GOVERNMENT OF PAKISTAN

# *Quarterly Drought Bulletin of Pakistan*

# *January - March 2025*


**PAKISTAN METEOROLOGICAL DEPARTMENT**

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URL: https://ndmc.pmd.gov.pk/new/

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## 1. Introduction

Pakistan’s diverse latitudinal extent contributes to pronounced spatial and temporal variability in precipitation patterns across the country. The national climate ranges from arid to hyper-arid in the southern lowland regions, while the northern half exhibits semi-arid to humid conditions. Persistent dry spells are a common feature in several regions, rendering them susceptible to drought throughout the year. Extended periods without rainfall can aggravate these conditions, resulting in significant hydrometeorological drought events. Historically, all provinces of Pakistan have been affected by severe drought episodes, underscoring the country's vulnerability.

Unlike other natural hazards such as floods, cyclones, and earthquakes, droughts often have a slow onset and prolonged duration. In some cases, they may develop rapidly due to extreme temperature anomalies, manifesting as flash droughts—a phenomenon increasingly linked to heatwave occurrences. Although less immediately visible, the effects of droughts are expansive and can impact broader geographical areas and larger populations compared to many other environmental disasters.

In response to the devastating drought of 1999–2001, the Pakistan Meteorological Department (PMD) established the National Drought/Environment Monitoring and Early Warning Centre (NDMC) during 2004–2005. The center's primary mandate is to conduct nationwide monitoring of drought conditions and to disseminate timely advisories and warnings to mitigate impacts.

The NDMC operates from its central headquarters in Islamabad and is supported by four Regional Drought Monitoring Centers (RDMCs) located in Lahore, Karachi, Peshawar, and Quetta. These centers serve as regional hubs for the acquisition, integration, and analysis of drought-related data. To strengthen the observation network, Automatic Weather Stations (AWS) have been strategically deployed, particularly across drought-prone zones, significantly improving real-time data accessibility from remote areas.

In addition, NDMC maintains an extensive network of Ordinary Rain Gauges (ORGs) across the country, covering the most drought-vulnerable districts in all four provinces. The spatial distribution of this monitoring infrastructure is presented in Figure 1.

NDMC has also Ordinary Rain Gauges (ORG) network across the country covering most of the vulnerable districts in the four provinces, as illustrated in Figure-1.

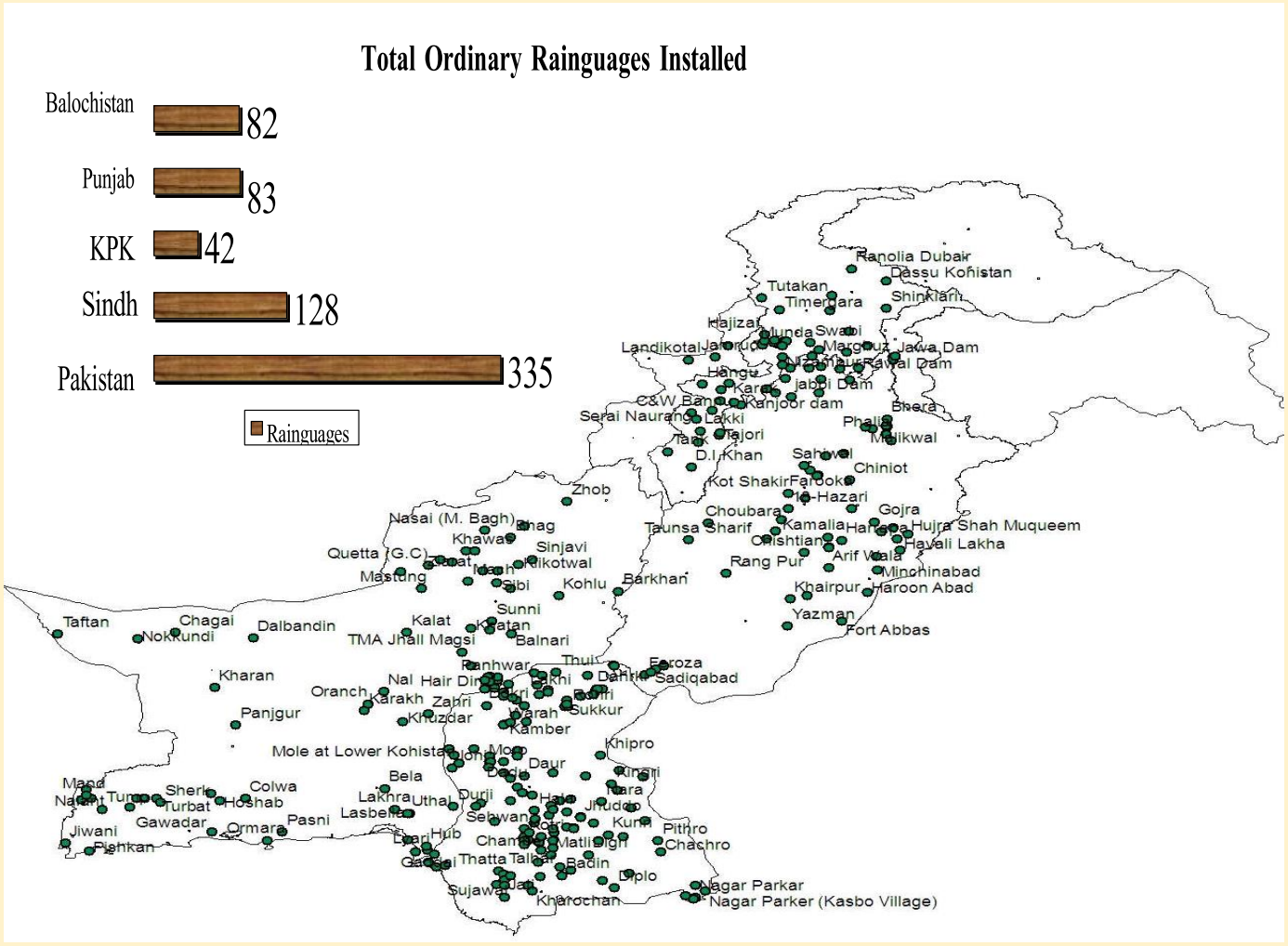



Figure-1: Rain-gauges network of Pakistan by NDMC

## 2. Historical Background

Western disturbances serve as the principal source of winter precipitation, especially in the northern and western regions of the country. These disturbances are crucial for replenishing reservoirs, maintaining river flows, and supporting Rabi (winter) crops like wheat and barley.

Droughts in Pakistan during the winter season are primarily linked to reduced western disturbances, which typically bring rainfall from December to March. Historically, winter droughts have been less frequent but still impactful, particularly in arid and semi-arid regions like Balochistan and parts of Sindh. Furthermore, events like El Nino can indirectly suppress winter precipitation in this region by altering upper atmospheric circulation.

Pakistan has witnessed several drought episodes with significant impacts across its provinces. The Punjab province experienced severe droughts in 1899, 1920, and 1935. North west of Khyber Paktunkhwa (KP) experienced worst droughts in 1902 and 1951, while Sindh endured notable

droughts in 1871, 1881, 1899, 1931, 1947, and 1999. Among the most severe nationwide droughts were those in 1999–2000, extending into 2002. These droughts significantly affected agricultural output, with a notable setback during 2000–2001. Major crops experienced a decline of nearly 10% in growth, contributing to an overall negative growth rate of 2.6% for the agricultural sector. The water shortage persisted into 2001–2002, reaching levels of up to 51% below normal supplies, compared to 40% in the previous year (Shahid Ahmad, et al 2020).

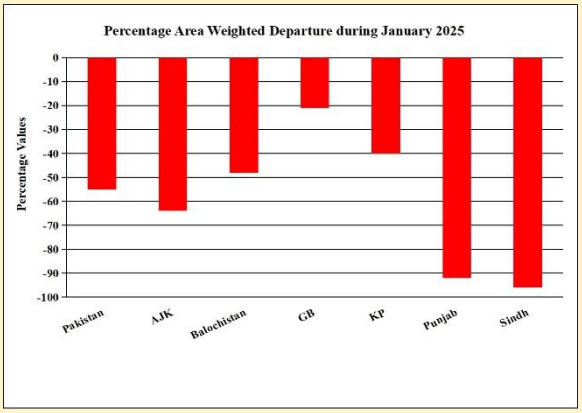
During winter of 2025, Pakistan experienced another phase of weak winter precipitation due to a reduction in the frequency and intensity of western disturbances. These western disturbances during the recent winter were notably weak, resulting in below-average snowfall and rainfall across Balochistan, KP, Sindh and northern Punjab. This dry spell was especially hard-hitting in rainfed areas, further stressing already vulnerable water resources. The drought so emerged, caused a substantial drop in groundwater levels and reservoir capacities, particularly affecting the wheat crop during the Rabi season.

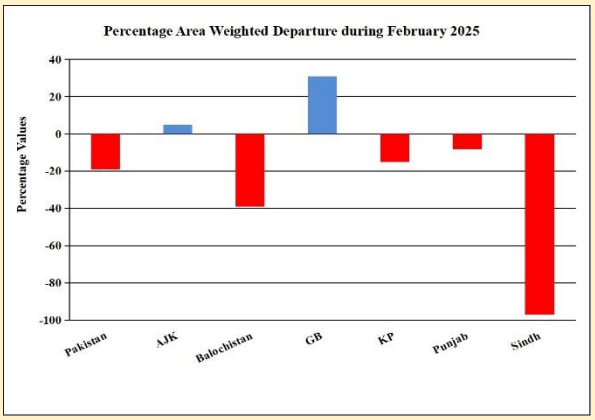
### 3. Rainfall Distribution (Jan-March) 2025

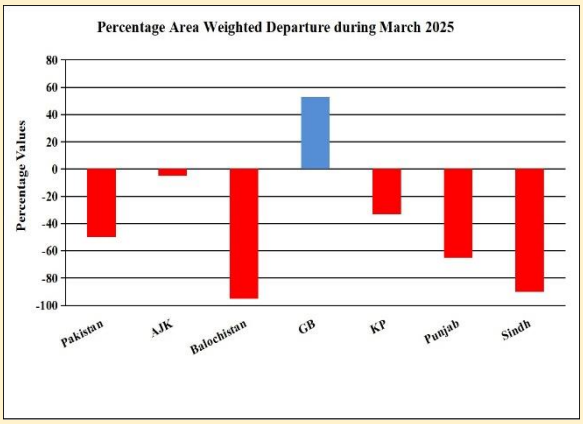
During the first quarter of 2025 (January to March), Pakistan experienced significantly below-average precipitation, with an overall decline of 41% compared to normal levels. The most pronounced deficit occurred in January, when rainfall was substantially lower than average across the country. Punjab and Sindh were particularly affected, recording extreme departures from normal rainfall at 92% and 96%, respectively.

The dry conditions persisted into February, with rainfall departures ranging from -8% to -97% across most regions, excluding Azad Jammu & Kashmir (AJK) and Gilgit-Baltistan (GB), which experienced relatively normal precipitation. In March, the nationwide rainfall deficit continued, with a 50% decrease recorded across the country.

Cumulatively, all major regions experienced significant rainfall reductions during this quarter: Kashmir (-17%), Khyber Pakhtunkhwa (-29%), Punjab (-51%), Sindh (-95%), and Balochistan (-62%). These figures underscore the prevalence of dry conditions and highlight the onset of a winter drought episode, with serious implications for water availability, agriculture, and hydrological systems in the affected areas.



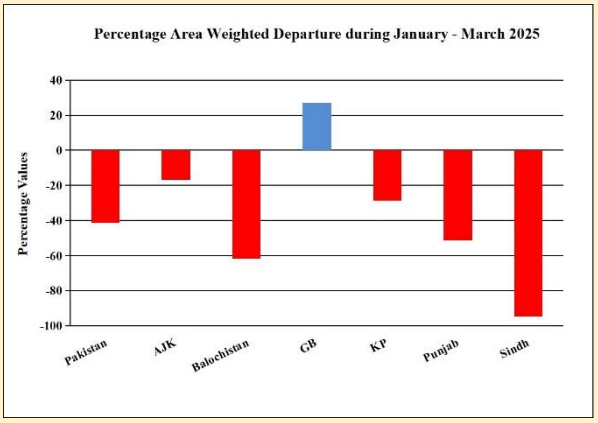




Figure-2: Percentage area weighted departure of rainfall during (January-March) 2025

The quarterly analysis reveals a nationwide deficit in rainfall, with precipitation levels remaining below the climatological average. The area-weighted distribution of rainfall for this period is illustrated in **Figure 2**.

The spatial variability of rainfall from January to March is depicted in **Figure 3**. During this quarter, precipitation events occurred across much of the country; however, southern Sindh and parts of southern Balochistan experienced persistently dry conditions. Notable rainfall accumulations were concentrated in upper Khyber Pakhtunkhwa, upper Punjab, northwestern Balochistan, the Potohar Plateau, Kashmir, and adjacent areas of Gilgit-Baltistan.

Despite these localized precipitation events, overall rainfall remained below normal throughout the country. This anomaly has contributed to an increased soil moisture deficit, particularly in drought-prone regions, exacerbating existing vulnerabilities in agricultural and water resource sectors.

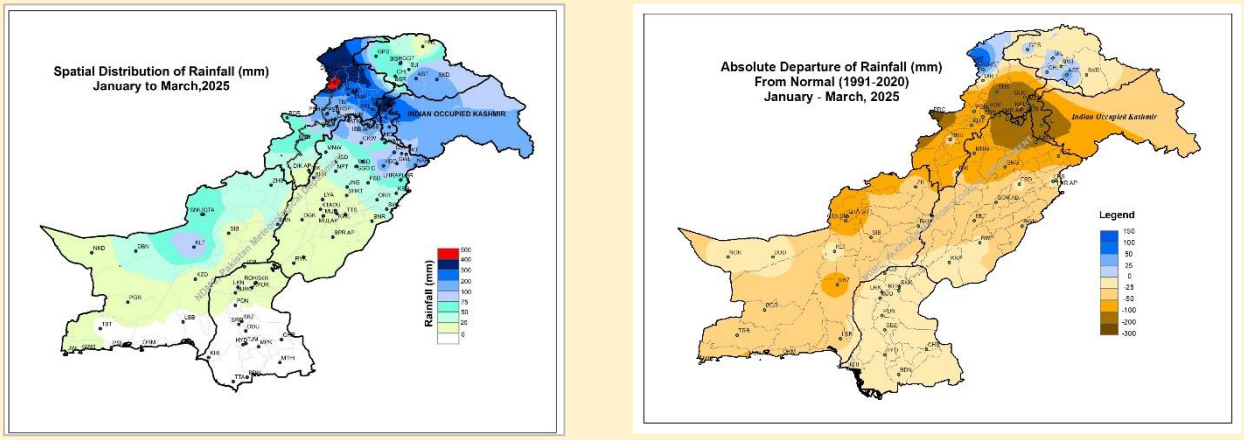



Figure-3: Spatial distribution and departure of rainfall during (Jan-March) 2025 in Pakistan

### 3.1 PMD Stations with Highest Rainfall (mm) (Jan-March) 2025

| Highest Rainfall (mm) during Jan – March 2025 | | | | | |
|---|---|---|---|---|---|
| **S. No** | **Station** | **Rainfall (mm)** | **S. No** | **Station** | **Rainfall (mm)** |
| 1. | Dir | 493.5 | 11. | Balakot | 255.0 |
| 2. | Kalam | 390.8 | 12. | Rawalakot | 247.8 |
| 3. | Chitral | 379.9 | 13. | Kakul | 231.5 |
| 4. | Mir Khani | 341.3 | 14. | Murree | 231.5 |
| 5. | Gari Dopatta | 335.0 | 15. | Lower Dir | 225.0 |
| 6. | Malam Jabba | 333.0 | 16. | Astore | 201.9 |
| 7. | Muzaffarabad | 306.9 | 17. | Saidu Sharif | 180.9 |
| 8. | Pattan | 297.0 | 18. | Cherat | 178.0 |
| 9. | Muzaffarabad AP | 292.4 | 19. | Kotli | 145.0 |
| 10. | Drosh | 270.6 | 20. | Peshawar | 139.7 |

### 3.2 The Maximum Length of Dry Spell

Consecutive dry days refers to the number of consecutive days during which no significant rainfall occurs. This term is often used to quantify dry spells or drought conditions. It is considered as a key indicator of drought severity, particularly in regions where rainfall is crucial for agriculture, water supply, and ecosystem health. Here Figure 4 illustrates the maximum duration of dry spell events during the period, with the longest periods observed in southern Balochistan and most parts of Sindh province.

This prolonged dryness depleted soil moisture, limited the availability of water in rivers, lakes, and reservoirs, leading to water shortages for irrigation. Notably, Turbat recorded an extended dry spell, lasting 237 consecutive days as of March 31, 2025.

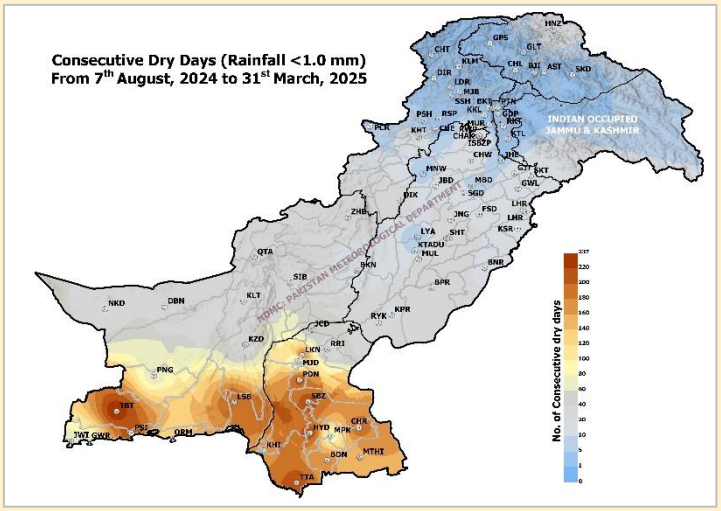



Figure-4: Maximum length of dry spell up to March 2025 in Pakistan

## 4. Drought Products

### 4.1 Drought Monitor

**Figure 5** presents the Drought Monitor for March 2025, highlighting the distribution of drought severity across the country. Areas experiencing Moderate Drought are marked in orange, affecting regions such as Turbat, Jiwani, Ormara, Dadu, Mithi, Badin, Thatta, Shaheed Benazirabad, and Karachi. Mild Drought conditions, shown in pale yellow, are observed in various parts of Sindh, Balochistan, and southern Punjab. Regions not affected by drought are classified as Normal, indicated by white, and are predominantly found in the northern and some central areas of the country.

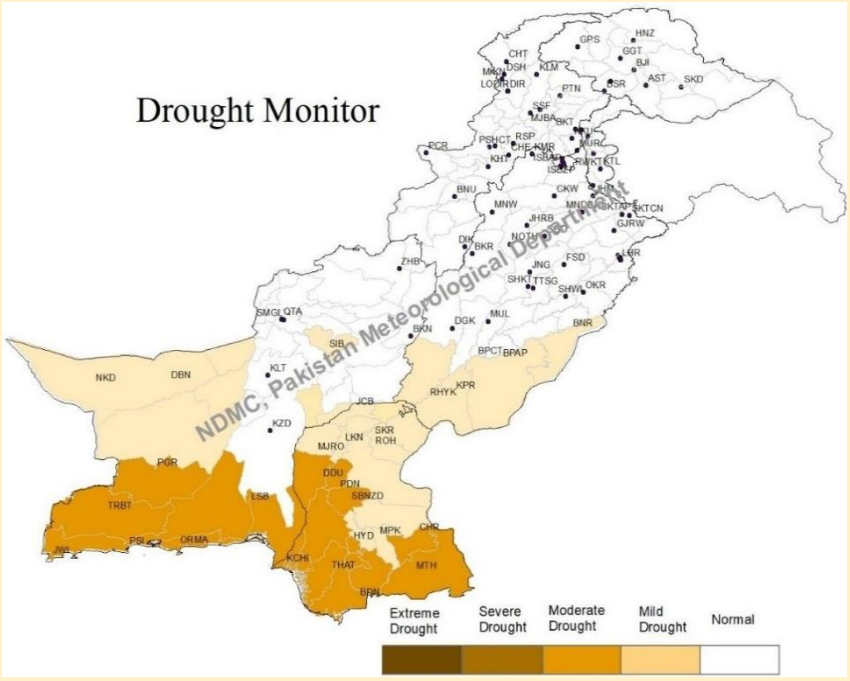



Figure-5: Drought conditions of Pakistan March 2025

### 4.2 Cumulative Precipitation Anomaly (CPA)

The Cumulative Precipitation Anomaly (CPA) is an important metric in tracking the development of droughts, as it helps to quantify how much precipitation is lacking compared to expected norms. The current CPA was calculated from September 1, 2024, for each month of the first quarter of 2025. The CPA maps till January, February, and March 2025 are presented in Figure 6. Overall, the country experienced below-normal rainfalls, and are reflected as the negative precipitation anomaly in the figures below, highlighting dry conditions.

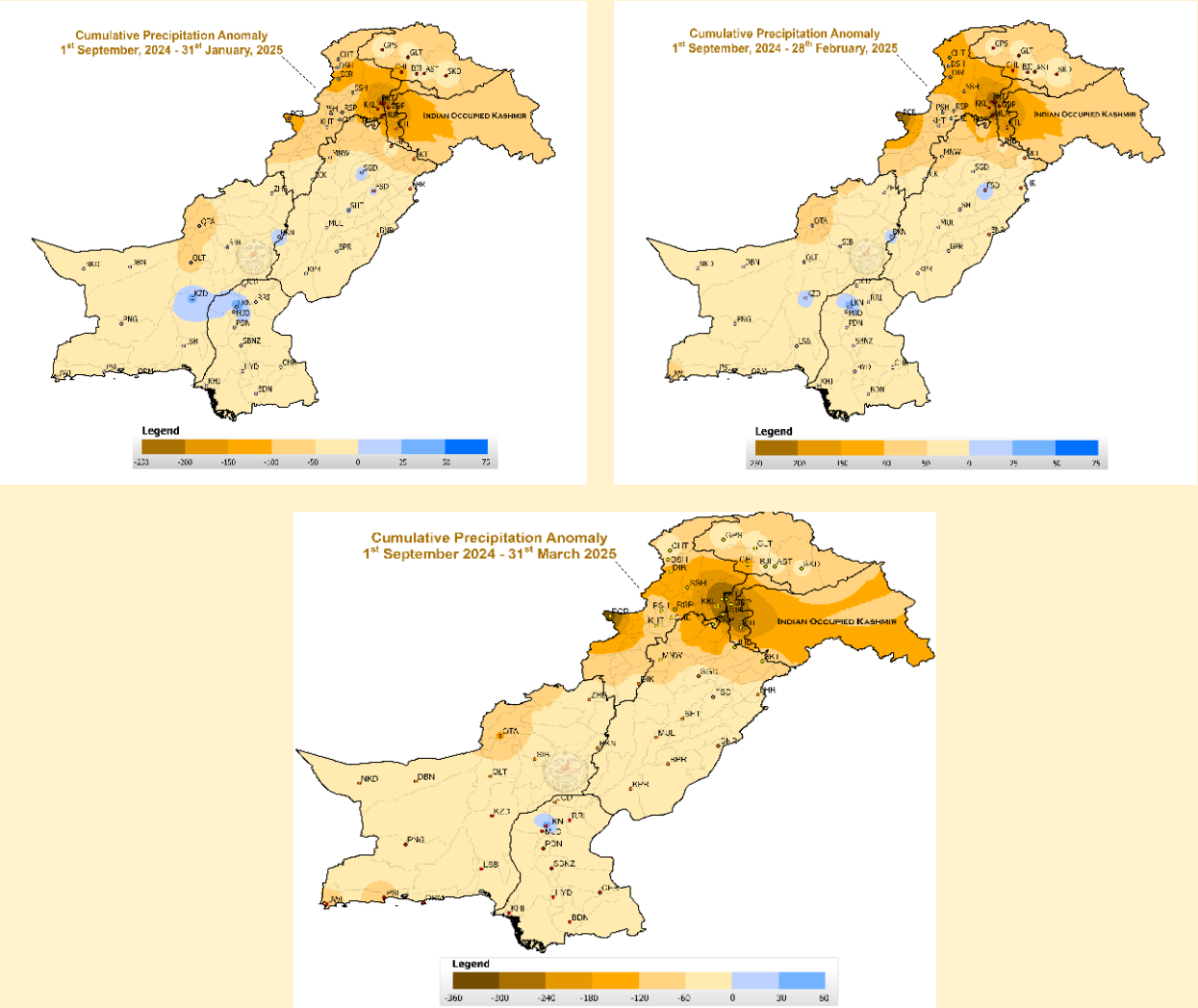



Figure-6: Cumulative precipitation anomaly during (Jan-March 2025) in Pakistan

### 4.3 Soil Moisture Anomaly (SMA)

It refers to the deviation of soil moisture from its normal or expected level and is an important indicator in drought monitoring, as it directly influences crop growth, water availability, and land degradation. During the first quarter of 2025, the country recorded below normal rainfall which has caused soil moisture deficit in Potohar region, Sialkot region, Kashmir, few parts of upper KPK, and

south western Baluchistan, as shown in Figure 7. These negative anomalies indicate the depleted soil moisture leading to drought conditions, crop stress, and a clear sign of water scarcity.

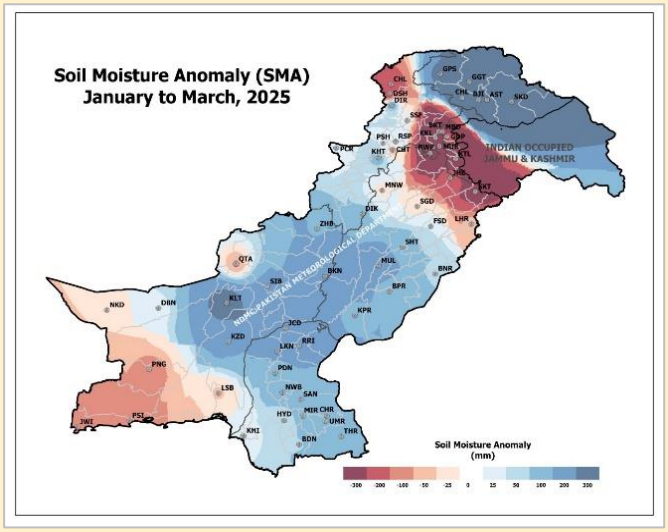



Figure-7: Soil moisture anomaly (First Quarter)

### 4.4 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 1402 feet while the maximum conservation level is 1550 feet whereas Mangla has a dead level of 1050 feet and a maximum conservation level of 1242 feet. During January, the water level (%) of Mangla dam was above normal, whereas in February and March, it was below 21-year average.

However, due to significant less rain, many small dams across the country did not reach optimal levels in first quarter of 2025, which is likely to negatively impact agriculture and socio-economic activities. Figure 7 below illustrates the percentage of average water levels for both dams from January to March 2025.

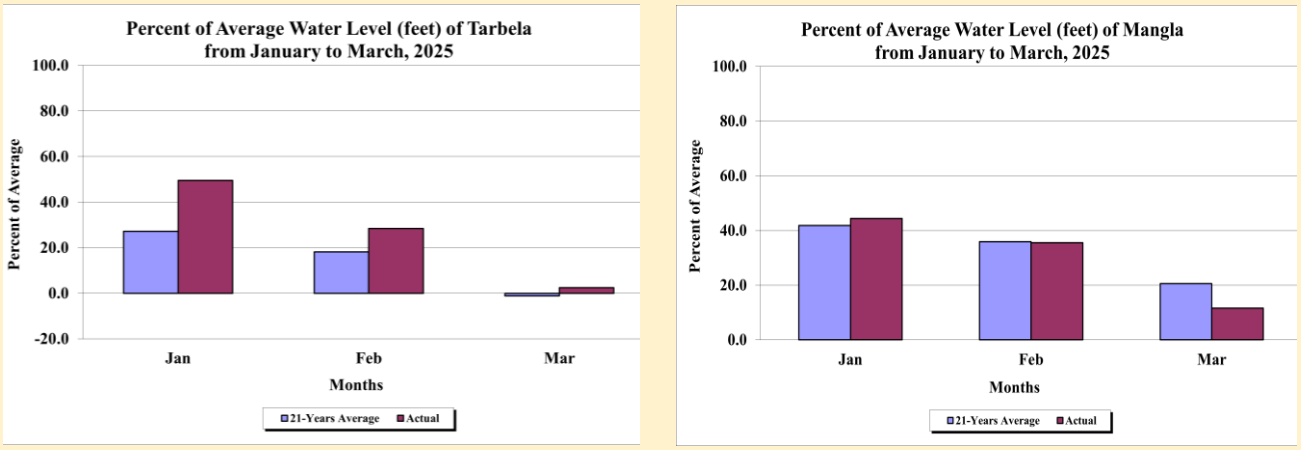



Figure-7 percent of the water level of Mangla and Tarbela during (Jan-March) 2025

### 5. District-wise impact of drought

During this quarter, the month of January experienced markedly dry conditions across the entire country. Currently districts that are affected by moderate drought are Kech, Gwadar, Dadu, Tharparkar, Badin, Thatta, Shaheed Benazirabad, and Karachi. Whereas, Larkana, Sukkur, Mirpurkhas, Hyderabad, Sibi, Chagai, Rahim Yar Khan, Bahawalnagar, and Bahawalpur district facing mild drought conditions.

### 6. Kharif season forecast of Mangla and Tarbela Dams (2025)

The predicted water availability forecast (MAF) forecast in two big reservoirs i.e., Tarbela and Mangle during the Rabi season (October-March) is shown in Figure 9.

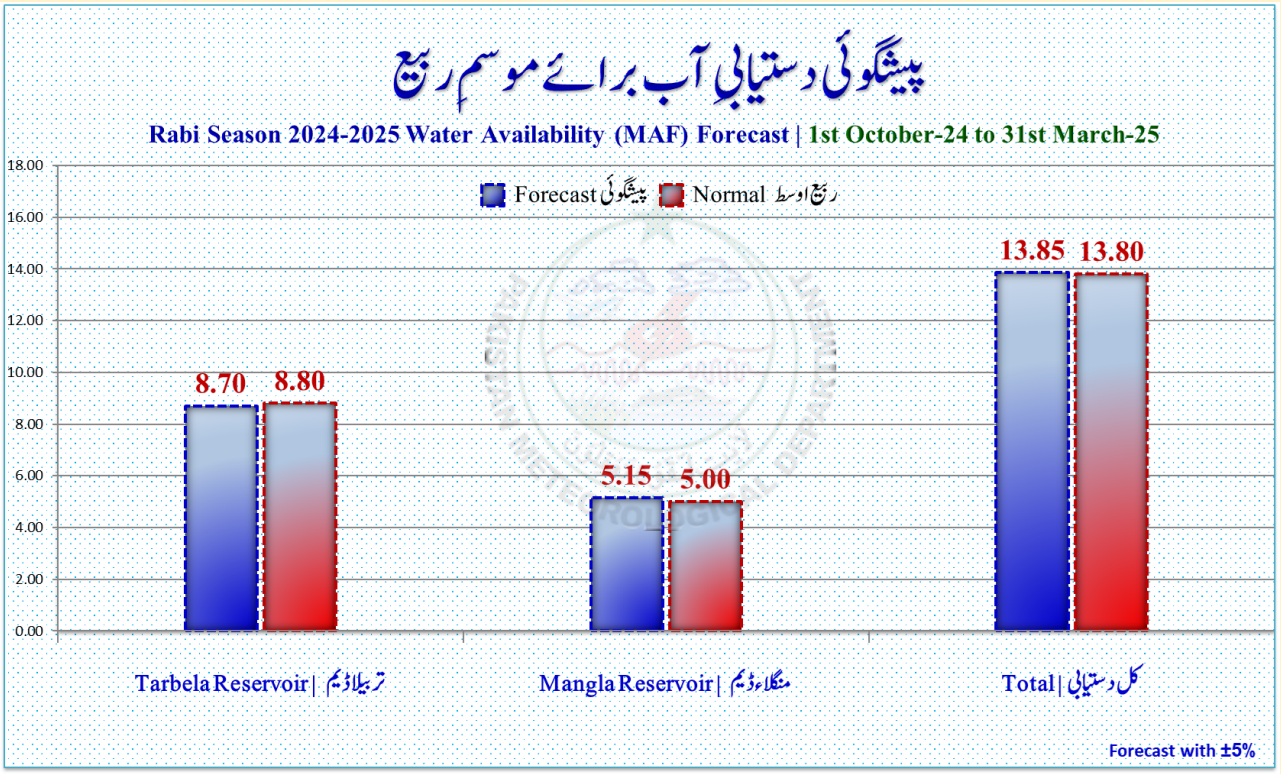



Figure-8 Rabi season forecast of Mangla and Tarbela dams

## 7. Crop Report: January-March 2025

### Punjab

The major crops in Punjab are wheat, sugarcane, maize, and rice. The initial growth and development of the wheat crop had been reported as satisfactory. However, the crop faced moisture deficiency in rainfed areas such as Potohar and parts of Central Punjab due to persistent dry weather. The harvesting of high-grade Basmati rice had been completed, and its condition remained satisfactory. The sugarcane crop was reported in good condition, and its harvesting was in progress. The autumn maize crop had been sown, with germination and early growth observed as satisfactory. The growth and production of orchards, including oranges, were also satisfactory. Moreover, the sowing of pulses and winter vegetables was ongoing during this period.

### Sindh

The major crops in Sindh are wheat, rice, and sugarcane. Wheat grew well in most parts of the province, and the harvesting of high-grade rice varieties had been completed. The condition of the sugarcane crop remained satisfactory, and its harvesting was in progress across various regions. Seasonal vegetables such as tomatoes, chilies, and onions, along with pulses, showed satisfactory growth.

### Khyber Pakhtunkhwa

The major crops in the province are wheat, sugarcane, and maize, all of which showed satisfactory growth. The harvesting of sugarcane continued during the period. The condition of orchards, including citrus fruits like oranges, was reported satisfactory in most regions. However, below-normal rainfall affected the condition of standing crops and vegetables in certain rainfed areas.

### Baluchistan

The growth of standing crops, vegetables, and orchards in the province was generally reported as satisfactory. However, moisture stress due to below-normal rainfall in most parts of the province affected the growth of crops in some areas. In other regions, rice, fruits, and vegetables remained in good condition.

### Gilgit-Baltistan

The growth of major crops, including maize and seasonal orchards, was reported as satisfactory.

Due to harsh winter conditions, agricultural activity remained low during much of the period. However, by late March, early signs of spring appeared, and preparations for the upcoming cropping season had begun

## 8. Recommendations

Based on the above submissions following recommendations are made to ease the situation,

- Prudent and efficient utilization of available water resources is strongly advised to ensure adequate reserves are maintained in anticipation of the upcoming summer monsoon season.
- Adoption of smart irrigation techniques, particularly water-efficient systems such as drip irrigation, is essential to optimize agricultural water use and reduce wastage.
- Awareness and education campaigns led by local schools, community organizations, and NGOs should be launched to sensitize the public about the severity of water scarcity and promote responsible water use at all levels.
- Strategic development of both large and small-scale water storage infrastructure, including dams, is imperative for long-term water security and to harness excess surface runoff during high rainfall periods.
- For detailed information regarding the drought situation in Pakistan, please visit http://www.ndmc.pmd.gov.pk/index.htm

## 9. Acknowledgement

National drought monitoring Centre, Pakistan Meteorological Department, Islamabad acknowledges SUPARCO and, NOAA for sharing the information.

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