Government of India
Ministry of Earth Sciences
India Meteorological Department

Press Release
Date: 30th September, 2021
Time of Issue: 1730 hrs IST

Salient Features of Monsoon 2021

- The southwest monsoon seasonal rainfall during June to September for the country as a whole has been normal (96 -104% of LPA).
- Quantitatively the 2021 all India monsoon seasonal rainfall during 1 June to 30 September 2021 has been 87.0 cm against long period average of 88.0 cm based on data of 1961-2010 (99% of its Long Period Average (LPA)) **Fig.1**.
- The southwest monsoon seasonal (June to September) rainfall over the four homogeneous regions is Normal over Northwest India (96%) and central India (104%). Seasonal rainfall is below normal over East and Northeast India (88%) and above normal over South Peninsula India (111%). Monthly and seasonal total rainfall over four homogeneous regions and all India are given in **Fig.2**
- The southwest monsoon seasonal (June to September) rainfall over the monsoon core zone, which consists of most of the rainfed agriculture regions in the country is above normal (>106% of LPA).
- Out of the total 36 meteorological subdivisions, 20 subdivisions constituting 58% of the total area of the country received normal seasonal rainfall, 10 subdivisions received excess rainfall (25% of the total area) and 6 subdivisions (17% of the total area) received deficient season rainfall **(Fig. 3)**. These 6 Met subdivisions which got deficient rainfall are Nagaland, Manipur, Mizoram & Tripura, Assam and Meghalaya, Arunachal Pradesh, Jammu & Kashmir and Ladakh, West Uttar Pradesh and Lakshadweep (Fig. 3). Out of these six Subdivisions, three lie in northeast India. Two Met Subdivisions which got much higher than normal rainfall in the season are Marathawada and Telangana.
- Considering month to month rainfall variation over India as a whole, the season is very uniquely placed in the historical record for its distinct and contrasting month to month variation. The rainfall over country as a whole was 110%, 93%, 76% and 135% of LPA during June, July, August and September respectively**.**
- The week to week progress of monsoon rainfall over country as a whole and cumulative rainfall in % departure is shown in **Fig. 4** while spatial distribution of monthly rainfall over different Met-Subdivisions is shown in **Fig**. **5**.
- All India rainfall % departure for the months of August and September are shown in **Fig. 6** and **Fig**. **7 respectively.**
- A deep depression formed during 12-15 September and cyclonic storm “GULAB” during 24-28 September. The tracks of the Cyclonic Storm and Deep Depression are shown in **Fig 8.** The number of low pressure systems formed during the season is shown in **Table 1**.
- The formation and movement of the cyclone TAUKTAE, over Arabian Sea (during 14-19 May) and severe Cyclonic storm “YAAS” over Bay of Bengal (during 23 to

28th May) helped to increase cross equatorial flow and the onset of monsoon.

- Subsequent features favored timely advance and monsoon covered entire country over many regions. However, monsoon cover entire country by 13th July against normal date of 8th July.
- In July, the country received slightly below normal rainfall (94% of LPA). The weak monsoon in July was mainly due to absence of any major monsoon disturbance over Bay of Bengal. Absence of such major systems in July (Table 1) also caused the weak monsoon trough. The monsoon trough lay to the north of the normal position or close to the foot hills of Himalayas on many days. It resulted in frequent and prolonged floods over northeastern India, Bihar and adjoining areas of east Uttar Pradesh. At the same time, major parts of central India received deficient rainfall.
- During August, many unfavorable features of monsoon appeared resulting in deficient rainfall for the country (76%). Negative Indian Ocean Dipole unfavorable for Indian monsoon prevailed during this month. Also, the absence of formation of monsoon depression and a smaller number of low pressure area (16-18 & 28-30 August) over Bay of Bengal caused this rainfall deficiency. Normally two monsoon depressions and two low pressure area forms in the month of August. Most of the days monsoon trough was located north of its normal position which cause subdued rainfall over Central Indian Region. Most of the days Madden Julian Oscillation (MJO) was in the phase 8, 1 and 2 which are unfavorable for monsoon rainfall activity. Also, there was less West Pacific Typhoon activity. Normally remnants of westward moving typhoons help to form Low Pressure Systems (LPS) over Bay of Bengal.
- In September, the country as whole received excess rainfall due to many favourable conditions for the monsoon. The negative Indian Ocean dipole weakened during the month of August and at the same time the cold anomaly in the equatorial Pacific strengthened. There was a monsoon depression and a cyclonic storm formed in the month of September. During most of the days MJO was in the phase 3, 4 and 5 which are favorable for monsoon rainfall activity and low pressure system. More West Pacific Typhoon activity and the remnants of these westward moving systems helped to form LPS over Bay of Bengal. All the LPSs followed west/northwestward track causing good rainfall activity, especially over central India and adjoining areas.
- The number of heavy rainfall events during the last five years is given in **Table 2**. 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 2021 given in **Fig 9.** The extremely rainfall events were more realized over Konkan and Madhya Maharashtra, North coastal Karnataka, parts of West Madhya Pradesh, East Rajasthan, south Gujarat, Odisha, coastal West Bengal and isolated places of Uttar Pradesh, Jammu, Himachal Pradesh, Uttarakhand, Bihar, sub-Himalayan West Bengal, Assam & Meghalaya.

Verification of Long Range Forecast:

- The forecast for monsoon onset over Kerala for this year was correct, which is the fifteenth consecutive correct forecast for this event except year 2015 since the commencement of this forecast in 2005. The Forecast date of onset of monsoon over Kerala was 31st May with a model error of ± 4 days and realized date of onset

of monsoon over Kerala was 3rd June.

- The first stage forecast for the season (June-September) rainfall over the country as a whole issued in April was 98% of LPA with a model error of ± 5% of LPA. The forecast was upgraded to 101% of LPA with a model error of ± 4% of LPA in the updated forecast issued in 1st June. The actual season rainfall for the country as a whole was 99% of LPA.

- Considering the four broad geographical regions of India, the forecasts issued in 1st June for the season rainfall over Northwest India, Central India, Northeast India and South Peninsula were Normal (92-108% of LPA), Above Normal (>106% of LPA) , Below Normal (<95% of LPA) & Normal (93-107% of LPA) respectively. The newly introduced seasonal rainfall over Monsoon Core Zone (MCZ) was forecast as Above Normal (>106% of LPA). The actual rainfall over Northwest India, Central India, Northeast India, South Peninsula and Monsoon Core Zone were 96%, 104%, 88%, 111% and 107 % of the LPA respectively. The monthly forecast issued for July and August were overestimated whereas for September was within the range of the forecast. The forecast for the second half of the monsoon season (August – September) for the country as a whole was within the forecast limit. Details of the verification of forecast are shown in **Table 3.**

- This year, IMD had indicated possibility of development of negative IOD over Indian Ocean and ENSO Neutral conditions over the equatorial Pacific Ocean during the monsoon season in its forecasts issued in April and May. The cold ENSO neutral conditions and negative IOD were observed over the equatorial Pacific and Indian Ocean as predicted by IMD.

➢

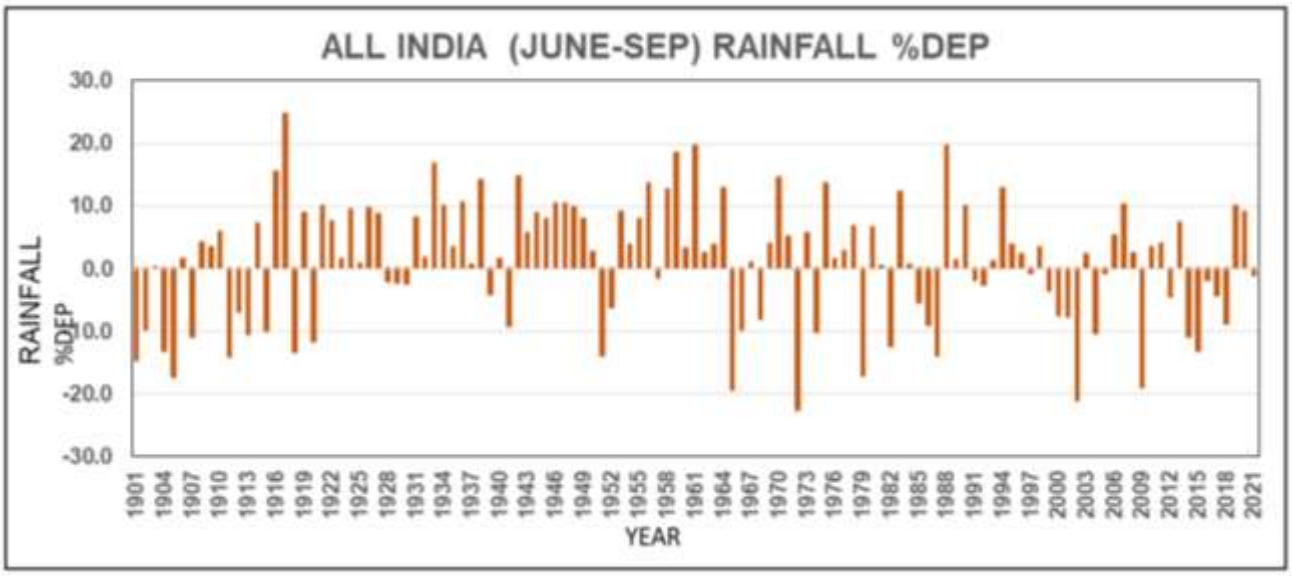


Fig 1. All India seasonal Monsoon rainfall in % departure from normal

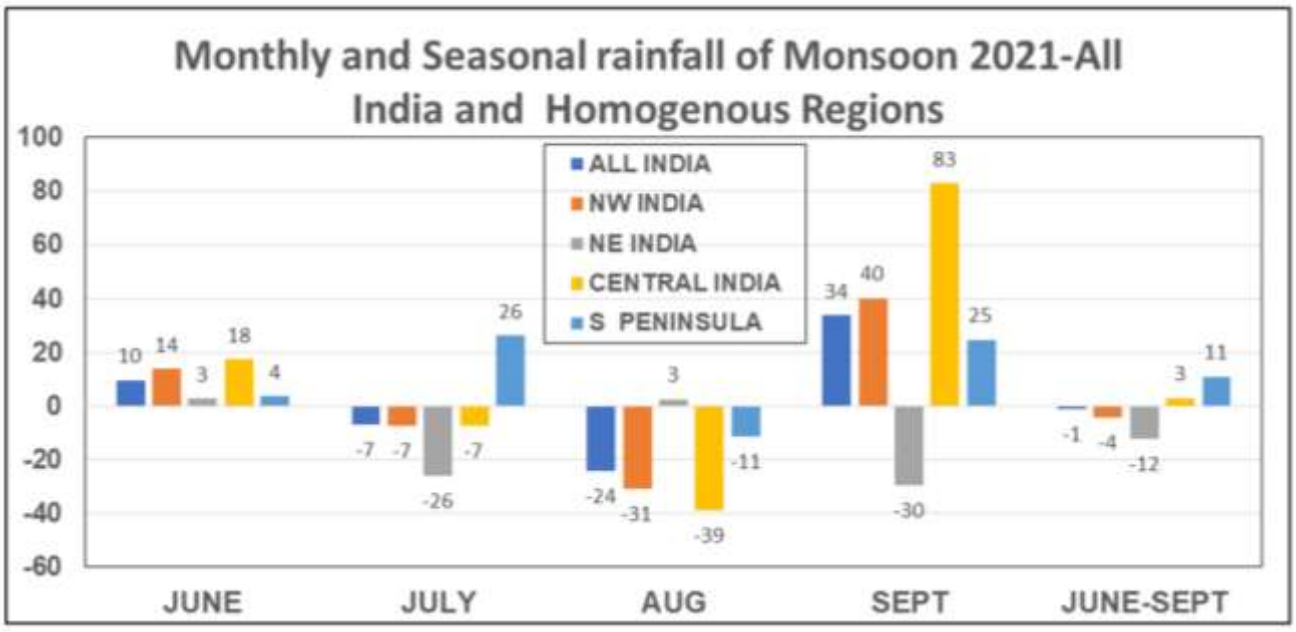
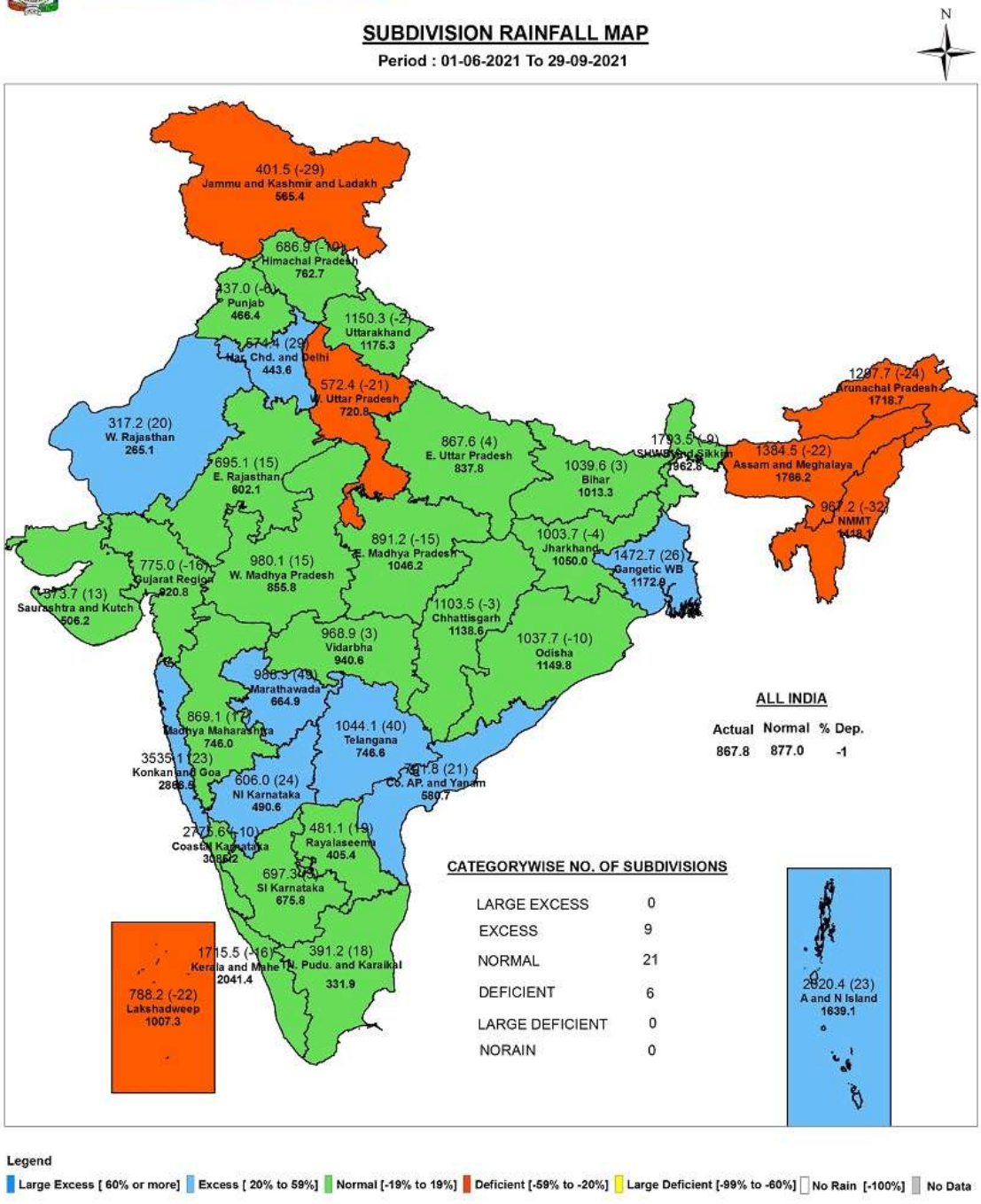


Fig.2. Monthly and seasonal monsoon rainfall of 2021 over Broad homogenous region and Country as a whole in % departure

भारत मौसम विज्ञान विभाग
INDIA METEOROLOGICAL DEPARTMENT

जल मौसम विज्ञान प्रभाग, नई दिल्ली
HYDROMET DIVISION, NEW DELHI



NOTES :
a) RainFall figures are based on operation data.
b) Small figures indicate actual rainfal (mm), while bold figures indicate Normal rainfall (mm).
c) Percentage Departures of rainfall are shown in brackets.

Fig.3. Met-sub-division wise seasonal rainfall of monsoon 2021

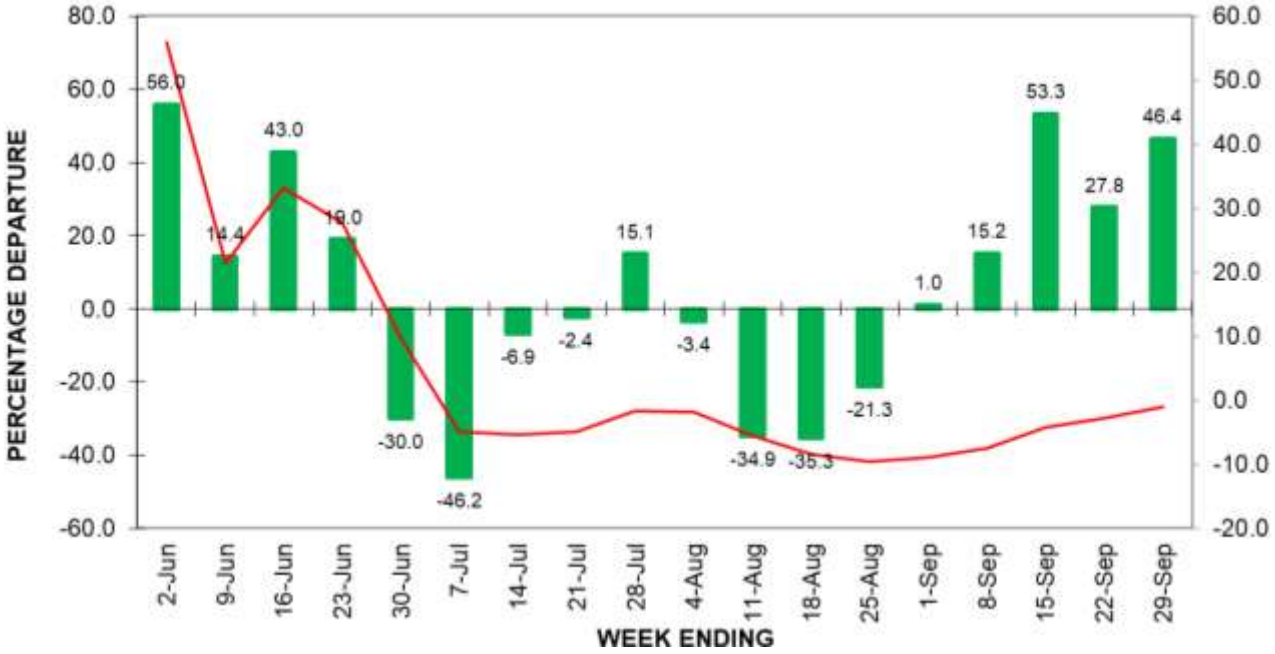


Fig 4. Week by week progress and cumulative rainfall (% departure from normal) over Country as a whole

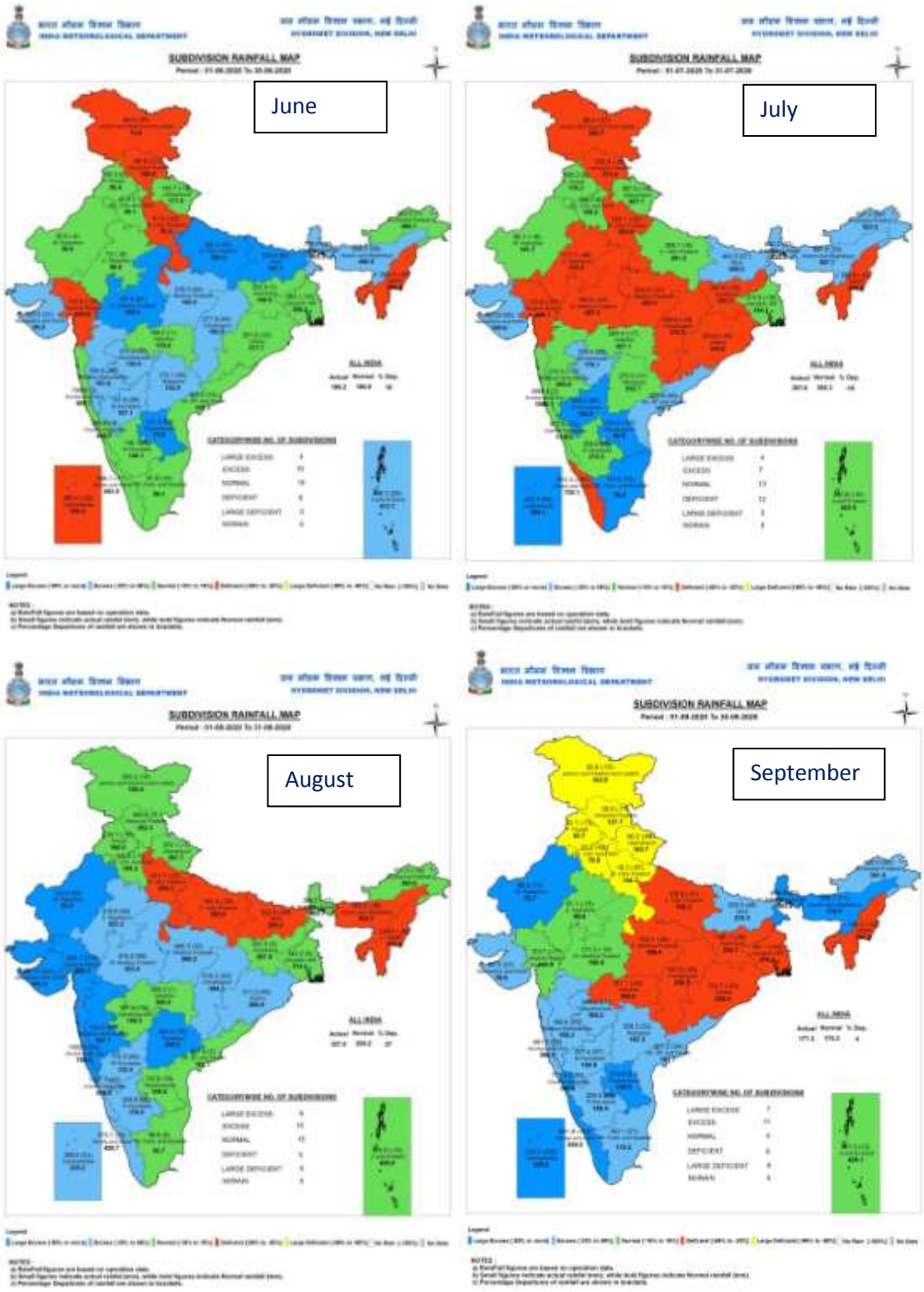


Fig 5: Monthly Met-subdivision wise seasonal rainfall of monsoon 2021

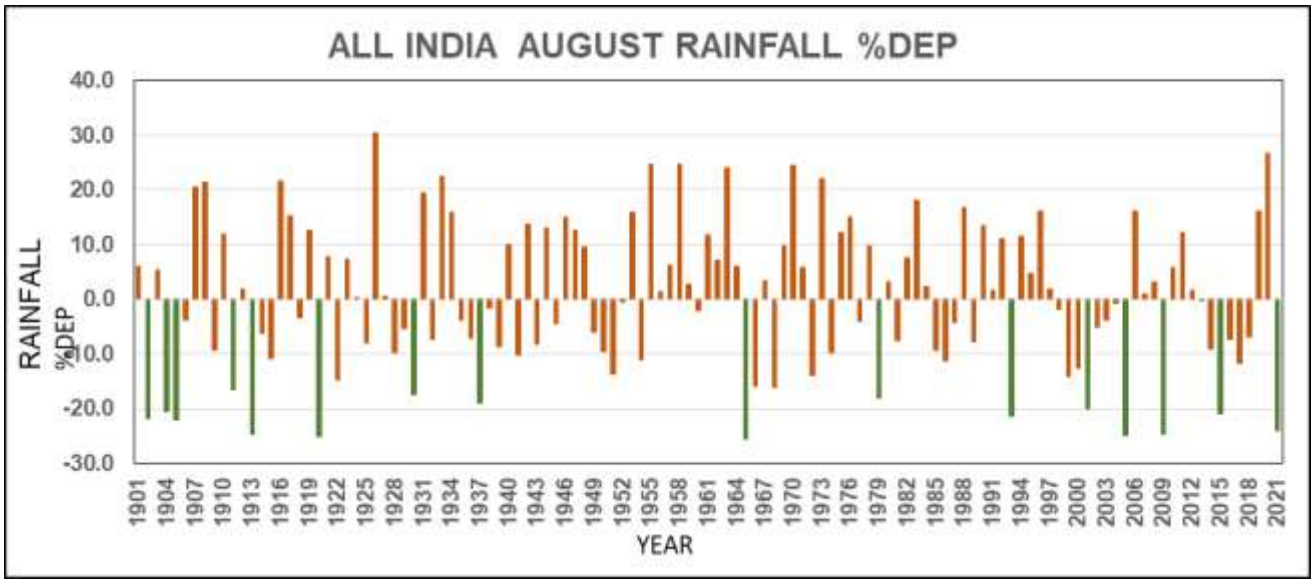


Fig.6. All India rainfall % departure for August during 1901-2021

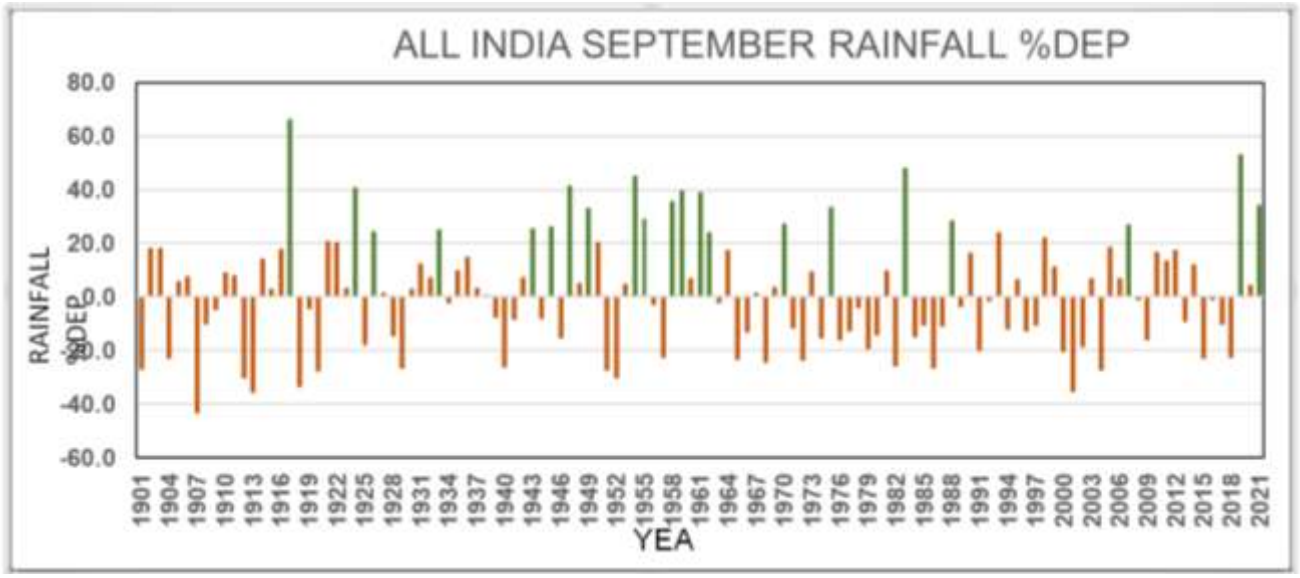


Fig. 7. All India rainfall % departure for September during 1901-2021

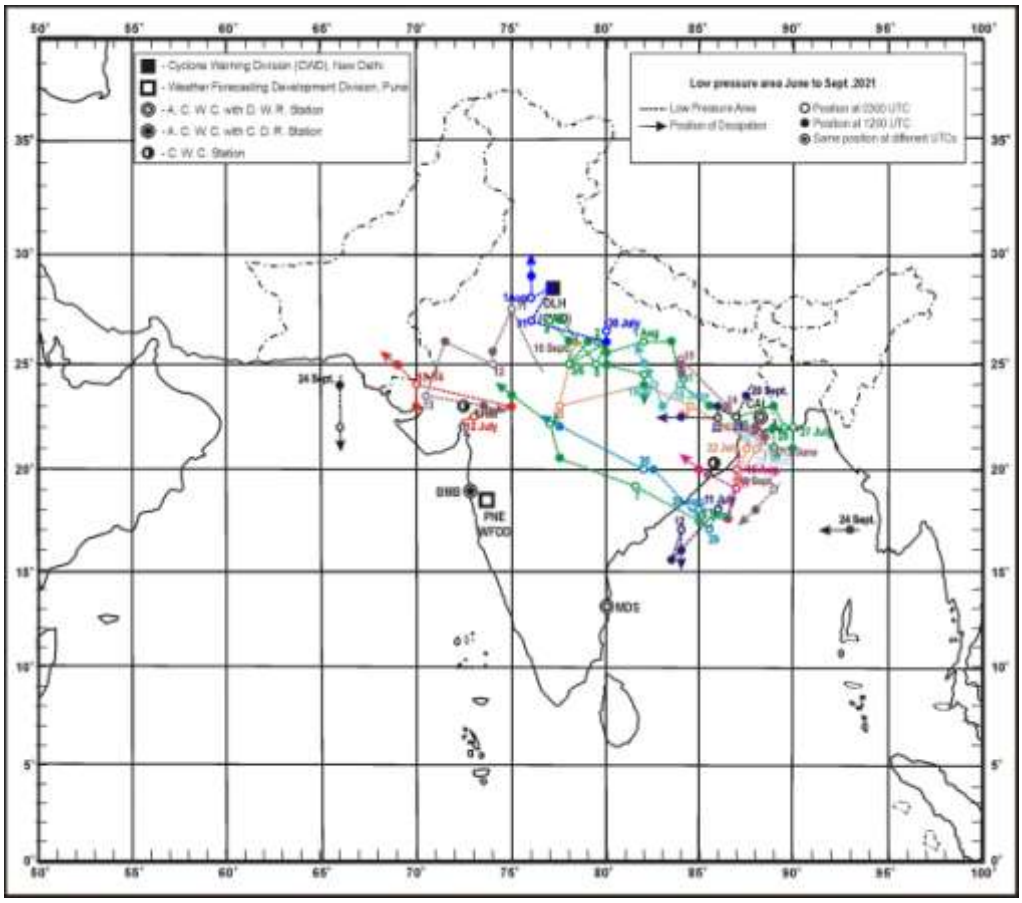


Fig. 8. Tracks of the Cyclonic Storm, Deep Depression and Lows during Monsoon 2021

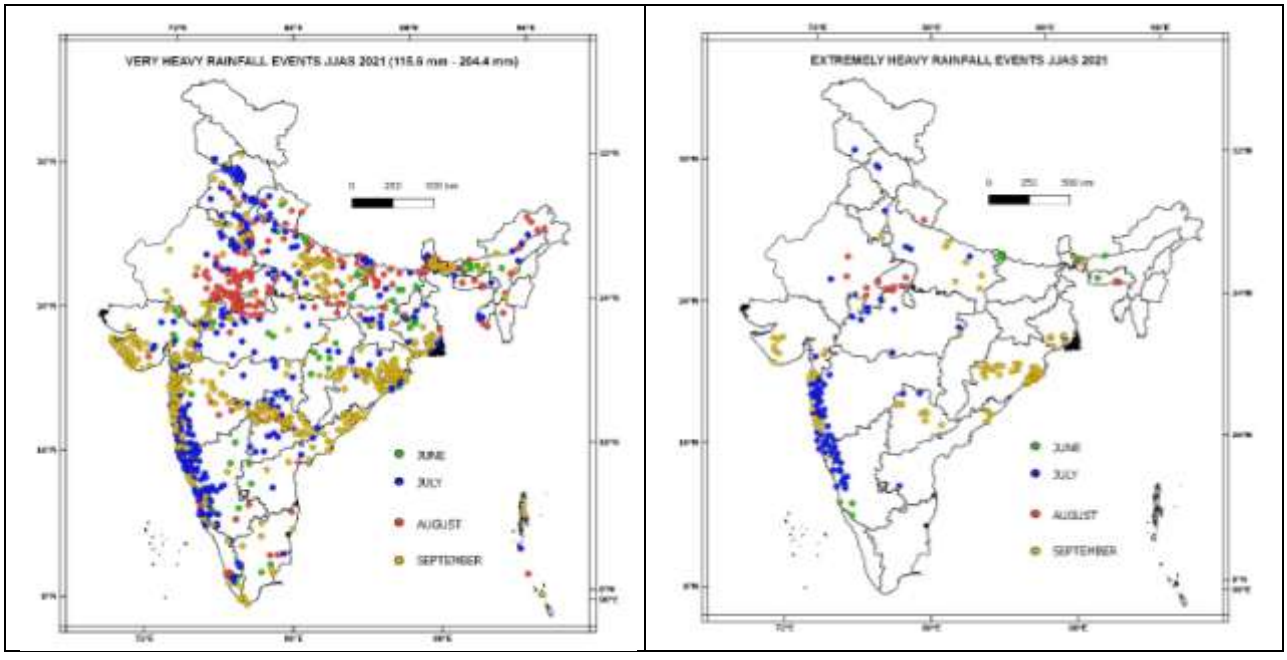


Fig 9. The location of Very Heavy Rainfall (115.6 to 204.4 mm)(left one) and Extremely Heavy Rainfall (more than 204.4 mm) (right one) stations during JJAS 2021.

Table 1: 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 2021

Systems / Month	CS	Deep Depression	Depression	Well-marked low-pressure area	Low-pressure area
June	0	0	0	0	1
July	0	0	0	1	2
August	0	0	0	0	2
Sept.	1	1	1	2	1

Table 2: The number of heavy rainfall events during the last five years

Year	2017		2018		2019		2020		2021	
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	248	36	380	64	211	52	262	36	277	35
Jul	709	106	741	117	753	161	447	90	638	121
Aug	401	90	510	96	987	282	1008	165	272	28
Sep	205	29	229	44	551	59	308	61	449	89
Monsoon	1563	261	1860	321	2502	554	1912	341	1636	273

Table 3: Details of the verification of forecast

Region	Period	Forecast (% of LPA)	Actual Rainfall
			(% of LPA)
		(issued on 16th April)	
All India	June to September	Normal (96-104% of LPA) 98± 5 of LPA	99
		(issued on 1st June)	
All India	June to September	Normal (96-104% of LPA) 101± 4 of LPA	99
Northwest India	June to September	Normal (92-108% of LPA)	96
Central India	June to September	Above Normal (>106% of LPA)	104
Northeast India	June to September	Below Normal (<95% of LPA)	88
South Peninsula	June to September	Normal (93-107% of LPA)	111
Monsoon Core Zone	June to September	Above Normal (>106% of LPA)	107
All India	July (issued on 1st July)	July: Normal (94-106% of LPA	93
All India	August & Aug-Sept (issued on 2nd Aug)	August: Normal (94-106% of LPA	76
		Aug+Sept: Normal (95-105% of LPA)	99
All India	September (issued on 1st Sept)	Above Normal (>110% of LPA)	135