport	170.6
7	W.S.R. Mangla	202.3	17	Kalam	162.4
8	Murree	191.6	18	Dir	161.0
9	Chaklala Airbase	185.9	19	Lahore	160.5
10	Pasni	185.0	20	Kakul	152.9

During **February** 2022, 2-3 rain spells were received in most of the northern half of the country.

S. No.	Stations	Rainfall (mm)	S. No.	Stations	Rainfall (mm)
1	Rawalakot	149.7	11	Deolian (AJK)	62.9
2	Dhulli (AJK)	142.5	12	Murree	62.8
3	Malam Jabba	126.7	13	Balakot	61.0
4	Chakothi (AJK)	95.0	14	Chattar Kalas (AJK)	58.3
5	Muzaffarabad City	87.4	15	Kotli	55.0
6	Bandi Abbaspur (AJK)	83.4	16	Saidu Sharif	52.0
7	Gsrhi Dupatta	78.7	17	W.S.R Mangla	50.3
8	Haraman (AJK)	78.2	18	Babusar	50.0
9	Pattan	72.0	19	Joharabad	49.0
10	Dir	67.0	20	Kalam	47.9

During **March** 2022, 2-3 widespread rain spells were received in most of the northern half of the country.

S. No.	Stations	Rainfall (mm)	S. No.	Stations	Rainfall (mm)
1	Ghalanai (KP)	163.2	11	Kalam	70.0
2	Kakul	125.3	12	Garhi Dupatta	69.4
3	Muzaffarabad City	114.0	13	Murree	68.0
4	Chattar Kalas (AJK)	101.3	14	Deolian (AJK)	63.7
5	Chakothi (AJK)	98.8	15	Babusar	61.6
6	Rawalakot	95.1	16	Chaklala Airbase	59.5
7	Haraman (AJK)	94.8	17	Astore	58.9
8	Dhulli (AJK)	87.6	18	Tirah (KP)	58.0
9	Dir	73.0	19	Bandi Abbaspur (AJK)	53.7
10	Balakot	72.2	20	Parachinar	53.0

- **Temperature**

The maximum temperature remained 2-5°C higher as compared to the last five years during this quarter. The minimum temperature during early January remained well below normal and further decreased during the second half of the month. In January, a severe cold wave (10-15) days was observed in most parts of the country due to which temperature fell below zero degrees in the agricultural plains of the country including Sindh. However, the temperature sharply increased during February and March over most of the agricultural plains of the country.

- **Mist and Fog Development**

Mist and Fog are atmospheric natural phenomena where small water droplets become suspended in the air for a longer period. The water vapours condense into the fog when ambient temperatures become cooler. In the South Asian region, fog formation starts from the foothills of the Himalayas in India and moves towards the eastern parts of Pakistan in Punjab. It finally covers large parts of Punjab, major areas of Sindh crossing into adjoining districts of Balochistan across Sibbi, southern parts of Khyber Pakhtunkhwa mainly around the Indus River. Dense fog covered the upper half of the country about two weeks earlier compared to last year due to lower temperatures. This fog continued for almost the second half of December up to the mid of February.

4. Drought products

i. Standardized Precipitation Index (SPI)

The Standardized Precipitation Index (SPI) was developed to define and monitor 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.

As predicted by Pakistan Meteorological Department (PMD), the country overall received normal to near normal rainfall **(-5.24%)** rainfall during January to March 2022. The good amount of rainfall during January subsided the prevailing drought conditions in Balochistan Province and provided significant relief to drought-prone areas. Earlier, the moderate drought prevailed in districts of Balochistan of **Chagi, Gawadar, Harnai, Kech, Kharan, Mastung, Nushki, Pishin, Panjgur and Washuk).** The climatological normal shows that the Sindh province remains dry from October to May, and

moderate drought prevailed during these months. Currently, the **Taftan, Dalbandin, Naushki, Mashkhel and Kharan areas** of Balochistan are facing mild to moderate drought.

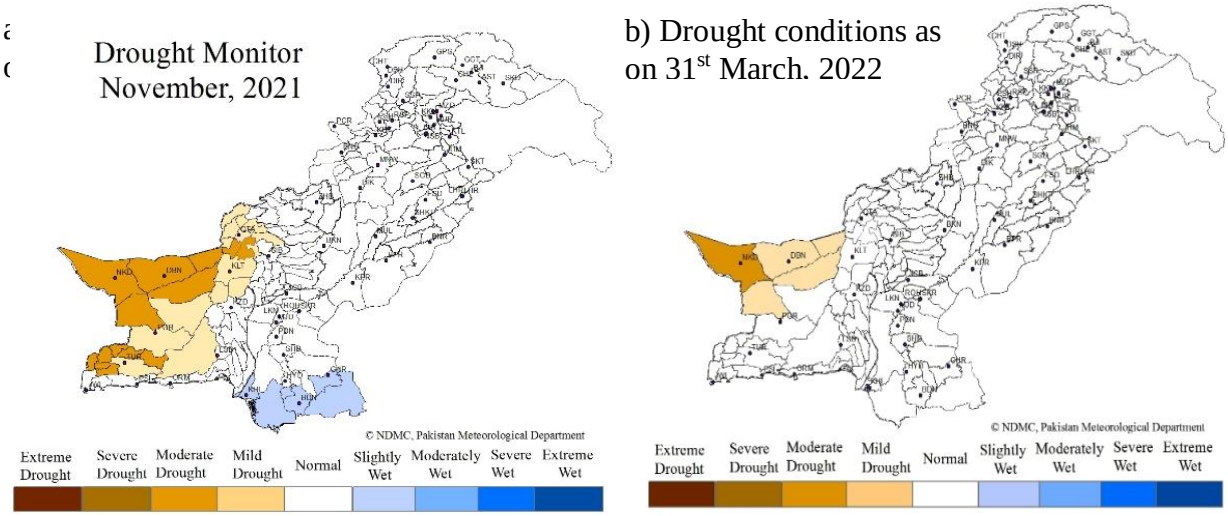


Figure-4 Drought conditions of Pakistan from January to March 2022.

Note: The drought monitor is prepared based on different drought indices.

ii. Cumulative Precipitation Anomaly (CPA)

January is the coldest month of the year for Pakistan. Due to lower solar angle, active western disturbance and sometimes due to the extension of secondary disturbances of frontogenesis systems, higher latitudes of the country are cooler than the lower latitudes. At high elevations, the frequency of occurrence of freezing temperature is highest in January as a normal feature. Westerly waves would continue to move along the middle latitudes and their troughs are expected to extend south-wards occasionally affecting the country's agricultural plains.

During February, the days were cooler and night temperatures were very cold. Such daytime and night temperatures resulted in below normal mean daily temperatures throughout the cultivated plains of the country. In this way temperature regime during February remained less favourable for the Rabi crop's growth and development process. The soil moisture reserves were available and lower temperatures retarded evapotranspiration loss of moisture.

March is normally the wettest month of the winter season. Heating starts over the subcontinent due to increasing solar angle and the sunshine over the equator during the last decade of the month. The heating trend triggers energetic weather systems, which resulted in an increasing number of dust/wind storms and precipitation. March marks substantial addition to the Rabi season, precipitation and rising temperatures contribute significantly to the photosynthesis process

From January to March 2022, it was observed that the Cumulative Precipitation Anomaly was positive in the country. Therefore, conditions are becoming satisfactory and moisture stress has been reduced due to normal to above-normal rainfall in most parts of the country which subsided the drought (moderate) situation in the southern half of Pakistan. However, the extreme cold wave gripped the whole country due to which the minimum temperature was observed below the freezing level in most parts of the country during January.

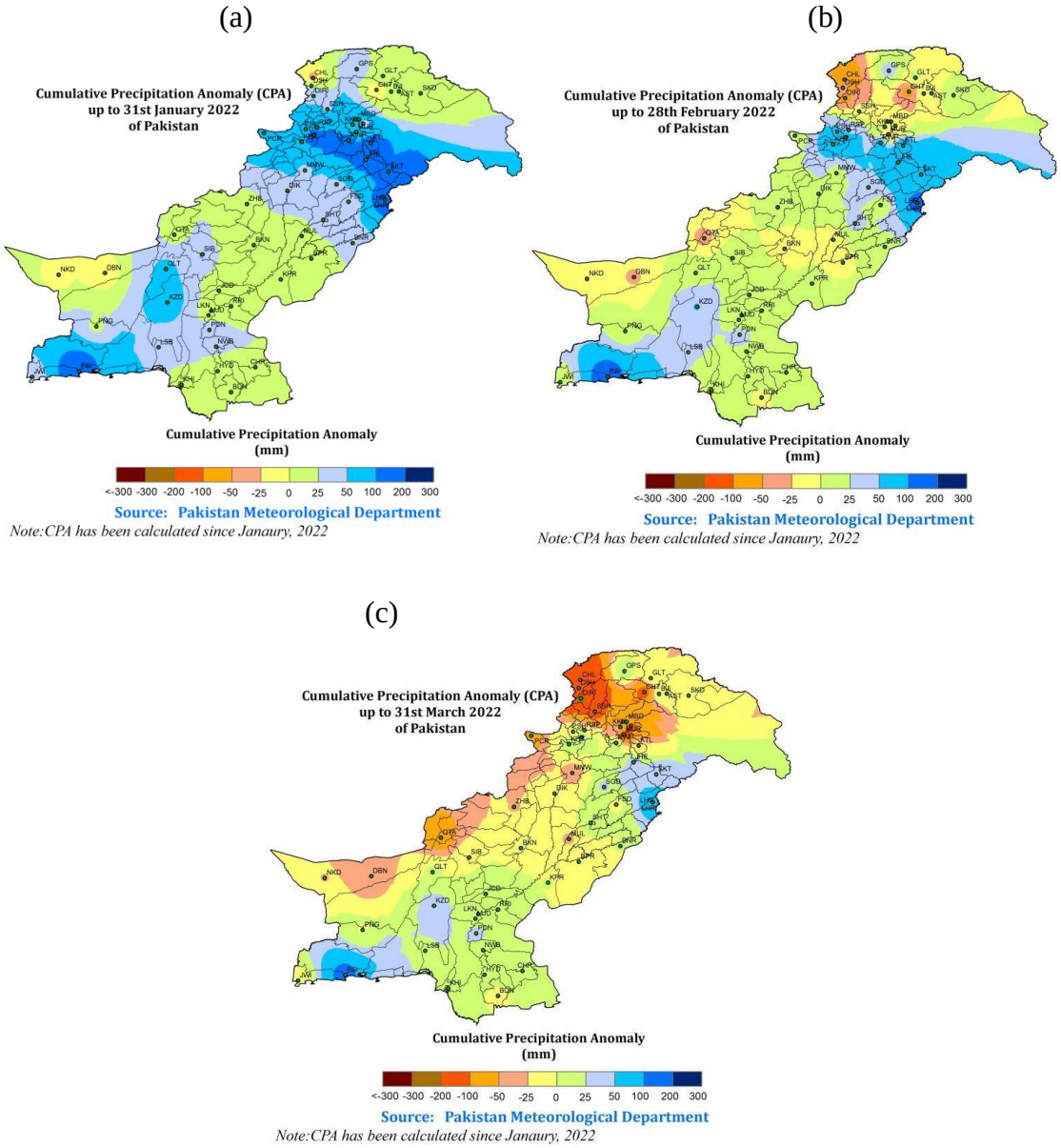
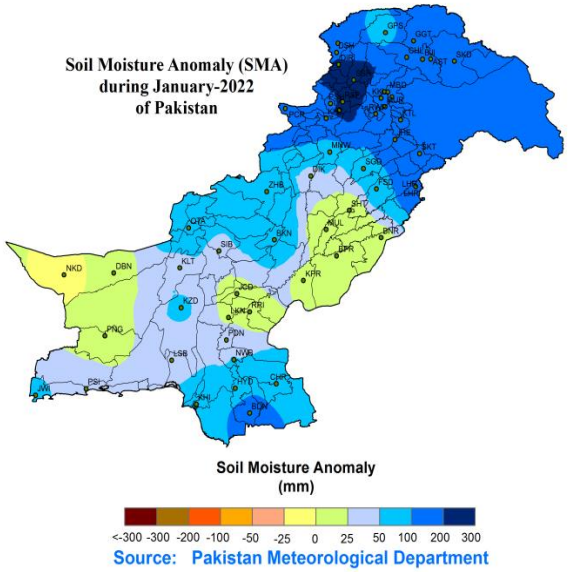


Figure 5: Cumulative precipitation anomaly during (Jan-Mar) 2022 in Pakistan

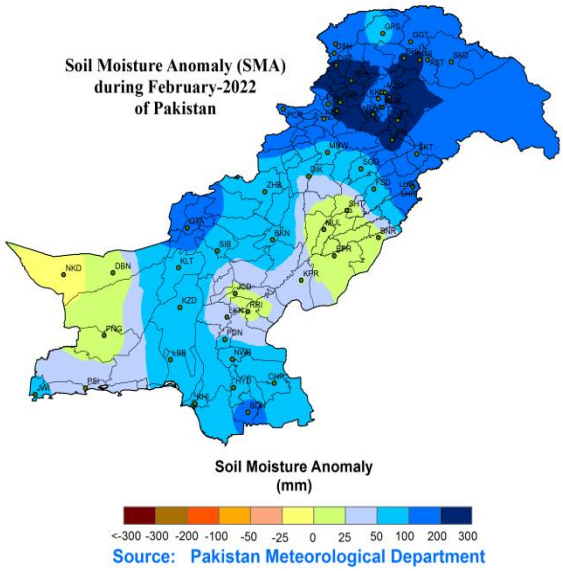
iii. Soil Moisture Anomaly (SMA)

It was observed that the amount of rainfall from January to March was normal to above normal which improved the soil moisture conditions in the country as shown in figure 6. Soil moisture conditions are near normal after the stress of soil moisture during the previous quarter (October-December) 2021, in southern parts of Pakistan. Above normal rainfall during January-March 2022 provided significant relief to soil moisture stress and conditions are back to normal in most of the southern parts of Pakistan.

(a)



(b)



(c)

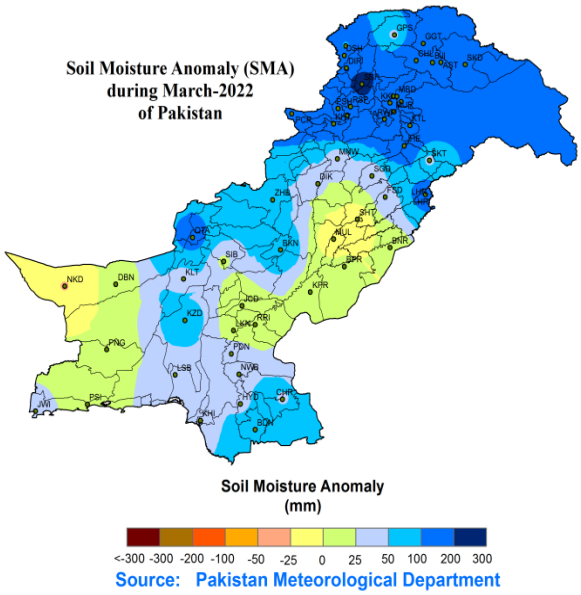


Figure 6: soil moisture anomaly during (Jan-Mar) 2022of Pakistan
(Courtesy http://www.cpc.ncep.noaa.gov/soilmst/glb_lb/curr.w.anas.gif)

iv. Water Level of Reservoirs

Pakistan has two main reservoirs of water in the form of the dam, i.e. Tarbela and Mangla. The dead level of Tarbela is 1378feet and its maximum conservation level is 1550 feet while Mangla has a dead level of 1040 feet and a maximum conservation level of 1242 feet. The water level of Mangla and Tarbela reservoirs has improved and it was well above normal due to above normal rainfall experienced in the catchment areas of these two reservoirs. Percentage of average water level from January to March 2022 was calculated for both dams is shown below in figure 7.

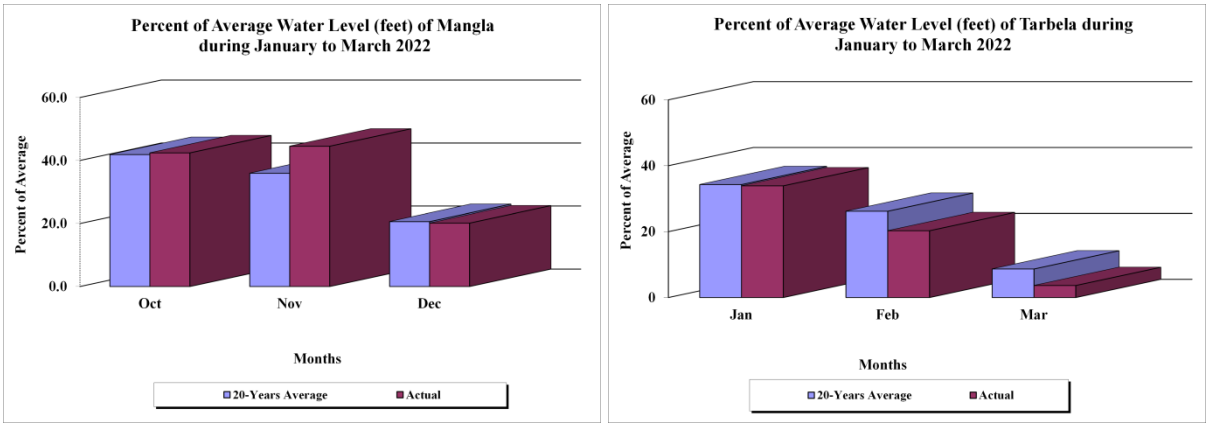


Figure 7:Percent of water level of Mangla and Tarbela during (Jan-Mar) 2022

5. Agriculture

Agriculture is the main livelihood of about 70% population of the country. Due to the direct relationship between agriculture and water scarcity/drought, drought mapping data is of vital importance. Efforts are being made to inform farmers of drought updates in a timely fashion for better utilization of data. The sowing period of wheat crop in various regions and cropping patterns of Pakistan starts from the 20th of October and concludes around the end of December. As per the rule of thumb, the wheat productivity decreases by about 1 percent for each passing day after 20th November. The wheat sowing time covers the period from late October to the end of November. This is long duration; wheat is sown on fallow fields. The prime time sown wheat has two subcategories of (i) rainfed, un-irrigated wheat or wheat irrigated once during crop growth by non-perennial canals /other sources and(ii) wheat sown on Irrigated fallow fields.

5.1 Crop Condition: January-2022

The sowing of Rabi crops in Pakistan stretches from mid-September to the end of December. Rabi season in Pakistan began at the start of November and reached the active vegetative growth stage at the end of January 2022. The potato crop has reached its harvesting stage in major growing areas of Punjab. Oilseeds like Mustard and Gram crops were thriving well by the end of January in

major crops growing areas of Pakistan except in a few rainfed areas as crops have reached almost peak vegetative growth stage. However, the wheat condition is satisfactory in irrigated areas of Punjab, Sindh, Balochistan and Khyber Pakhtunkhwa. Conditions remained favorable for wheat growth. The crop has reached the flag leaf stage in the Katcho areas of Sindh and southern Punjab by the end of January.

Rabi Crops

The sowing situation of Rabi crops is as follows:

- **Wheat Crop**

This Rabi season 2021-2022 is promising due to effective and widespread rains from October to January as compared to last year. The wheat crop was at tillering / booting stages depending upon sowing time. Wheat crop condition is generally good and no serious stress condition is observed in barani and irrigated areas of the country. In a few parts of lower Sindh, a stressed wheat crop situation was observed, mainly due to fewer rains and irrigation water shortage.

During January, Punjab, Sindh and Balochistan faced a shortage in the irrigation water supply of 16, 20 and 7 percent respectively. This shortage in water supply was supplemented by subsurface irrigation water and widespread effective rains in the country. These rains will also help to improve the water situation in the reservoirs to meet Rabi crops requirements in the coming days.

- **Potato Crop**

Autumn potato crop was mostly sown in the districts of Okara, Kasur, Pakpattan, Sahiwal, Chiniot, Faisalabad, Toba Tek Singh, Sialkot, Jhelum and others during October. The harvesting of the crop started in December and is continuing.

5.2 Crop Situation: February 2022

Wheat is the most important food security crop in Pakistan. The growth of the wheat crop is generally slow across the country due to multiple factors mainly low ambient temperatures. The harvest of the crop is likely to be delayed by 10 days or so.

Wheat crop growth was at varying stages from booting to maturity depending upon location and sowing time. In some parts of lower Sindh, the wheat crop was near maturity at the end of February. In different parts of Punjab, the wheat crop was at spike formation to grain filling stage. In Khyber Pakhtunkhwa, the wheat crop was at the vegetative growth stage.

The wheat crop has generally been sown throughout irrigated as well as rainfed areas and reached different growth stages of their development depending on sowing time and location. Wheat crop

in the Potohar region has suffered from medium level drought due to fewer rains in the season. However, the wheat condition is satisfactory in irrigated areas of Punjab, Sindh, Balochistan and Khyber Pakhtunkhwa. Water stress might be due to fewer rains and less water availability in some parts of Sindh and Punjab during February. The sowing of early and medium season wheat crop was completed by end of November and the late-season crop in cotton, rice and sugarcane harvested fields was sown during December.

5.3 Crop Situation: March 2022

Early satellite-based indicators from December to February showed around a 35-40 % decrease in crop yields in the Potohar area than last Rabi season. However, significant rainfall during March improved the wheat crop stand but will not recover the drought-related losses so much. Wheat conditions in irrigated areas of Punjab, Sindh, Balochistan and Khyber Pakhtunkhwa remained satisfactory to some extent. Wheat harvesting began by mid of March in southern areas of Sindh including districts of Badin, Thatta, Umerkot and Mirpur Khas. It has progressively moved towards the northern areas of Sindh and southern Punjab.

Wheat Crop

The wheat crop was generally sown throughout in irrigated as well as rainfed areas and has reached different growth stages of its development depending on sowing time and location. Wheat crop in the Potohar region has suffered from medium drought due to fewer rains in the early part of the season resulting in stunted crop growth, less plant population, yellowing of plants and early maturity. In some areas of the Potohar region, the wheat crop has been observed healthy due to more rainfall especially in hilly areas of Rawalpindi and Jhelum while drastically affected by drought in Attock and Chakwal districts.

Early satellite-based indicators showed around 35-40 % decrease in crop yields in the Potohar area than last Rabi season. However, significant rainfall during March improved the wheat crop stand but will not recover drought-related losses so much. Wheat condition in irrigated areas of Punjab, Sindh, Balochistan and Khyber Pakhtunkhwa has remained satisfactory to some extent. Crop in Katcho areas of Sindh and southern Punjab reached the maturity stage by end of March. Harvesting began by mid of March in southern areas of Sindh including districts of Badin, Thatta, Umerkot, and Mirpur Khas progressively moving towards northern areas of Sindh and southern Punjab.

Maize Crop

Most of the autumn potato harvested area comes under spring maize in Sahiwaldivision of Punjab, during February-march. Spring maize is mostly thriving well due to more rains in major growing areas during March.

6 District wise impact of drought

Due to normal to above normal rainfall during this quarter of the year, the intensity of drought has been reduced in most of the southern parts, especially Balochistan. Currently, the **Taftan, Dalbandin, Naushki, Mashkhel and Kharan areas** of Balochistan are facing mild to moderate drought.

7 Kharif season forecast of Mangla and Tarbela Dams (2022)

The predicted water availability forecast (MAF) forecast in two big reservoirs i.e. Tarbela and Mangle during the Kharif season (April-September) 2022 is shown in figure 8.

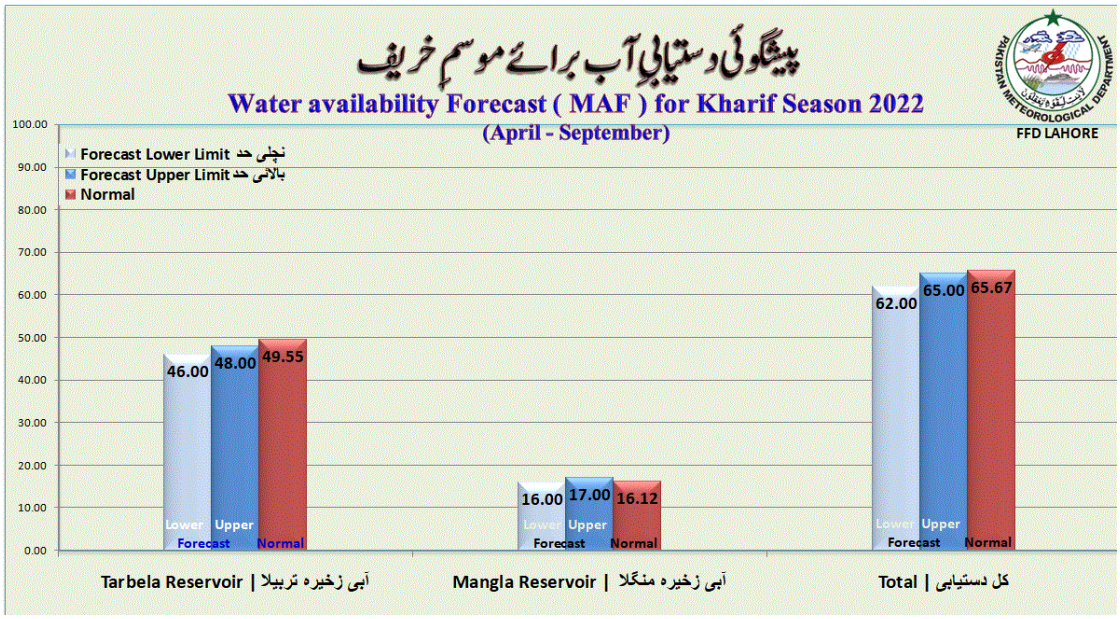


Figure 8: Forecasted water volume (MAF) for Kharif Season 2022 in Tarbela and Mangla

8 Recommendations

A 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. The water situation in the dams has improved due to the above rainfall and will further be improved due to snow melting with the increase of temperature after mid-April. It is, therefore, advised to all stakeholders for an immediate water management strategy to avoid drought impacts on the

agriculture sector in future. NDMC continued its monitoring activities and drought monitoring was regularly updated on weekly basis at the PMD website http://www.pmd.gov.pk/ndmc/index.htm.

9 Acknowledgement

National Drought Monitoring Centre (NDMC), Pakistan Meteorological Department, Islamabad acknowledges, National Agromet Centre PMD, Islamabad, SUPARCO, CPC, NOAA, and NDMA for sharing the information.

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