



SOUTH WEST MONSOON SEASON REPORT 2024 PUNJAB

Main Highlights

- During this year, monsoon was advanced through some parts of Punjab on 27th June and covered the entire state of Punjab on 02nd July 2024.
- Long Range Forecast issued on 15th April 2024 for 2024 southwest monsoon seasonal (June to September) rainfall over the country as a whole 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 106% of LPA with a model error of $\pm 5\%$.
- Monsoon rainfall (June – September) was 108% of LPA for country as a whole and 107% of LPA for NW India.
- During this monsoon season (1st Jun- 30th Sep 2024), State of Punjab received 314.6 (-28%) mm of rainfall against its average of 439.8 mm which is 28% less than the normal.
- District Tarn Taran received highest rainfall (+48%) while district Bathinda observed least rainfall (-59%) during this monsoon season.
- Month wise, rainfall in the m/o Jun 29.2 mm (-46%) and Jul 89.5 mm (-44%), was Deficit and in Aug 153.7mm (5%) was normal and in the m/o Sep it was Deficit i.e. 42.2 (-46%).
- Highest rainfall received in Punjab during September month during (1901–2024) was in year 1950 when state received 431.4 mm of rainfall against its normal rainfall of 89.1 mm with departure of 384% from normal followed by 1988 and 1958 when state received 429.6 mm and 368.7 mm of rainfall respectively.
- Out of total 22 districts in Punjab, 04-districts have received normal rainfall, 1-district received excess, where in rainfall in 17 districts were deficient in the state.
- Monsoon withdraws from the entire Punjab state on 02nd October 2024.
- The forecast for the rainfall over the country as whole during the season as a whole was correct as the realized rainfall is 108% of LPA against the forecast of $106\% \pm 4\%$.

Monsoon performance, rainfall distributions and associated Meteorological Conditions during Monsoon 2024 (June to September)IN PUNJAB

Monsoon advanced northern parts of Punjab on 27th June and covered entire state on 02nd July 2024. Earliest onset so far in Punjab is 13th June 2008 and latest is 27th July 1987. Monsoon advanced over Kerala coast on 31st May coinciding with its normal date of arrival thereafter it followed normal pattern of advancement. Advancement of monsoon in Punjab is shown in Figure 1 below.

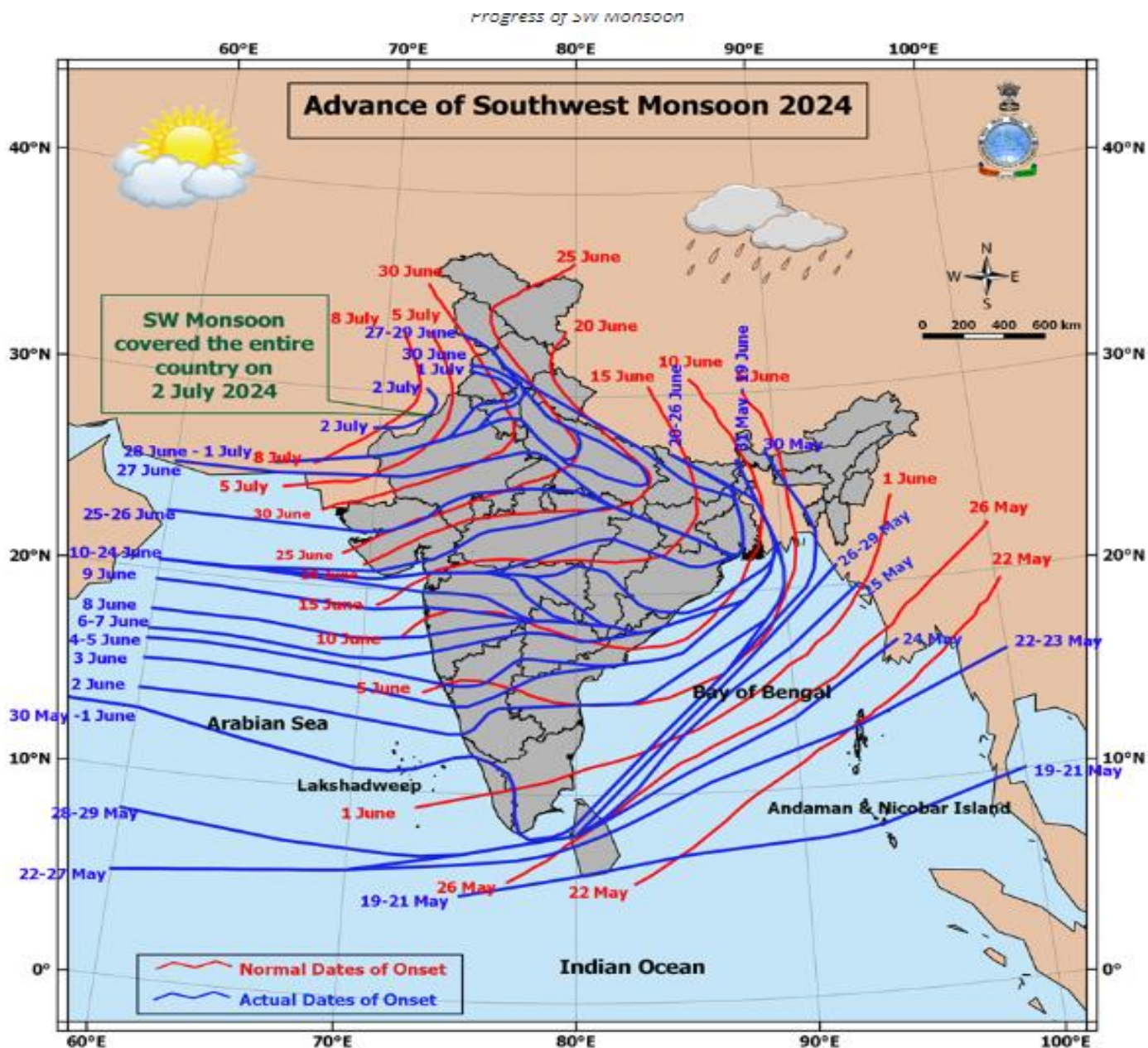
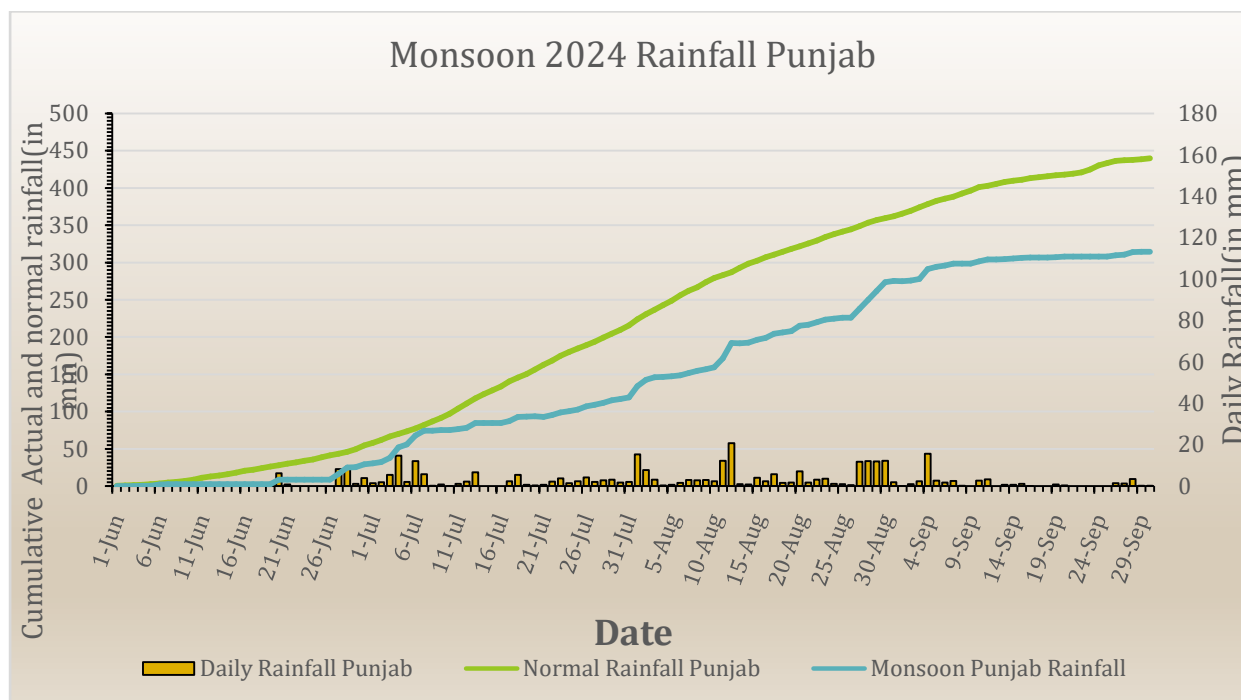


Figure 1: Advance of Southwest Monsoon 2024

RAINFALL DISTRIBUTION IN PUNJAB

Punjab State received 314.6 mm of rainfall against its average of 439.8 mm with deviation of (-28%) during monsoon 2024 which were within normal range as per IMD classification. Daily time series of rainfall from (June to September) during monsoon 2024 in Punjab along with cumulative and normals is shown in Figure 2. Cumulative rainfall followed normal curve till ending August thereafter due to deficit rainfall in the month of September overall deficit of 28 % was created.

Figure 2: Daily cumulative Monsoon rainfall Punjab 2024



WEEKLY% DEPARTURE OF RAINFALL (PUNJAB)

Weekly cumulative departure of Rainfall is shown in Fig 2. As evident from the Figure 3 there were positive departure in 5th, 11th, 13th and 14th week of the monsoon season and for rest period there were negative departures were seen.

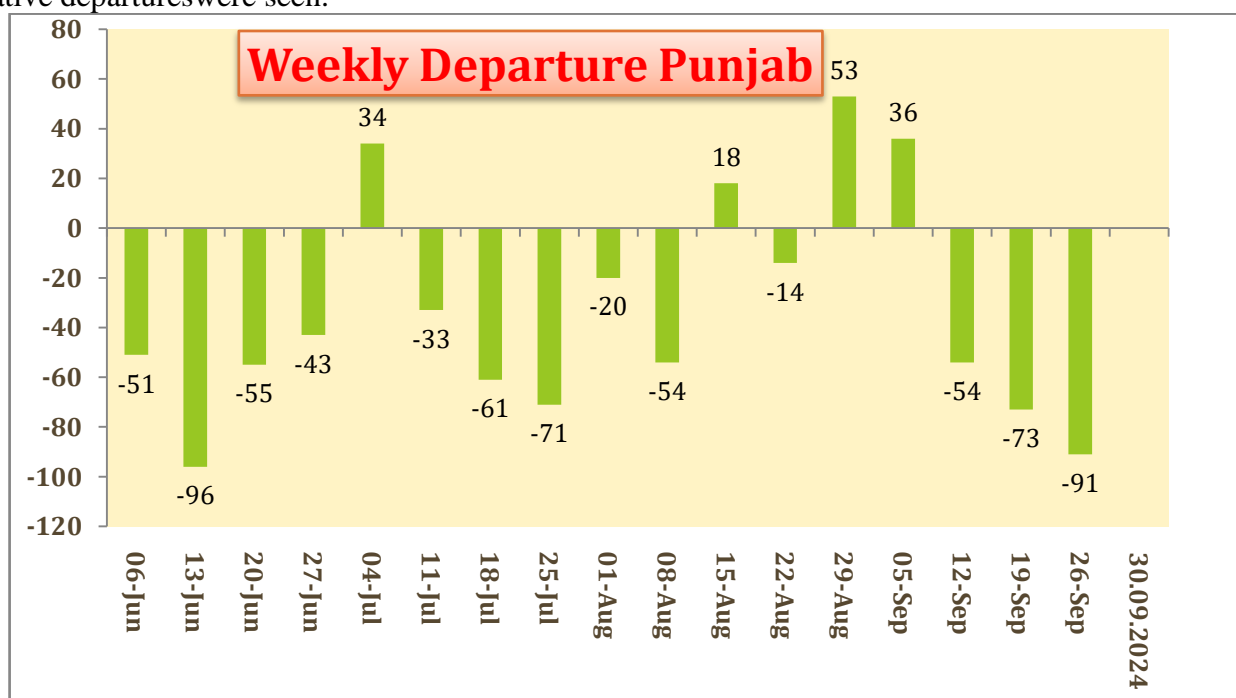


Figure 3: Weekly Rainfall % Departure

DISTRICT WISE RAINFALL STATUS

Out of total 22 districts in Punjab, 04-districts have received normal rainfall, 1-district received excess, where in rainfall in 17 districts were deficient in the state. District Tarn Taran received highest rainfall (+48%) while district Bathinda observed least rainfall (-58%) during this monsoon season Percentage departure of district wise rainfall Punjab from normal for the monsoon 2024 is shown in Figure 4 below.

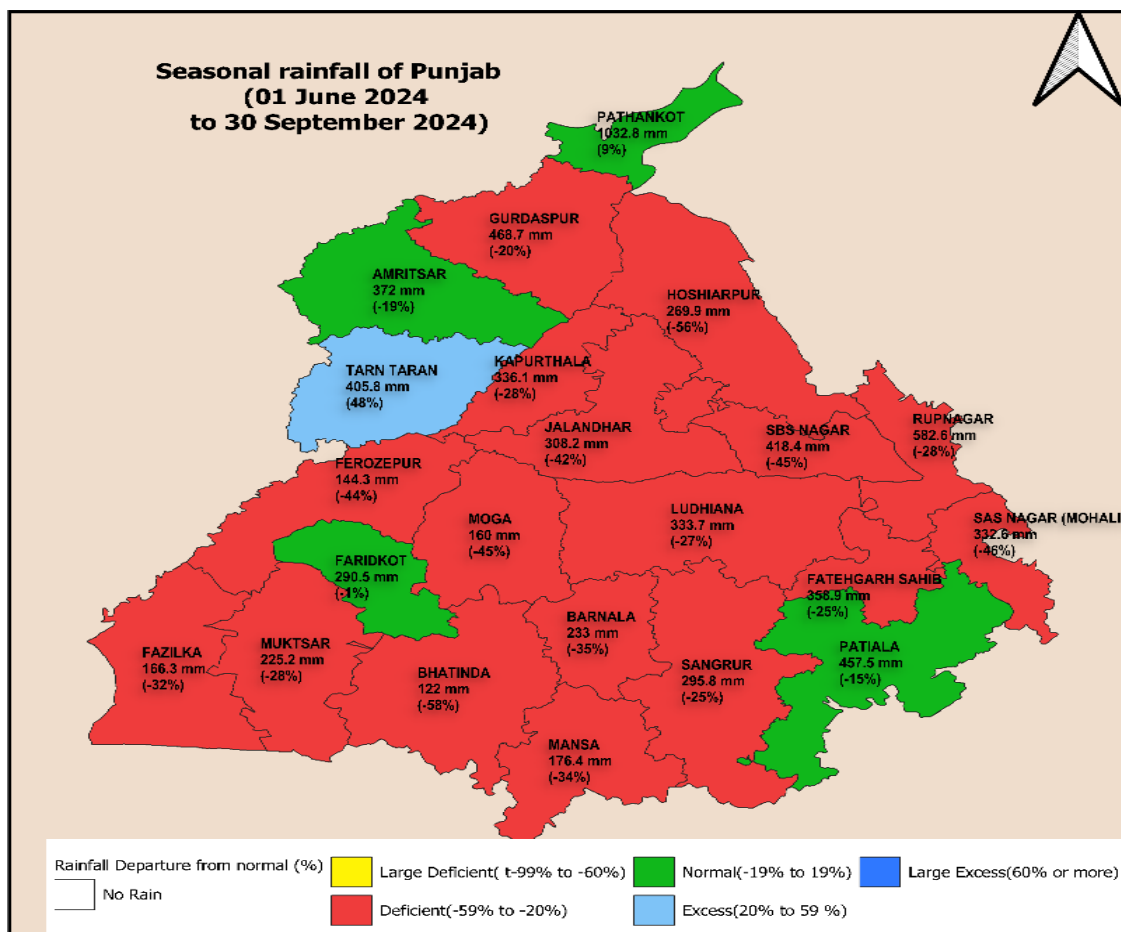


Figure 4: District wise % Departure in Rainfall for Punjab state during Monsoon 2024.

| <u>MONSOON 2024 RAINFALL</u> | | | |
|------------------------------|----------------------|--------------------------|----------|
| Region | Actual Rainfall (mm) | Long Period Average (mm) | % Of LPA |
| All India | 934.8 | 868.6 | 108% |
| NW India | 628.6 | 587.6 | 107% |
| Punjab | 314.6 | 439.8 | -28% |

MONTHLY RAINFALL DISTRIBUTION

Monthly rainfall distribution for the month of June, July, August and September and for first & second half of monsoon 2024 for Punjab is shown below.

| Months | Actual (mm) | Normal (mm) | % of LPA |
|---|-------------|-------------|----------|
| June | 29.2 | 54.5 | -46 |
| July | 89.5 | 161.4 | -44 |
| August | 153.7 | 146.2 | 5 |
| September | 42.2 | 77.7 | -46 |
| June – July (1 st Half) | 118.7 | 215.9 | -45 |
| August – September (2 nd Half) | 195.9 | 223.9 | -13 |

Monsoon Rainfall trend since 1901-2024

Departure of Monsoon rainfall since 1901 for Punjab is shown in Figure 5 & 6, a peculiar feature of the last decade (2011-2024) is that it has been the longest period with negative departure since 1901 even though monsoon rainfall during the last 3 years has been in normal category. Overall last 2 decades has seen more frequency of negative departures and deficit year as well.

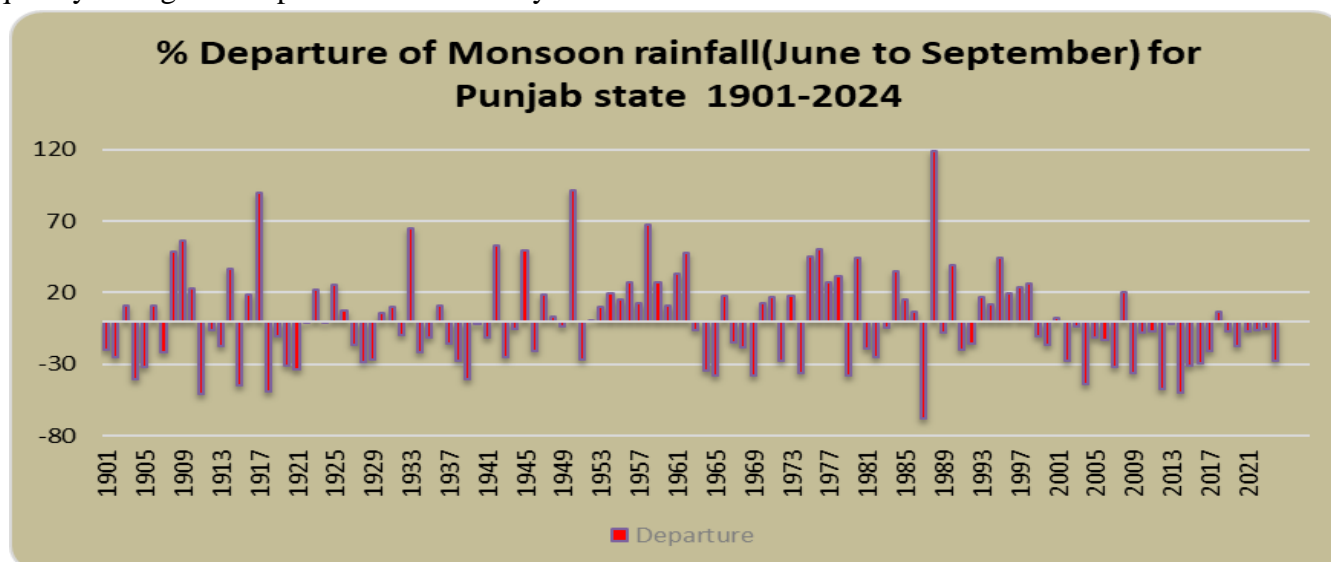


Figure 5: % Departure of Monsoon rainfall since 1901 for Punjab.

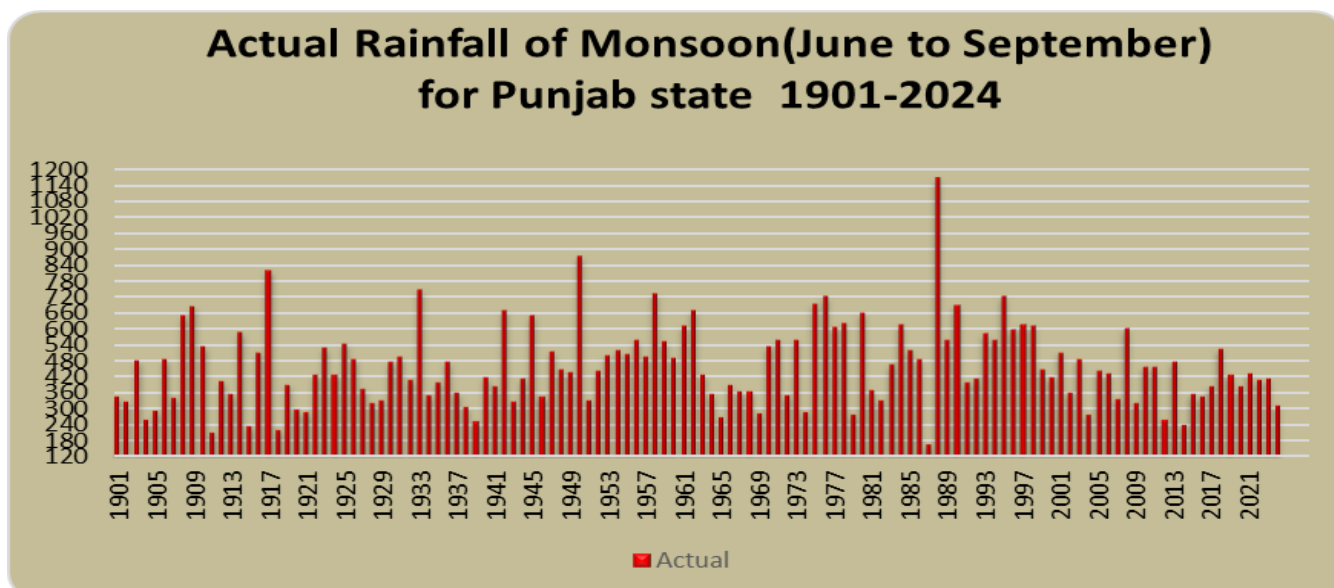
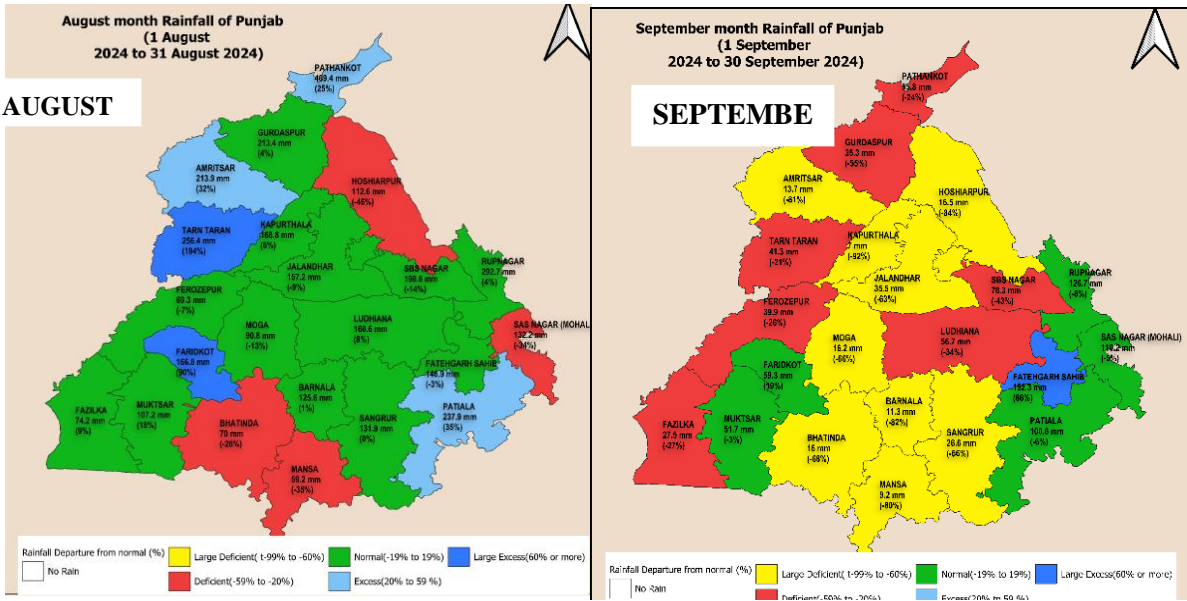
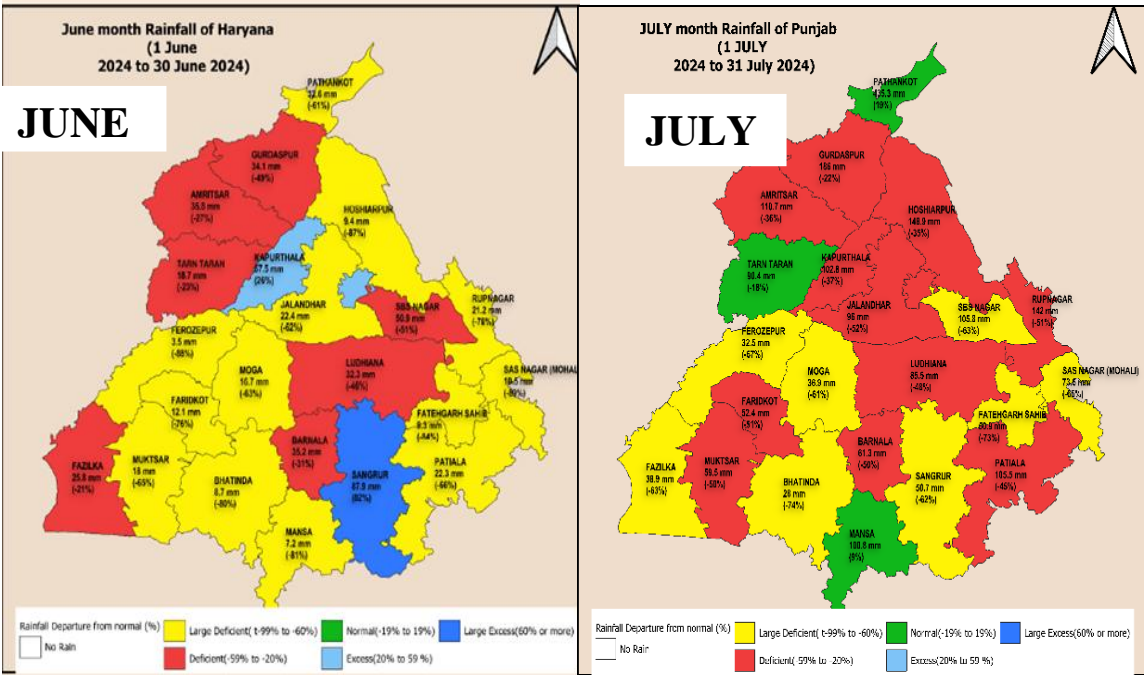
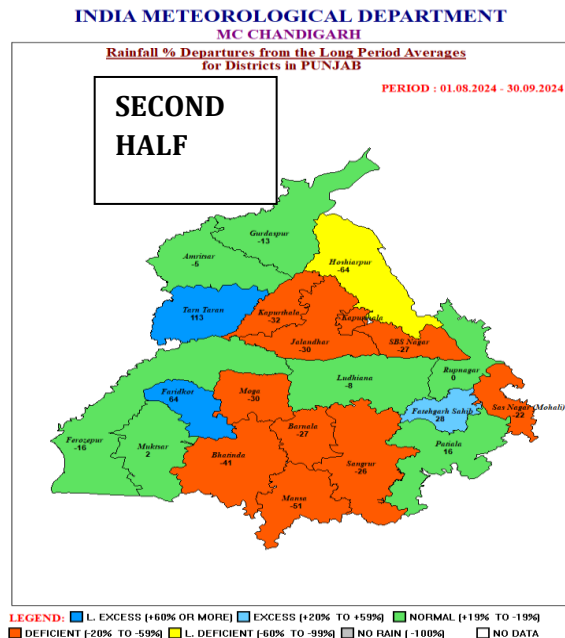
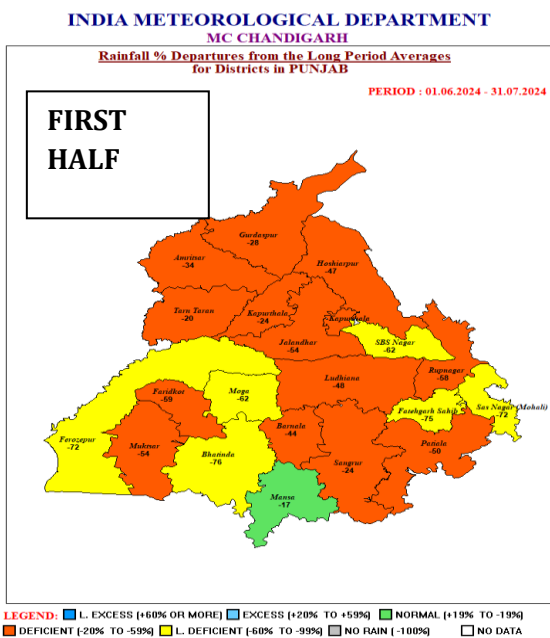


Figure 6: Actual Rainfall of Monsoon since 1901 for Haryana

District wise excess, large excess, deficient, large deficient and normal rainfall for month of June, July, August and September2024 in Punjab is shown in the following table

| MONTHS | L.EXCESS | EXCESS | NORMAL | DEFICIENT | L DEFICIENT | NO RAIN |
|-----------|----------|--------|--------|-----------|-------------|---------|
| June | 1 | 2 | 0 | 7 | 12 | 0 |
| July | 0 | 0 | 3 | 11 | 8 | 0 |
| August | 2 | 3 | 13 | 4 | 0 | 0 |
| September | 1 | 0 | 5 | 7 | 9 | 0 |
| Season | 0 | 1 | 4 | 17 | 0 | 0 |





MAIN FEATURES OF MONTHLY RAINFALL DURING MONSOON 2024(PUNJAB)

JUNE

- In June 2024 Punjab state received 29.2 mm against its normal rainfall of 54.5mm long period average which is -46% less than LPA.
- Highest rainfall in Punjab during last 120(1901–2024) was 203.3 mm recorded in 2008 which was 488.7 % of LPA followed by year 1996 and 1986 with rainfall of 158.0 mm and 151.1 mm respectively.
- The rainfall during June 2024 was deficient in the state with almost all districts reporting less rainfall than LPA. District Sangrur and Kapurthala showed positive departures.

July

- State received 89.5 mm of rainfall in July 2024 against its normal rainfall of 161.4mm which is 44% less than LPA.
- Highest rainfall received in Punjab during July month during (1901–2024) was in year 1988 when state received 455.1 mm of rainfall against its normal rainfall of 190.5 mm which is 122% of LPA followed by 1980 and 1993 when state received 443.8 mm and 413.9 mm of rainfall respectively.
- Lowest rainfall in July during (1901-2024) was in 1911 when state received 25.0 mm of rainfall against 158.4 mm with deficit of 84.2% followed by year 1987 and 1964 when rainfall was 31.8 mm and 35.4 mm respectively.
- The rainfall during July 2024 was deficient in the state with almost all districts reporting less rainfall than LPA. District Pathankot and Mansa showed positive departures.

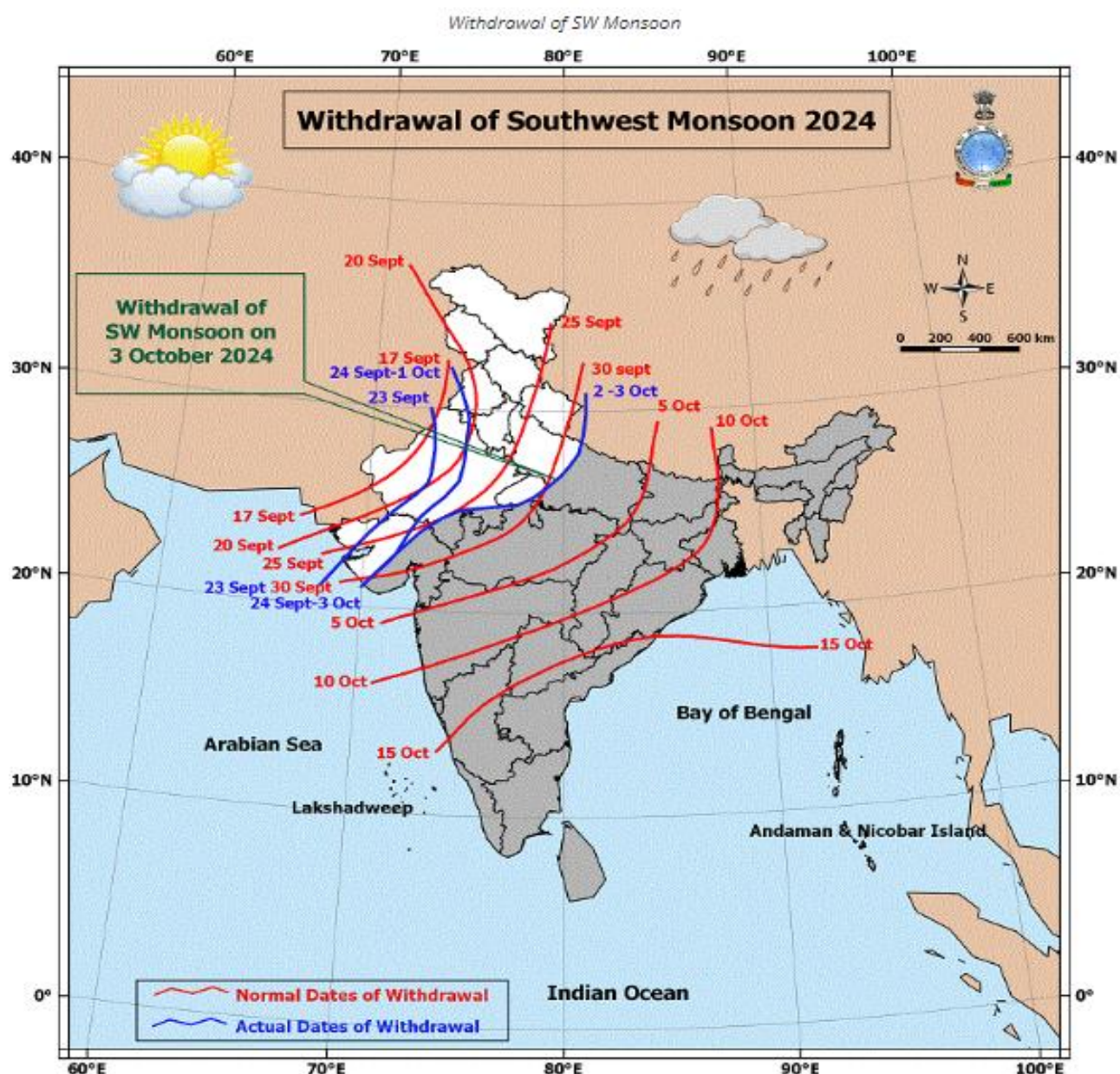
August

- Punjab received 153.7mm of rainfall against its normal of 146.2 mm and was 5% more than LPA.
- Highest rainfall in Punjab during (1901–2024) was in 1908 when state received 402.7 mm of rainfall against its normal of 152.9 mm with overall excess of 163% followed by year 1976 and 1933 when rainfall was 357.0 mm and 325.9 mm respectively.
- The rainfall during August 2024 was near normal in the state with almost all districts reporting normal rainfall against LPA. District Hoshiarpur, SAS Nagar, Mansa, Bathinda, Fatehgarh, SBS Nagar, Jalandhar, Moga and Ferozpur showed positive departures.
- State experienced couple of heavy (7-11cm) to very heavy rainfall (12 - 20cm) in August 2024 as shown in Tables given below.

September

- State received 42.2 mm of rainfall against its normal of 77.7 mm and was 46% less than of LPA.
- During the last decade rainfall was highest in the year 2018 followed by year 2014 and 2012 wherein state received 205%, 131% and 82% respectively.
- State experienced couple of spells of heavy rainfall (more than 7 cm) during first quarter of September.
- Highest rainfall received in Punjab during September month during (1901–2024) was in year 1950 when state received 431.4 mm of rainfall against its normal rainfall of 89.1 mm which is 484% of LPA followed by 1988 and 1958 when state received 429.6 mm and 368.7 mm of rainfall respectively.

Withdrawal of Monsoon 2024



In view of setting up of North westerly winds over Northwest India and reduction of moisture in water vapour imageries in the region monsoon withdrew from Punjab on 02nd October 2024.

VIGOROUS AND ACTIVE DAYS OF MONSOON SEASON 2024 OVER PUNJAB:

| Date | Monsoon Status |
|-----------|-----------------|
| 27-Jun-24 | VIGROUS |
| 04-Jul-24 | VIGOROUS |
| 06-Jul-24 | ACTIVE |
| 01-Aug-24 | ACTIVE |
| 12-Aug-24 | VIGOROUS |
| 17-Aug-24 | ACTIVE |
| 20-Aug-24 | ACTIVE |
| 27-Aug-24 | ACTIVE |
| 28-Aug-24 | ACTIVE |
| 29-Aug-24 | ACTIVE |
| 30-Aug-24 | VIGROUS |
| 04-Sep-24 | ACTIVE |

District wise Heavy Rainfall Events (June to September) 2024 in Punjab

District wise **Heavy Rainfall(>6cm)**events in June to September 2024 in Punjab

| | DATE | STATION | DISTRICT | RAINFALL(incm) |
|-----------|------------|---------------------|-----------------|----------------|
| JUNE | 06/28/2024 | Khanna | Ludhiana | 9 |
| | 06/28/2024 | Sunam | Sangrur | 8 |
| | 06/28/2024 | Sangrur Aws | Sangrur | 7 |
| | 06/28/2024 | Mahurana Arg | Kapurthala | 7 |
| | 06/28/2024 | Sangrur | Sangrur | 6 |
| | 06/28/2024 | DorahaIrr | Ludhiana | 6 |
| JULY | 07/04/2024 | Payal Rev | Ludhiana | 8 |
| | 07/04/2024 | Dhuri | Dhuri | 7 |
| | 07/04/2024 | Jagraon | Jagraon | 6 |
| | 07/04/2024 | HandiayaHmo | Barnala | 6 |
| AUGUST | 08/01/2024 | Pathankot Iaf | Pathankot | 16 |
| | 08/01/2024 | Taran Taran | Taran Taran | 14 |
| | 08/01/2024 | Phangota | Ropar | 12 |
| | 08/01/2024 | Amritsar | Amritsar | 9 |
| | 08/01/2024 | JandialaIrr | Ludhiana | 9 |
| | 08/01/2024 | Bhuchar Irr | Gurdaspur | 9 |
| | 08/12/2024 | Nangal | Nangal | 11 |
| | 08/12/2024 | Nabha | Patiala | 11 |
| | 08/12/2024 | BhadsonIrr | Patiala | 9 |
| | 08/12/2024 | Nawanshahr | Nawanshahr | 8 |
| | 08/12/2024 | BallowalSaunkri | Gurdaspur | 8 |
| | 08/12/2024 | Anandpur Sahib | Anandpur Sahib | 7 |
| | 08/12/2024 | Ropar | Ropar | 7 |
| | 08/12/2024 | Adampur Arg | Jalandhar | 7 |
| | 08/12/2024 | HalwaraIaf | Ludhiana | 7 |
| | 08/12/2024 | Nabha Arg | Patiala | 7 |
| | 08/12/2024 | Fatehgarh Sahib Arg | Fatehgarh Sahib | 7 |
| | 08/12/2024 | Mahurana Arg | Kapurthala | 7 |
| | 08/12/2024 | Ludhiana Irr | Ludhiana | 7 |
| | 08/12/2024 | Balachaur | Balachaur | 7 |
| | 08/30/2024 | Taran Taran | Taran Taran | 15 |
| | 08/30/2024 | Patti | Patiala | 8 |
| | 08/30/2024 | Aliwal | Ludhiana | 6 |
| SEPTEMBER | 09/04/2024 | Nabha Arg | Patiala | 10 |
| | 09/04/2024 | Anandpur Sahib | Anandpur Sahib | 9 |
| | 09/04/2024 | Patiala | Patiala | 9 |
| | 09/04/2024 | Patiala Aws | Patiala | 7 |
| | 09/04/2024 | Fatehgarh Sahib Aws | Muktsar | 7 |
| | 09/04/2024 | Muktsar | Muktsar | 7 |
| | 09/04/2024 | Rauni Aws | Patiala | 6 |

DISTRICT WISE VERY HEAVY RAINFALL(>12) EVENTS IN JUNE TO SEPTEMBER 2024 IN PUNJAB

| District wise Very Heavy Rainfall events in June to September 2024 in Punjab | | | | |
|--|------------|---------------|-------------|------------------|
| | DATE | STATION | DISTRICT | RAINFALL (in cm) |
| JUNE | - | - | - | - |
| JULY | - | - | - | - |
| AUGUST | 08/01/2024 | Pathankot Iaf | Pathankot | 16 |
| | 08/01/2024 | Taran Taran | Taran Taran | 14 |
| | 08/01/2024 | Phangota | Ropar | 12 |
| | 08/30/2024 | Taran Taran | Taran Taran | 15 |
| SEPT | - | - | - | - |

HEAVY TO VERY HEAVY RAINFALL EVENTS IN HARYANA during Monsoon 2024.

August: In the month of August 2024 three districts of Punjab received heavy to very heavy rainfall spell on 01th & 30th August 2024 respectively.

Monsoon forecast verification

The first stage forecast for the seasonal (June-September) rainfall over the country as a whole issued in April was 104% of LPA with a model error of $\pm 5\%$. The updated forecast issued on 27th May was 106% of LPA with a model error of $\pm 4\%$ of LPA. The actual seasonal rainfall for the country as a whole was 108% of LPA.

Considering the four broad geographical regions of India, the forecasts issued in May for the seasonal rainfall over Northwest India, Central India, Northeast India and South Peninsula were 92-108%, 106%, 94% & 106% of the LPA respectively with model errors of $\pm 8\%$. The actual rainfall over Northwest India, Central India, Northeast India and South Peninsula was 107%, 119%, 086% and 114% of the LPA respectively. Thus, the forecasts of season rainfall over the Central India was underestimated to the actual rainfall, while the forecast for other regions were nearly estimated. Realized rainfall for Haryana was 95% of LPA hence was normal.

Forecast issued and realized rainfall monsoon 2024

| Region | Period | Stage of forecast | Forecast % of LPA | Actual rainfall %LPA |
|-----------|-----------|--|-------------------|----------------------|
| All India | June-Sept | 1 st Stage 15 th April | $>104 \pm 5\%$ | 108% |
| All India | June-Sept | 2nd Stage 27 th May | $106 \pm 4\%$ | |
| NW India | June-Sept | 27 th May | $92-108 \pm 8\%$ | 107% |
| Punjab | June-Sept | - | - | 82% |

EXCESS ,NORMAL AND DEFICIENT MONSOON YEAR IN PUNJAB
(1901-2024)

Punjab (1901-2024)

Monthly and Seasonal (June-September) rainfall anomalies observed during extreme Southwest monsoon years for the period 1901-2024 for Punjab

| Excess Monsoon Rainfall Years | | | | | | Deficient Monsoon Rainfall Years | | | | | | Normal Monsoon Rainfall Years | | | | | |
|-------------------------------|-------|-------|-------|-------|-------|----------------------------------|-------|-------|-------|-------|-------|-------------------------------|-------|-------|-------|-------|-------|
| YEAR | JUN | JUL | AUG | SEP | JJAS | YEAR | JUN | JUL | AUG | SEP | JJAS | YEAR | JUN | JUL | AUG | SEP | JJAS |
| 1908 | -65.5 | 19.7 | 163.4 | -49.1 | 48.4 | 1901 | -77.6 | 11 | -8.4 | -71.8 | -24.7 | 1903 | -88.4 | 36.7 | -22.3 | 67.5 | 10.6 |
| 1909 | -85.7 | 38.5 | 14.6 | 151.3 | 56.6 | 1902 | 20 | -25.4 | -36.6 | -23.3 | -24.7 | 1906 | -13.1 | -40.4 | 13.4 | 114.8 | 11.1 |
| 1910 | 175.4 | -12.7 | 42.1 | -18.2 | 22.7 | 1904 | -50 | -67.6 | -22.4 | -16.4 | -40.3 | 1912 | -76.2 | 8.1 | 30 | -64.3 | -6.2 |
| 1914 | 37 | 77 | -51.2 | 116 | 36.3 | 1905 | -53.9 | -27.1 | -67.4 | 32.2 | -32.1 | 1913 | 113.2 | -32.6 | -4.6 | -75.3 | -17.6 |
| 1917 | 112.9 | 4.9 | 47.4 | 313.1 | 89.7 | 1907 | -48 | -53.5 | 56.7 | -90.8 | -22 | 1916 | -20.8 | 42.2 | 21.3 | -13.2 | 18.3 |
| 1923 | -46 | 35.9 | 86.1 | -86.5 | 21.8 | 1911 | 53.3 | -84.2 | -36.9 | -63.9 | -51 | 1919 | -82.8 | 23.9 | -4.6 | -49.1 | -10.1 |
| 1925 | 159.6 | 79.7 | -4.2 | -85.2 | 25.8 | 1915 | -41.4 | -70.1 | -56.8 | 22.2 | -44.8 | 1922 | 57.3 | -19.9 | -42 | 83.9 | -0.2 |
| 1933 | -0.2 | 9.8 | 105.1 | 129.5 | 65.2 | 1918 | -18.1 | -76.6 | -8.3 | -83.7 | -48.8 | 1924 | -92.3 | 17.7 | -27.5 | 57.9 | -0.4 |
| 1942 | 18.8 | 53.4 | 67.5 | 44.5 | 53.3 | 1920 | -9.7 | -6.2 | -40.1 | -72.2 | -31.2 | 1926 | -86.1 | 12.7 | 51.2 | -36.4 | 7.6 |
| 1945 | -14.4 | -9 | -12.5 | 297 | 49.2 | 1921 | -57.8 | -24.2 | -29.1 | -45.6 | -33.2 | 1927 | -54.3 | 40.4 | -34.9 | -74.9 | -16.8 |
| 1950 | -70.2 | 29.2 | 35.7 | 384.2 | 91.2 | 1928 | -13.6 | -40.7 | -18.5 | -31.5 | -28.7 | 1930 | 32.5 | 60.7 | -60.2 | 6.4 | 5.5 |
| 1956 | 53.8 | 49.2 | -51.6 | -67.8 | 27.5 | 1929 | 10 | 3.6 | -33 | -89.6 | -26.6 | 1931 | -76.3 | 8.5 | 49.2 | -16.7 | 10 |
| 1958 | -36.1 | 13.3 | 5.6 | 327.2 | 67.6 | 1934 | 26.3 | -10 | -13 | -83.5 | -21.9 | 1932 | -51.9 | 26.1 | -3.3 | -67 | -9.3 |
| 1959 | -51.2 | 20.3 | 43.9 | 47.3 | 27 | 1938 | 189.8 | -34.8 | -40.4 | -94.3 | -27.5 | 1935 | -78.1 | 19.8 | -2.7 | -56.7 | -11.7 |
| 1961 | 58.5 | 43.9 | 30.8 | 10.3 | 33.5 | 1939 | 20.4 | -41.1 | -51.7 | -49 | -40.6 | 1936 | 137.5 | 4.6 | 8.9 | -35 | 10.7 |
| 1962 | 1.6 | 10 | -12.5 | 238.7 | 47.4 | 1943 | -28 | -19.5 | -15.2 | -50.1 | -24.8 | 1937 | 38.8 | 36.6 | -82.1 | -19.7 | -15.4 |
| 1975 | 23.9 | 59.3 | 23.3 | 69.7 | 45.6 | 1946 | 58 | -18 | -2.8 | -93.3 | -20.4 | 1940 | 67.8 | -4.7 | 20 | -70.7 | -2.3 |
| 1976 | 62.1 | 17.5 | 113 | -4.1 | 50.3 | 1951 | -93.8 | 22.2 | -26.2 | -91.2 | -26.9 | 1941 | 113.4 | -28 | -3.6 | -53.3 | -11.3 |
| 1977 | 71.9 | 30.9 | 15 | 20.1 | 27 | 1964 | -74.3 | -79.1 | -16.8 | 15.4 | -34.2 | 1944 | -45.9 | 12 | -1.8 | -22.8 | -5 |
| 1978 | 166.9 | 23.3 | 53.5 | -56.1 | 31.1 | 1965 | -99.6 | 11.3 | -47 | -91.9 | -37.9 | 1947 | -93.4 | -56.3 | 21.7 | 206.4 | 18.6 |
| 1980 | 32.2 | 160.1 | -26.7 | -39.5 | 44.6 | 1969 | -89.6 | -42.2 | -31.3 | -17.6 | -37.9 | 1948 | -54.6 | 20.2 | 33.8 | -55.5 | 3 |
| 1984 | 27.7 | 61.1 | 19.2 | 17.8 | 35.2 | 1972 | -48.7 | -5.4 | -17.4 | -76.6 | -27.6 | 1949 | -34.7 | 60.4 | -41.4 | -43.7 | -3.6 |
| 1988 | 0 | 138.9 | 34.5 | 255.3 | 119.1 | 1974 | 138.3 | -37.3 | -40.9 | -90.6 | -36.1 | 1952 | 53.7 | -19.3 | 63.4 | -99 | 0.5 |
| 1990 | 11.7 | 26.1 | 8.5 | 133.9 | 38.9 | 1979 | -1.6 | -7.8 | -68.8 | -58.4 | -38.3 | 1953 | -3.8 | 49.2 | -8.2 | -23.4 | 10.5 |
| 1995 | 11.6 | -6.8 | 88.8 | 78.8 | 44.1 | 1982 | 36.7 | -32.1 | 37.9 | -96.2 | -24.9 | 1954 | -32.6 | 19.5 | -67.2 | 197.9 | 19.5 |
| 1996 | 267.4 | -37.9 | 42.4 | -15 | 19.9 | 1987 | -35 | -81.7 | -46.2 | -93.1 | -67.6 | 1955 | -3.6 | -10.2 | 16.3 | 69.5 | 15.2 |
| 1997 | 97.6 | -3.7 | 87.1 | -62 | 24 | 2002 | -7 | -62.1 | -28.7 | 32.9 | -27.2 | 1957 | -57.4 | 25.4 | 22.7 | 5.3 | 12.8 |
| 1998 | 64.3 | 22.3 | -12.1 | 78.8 | 26.3 | 2004 | 23.8 | -62.5 | -13.9 | -87.6 | -44.1 | 1960 | -10.9 | 48 | 33.6 | -89.7 | 10.8 |
| 2008 | 388.7 | -49 | 46.4 | -44.3 | 20.3 | 2007 | 93.8 | -53.8 | 21.8 | -60.4 | -32.2 | 1963 | -14.7 | -16.6 | 27.4 | -46 | -6.4 |
| 2018 | 101.6 | -18.8 | -3.8 | 104.7 | 20.1 | 2009 | -68.8 | -11.8 | -51.2 | -37.1 | -34.9 | 1966 | 84.6 | -25.4 | 83.3 | -23 | 18.2 |
| | | | | | | 2011 | 140.4 | -54.7 | -3.4 | -85.9 | -27.6 | 1967 | -74.7 | -11.6 | 16.3 | -45.7 | -15.1 |
| | | | | | | 2012 | -77 | -64 | -37 | -18 | -46 | 1968 | -22 | 15.1 | -8.9 | -99.7 | -18.6 |
| | | | | | | 2014 | -53 | -59 | -75 | 16 | -50 | 1970 | 123.6 | -53.9 | 63.9 | -2.6 | 13 |
| | | | | | | 2015 | 9 | -29 | -48 | -24 | -31 | 1971 | 103.3 | 9.7 | 41.2 | -53.7 | 16.8 |
| | | | | | | 2016 | 15.5 | -17.6 | -15 | -80.9 | -25.4 | 1973 | 132.6 | -4.8 | 64.3 | -70.6 | 17.9 |
| | | | | | | 2017 | 147.9 | -49.2 | -29.9 | -33.0 | -21.7 | 1981 | -78.7 | 57.3 | -45.7 | -83.8 | -18.8 |
| | | | | | | 2024 | 29.2 | 89.5 | 153.7 | 42.2 | -28 | 1983 | -2.1 | -6.3 | 27 | -45.9 | -4.4 |
| | | | | | | | | | | | | 1985 | 25.8 | 36.3 | 31.4 | -50.6 | 14.9 |
| | | | | | | | | | | | | 1986 | 301.9 | -17.4 | -14.9 | -31.7 | 6.3 |
| | | | | | | | | | | | | 1989 | -6.2 | 13.2 | -4.1 | -57.3 | -8.1 |
| | | | | | | | | | | | | 1991 | 75.8 | -43 | 0.1 | -48.5 | -19.5 |
| | | | | | | | | | | | | 1992 | -23.8 | -26.5 | 10.1 | -37 | -16 |
| | | | | | | | | | | | | 1993 | -4.5 | 118 | -85.7 | 9.7 | 17.2 |
| | | | | | | | | | | | | 1994 | -15.2 | 14.7 | 35.5 | -20.1 | 12.2 |
| | | | | | | | | | | | | 1999 | 35.7 | 17.9 | -26 | -56.4 | -10.4 |
| | | | | | | | | | | | | 2000 | 66.3 | 3 | -42.2 | -42.3 | -16.1 |
| | | | | | | | | | | | | 2001 | 197.8 | 37.1 | -37.5 | -75.5 | 2.6 |
| | | | | | | | | | | | | 2003 | 48 | 7.8 | -10 | -36.6 | -3.9 |
| | | | | | | | | | | | | 2005 | 14.2 | 5.9 | -48.7 | 8.3 | -11.3 |
| | | | | | | | | | | | | 2006 | 42.1 | -9.1 | -36.8 | -3.5 | -13 |
| | | | | | | | | | | | | 2010 | -16.1 | 11 | -27.5 | -6.8 | -7.8 |
| | | | | | | | | | | | | 2013 | 170.3 | -36.6 | 27.5 | -79.1 | 0.9 |
| | | | | | | | | | | | | 2019 | -50.6 | 4.2 | -2.3 | -15 | -7.2 |
| | | | | | | | | | | | | 2020 | -8.5 | 5.1 | -16.2 | -72.5 | -17.1 |
| | | | | | | | | | | | | 2021 | 49.7 | 174.9 | 70.3 | 143.2 | -7.0 |
| | | | | | | | | | | | | 2022 | 39.7 | 219.3 | 58.4 | 96.5 | -6.0 |
| | | | | | | | | | | | | 2023 | 65.9 | 231.3 | 54.9 | 64.6 | -5.0 |

EVENT OF 11th -12TH AUGUST

SYNOPTIC FEATURES:

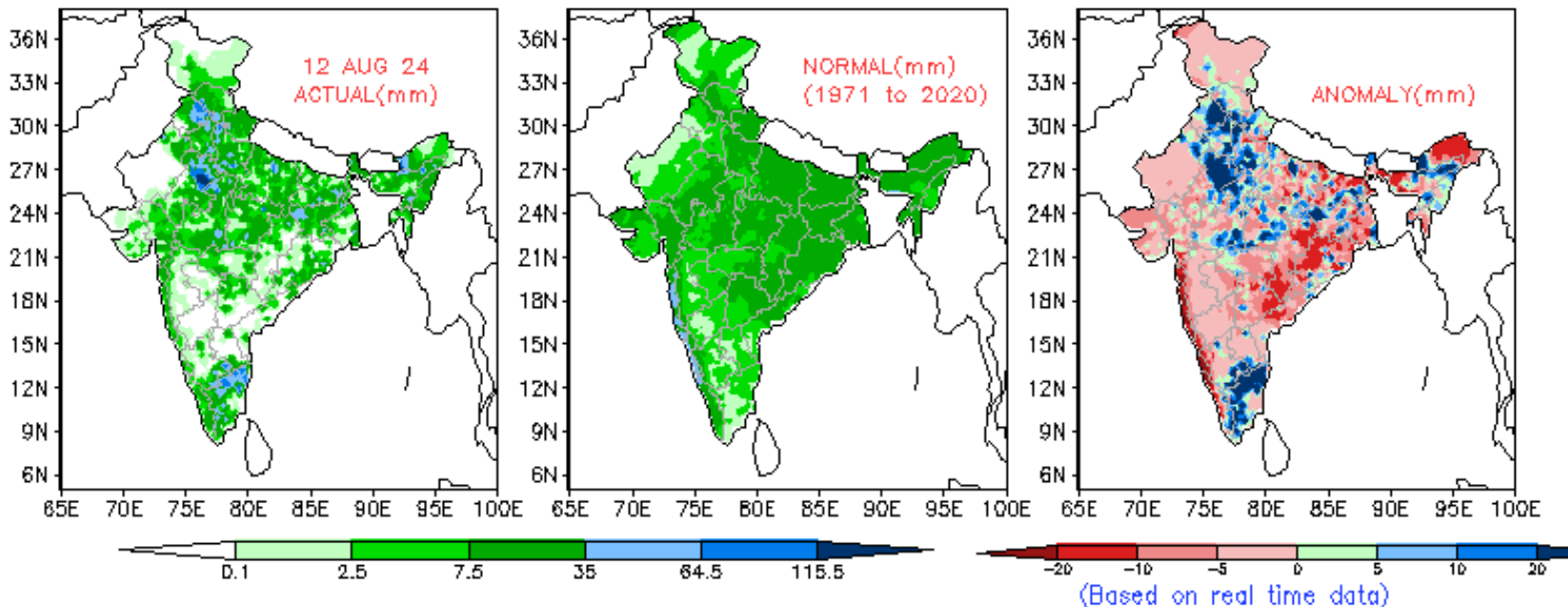
The Monsoon trough at mean sea level was passing through Bikaner, Rohtak, Fatehgarh, Churk, Purulia, Contai and thence east-southeastwards to northeast Bay of Bengal on 10th of August 2024. The cyclonic circulation over northeast Rajasthan and neighbourhood extending upto 5.8 km above mean sea level tilting southwestwards with height persisted. On 11th of August 2024 monsoon trough shifted slightly northward with its axis at mean sea level through Sri Ganganagar, Delhi, Orai, Sidhi, Digha and thence east-southeastwards to northeast Bay of Bengal.

DISTRICT WISE HEAVY RAINFALL EVENTS

| DISTRICT WISE HEAVY RAINFALL EVENTS IN 12 th AUGUST 2024 IN HARYANA | | | |
|--|---------------------|-----------------|-----------------|
| DATE | DISTRICT | STATION | RAINFALL(in cm) |
| 08/12/2024 | Nangal | Nangal | 11 |
| 08/12/2024 | Nabha | Patiala | 11 |
| 08/12/2024 | Bhadson Irr | Patiala | 9 |
| 08/12/2024 | Nawanshahr | Nawanshahr | 8 |
| 08/12/2024 | Ballowal Saunkri | Gurdaspur | 8 |
| 08/12/2024 | Anandpur Sahib | Anandpur Sahib | 7 |
| 08/12/2024 | Ropar | Ropar | 7 |
| 08/12/2024 | Adampur Arg | Jalandhar | 7 |
| 08/12/2024 | Halwara Iaf | Ludhiana | 7 |
| 08/12/2024 | Nabha Arg | Patiala | 7 |
| 08/12/2024 | Fatehgarh Sahib Arg | Fatehgarh Sahib | 7 |
| 08/12/2024 | Mahurana Arg | Kapurthala | 7 |
| 08/12/2024 | Ludhiana Irr | Ludhiana | 7 |
| 08/12/2024 | Balachaur | Balachaur | 7 |

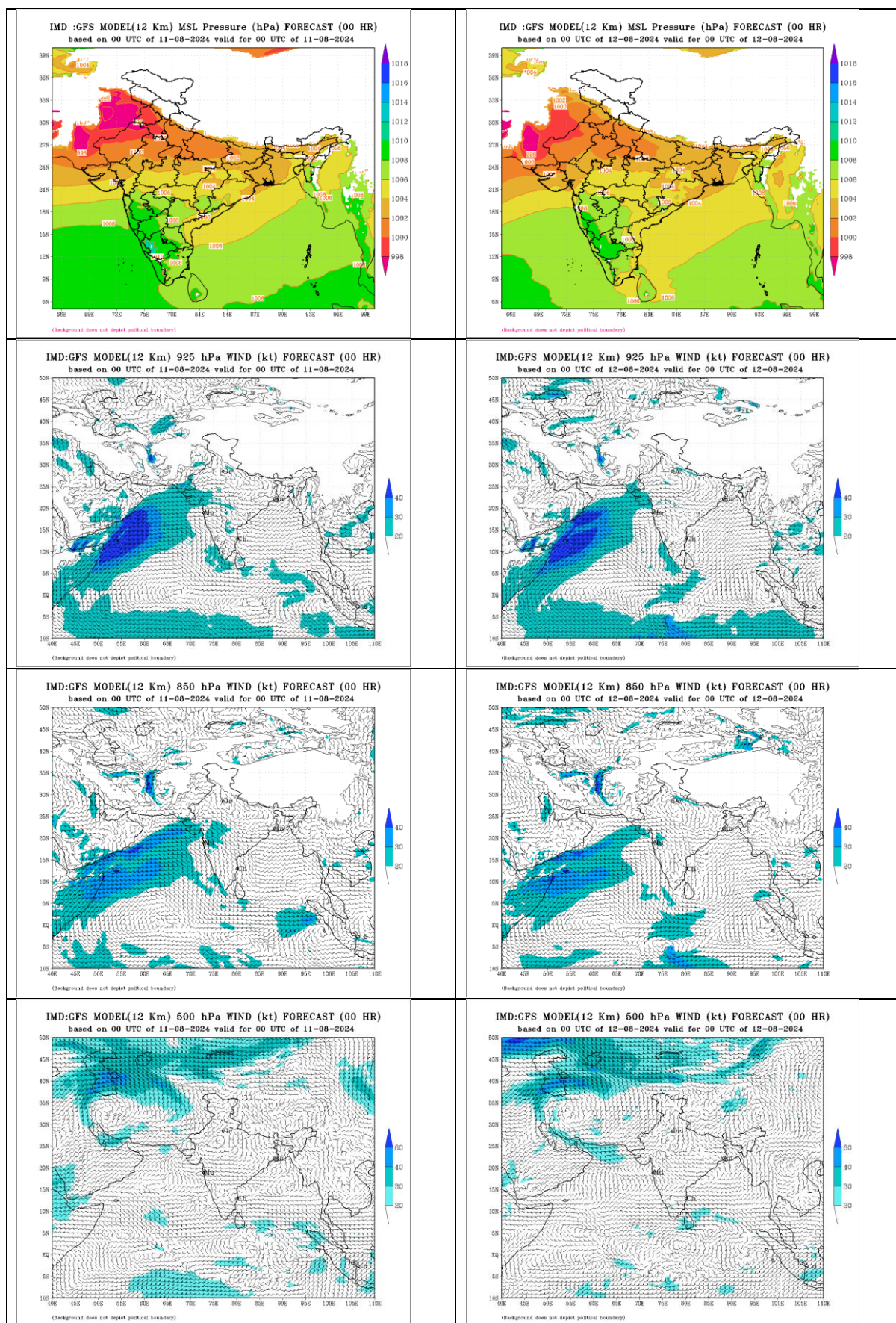
CLIMATE MONITORING AND PREDICTION GROUP

Past 24 hours Rainfall Recorded at 0830 hrs IST on 12 AUG 24



Model Analysis

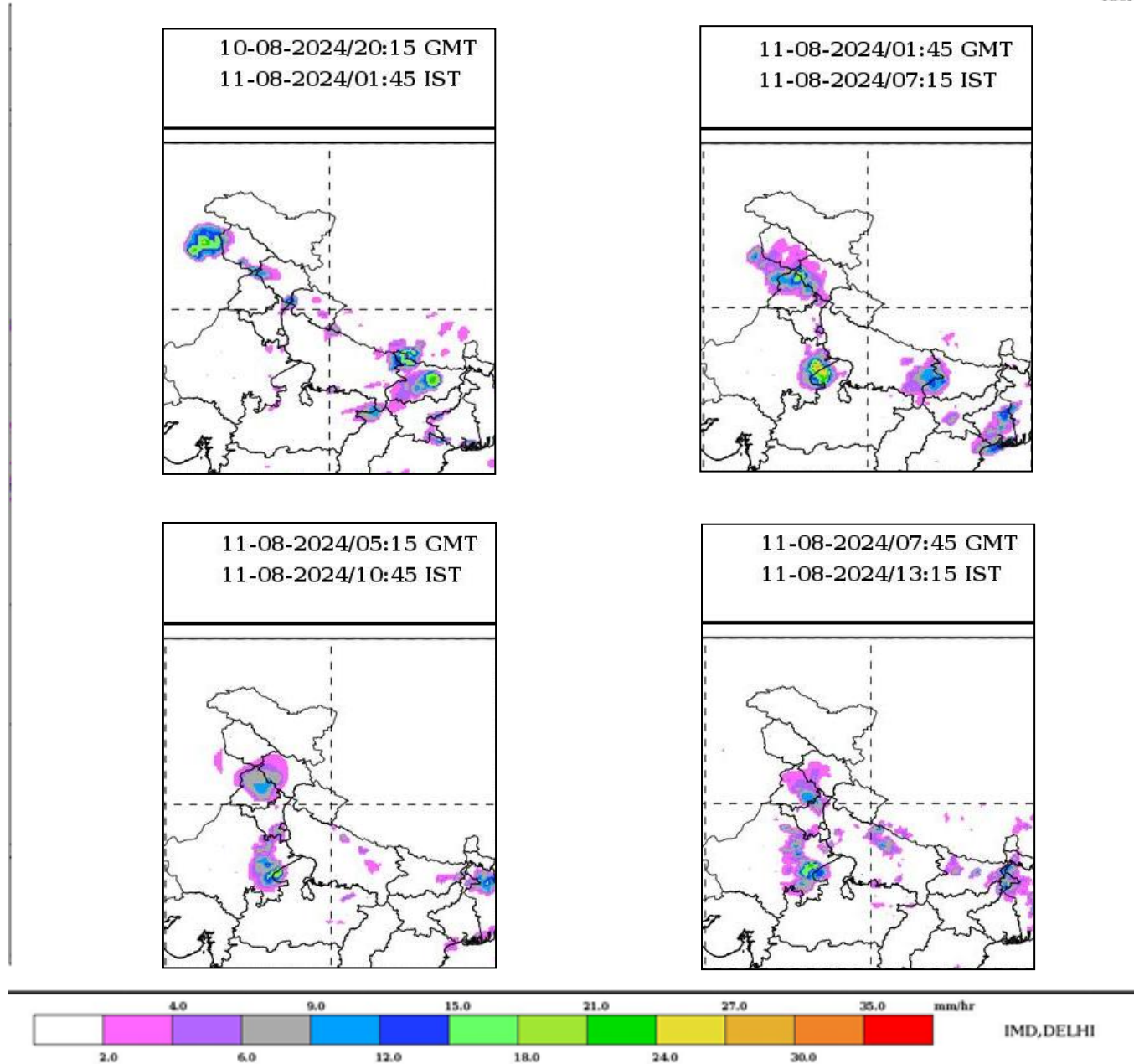
GFS Analysis Charts showing the organization of Monsoon trough during 11th August 2024 and them movement southward on 12th August 2024. Also, during same time moisture flux from Arabian sea associated with somalin jet was high.



Satellite Analysis

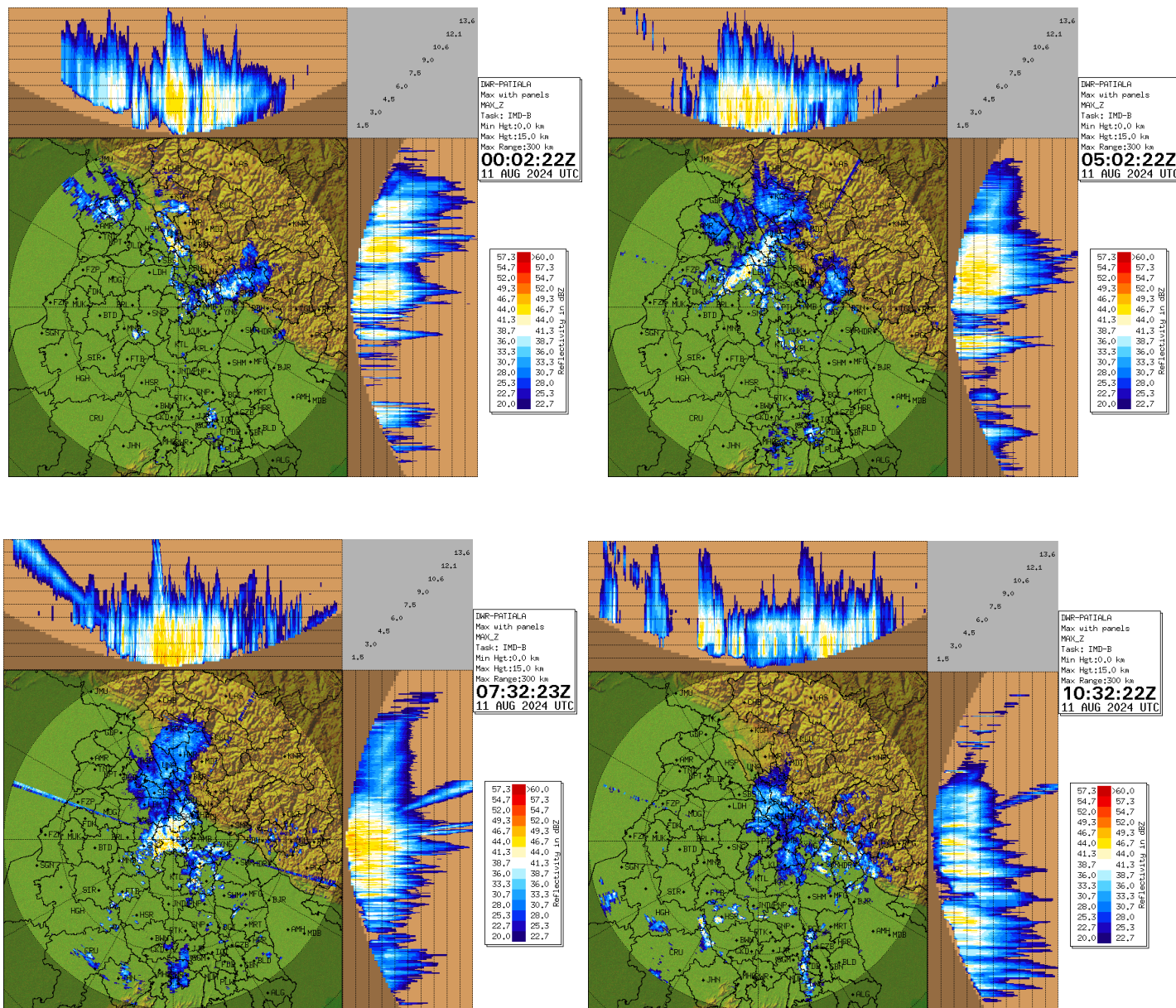
As seen in the satellite imagery Convective cloud mass started developing over North Punjab around 2015 UTC of 10th August 2024 and was at its maximum development around 0145 UTC of 11th August. This cloud mass gradually shifted southeastward along foothills of Himalayas towards Eastern parts of Punjab by 0515 UTC of 11th August.

SAT : INSAT-3DR IMG
INSAT Multispectral Rainfall
L2G GEOPHYSICAL PARAMETER GRIDDED



Radar Analysis:

In Radar Imagery also convection pattern is similar to what was observed in Satellite imagery. Convection was maximum in intensity and distribution around 0730UTC of 11th August with maximum cloud height reaching up to 12-13 km. By 1030 UTC entire cloud mass shifted towards northern parts of Haryana and rainfall over Punjab was significantly reduced.





जारी करने का समय: 1300

भा.स.मा.

दिनांक : 11-08-2024

मौसम चेतावनी पंजाब मौसम संपींचेतावनीएं पंजाब

मौसम चेतावनीबुलेटिन. FS(W)/11/अगस्त 2024

Note: Forecast/Warning for any day is valid from 0830 hours IST of that day till 0830 hours IST of next day

| क्षेत्र | ज़िला | 11-08-24 | 12-08-24 | 13-08-24 | 14-08-24 | 15-08-24 |
|-------------|--------------------------|--|----------|----------|----------|----------|
| | | चेतावनी | चेतावनी | चेतावनी | चेतावनी | चेतावनी |
| MAJHA/माझा | पठानकोट PATHANKOT | भारीतें बहुत भारी भीह HEAVY TO VERY HEAVY RAIN | NIL | NIL | NIL | NIL |
| | गुरदासपुर GURDASPUR | भारीभीह HEAVY RAIN | NIL | NIL | NIL | NIL |
| | अमृतसर AMRITSAR | भारीभीह HEAVY RAIN | NIL | NIL | NIL | NIL |
| | तारनतारन TARN TARAN | भारीभीह HEAVY RAIN | NIL | NIL | NIL | NIL |
| DOABA/दोआबा | होशियारपुर HOSHIARPUR | भारीतें बहुत भारी भीह HEAVY TO VERY HEAVY RAIN | NIL | NIL | NIL | NIL |
| | नवांशहर NAWANSHAHR | भारीतें बहुत भारी भीह HEAVY TO VERY HEAVY RAIN | NIL | NIL | NIL | NIL |
| | कपूरथला KAPURTHALA | भारीतें बहुत भारी भीह HEAVY TO VERY HEAVY RAIN | NIL | NIL | NIL | NIL |
| | जलंधर JALANDHAR | भारीतें बहुत भारी भीह HEAVY TO VERY HEAVY RAIN | NIL | NIL | NIL | NIL |

| ਖੇਤਰ | ਜ਼ਿਲ੍ਹਾ | 11-08-24 | 12-08-24 | 13-08-24 | 14-08-24 | 15-08-24 |
|------------------------|------------------------|----------|----------|----------|----------|----------|
| | | ਚੇਤਾਵਨੀ | ਚੇਤਾਵਨੀ | ਚੇਤਾਵਨੀ | ਚੇਤਾਵਨੀ | ਚੇਤਾਵਨੀ |
| WEST MALWA/ਪੱਛਮੀ ਮਾਲਵਾ | ਫ਼ਿਰੋਜ਼ਪੁਰ FIROZPUR | NIL | NIL | NIL | NIL | NIL |
| | ਫ਼ਾਜ਼ਿਲਕਾ FAZILKA | NIL | NIL | NIL | NIL | NIL |
| | ਫਰੀਦਕੋਟ FARIDKOT | NIL | NIL | NIL | NIL | NIL |
| | ਮੁਕਤਸਰ MUKTSAR | NIL | NIL | NIL | NIL | NIL |
| | ਮੋਗਾ MOGA | NIL | NIL | NIL | NIL | NIL |
| | ਬਠਿੰਡਾ BATHINDA | NIL | NIL | NIL | NIL | NIL |

| ਖੇਤਰ | ਜ਼ਿਲ੍ਹਾ | 11-08-24 | 12-08-24 | 13-08-24 | 14-08-24 | 15-08-24 |
|------------------------|--|--|----------|----------|----------|----------|
| | | ਚੇਤਾਵਨੀ | ਚੇਤਾਵਨੀ | ਚੇਤਾਵਨੀ | ਚੇਤਾਵਨੀ | ਚੇਤਾਵਨੀ |
| EAST MALWA/ਪੂਰਬੀ ਮਾਲਵਾ | ਲੁਧਿਆਣਾ LUDHIANA | ਭਾਰੀ ਤੋਂ ਬਹੁਤ ਭਾਰੀ ਮੀਂਹ HEAVY TO VERY HEAVY RAIN | NIL | NIL | NIL | NIL |
| | ਬਰਨਾਲਾ BARNALA | NIL | NIL | NIL | NIL | NIL |
| | ਮਾਨਸਾ MANSA | NIL | NIL | NIL | NIL | NIL |
| | ਸੰਗਰੂਰ SANGRUR | ਭਾਰੀ ਤੋਂ ਬਹੁਤ ਭਾਰੀ ਮੀਂਹ HEAVY TO VERY HEAVY RAIN | NIL | NIL | NIL | NIL |
| | ਫ਼ਤਹਿਗੜ੍ਹ ਸਾਹਿਬ FATEHGARH SAHIB | ਭਾਰੀ ਤੋਂ ਬਹੁਤ ਭਾਰੀ ਮੀਂਹ HEAVY TO VERY HEAVY RAIN | NIL | NIL | NIL | NIL |
| | ਰੂਪਨਗਰ RUPNAGAR | ਭਾਰੀ ਤੋਂ ਬਹੁਤ ਭਾਰੀ ਮੀਂਹ HEAVY TO VERY HEAVY RAIN | NIL | NIL | NIL | NIL |
| | ਪਟਿਆਲਾ PATIALA | ਭਾਰੀ ਤੋਂ ਬਹੁਤ ਭਾਰੀ ਮੀਂਹ HEAVY TO VERY HEAVY RAIN | NIL | NIL | NIL | NIL |
| | ਐਸ. ਏ. ਐਸ. ਨਗਰ SAS NAGAR | ਭਾਰੀ ਤੋਂ ਬਹੁਤ ਭਾਰੀ ਮੀਂਹ HEAVY TO VERY HEAVY RAIN | NIL | NIL | NIL | NIL |
| | ਮਲੇਰਕੋਟਲਾ MALERKOTLA | ਭਾਰੀ ਤੋਂ ਬਹੁਤ ਭਾਰੀ ਮੀਂਹ HEAVY TO VERY HEAVY RAIN | NIL | NIL | NIL | NIL |



प्रेसविज्ञप्ति

PRESS RELEASE

दिनांक: 11.08.2024

जारी करने का समय: 1500भा.स.मा.

विषय:पंजाब, हरियाणा और चंडीगढ़ में 11अगस्त से15 अगस्त 2024 के दौरान वर्षा गतिविधि के संबंध में।

Subject: Regarding rainfall activity over Punjab, Haryana and Chandigarh during 11TH August to 15th August 2024.

Observed weather at 0830 IST of today over Punjab & Haryana

Light to Moderate rain occurred at few places in Punjab and Haryana. Heavy to very Heavy rain reported from isolated places in Haryana and Punjab

Heavy to Very Heavy rain observed over Nangal Dam (165.0mm) & Anandpur sahib (115.0), ShahKandi (88.7mm) & Pathankot (82.0mm) districts in Punjab and Ambala (120.0mm), Ambala Cantt (98.0mm) & Yamunanagar (85.0mm) districts in Haryana.

मौसम पूर्वानुमानऔर चेतावनी

- पंजाबऔर हरियाणामें 14 और 11अगस्त 2024 को कईस्थानों और 12, अगस्त को कुछ स्थानों 15 और 13परहल्की से मध्यम वर्षा होने की संभावना है।
- चंडीगढ़में 11 अगस्त कोकई स्थानों और उसके बाद कुछ स्थानों पर हल्की से मध्यम वर्षा होने की संभावना है।
- उपरोक्त के प्रभाव में हरियाणा, चंडीगढ़ और पंजाब मेंइस अवधि के दौरान कुछ स्थानों पर गरजचमक की संभावना है।
- को चंडीगढ़ और आसपास के 2024 अगस्त 11क्षेत्रों में भारी से अति भारी वर्षा होने की संभावना है।**
- पंजाब और हरियाणा में 11 अगस्त, 2024 को कुछ स्थानों पर भारी से अति भारी वर्षा हो सकती है।12से 15अगस्त, 2024कोहरियाणा में एक दो स्थानों पर भारी बारिश होने की संभावना है।**
- कृपया इस संबंध में जारी किए गए विस्तृत जिलावार पूर्वानुमान और चेतावनियों को देखें-।पंजाब और हरियाणा के लिए दिन 7-वार मौसम की चेतावनियाँ अनुबंध-में दी गई हैं।

Weather Forecast and Warning –

- Light to moderate rain likely at many places on 11th&14th August and few places on 12th, 13th& 15th over Punjab and Haryana.
- Light to moderate rain likely at many places on 11th August and few places thereafter in Chandigarh.
- Thunderstorm/Lightning likely at isolated places over Punjab, Haryana and Chandigarh during the Period.
- Heavy to Very Heavy rain at isolated over Chandigarh and adjoining areas on 11th August 2024.**
- Heavy to Very Heavy rainfall likely at isolated places on 11th August 2024over Punjab and Haryana. Heavy Rainfall also likely at isolated places on 12th to 15th August over Haryana.**
- Kindly Refer to Detailed District-wise forecast and warnings issued in this regard.Day wise weatherwarnings are given in Annexure-1 for Punjab and Haryana.

(During 11 August 2024 over Parts of Punjab, Haryana and Chandigarh)

| Alert | HEAVY RAIN TO VERY HEAVY RAIN |
|--------------------|---|
| Expected Impacts | <ul style="list-style-type: none"> • Damage to harvested crops lying in open. • Water logging of low-lying areas. • Rise of water level in Rivers and seasonal streams • Closures of some underpasses. • Damage to Weak structures. • Short term Disruptions of Municipal services (Water, Electricity etc) • Traffic congestion due to water logging, slippery roads and low visibility may lead to increased travel time. |
| Suggested Measures | <ul style="list-style-type: none"> • Don't keep harvested crop in open. • Avoid venturing into water logged areas. • Don't stand near weak structures. • Avoid application of Fertilizers and Pesticides. • Drive carefully during rain. • Don't take shelter under trees. • Don't go near water bodies • Avoid taking shelter in weak structures during thunderstorm. <p>During a Thunderstorm event</p> <ul style="list-style-type: none"> • Take safe shelters; do not take shelter under trees. • Unplug electrical/ electronic appliances. • Immediately get out of water bodies. • Keep away from all the objects that conduct electricity. • Farming operations may be suspended during the event. |

EXPECTED IMPACTS AND SUGGESTED MEASURES FOR HEAVY RAINFALL AND THUNDERSTORM/LIGHTNING

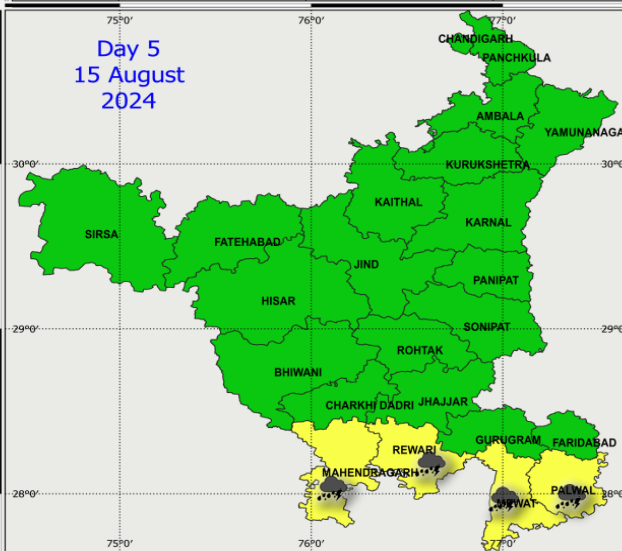
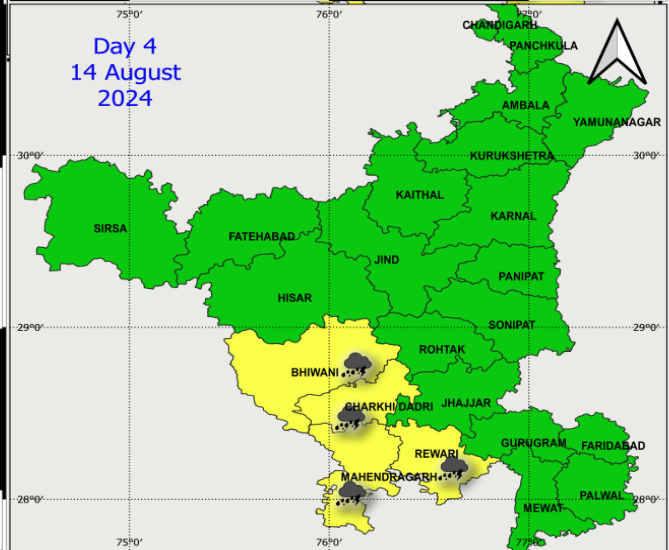
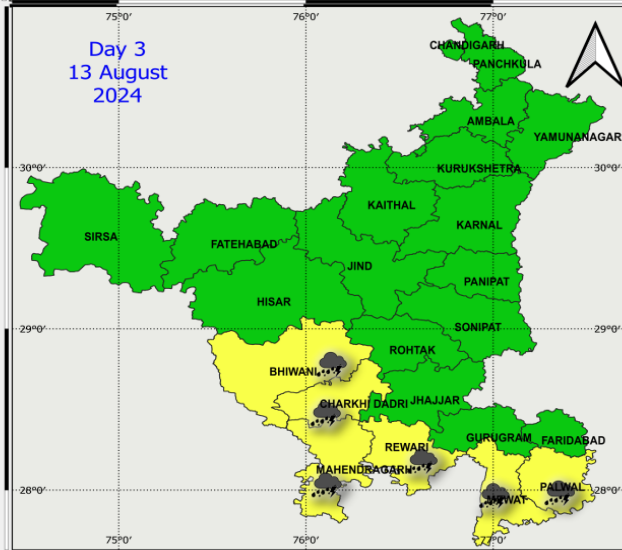
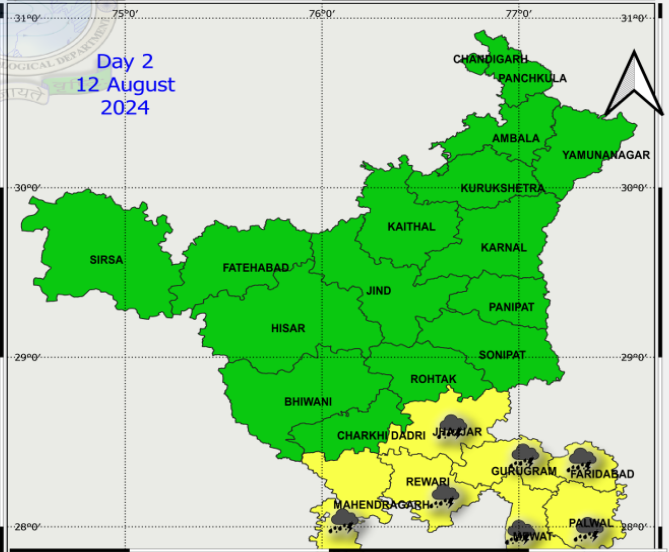
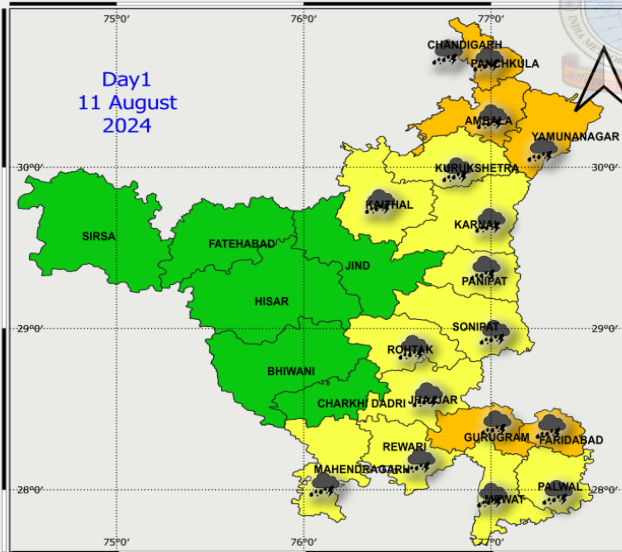
(During 12th to 15th August 2024 over parts of Haryana)

| Heavy Rainfall and Thunderstorm/Lightning | |
|--|---|
| Expected impacts | Suggested measures |
| <ul style="list-style-type: none"> • Damage to harvested crops lying in open. • Water logging of low lying areas. • Short term Disruptions of Municipal services (Water, Electricity etc) • Traffic congestion due to water logging, slippery roads and low visibility may lead to increased travel time. | <ul style="list-style-type: none"> • Don't keep harvested crop in open. • Avoid venturing into water logged areas. • Don't stand near weak structures. • Avoid application of Fertilizers and Pesticides. • Drive carefully during rain. • Don't take shelter under trees. • Don't go near water bodies • Avoid taking shelter in weak structures during thunderstorm. |

(Annexure I)

District wise weather warnings for Haryana Dated 11 August 2024

हरियाणा के लिए जिलेवार मौसम चेतावनी
Note: Warning for any day is valid from 0830 hours IST of that day till 0830 hours IST of next day
किसी भी दिन की चेतावनी उस दिन के 0830 बजे IST से अगले दिन के 0830 बजे IST तक मान्य है



Legend Phenomenon



Heavy rain



Heavy to very heavy rain

Warning Level चेतावनी श्रेणी

 No Warning
कोई चेतावनी नहीं

 Be Updated
निगरानी

 Be Prepared
सचेत(तैयार रहे)

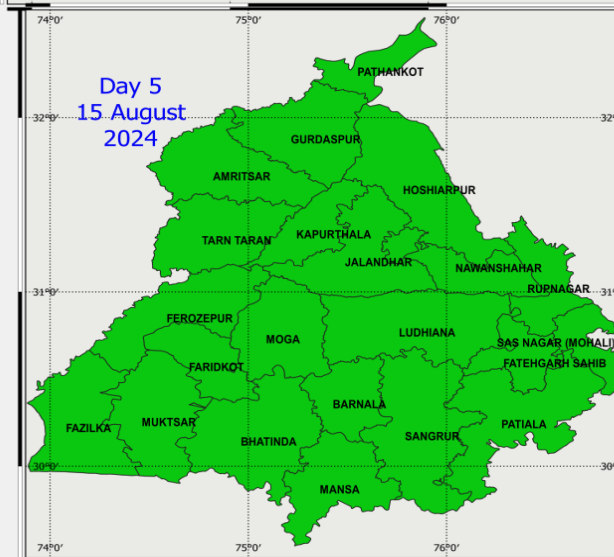
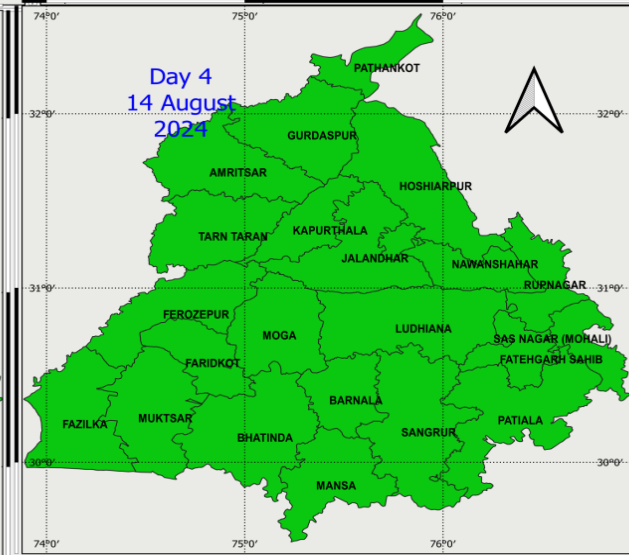
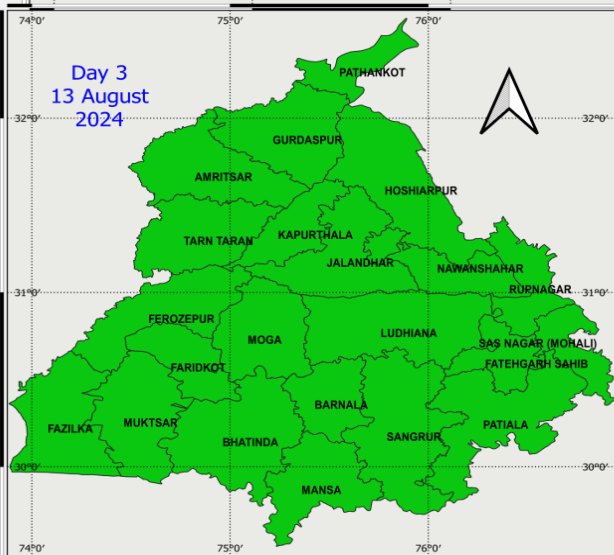
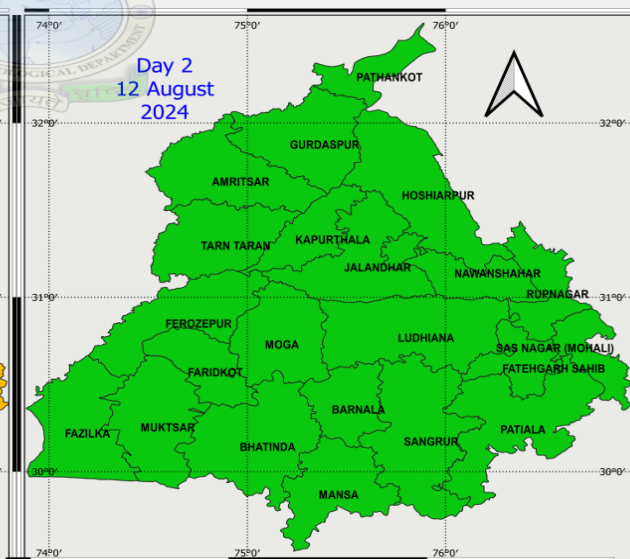
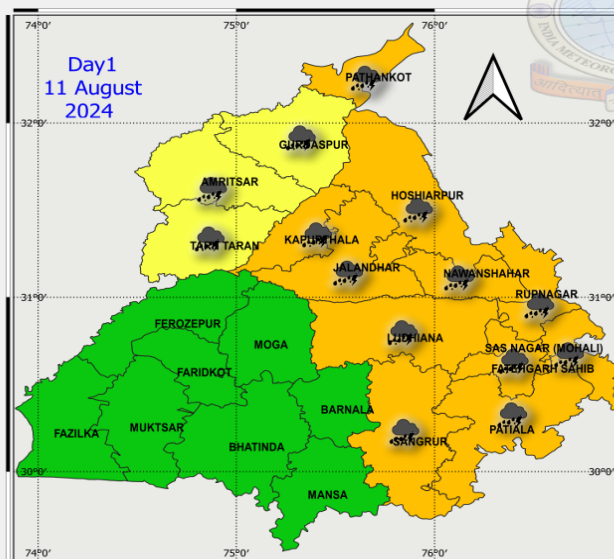
 Take Action
चेतावनी(कार्रवाई करें)

District wise weather warnings for Punjab

Date 11 August 2024

ਪੰਜਾਬ ਦੇ ਲਿਏ ਜ਼ਿਲ੍ਹੇਵਾਰ ਮੌਸਮ ਚੇਤਾਵਨੀ

Note: Warning for any day is valid from 0830 hours IST of that day till 0830 hours IST of next day
ਕਿਸੀ भी दिन की चेतावनी उस दिन के 0830 बजे IST से अगले दिन के 0830 बजे IST तक मान्य है



Legend Phenomenon



Heavy rain



Heavy to very heavy rain

Warning Level ਚੇਤਾਵਨੀ ਸ਼੍ਰੇਣੀ



No Warning

कोई चेतावनी नहीं



Be Updated

निगरानी



Be Prepared

सचेत(तैयार रहे)



Take Action

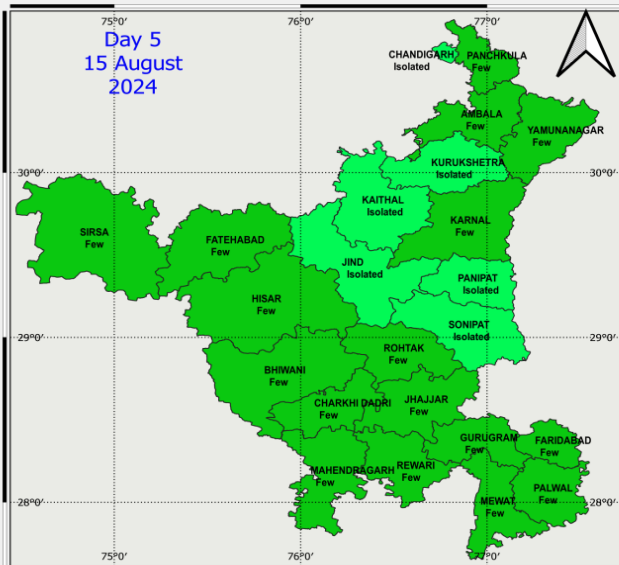
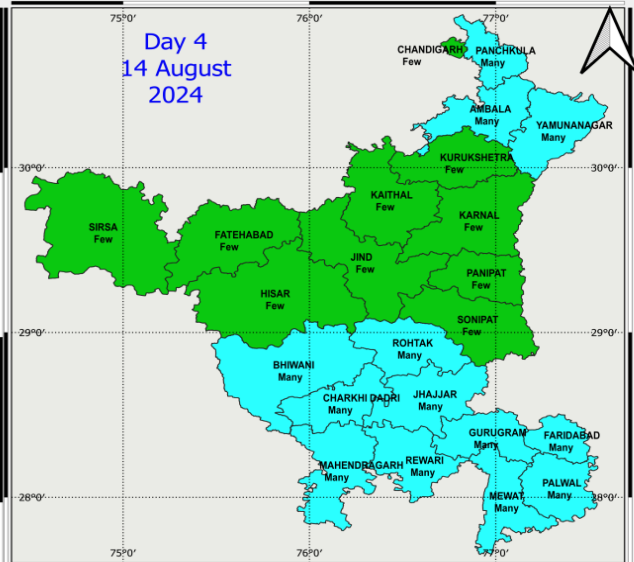
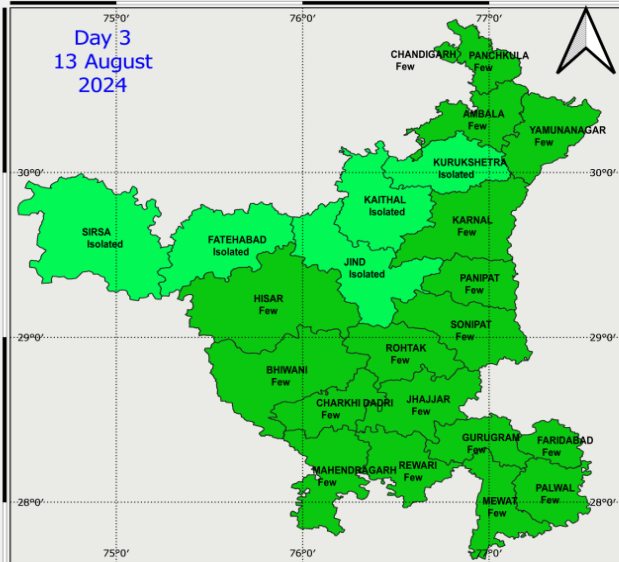
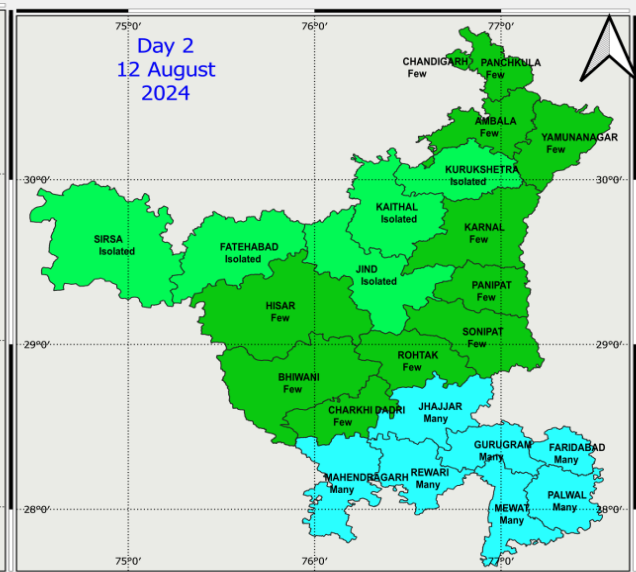
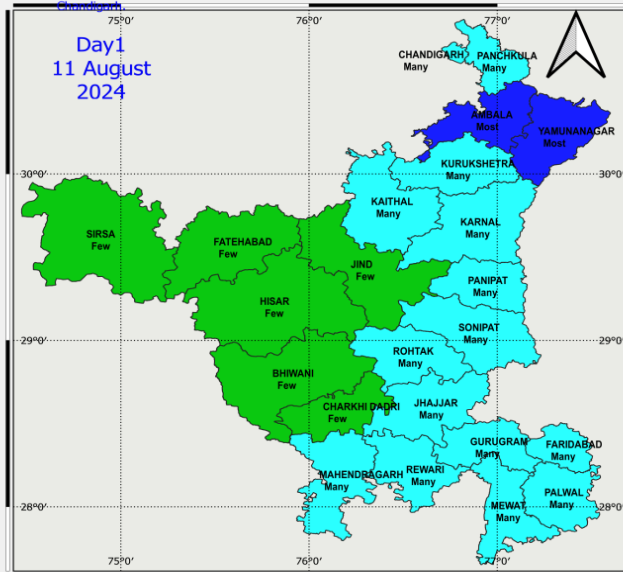
चेतावनी(काइवाई करें)



India Meteorological
Department,
Meteorological Centre,
Chandigarh

District Wise Rainfall Forecast for Haryana Dated 11 August 2024

Note: Forecast for any day is valid from 0830 hours IST of that day till 0830 hours IST of next day



Legend

Spatial Distribution
(Percentage of stations reporting rainfall)

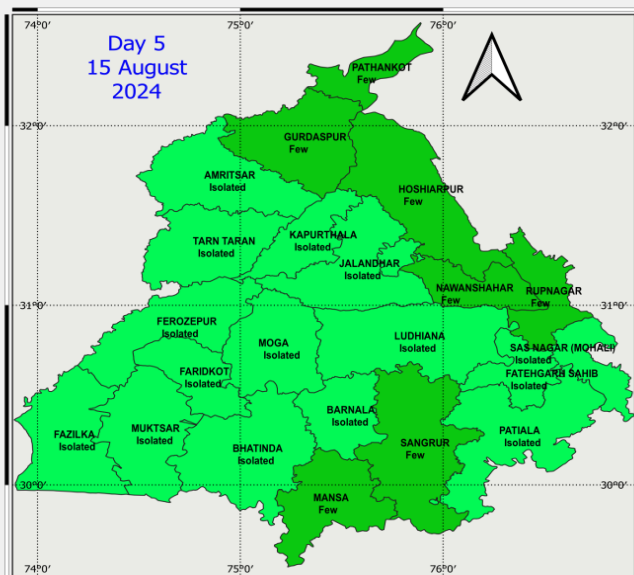
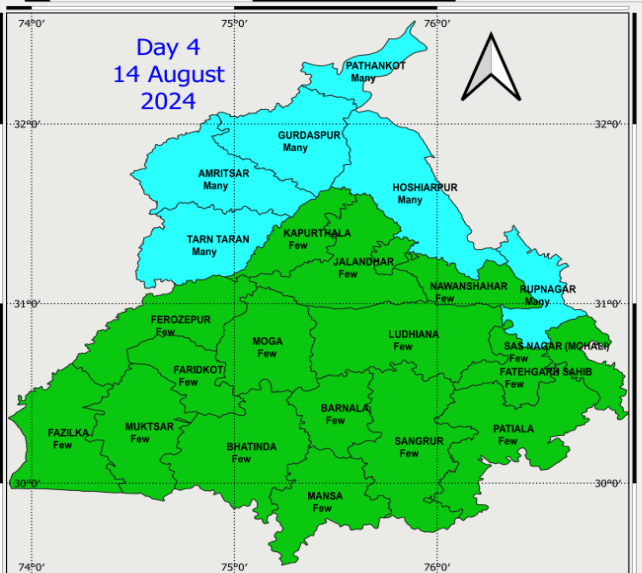
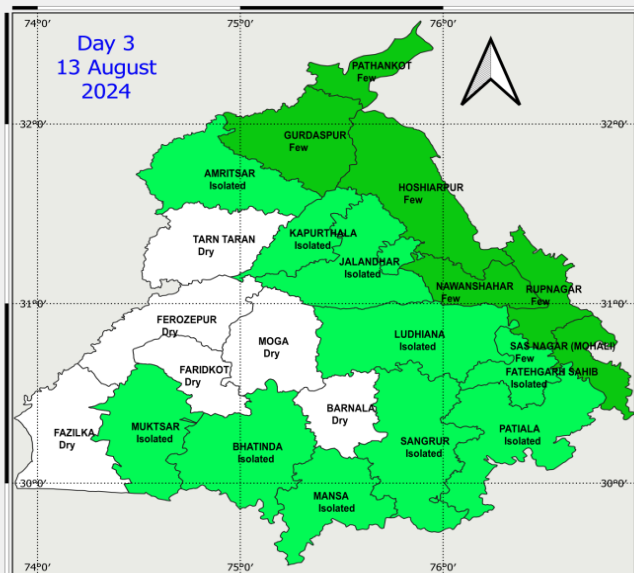
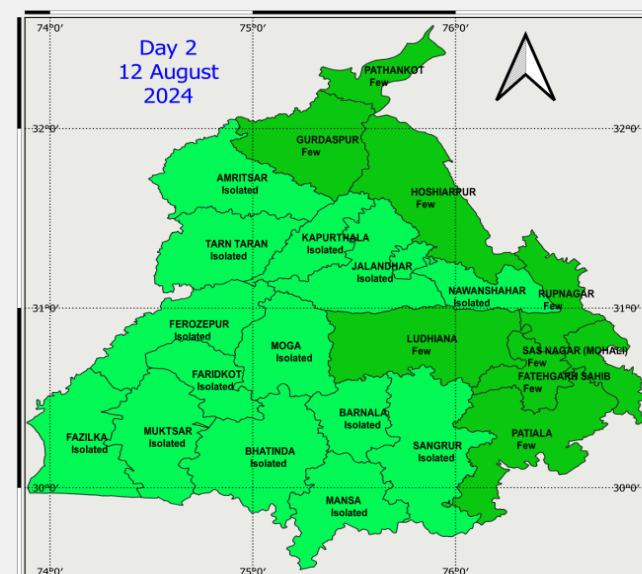
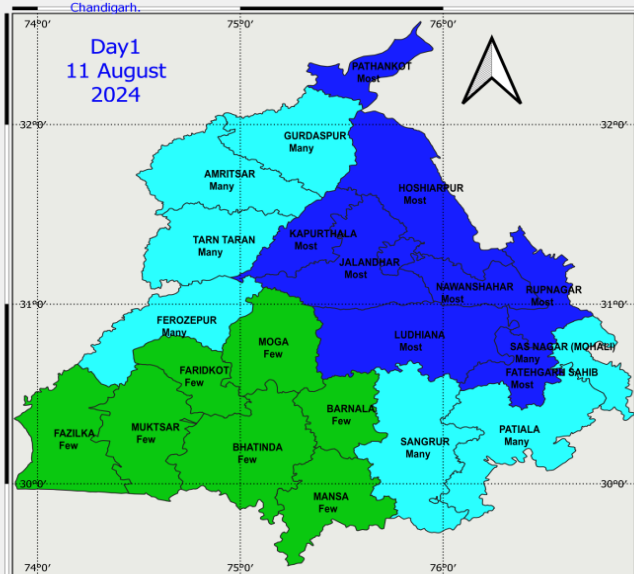
- Dry (No Rain)
- Isolated ($\leq 25\%$)
- Few (25-50 %)
- Many (50-75 %)
- Most (75-100%)



India Meteorological
Department,
Meteorological Centre,
Chandigarh.

District Wise Rainfall Forecast for Punjab Dated 11 August 2024

Note: Forecast for any day is valid from 0830 hours IST of that day till 0830 hours IST of next day



Legend

Spatial Distribution
(Percentage of stations reporting rainfall)

- Dry (No Rain)
- Isolated ($\leq 25\%$)
- Few (25-50 %)
- Many (50-75 %)
- Most (75-100%)

Punjab 2024 rainfall was Deficient. There were 30 Excess monsoon years, 57 Normal monsoon years and 37 deficient monsoon years during the period 1901-2024.

| Descriptive Term used | % Departure of Realised rainfall from Normal rainfall |
|-----------------------|---|
| Large excess | +60% or more |
| Excess | + 20% to +59%. |
| Normal | Between - 19 % to + 19 %. |
| Deficient | Between - 20 % to - 59 %. |
| Large deficient | Between - 60 % to - 99 %. |
| No rain | -100% |

Legends

| Rainfall | | |
|------------------------------------|-------------------|-------------------------------------|
| (Special Distribution of Rainfall) | | |
| Distribution | No. of Places | Description |
| Isolated | One or two Places | <25% of stations gets rainfall |
| Scattered | At a few Places | (26-50)% of stations gets rainfall |
| Fairly Widespread | At many Places | (51-75)% of stations gets rainfall |
| Wide spread | At Most place | (76-100)% of stations gets rainfall |
| Dry | - | No station reported rainfall |

| Intensity of Rainfall | |
|-----------------------|-----------------------------|
| Descriptive Term used | Rainfall amount in mms |
| Very Light Rain | 0.1 - 2.4 |
| Light Rain | 2.5 –15.5 |
| Moderate Rain | 15.6–64.4 |
| Heavy Rain | 64.5 – 115.5 |
| Very Heavy Rain | 115.6 - 204.4 |
| Extremely Heavy Rain | Greater or equal to 204.5mm |

| Weekly/Seasonal Rainfall distribution | |
|---------------------------------------|--|
| (On All India Scale) | |
| Descriptive Term used | % Departure of Realised rainfall |
| Normal | Within ± 10 % of the Long Period Average |
| Below Normal | < 10% of the Long Period Average |
| Above Normal | > 10% of the Long Period Average |

| Weekly/Seasonal Rainfall distribution | |
|---------------------------------------|---|
| (On Regional Scale) | |
| Descriptive Term used | % Departure of Realised rainfall from Normal rainfall |
| Large excess | +60% or more |
| Excess | + 20% to +59%. |
| Normal | Between - 19 % to + 19 %. |
| Deficient | Between - 20 % to - 59 %. |
| Large deficient | Between - 60 % to - 99 %. |
| No rain | -100% |

