भारत सरकार
Government of India
पृथ्वी विज्ञान मंत्रालय (एम.ओ.ई.एस.)
Ministry of Earth Sciences (MoES)

# भारत मौसम विज्ञान विभाग
# INDIA METEOROLOGICAL DEPARTMENT (IMD)
# 2025 दक्षिण-पश्चिम मानसून ऋतु की मुख्य विशेषताएं
# Salient Features of the 2025 Southwest Monsoon Season

## HIGHLIGHTS

- Rainfall over the country as a whole during the 2025 southwest monsoon season (June- September) was 108% of its long period average (LPA). Thus, the seasonal rainfall was above normal (>104% of LPA) as per the IMD forecast. All India Summer monsoon rainfall was 937.2 mm which is 5$^{th}$ highest since 2001 and 38$^{th}$ highest since 1901.
- Seasonal rainfall over Northwest India, Central India, South Peninsula, and Northeast India were 127%, 115%, 110% and 80% of the respective LPA. Rainfall over Northwest India was 747.9 mm which is highest since 2001 and 6$^{th}$ highest since 1901, However, Rainfall over East & Northeast India was 1089.9 mm which is 2$^{nd}$ lowest since 1901.
- The southwest monsoon seasonal (June to September) rainfall over the monsoon core zone, which consists of most of the rain-fed agriculture regions in the country, received 122% of LPA.
- Out of the 36 meteorological subdivisions, 2 subdivisions, covering 10% of the country's total area, experienced large excess rainfall. Twelve subdivisions, constituting 35% of the area, received excess rainfall, while 19 subdivisions, representing 46%, recorded normal rainfall. The remaining 3 subdivisions, Arunachal Pradesh, Assam & Meghalaya, and Bihar accounting for 9% of the total area, experienced deficient rainfall during the season.
- Monthly rainfall over the country as a whole was 109% of LPA in June,105% in both July and August and 115% of LPA in September.
- The southwest monsoon advanced over the South Andaman Sea and Nicobar Islands on 13 May 2025, nearly nine days ahead of the normal schedule. It arrived in Kerala on 24 May 2025, ahead of the usual onset date of 1 June, and covered the entire country by 29 June 2025, earlier than the normal date of 8 July. The monsoon withdrawal began from west Rajasthan on 14 September, advancing by 3 days.
- There were Seven Monsoon Depressions formed during the season, out of that one intensified in to Deep Depression Category. There were 69 Low Pressure System Days against its normal 55 days.
- The seasonal forecast issued by IMD for the SW monsoon season rainfall was accurate, including the monsoon onset forecast over Kerala and ENSO and IOD forecast.

## 1. Onset and Advance of 2025 Southwest Monsoon

The Southwest Monsoon advanced into parts of the South Bay of Bengal, South Andaman Sea, Nicobar Islands, and some areas of the North Andaman Sea on 13 May 2025, ahead of the normal date of 19 May. By 19 May, it further progressed into parts of the Southeast Arabian Sea, South Bay of Bengal, South Arabian Sea, Maldives, Comorin area, Central Bay of Bengal, and Northeast Bay of Bengal.

On 24 May 2025, the monsoon advanced rapidly over the remaining parts of the South Arabian Sea, West central and East central Arabian Sea, entire Lakshadweep region, Kerala, Mahe, parts of Karnataka, Maldives, Comorin area, many parts of Tamil Nadu, Southwest and Eastcentral Bay of Bengal, West central and North Bay of Bengal, and some parts of Mizoram. The monsoon set in over Kerala on 24 May, eight days earlier than the normal date of 1 June, marking the earliest onset since 2009.

Following its onset in Kerala, the Southwest Monsoon progressed swiftly, covering South India and Northeast India by 29 May. After a brief pause, further advance resumed on 16 June. By 26 June, most parts of the country were covered except for some areas of Northwest Rajasthan, West Uttar Pradesh, South Punjab, South Haryana, and Delhi. The monsoon covered the entire country by 29 June 2025, nine days ahead of the usual date of 8 July. The onset dates of Monsoon 2025 are shown in **Fig.1**.

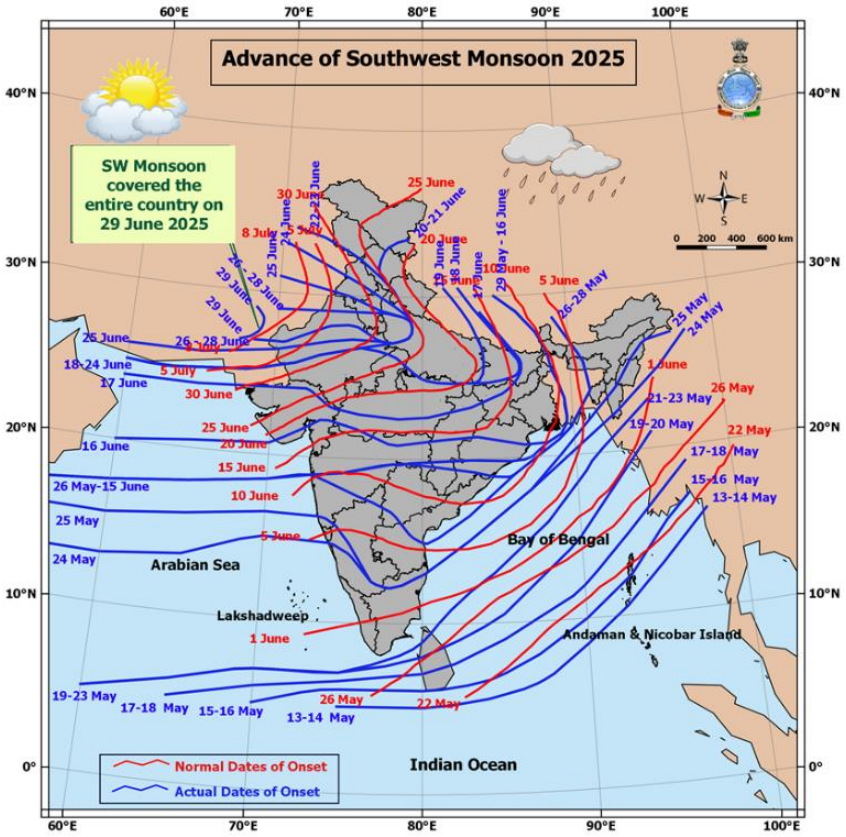



**Fig.1:** Isochrones of advance of the Southwest monsoon during 2025

The withdrawal of the Southwest Monsoon 2025 commenced on September 14, 3 days earlier than its normal date of September 17. The withdrawal dates of the 2025 Southwest Monsoon are illustrated in **Fig. 2**.

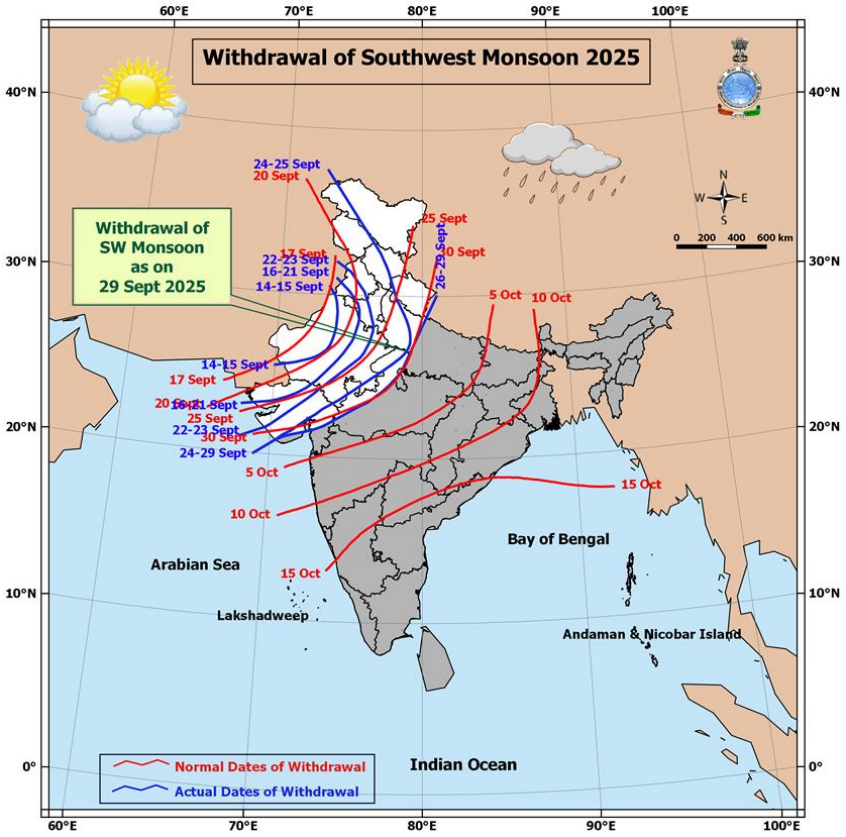



**Fig. 2:** Isochrones of withdrawal of southwest monsoon – 2025 as on 29th September 2025.

## 2. Rainfall Distribution

The actual rainfall during the 2025 southwest monsoon season (June to September) for the entire country and four broad geographical regions is presented in the table below, alongside their respective Long Period Average (LPA) values. The **Table 1** also includes rainfall data for the full four-month monsoon period as well as for the second half of the season (August and September) across the country. As shown in Table-1, the 2025 seasonal rainfall for the country as a whole was above normal, exceeding 104% of the Long Period Average (LPA). Regionally, three of the four geographical zones recorded above-normal rainfall: Central India (>106% of LPA), Northwest India (>108% of LPA), and the South Peninsula (>106% of LPA). In contrast, East and Northeast India experienced below-normal rainfall, receiving less than 94% of the LPA. Additionally, rainfall in the monsoon core zone was above normal, exceeding 106% of the LPA.

| Table 1. Season (June to September) Rainfall | | | |
|---|---|---|---|
| **Region** | **Long Period Average (LPA) (mm)** | **Actual Rainfall for 2025** | |
| | | **Rainfall (mm)** | **Rainfall (% of LPA)** |
| All India | 868.6 | 937.2 | 108 |
| Northwest India | 587.6 | 747.9 | 127 |
| Central India | 978.0 | 1125.3 | 115 |
| East & Northeast India | 1367.3 | 1089.9 | 80 |
| South Peninsula | 716.2 | 787.4 | 110 |
| Monsoon Core Zone | 832.2 | 1015.8 | 122 |
| ***Monthly & second half of the monsoon season rainfall over the country as a whole (All India)*** | | | |
| **Month** | **LPA (mm)** | **Actual Rainfall for 2025** | |
| | | **Rainfall (mm)** | **Rainfall (% of LPA)** |
| June | 165.4 | 180.0 | 109 |
| July | 280.5 | 294.1 | 105 |
| August | 254.9 | 268.1 | 105 |
| September | 167.9 | 193.6 | 115 |
| August + September | 421.5 | 461.6 | 110 |

Month wise, the rainfall over the country as a whole was above normal in June (>108% of LPA) and September (>109% of LPA), normal in July (94-106% of LPA) and August (94-106% of LPA). The rainfall during the second half of the seasonal over the country as whole was also above normal (> 106% of LPA).

**Fig. 3** shows the subdivision wise season (June to September) rainfall for 2025.

Out of the total 36 meteorological subdivisions, 2 subdivisions received large excess rainfall (10% of the total area of the country), 12 subdivisions constituting (35% of the total area) received excess, 19 subdivisions received normal rainfall (46% of the total area) and 3 subdivisions (Arunachal Pradesh, Assam & Meghalaya & Bihar) constituting (9% of the total area) received deficient season rainfall.

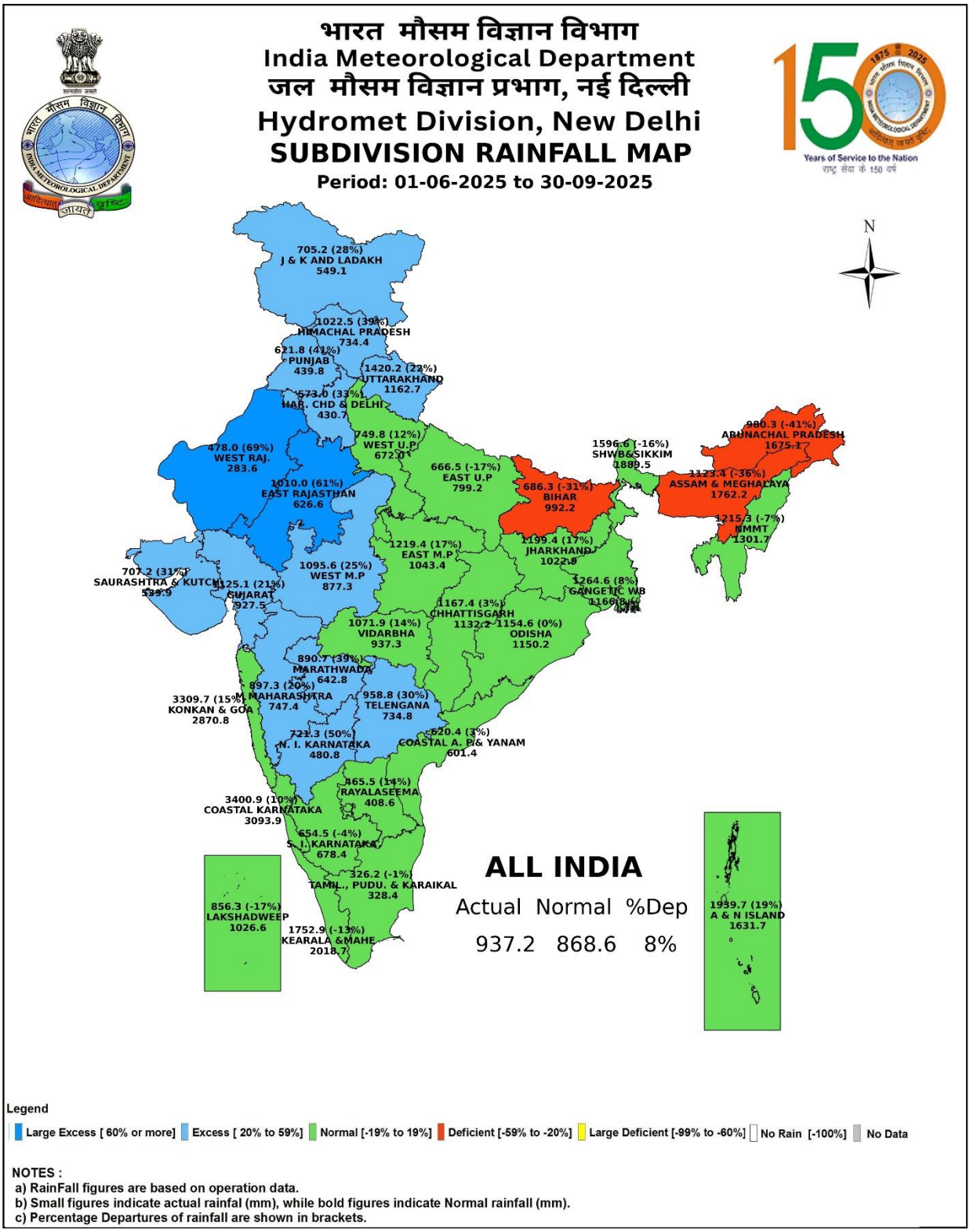



**Fig. 3:** Sub-division wise rainfall distribution over India during southwest monsoon season (June to September) – 2025.

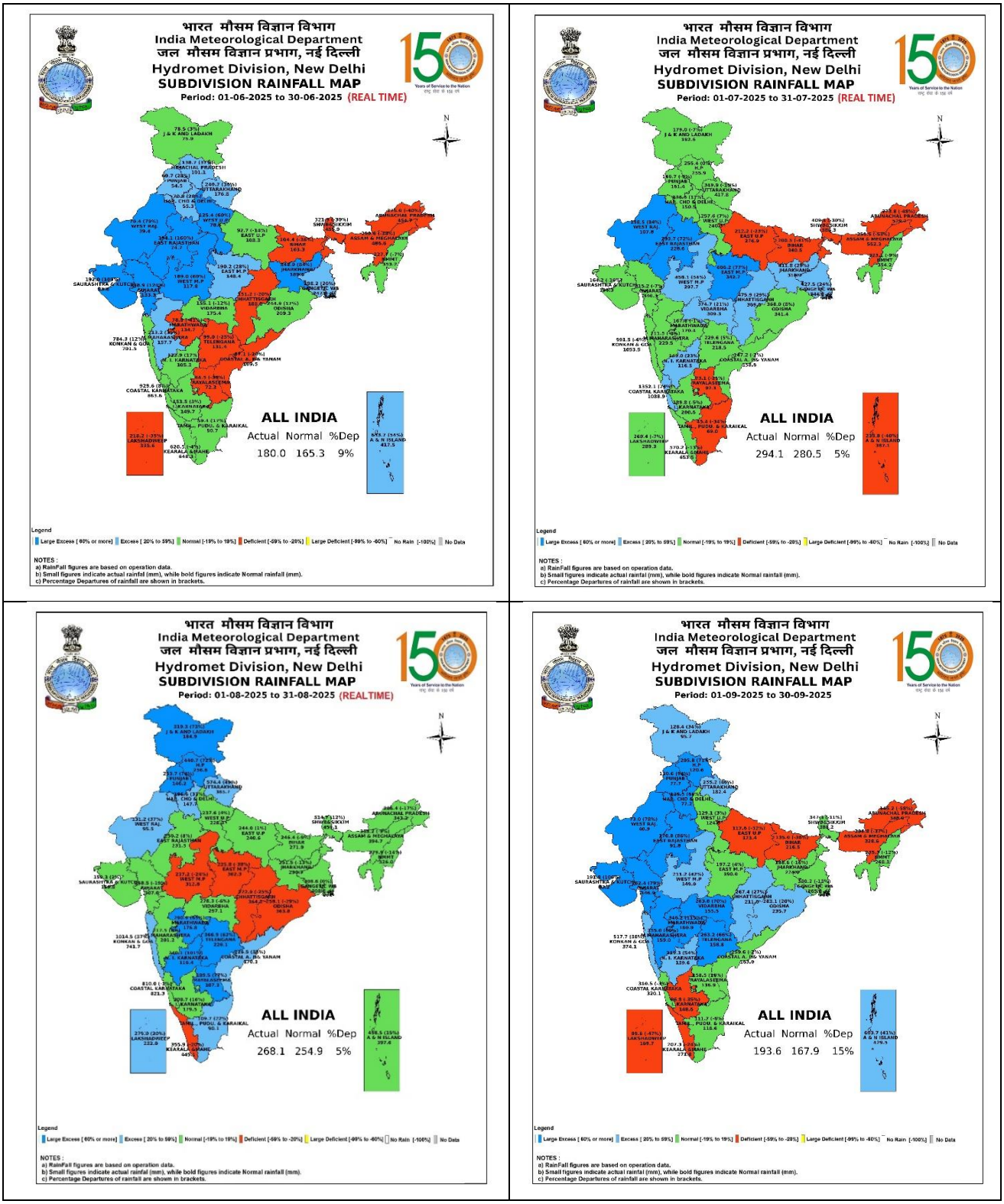



**Fig. 4:** Sub-division wise monthly rainfall distribution over India during southwest monsoon season – 2025

The Sub-division wise monthly rainfall distribution over India during southwest monsoon season – 2025 is given in Fig. 4. In June, 7 subdivisions experienced large excess rainfall, 8 had excess rainfall, 11 recorded normal rainfall, and 10 faced deficient rainfall, with no subdivisions reporting large deficient rainfall. A key highlight was the significant spatial variability in Northwest India, where out of 9 subdivisions, 3 received large excess rainfall, 4 had excess rainfall, and 2 recorded normal rainfall. Regionally, Northwest India (142% of LPA) and Central India (125% of LPA) experienced above-normal rainfall, while the South Peninsula (97% of LPA) received normal rainfall. In contrast, Northeast India (83% of LPA) received below-normal rainfall.

In July, 3 subdivisions experienced large excess rainfall, 7 received excess rainfall, 18 recorded normal rainfall, and 8 had deficient rainfall, with no subdivisions reporting large deficient rainfall. A notable aspect was the considerable spatial variability in Central India, where out of 10 subdivisions, 1 had large excess rainfall, 3 had excess rainfall, and 6 recorded normal rainfall. In contrast, in East and Northeast India, 4 out of 7 subdivisions experienced deficient rainfall, 1 received normal rainfall, and 2 had excess rainfall. Regionally, Central India (122% of LPA) and Northwest India (113% of LPA) recorded above-normal rainfall, while the South Peninsula (98% of LPA) and North India received normal rainfall. Northeast India (74% of LPA) experienced below-normal rainfall.

In August, 7 subdivisions experienced large excess rainfall, 7 received excess rainfall, 17 recorded normal rainfall, and 5 faced deficient rainfall. Notable rainfall patterns were observed in Northwest India and the South Peninsula. Northwest India, with 9 subdivisions, received 134% of the LPA, including 3 subdivisions with large excess rainfall, 3 with excess rainfall, and 3 with normal rainfall; no subdivision recorded large deficient rainfall. Similarly, the South Peninsula received 131% of the LPA, where 3 subdivisions had large excess rainfall, 3 had excess rainfall, 3 recorded normal rainfall, and 1 experienced deficient rainfall out of 10 subdivisions. In contrast, Central India received deficient rainfall at 86% of the LPA, with 4 subdivisions facing deficient rainfall, 4 normal, and 1 each recording large excess and excess rainfall. East and Northeast India also recorded below-normal rainfall at 91% of the LPA.

In September, 11 subdivisions have received large excess rainfall, 08 subdivisions received excess rainfall, 10 subdivisions received normal rainfall, 7 subdivisions received deficient rainfall. No subdivision received large deficient rainfall. The most notable features of rainfall distribution in September were observed over Central India and Northwest India. Central India received 144% of LPA rainfall, where 5 subdivisions recorded large excess rainfall, 4 subdivisions received excess rainfall, 1 subdivision received normal rainfall, and no subdivision received deficient rainfall out of a total of 10 subdivisions. Similarly, Northwest India received 131% of LPA rainfall, with 5 subdivisions recording large excess rainfall, 2 subdivisions receiving excess rainfall, each 1 subdivision receiving normal & deficient rainfall out of a total of 9 subdivisions.

Region wise, Northwest India (131% of LPA), Central India (144% of LPA) and South Peninsula (112% of LPA) experienced excess rainfall whereas East & Northeast India (69% of LPA) received deficient rainfall.

**Fig. 5** depicts the monthly variation of rainfall for All India and four homogeneous regions during 2025 southwest monsoon season and **Fig. 6** depicts the weekly and cumulative weekly rainfall anomaly expressed as percentage departure from the LPA.

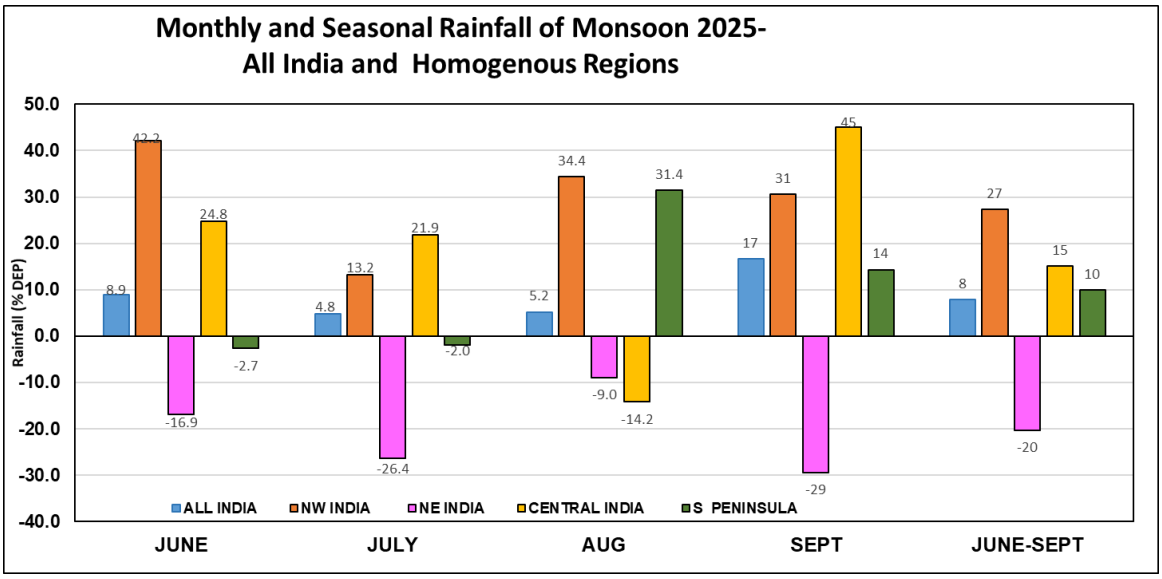



**Fig.5.** Monthly and seasonal monsoon rainfall of 2025 over Broad homogenous region and Country as a whole in % departure.

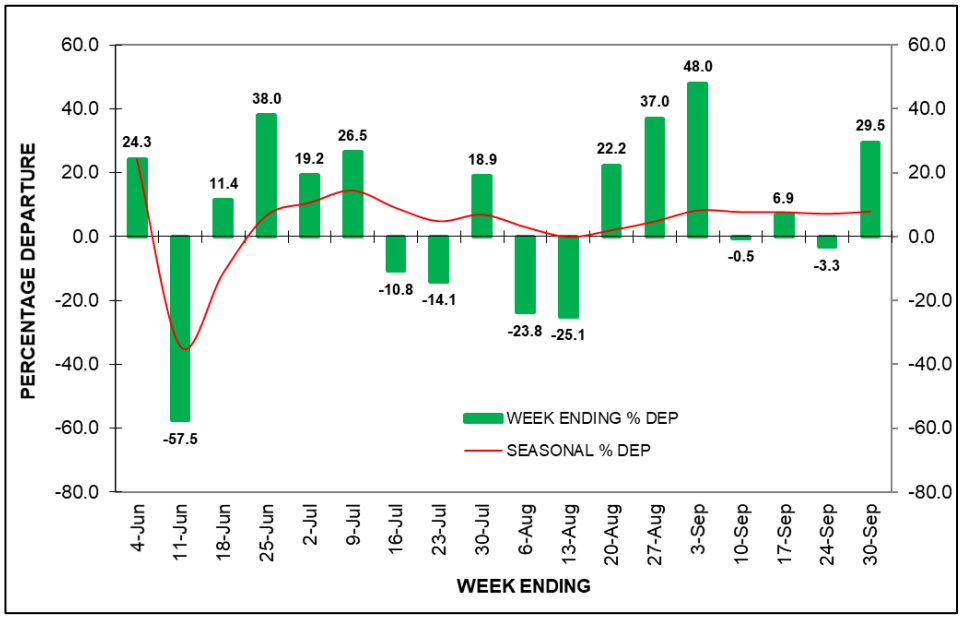



**Fig 6.** Week by week progress and cumulative rainfall (% departure from normal) over Country as a whole during 2025 monsoon season.

The all-India weekly rainfall anomalies indicate that out of 18 weeks, 11 recorded positive anomalies, while 7 recorded negative anomalies. In June, only the second week experienced a negative anomaly (-57.5%), with the remaining three weeks showing positive anomalies. The highest positive anomaly for June occurred in the week ending 25th June (38.0%). In July, the weeks ending 16th (-10.8%) and 23rd (-14.1%) recorded negative anomalies, while the other weeks experienced positive anomalies. In August, the first two weeks had negative anomalies, whereas the last two weeks recorded high positive anomalies. The season's highest positive anomaly was observed in the week ending 3rd September (48.0%).

## 3. Synoptic scale systems and Extreme weather events during the Southwest Monsoon Season

During the season, Seven Monsoon depressions formed during the season and one intensified into Deep Depression. The tracks of the Monsoon Depression are shown in **Fig.7.** The information of number of low-pressure systems formed during the season is shown in **Table-2**.

In June 2025, there were five low-pressure systems (LPS) formed during June. Three over the Head Bay of Bengal (17 to 23 June, 26 to 27 June and 29 June onwards). Out of these, one system (17th to 23rd June) intensified into a well-marked low-pressure system. Two systems formed over the Arabian Sea (17 to 19 June and 28 to 29 June). These low-pressure systems help to get good amount of rainfall over most part of country especially Northwest India, Central India and west coast of Peninsular India. There were four Western Disturbances (WDs) observed over Indian region during 29 May to 9 June, 6-9 June, 8-11 and 11-19 June.

During July 2025, four depressions formed during 15 – 16 July, 14 – 15 July, 17 – 20 July (remnant of depression over Gangetic West Bengal) and 25 – 27 July (remnant of cyclone WIPHA from south China Sea). Out of these four depressions three formed over land and one over north Bay of Bengal. Besides these depressions one low pressure area formed over Bay of Bengal during 6 – 10 July. During July 2025, there were five western disturbances affected the country during 11 – 13, 13 – 18, 18 – 20, 23 – 28 and 28 July onwards.

In August 2025, four low-pressure systems developed— slightly below the climatological normal of 5.38. These included one depression over the Bay of Bengal that formed during 18–19 August, a well-marked low-pressure area from 26–29 August, and two low-pressure areas that developed during 13–17 August and 22–25 August. The total number of low-pressure system (LPS) days was 15, compared to the normal of approximately 16.3 days. During August 2025, five Western Disturbances affected the country in the periods: 28 July–5 August, 5–10 August, 10–13 August, 18–22 August, and 24–31 August.

During September 2025, one deep depression formed over the north Bay of Bengal during 6–11 September, and another depression formed during 26–27 September. In addition, two low-pressure areas developed over the north Bay of Bengal during 12–15 September and 22–24 September.

**Table 2:** Number of Low-pressure System (LPS) including Low (L), Well Marked Low (WML), Depression (D), Deep Depression (DD), Cyclonic Storm (CS) and number of LPS days in monsoon 2025.

| Category | CS | DD | D | WML | LOW | Total LPS | Total LPS days | Long period Average of Total monsoon systems /Days | |
|---|---|---|---|---|---|---|---|---|---|
| June | 0 | 0 | 0 | 1 (BOB) | 2(BOB) 2(AS) | 5 | 13 | 3 | 11 |
| July | 0 | 0 | 1(BOB) 3(Land) | 0 | 1(BOB) | 5 | 18 | 3 | 14 |
| August | 0 | 0 | 1 (BOB) | 1 (BOB) | 1(BOB) | 4 | 15 | 4 | 17 |
| September | 0 | 1 (BOB) | 1 (BOB) | 0 | 2(BOB) | 4 | 23 | 3 | 12 |
| Season | 0 | 1 | 6 | 2 | 9 | 18 | 69 | 13 | 55 |
| | AS: Arabian Sea) (BOB: Bay of Bengal) | | | | | | | | |

During peak monsoon rainfall months of July and Aug 2025, most of the day's monsoon trough was in normal or south of its normal position, However, monsoon trough shifted to north of its normal position and there was a break monsoon like situation during 2nd August to 12th August. Again, Monsoon was active during 19th August to 25th August. Hence, core zone of Monsoon region received above normal rainfall. The standardized rainfall anomalies over the core monsoon zone region for 2025 are shown in **Fig. 8.**

The number of heavy rainfall events during the last five years is given in **Table 3.** Month-wise locations of Very Heavy Rainfall (115.6 to 204.4 mm) and Extremely Heavy Rainfall (more than 204.4 mm) reported stations for June to Sept 2025 are given in **Fig.9**. The extreme rainfall events were more realized over Konkan & Goa, coastal Karnataka, Uttaranchal, Himachal Pradesh, Gujarat, West Madhya Pradesh, Telangana, Bihar, Orissa and Gangetic West Bengal.

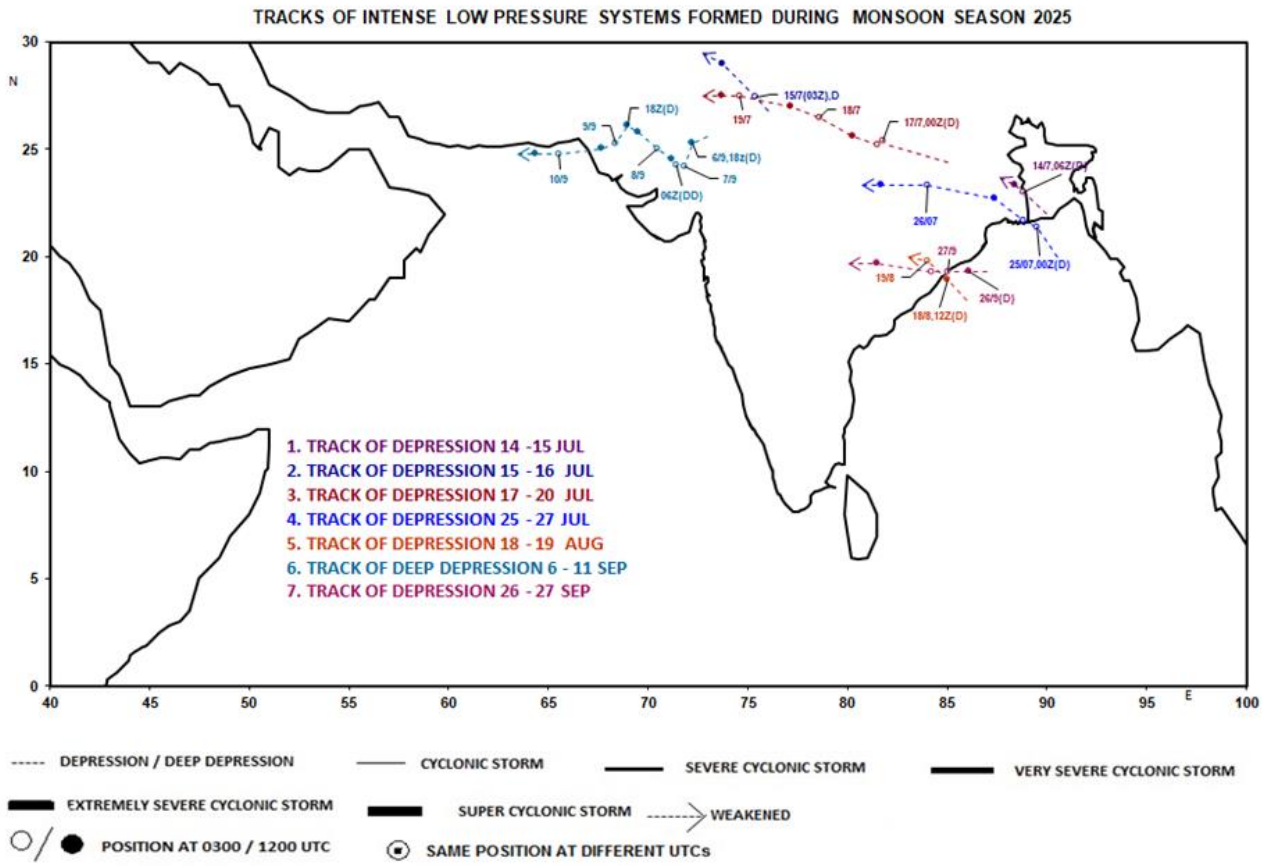



**Fig. 7.** Tracks of the Cyclonic Storms and Depressions formed during Monsoon 2025

**Table 3:** The number of heavy rainfall events during the last five years

| Year | 2021 | | 2022 | | 2023 | | 2024 | | 2025 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Month | >115.6 and <204.5 | >204.5 | >115.6 and <204.5 | >204.5 | >115.6 and <204.5 | >204.5 | >115.6 and <204.5 | >204.5 | >115.6 and <204.5 | >204.5 |
| Jun | 277 | 35 | 237 | 80 | 429 | 65 | 284 | 51 | 432 | 70 |
| Jul | 638 | 121 | 829 | 131 | 1113 | 205 | 1059 | 194 | 673 | 84 |
| Aug | 272 | 28 | 577 | 63 | 402 | 66 | 762 | 132 | 692 | 108 |
| Sep | 449 | 89 | 231 | 22 | 399 | 90 | 527 | 96 | 312 | 41 |
| Monsoon | 1636 | 273 | 1874 | 296 | 2343 | 426 | 2632 | 473 | 2109 | 303 |

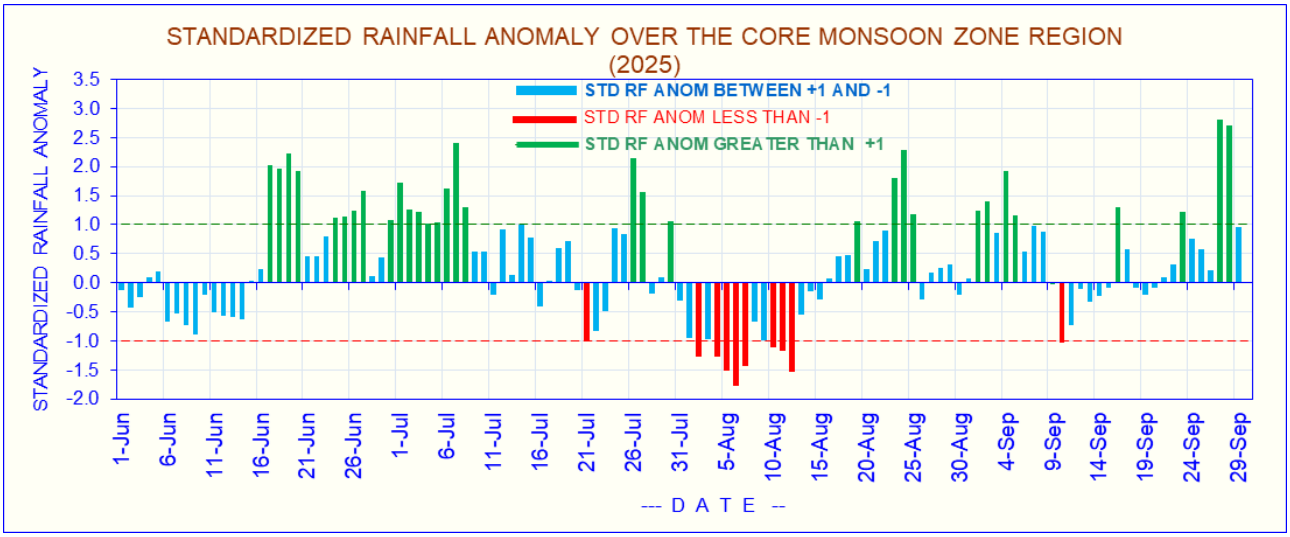



**Fig 8.** The standardized rainfall anomalies over the core monsoon zone region 2025

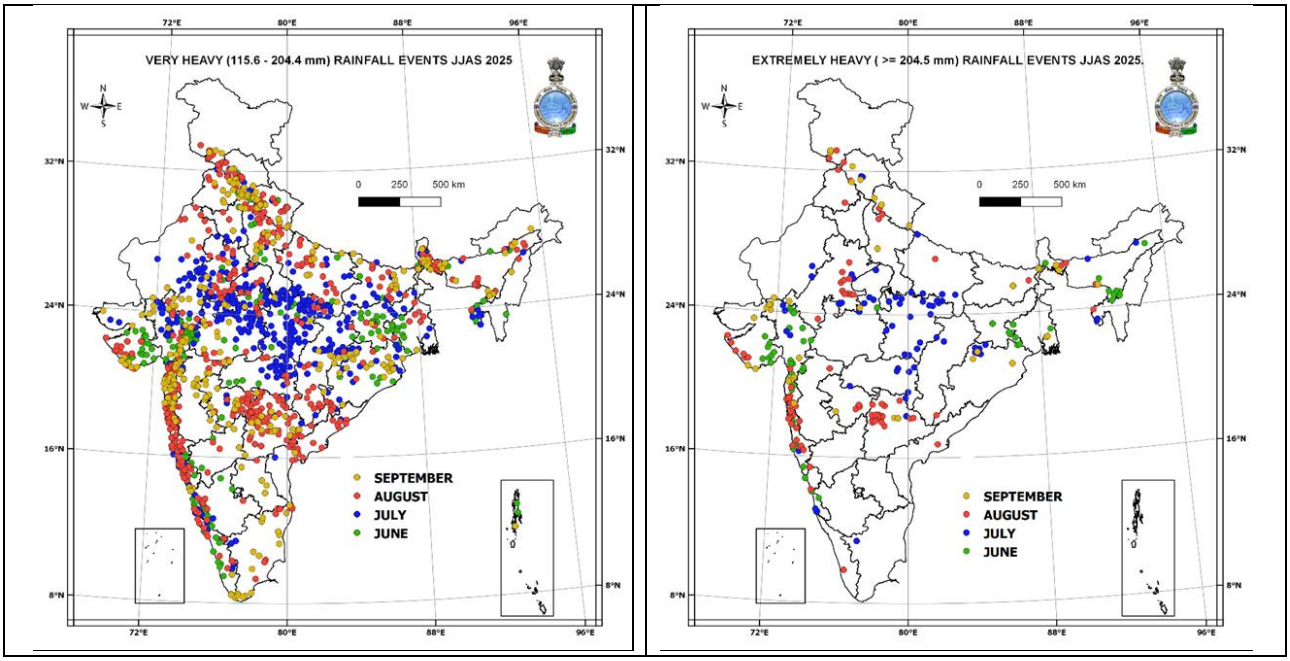



**Fig 9.** The location of Very Heavy Rainfall (115.6 to 204.4 mm) (left one) and Extremely Heavy Rainfall (more than 204.4 mm) (right one) stations during JJAS 2025.

## 4. Verification of Long-Range Forecast issued for SW Monsoon 2025

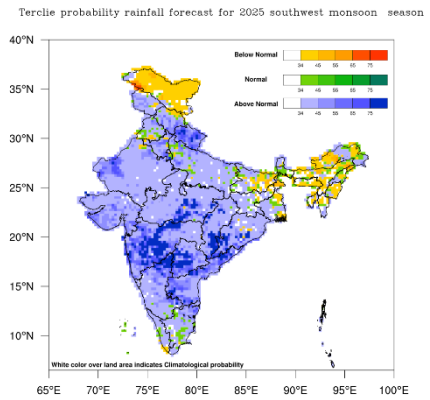
The forecast for monsoon onset over Kerala for this year was correct, which is the nineteenth consecutive correct forecast for this event except the year 2015 since the commencement of this forecast in 2005. The Forecast date of onset of monsoon over Kerala was 27$^{th}$ May with a model error of ± 4 days and realized date of onset of monsoon over Kerala was 24$^{th}$ May.

The first stage forecast for the season (June-September) rainfall over the country as a whole issued in April was 105% of LPA with a model error of ± 5% of LPA and the update forecast issued in the end of May 2025 was 106% of LPA with a model error of ± 4% of LPA. The actual season rainfall for the country as a whole was 108 % of LPA. Thus, the seasonal rainfall forecast for the country as a whole was correct.

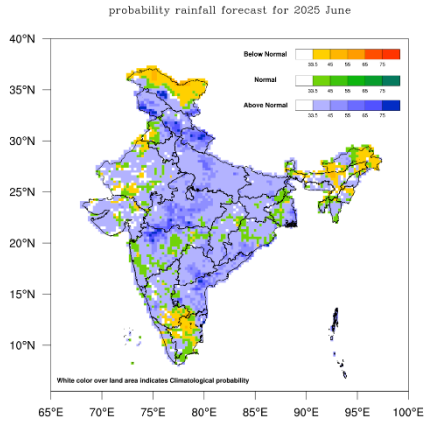
Considering the four broad geographical regions of India, the forecasts issued on 27$^{th}$ May, the southwest monsoon seasonal (June to September 2025) rainfall is most likely to be above-normal over Central India and South Peninsular India (>106% of LPA), above normal over Northwest India (>108% of LPA) and below normal over Northeast India (<94% of LPA). The southwest monsoon seasonal rainfall over the monsoon core zone consisting of most of the rainfed agriculture areas in the country was most likely to be above Normal (>106% of LPA). The actual rainfall over Northwest India, Central India, Northeast India, South Peninsula and Monsoon Core Zone were 27%, 15%, -20%, 10% and 22% of the LPA, respectively. The seasonal forecast issued for homogeneous regions during the season was within the range of the forecast except the Northwest India. All the monthly outlooks were within the forecast limit, except the July. The forecast for the second half of the monsoon season (August –September) for the country as a whole also was in the forecast limit.

The probabilistic forecasts issued for June to September season as a whole and monthly outlook for June to September are given in **Fig.10(a) to 10 (f)** along with seasonal forecast issued for August to September (second half of the monsoon season. The realized tercile rainfall category is also given in **Fig. 10(g) to (l).** It can be seen that, during June to September (JJAS) seasonal probabilistic forecast matches very well with the observed rainfall category over many regions, especially over Northeast India and many parts over Central India. In the monthly forecast outlooks also, after comparison with the observed rainfall, it can be seen that, outlook matches very well during most of the months for many parts of the country.

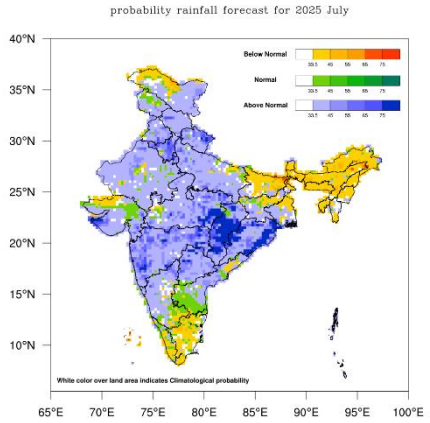
This year, Monsoon Mission Climate Forecast System (MMCFS) as well as other climate model forecasts indicate that the Neutral ENSO condition are likely to continue during the monsoon season and a weak negative IOD conditions are likely to develop during the southwest monsoon season. The **Tables 4(a)** and **4(b)** below gives the summary of the verification of the long-range forecasts issued for the 2025 Southwest monsoon.



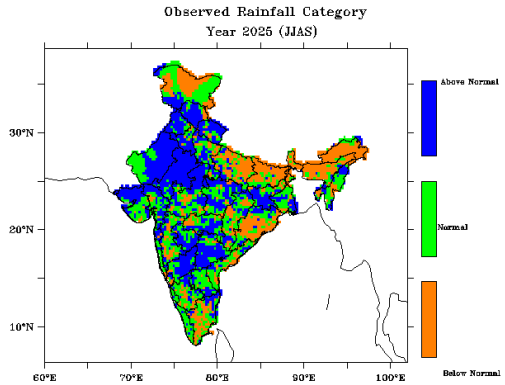

**(a) Probabilistic Rainfall Forecast for June to September 2025**



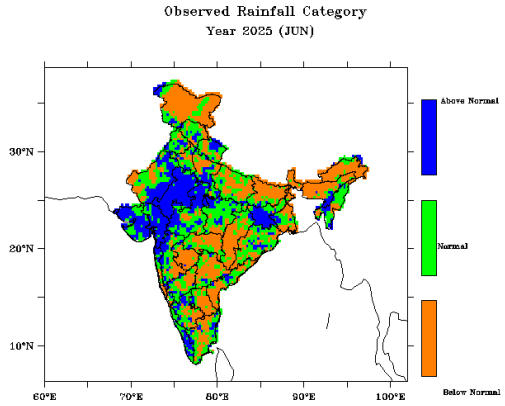

**(b) Probabilistic Rainfall Forecast for June 2025**



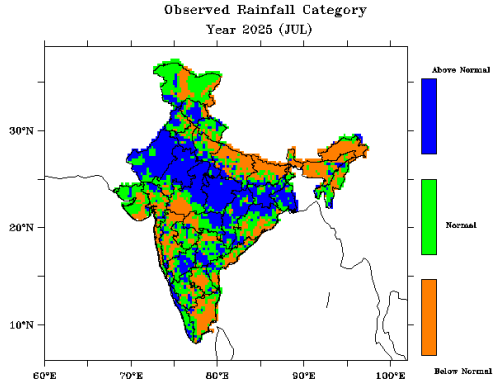

**(c) Probabilistic Rainfall Forecast for July 2025**



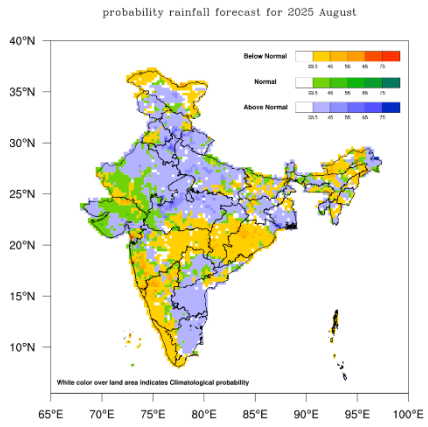

**(g) Observed Rainfall Category for June to September 2025**



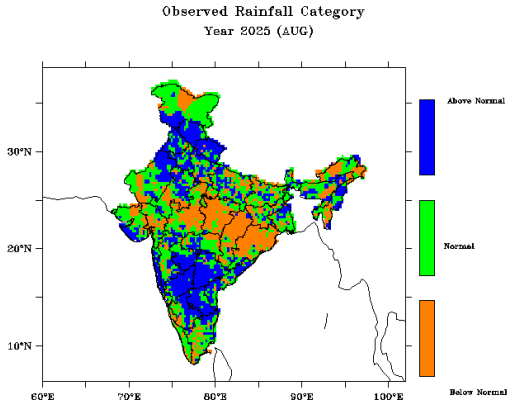

**(h) Observed Rainfall Category for June 2025**



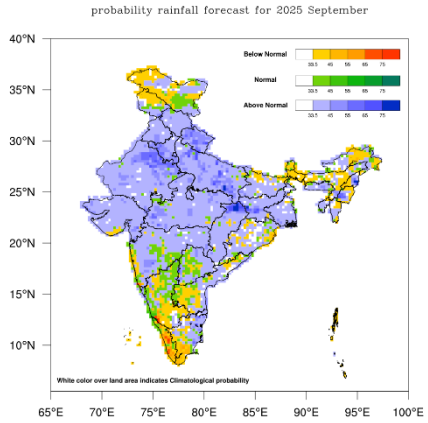

**(i) Observed Rainfall Category for July 2025**



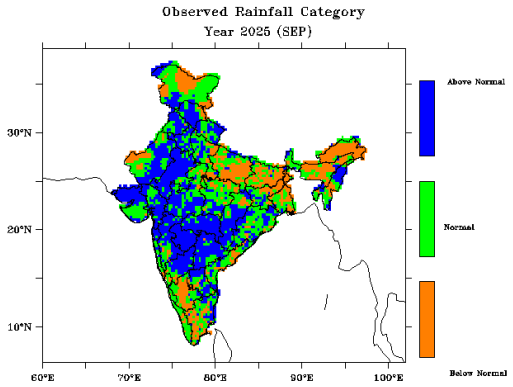

**(d) Probabilistic Rainfall Forecast for August 2025**



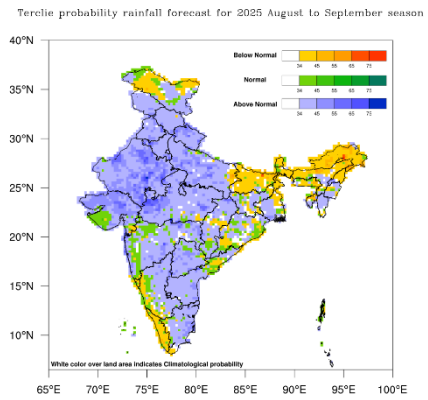

**(j) Observed Rainfall Category for August 2025**



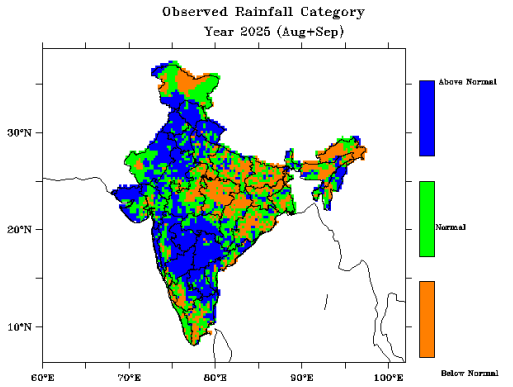

**(e) Probabilistic Rainfall Forecast for September 2025**




**(k) Observed Rainfall Category for September 2025**




**(f) Probabilistic Rainfall Forecast for August+September 2025**




**(l) Observed Rainfall Category for August+September 2025**

**Fig 10.** Spatial Probabilistic Forecast of 2025 in left panel and Forecast Verification plots in right panel for Seasonal and monthly forecasts.

**Table 4(a):** Performance of Long-Range Forecast of Southwest Monsoon 2025

<table>
<tr><th colspan="2">Seasonal Forecast</th><th rowspan="2">Observed</th></tr>
<tr><th>15th April 2025-1st Stage for Season as a whole</th><th>27th May 2025-2nd stage -</th></tr>
<tr><td>• The Neutral ENSO condition is likely to continue during the monsoon season.<br><br>• The Neutral IOD conditions are likely to continue during the southwest monsoon season.<br><br>• The snow cover areas of northern hemisphere and Eurasia during the last three months (January to March, 2025) were below normal. The winter and spring snow cover extent over Northern Hemisphere as well as Eurasia has in general an inverse relationship with the subsequent Indian summer monsoon rainfall.<br><br>• The southwest monsoon seasonal (June to September) rainfall over the country as a whole during 2025 is most likely to be above normal (>104% of the Long Period Average (LPA)). Quantitatively, the seasonal rainfall over the country as a whole is likely to be 105% of LPA with a model error of ± 5%.</td><td>• Same ENSO forecast.<br><br>• A weak negative IOD conditions are likely to develop during the southwest monsoon season.<br><br>• Quantitatively, the southwest monsoon seasonal rainfall over the country as a whole is likely to be 106% of the Long Period Average (LPA) with a model error of ±4%, indicating that above normal rainfall is most likely over the country as a whole during the monsoon season (June to September), 2025.</td><td>• Neutral El Nino Southern Oscillation (ENSO) conditions are prevailing over the equatorial Pacific region till September.<br><br>• IOD remained neutral till July and a weak negative IOD conditions are developed towards the end of the monsoon season.<br><br>• Rainfall is (108% of LPA).</td></tr>
<tr><th colspan="2">31st July -3rd Stage (For 2nd half of Monsoon 2025 (Aug- Sept)</th><th>Observed</th></tr>
<tr><td colspan="2">• Neutral El Nino-Southern Oscillation (ENSO) conditions are prevailing over the equatorial Pacific region. These neutral ENSO conditions are likely to continue during remaining part of the monsoon season.<br>• At present, neutral Indian Ocean Dipole (IOD) conditions are observed over the Indian Ocean. These neutral IOD conditions are likely to turn into weak negative IOD conditions at the end of the monsoon season.<br>• Rainfall is most likely to be above normal (>106% of LPA) for Second half of the monsoon season.</td><td>• Neutral El Nino-Southern Oscillation (ENSO) conditions prevailed.<br>• A weak negative IOD conditions are developed towards the end of the monsoon season.<br>• Above normal Rainfall received for Both 1st half (106% of LPA) & second half (110% of the LPA of the monsoon season 2025.</td></tr>
</table>

**Table 4(b):** Performance of monthly Rainfall Forecast during Monsoon 2025

| Month | Forecast | Realized |
|---|---|---|
| June 2025 | Above Normal rainfall (>108% of LPA) is most likely over the country as a whole during June, 2025 | 109% of LPA |
| July 2025 | Above Normal (>106% of LPA) is most likely over the country as a whole during July, 2025 | 105% of LPA |
| August 2025 | Normal ((94 to 106% of LPA) is most likely over the country as a whole during August, 2025 | 105% of LPA |
| September 2025 | Above Normal (>109% of LPA) is most likely over the country as a whole during September, 2025 | 115% of LPA |