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Government of India
पृथ्वी विज्ञान मंत्रालय (एम. ओ. ई. एस.)
Ministry of Earth Sciences (MoES)
भारत मौसम विज्ञान विभाग
INDIA METEOROLOGICAL DEPARTMENT
Climate Research and Services (CRS)

Climate Summary for the month of July 2023

1. Monthly Rainfall Scenario (01 to 31 Jul, 2023)

During July 2023, country as a whole received 315.9 mm rainfall, which is 13% more than its Long Period Average (LPA) 280.5 mm based on data of 1971-2020. Daily variation of the rainfall over the country as a whole during the month of July 2023 with normal (1971-2020) and All India rainfall percentage departure from normal for July during 1901-2023 is shown in the figure 1(a) and 1(b) respectively.

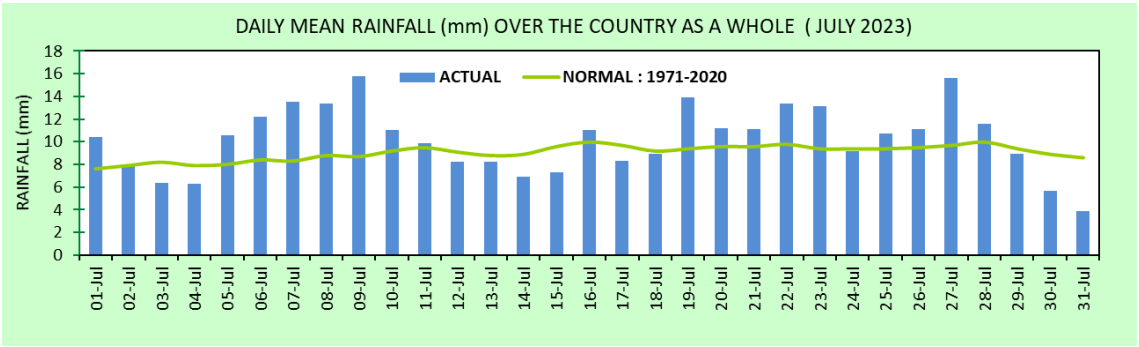


Fig.1 (a): Daily variation of rainfall over the country as a whole during July 2023.

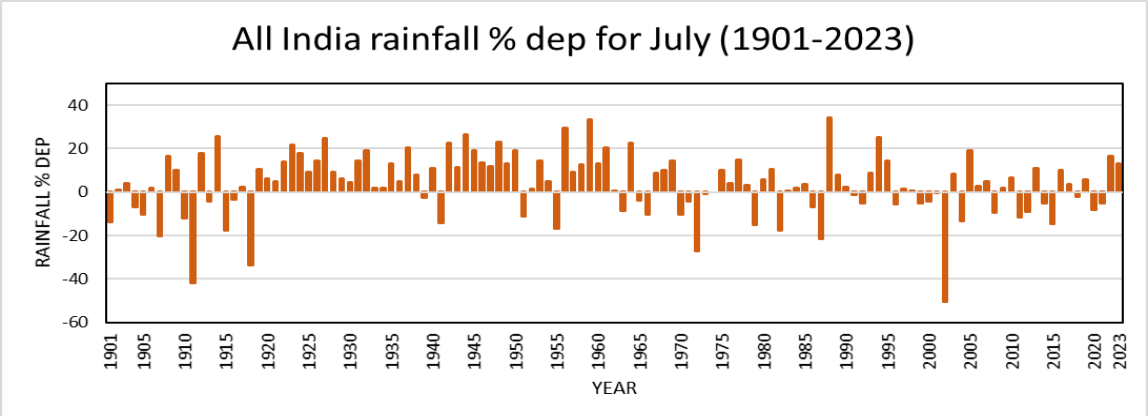


Fig 1(b). The time series of all India monthly rainfall expressed in percentage departure from normal (1971-2020) for July for the period 1901-2023.

Rainfall over homogeneous region of East & northeast India (286.6 mm) was 4th lowest since 1901. Prior lowest rainfall years are 2022 (234.8 mm), 1903 (249.5 mm) and 1973 (284.3 mm). Rainfall over homogeneous region of South peninsular India (295.5 mm) was 8th highest since 1901 after the years 1961 (344 mm), 2022 (327.5 mm), 1959 (322.1 mm), 1988 (305.7 mm), 1989 (301.8 mm), 1924 (301 mm) and 1903 (300.4 mm). The time series of actual rainfall since 1901 for East & northeast India and South Peninsular India is given in Fig. 2(a) and 2(b) respectively.

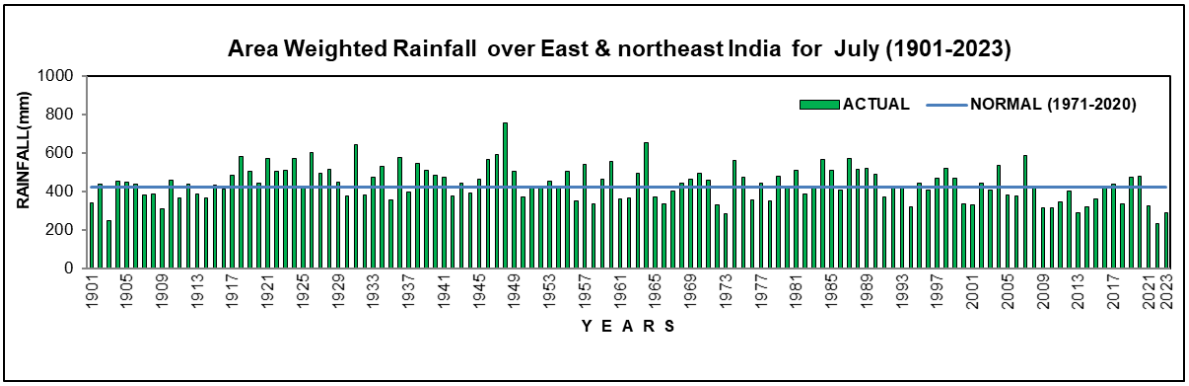


Fig.2 (a): Time series of area weighted rainfall over East & northeast India for July (1901 - 2023)

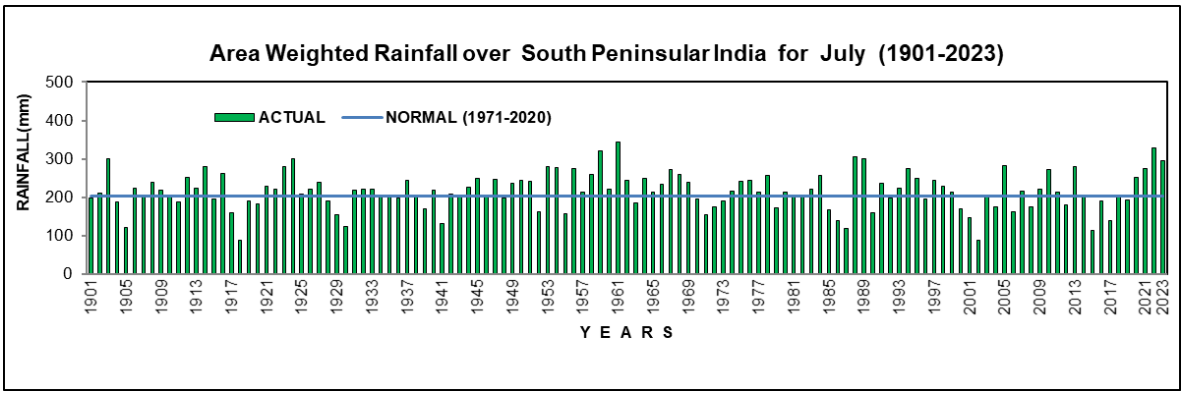


Fig.2 (b): Time series of area weighted rainfall over South Peninsular India for July (1901 - 2023)

The monthly rainfall for July 2023 is given in the table below:

Regions	Actual Rainfall (mm)	Normal Rainfall (mm)	% Departure from LPA
Country as a whole	**315.9**	**280.5**	**13.0**
Northwest India	**261.4**	**209.7**	**25.0**
Central India	**391.4**	**321.3**	**22.0**
South Peninsula	**295.5**	**204.5**	**45.0**
East & northeast India	**286.8**	**424.1**	**-32.0**

During this month, 7 sub division received large excess, 12 excess, 10 normal and 7 deficient rainfall. The rainfall distribution expressed in percentage departure is given in Fig.3.

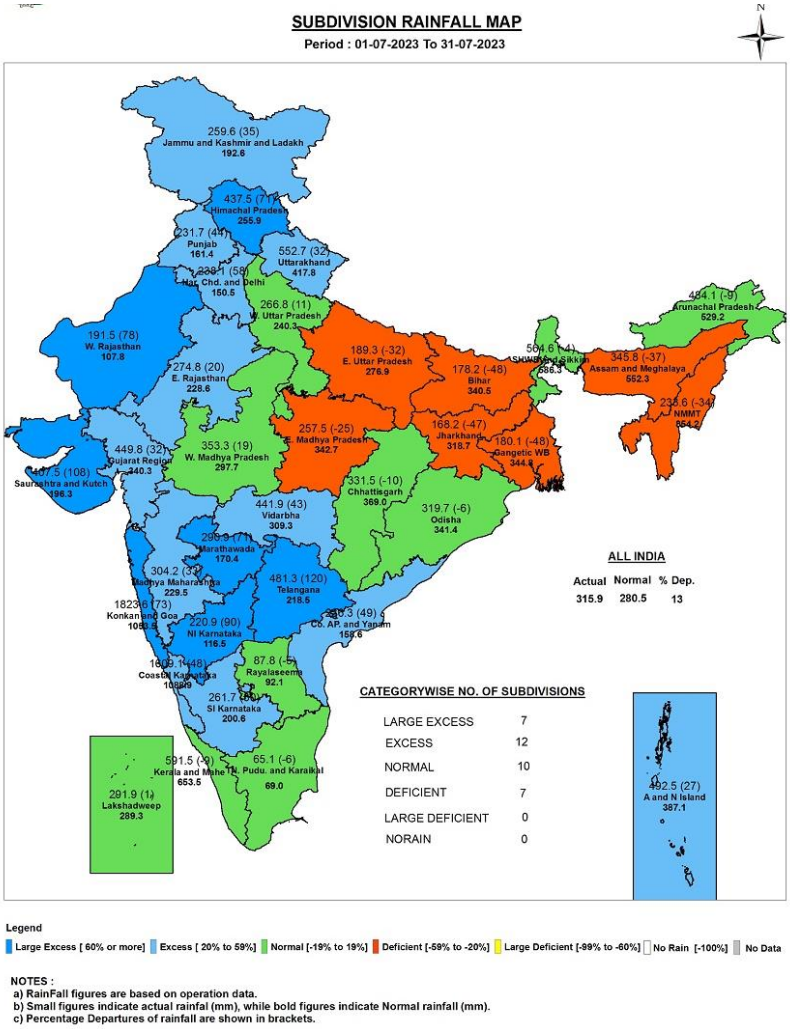


Fig 3: Subdivision-wise rainfall distribution for July 2023.

The observed spatial rainfall, normal rainfall for the period 1971 to 2020 and its departures from normal for the month of July 2023 are given in Fig.4.

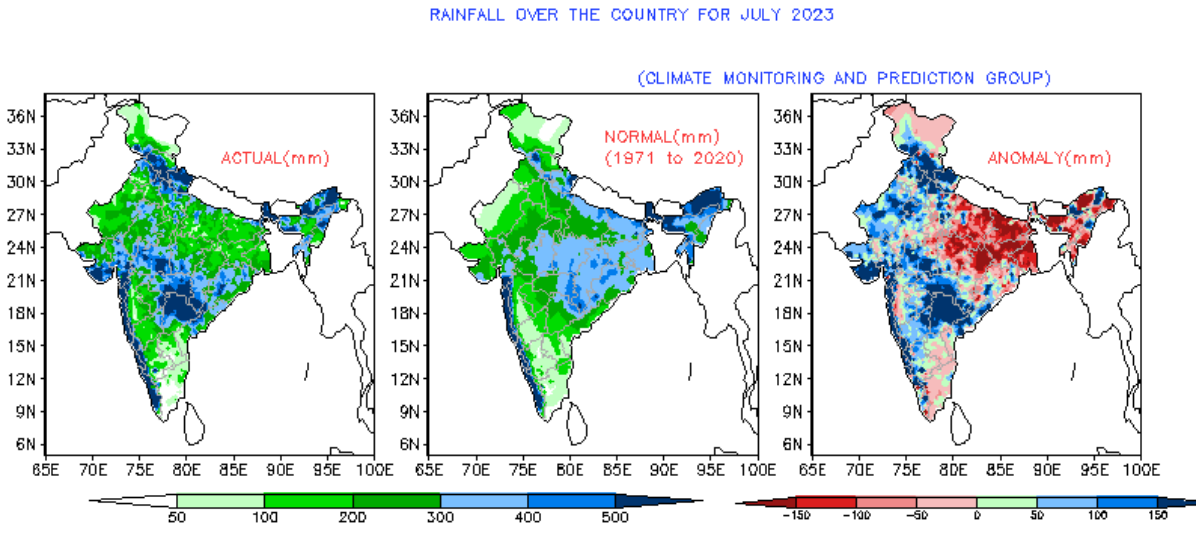
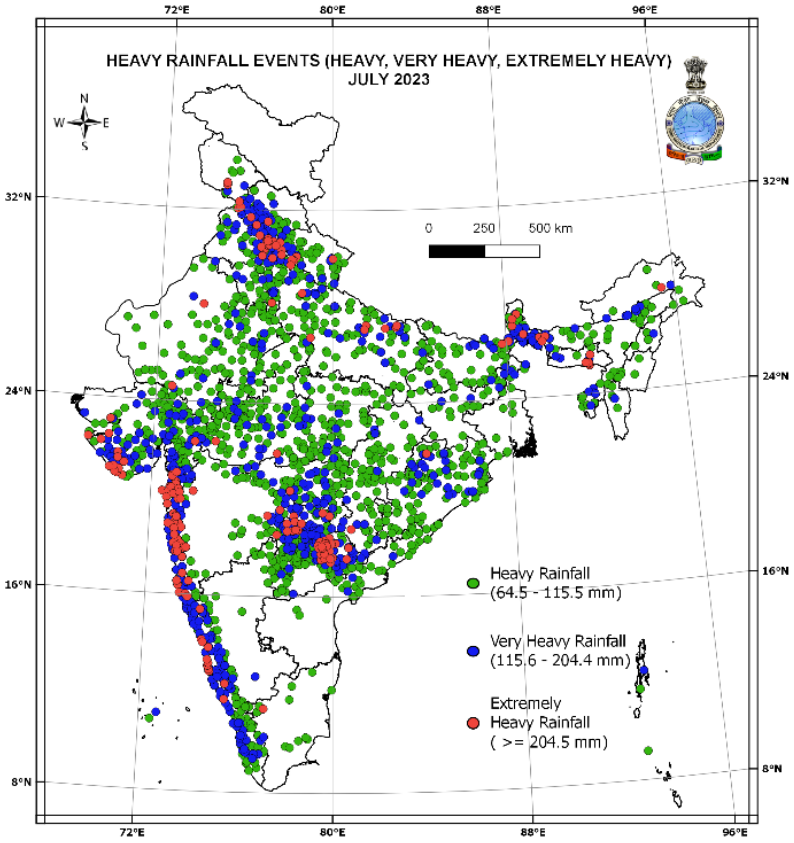


Fig 4: Observed spatial Rainfall pattern for the month of July 2023 over India and their departure from normal (1971 to 2020 period).

2. Frequency of Heavy Rainfall events

The July 2023 witnessed extremely heavy rainfall events (> 204.4 mm of rainfall) mainly from, Konkan & Goa, Telangana, Vidarbha, Haryana, Chandigarh & Delhi, Gujarat Region, Saurashtra & Kutch, Coastal Karnataka, Sub Himalayan West Bengal & Sikkim and Assam & Meghalaya. The location of occurrences of heavy and very heavy rainfall events is shown in the Figure 5. There were total 1817 stations which received heavy rainfall events in July 2023.Out of which, 168 station reported extremely heavy rainfall (> 204.4 mm), 548 station reported very heavy rainfall (115.6 to 204.4 mm) and 1101 stations reported heavy rainfall (64.5 to 115.5 mm of rainfall) during this month.

Country experienced three major Extremely Heavy rainfall Event (>204mm in a day) such as i) 8-13 July over Western Himalayan region and adjoining plains of northwest India; ii)18-28 July over Gujarat, Maharashtra (including over Mumbai), Goa and Karnataka and four Exceptionally heavy rainfall event(>250mm and the new value reported must be a record breaking or near record rainfall at a station or nearby station for the month) such as; i) 9 July 2023 –Chandigarh IMD(Dist Chandigarh)-30cm and adjoining Haryana and Himacha Pradesh- many stations breaking the all time records; ii)18 July- Saurasthra: Sutrapada (dist Gir Somnath) 54, Veraval (dist Gir Somnath) iii) 20 July- Konkan: Raigad (Matheran: 40cm)- Raigada landslide; iv) 27th July- Telangana:Laxmidevipeta (Mulugu)-65, Chityal (dist J. Bhupalpally) 62, Regonda (dist J. Bhupalpally) 47, Ghanpurjskb (dist J. Bhupalpally) 46, Parkal (dist Hanumakonda) 46, Mogullapalle (dist J. Bhupalpally) 43, Mogullapally, Karkagudem-39 each)



(Only highest category of rainfall event considered for a station)

Fig 5: The location of occurrences of heavy rainfall events in the month July 2023.

During July 2023 many stations received record 24 hours accumulated rainfall. The table below shows stations received 24-hour record rainfall and its previous record.

STATION	24 HOUR RECORD RAINFALL IN July 2023(mm)#	DATE	PREVIOUS RAINFALL RECORD(mm)	DATE	STATE
AMBALA	224.1	9	211.7	16-7-2001	Haryana
DELHI RIDGE	134.5	9	124	11-7-2003	Haryana
CHANDIGARH	302.2	9	262	18-7-2000	Chandigarh
BILASPUR SADAR	130	9	103.2	26-7-2012	Himachal Pradesh
MANALI	131.3	9	100	13-7-1993	Himachal Pradesh
PAHALGAM	73.3	8	71.2	27-7-1987	Jammu Kashmir
LEH	17.6	9	17.4	14-7-1980	Jammu Kashmir
KATRA	315.4	19	292.4	31-7-2019	Jammu Kashmir
MAHUVA	302	28	167.9	15-7-1957	Gujarat
VERAVAL	520.2	19	503.8	16-7-2009	Gujarat
YEOTMAL	236.2	22	196.4	28-7-2005	Maharashtra
HANAMKONDA	242.2	27	227.8	13-7-1903	Telangana

based on real time available data

Chief Synoptic weather features observed during July 2023.

During July 2023, total five low-pressure areas were formed. One over Land during 10 - 11 Jul, four low pressure areas over Bay of Bengal, two low pressure areas (during 16 - 17 Jul, 20 - 22 Jul) and two system intensified into well marked low pressure area

during 25-28 Jul, 29- 31 Jul). The low-pressure systems formed during the monsoon season contribute heavy and very heavy rainfall over many parts of the country. The figure 6 shows number of low-pressure systems developed during June from 2000 to 2023.

In addition to this, a total of 4 number of western disturbances (WD) (5-11, 13-18 20-23 and 28-31 July), affected the weather over north India during July 2023.

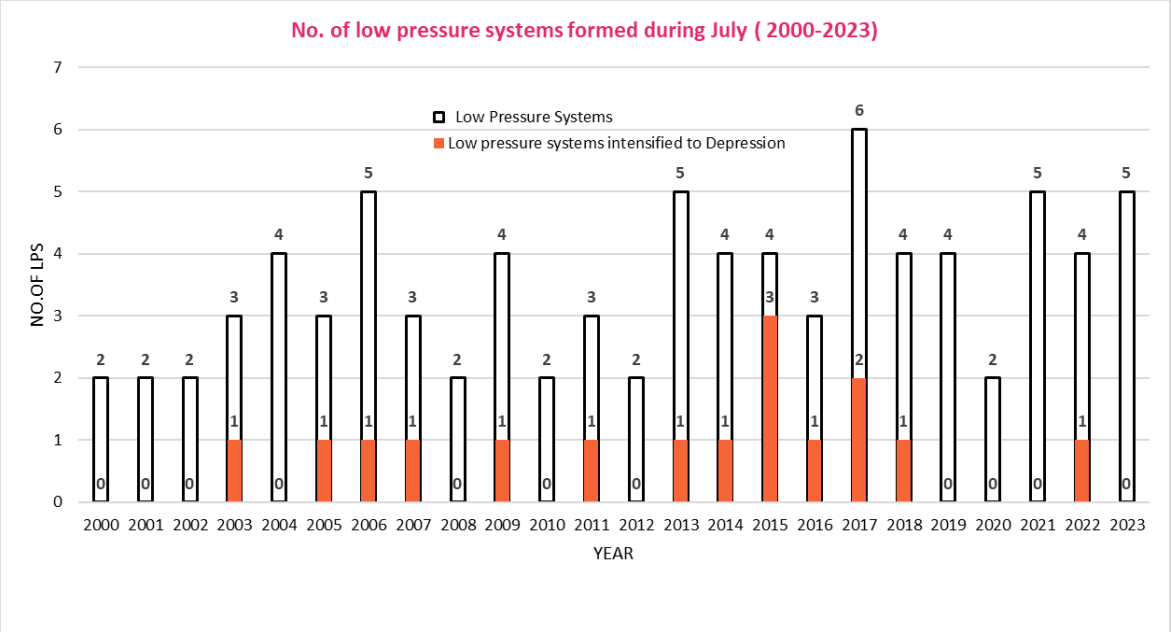


Fig 6: Number of low-pressure systems during July from 2000 to 2023

5. Characteristics of Temperatures for the month of July 2023

The average maximum, average minimum and mean temperature for the country as a whole during July 2023 are 31.91 ºC, 24.90 ºC and 28.40 ºC respectively, against the normal of 31.62 ºC, 24.33 ºC and 27.98 ºC based on period 1981-2010. Thus, the average maximum temperature, average minimum temperature and mean temperature are above normal by 0.29 ºC, 0.57 ºC and 0.43 ºC respectively for the country as a whole. The climatological data based on the period of 1981 to 2010 are used to calculate the normal and hence the anomaly (Actual average temperature in 2023 - normal temperature based on data of 1981-2010). The daily variation of maximum and minimum temperature anomaly over the country as a whole for July 2023 is shown in the figure 7(a) and (b).

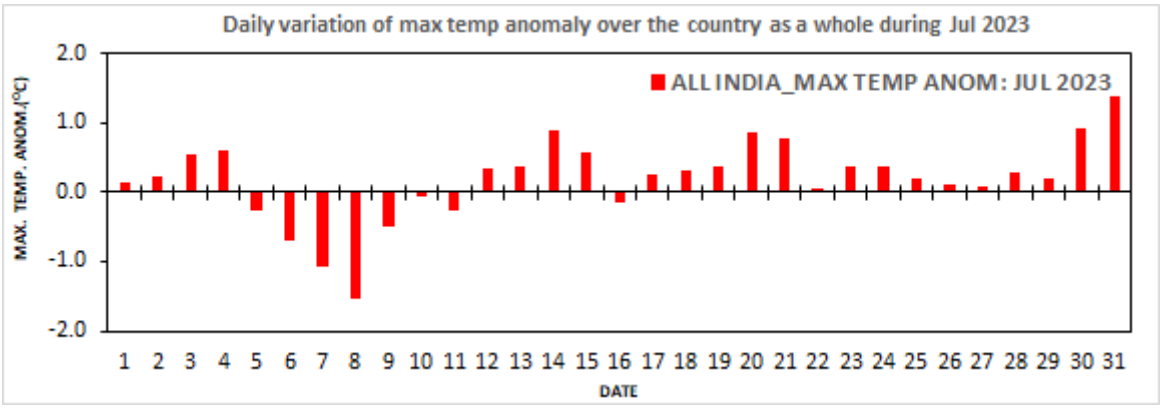


Fig 7(a): Daily variation of maximum temperature anomaly over the country as a whole for July 2023.

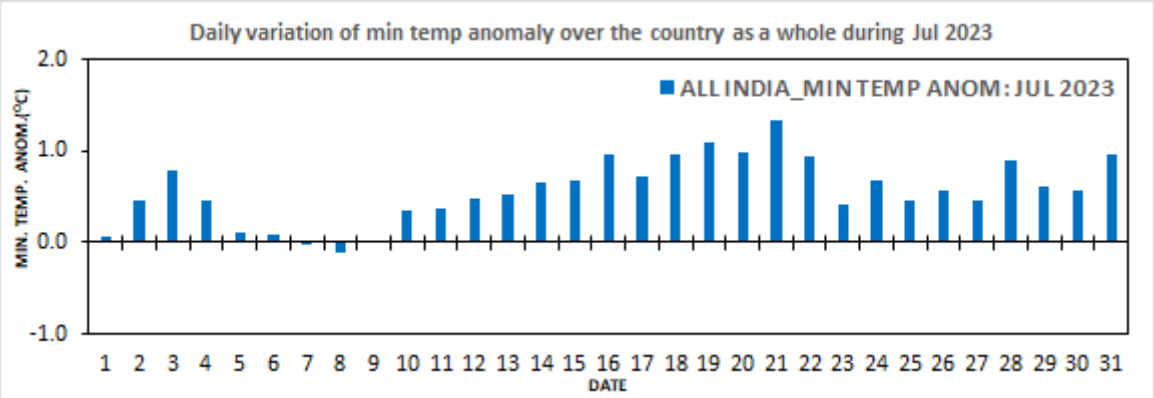


Fig 7(b): Daily variation of minimum temperature anomaly over the country as a whole for July 2023.

Figure 8 shows time series of monthly average maximum, average minimum and mean temperature over the country as a whole for the month of July 1901-2023. Over the country during July, the average maximum temperature is the 16th highest (31.91 ºC with an anomaly of 0.29 ºC) while the average minimum temperature is the 2nd highest (24.90 ºC with an anomaly of 0.57 ºC) since 1901. Over all India during July, the mean temperature is the 7th highest (28.40 ºC with an anomaly of 0.43 ºC) since 1901.

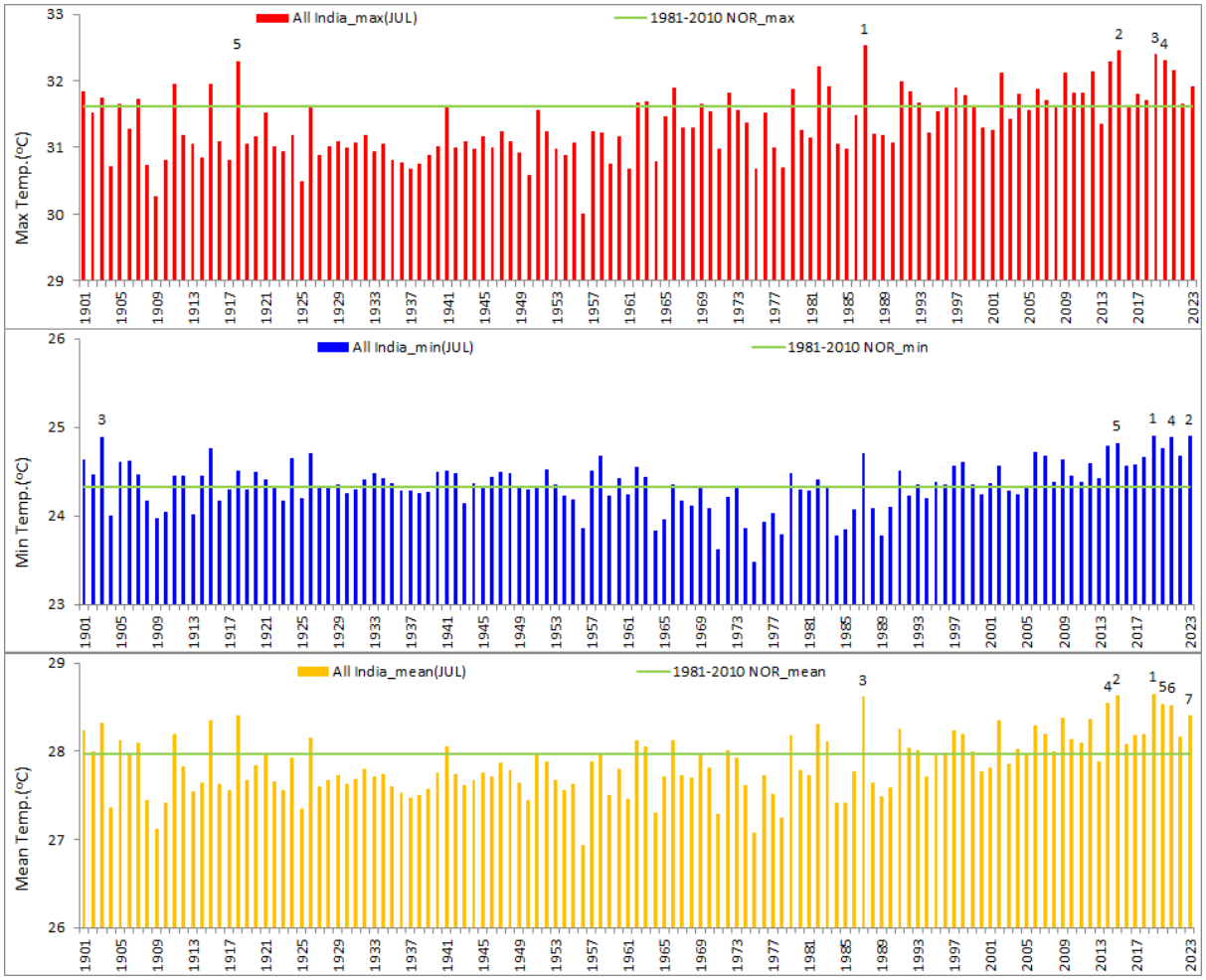


Fig 8: Time series of monthly average maximum, average minimum and mean temperature over the country as a whole for the month of July 1901-2023.

Figure 9 shows time series of monthly average maximum, average minimum and mean temperature over the East & Northeast India for the month of July 1901-2023. Over East & Northeast India during July, the average maximum temperature is the 2nd highest (33.23 ºC with an anomaly of 1.78 ºC) after the year 2022(33.59 °C) since 1901. The average minimum temperature is ever highest at 25.53 ºC since 1901 and it has broken the earlier ever-highest record of 25.31 ºC that was in 2022 for the month of July for the same period. The mean temperature is the 2nd highest (29.38 ºC with an anomaly of 1.45 ºC) after the year 2022(29.45 °C) since 1901.

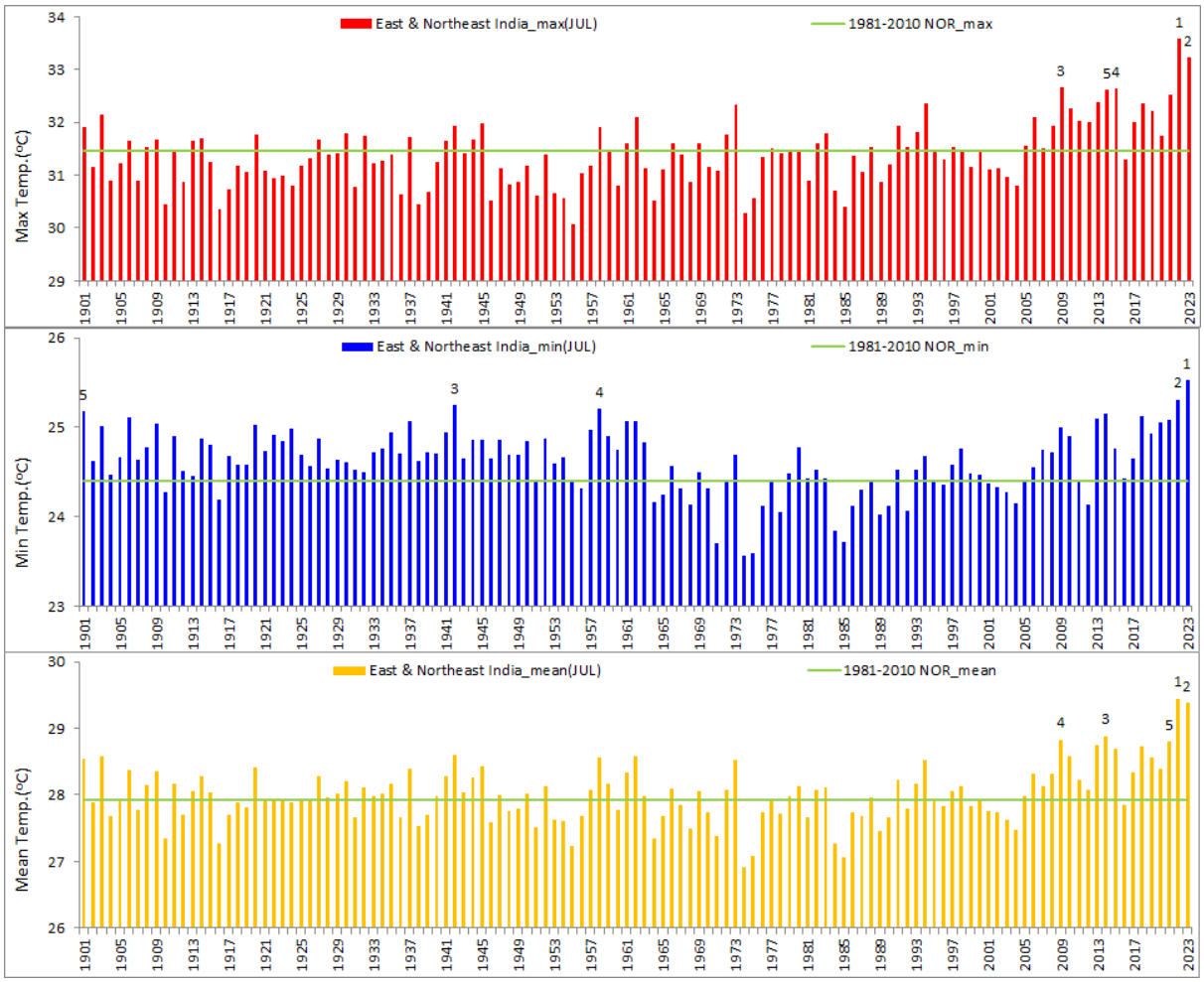


Fig 9: Time series of monthly average maximum, average minimum and mean temperature over East & Northeast India for the month of July 1901-2023.

The Temperatures during July 2023 for all India and homogeneous regions with its top ranks since 1901 are given bellow;

JULY 2023		Max Temp (^{0}C)	Min Temp (^{0}C)	Mean Temp (^{0}C)
ALL INDIA	**ACTUAL**	**31.91**	**24.90**	**28.40**
	NORMAL	31.62	24.33	27.98
	ANOMALY	0.29	0.57	0.43
	Rank Since 1901	**16**	**2**	**7**
NORTHWEST INDIA	**ACTUAL**	**32.13**	**23.98**	**28.06**
	NORMAL	32.85	23.56	28.20
	ANOMALY	-0.72	0.42	-0.15
	Rank Since 1901	**91**	**13**	**66**

EAST & NORTHEAST INDIA	**ACTUAL**	**33.23**	**25.53**	**29.38**
	NORMAL	31.45	24.41	27.93
	ANOMALY	1.78	1.13	1.45
	Rank Since 1901	**2**	**1**	**2**
CENTRAL INDIA	**ACTUAL**	**31.28**	**25.09**	**28.19**
	NORMAL	31.19	24.72	27.96
	ANOMALY	0.09	0.37	0.23
	Rank Since 1901	**34**	**8**	**25**
SOUTH PENNINSULAR INDIA	**ACTUAL**	**31.56**	**25.06**	**28.31**
	NORMAL	31.20	24.54	27.87
	ANOMALY	0.36	0.52	0.44
	Rank Since 1901	**13**	**7**	**9**

Note: Values are rounded off to nearest two decimal

The five highest temperature records with corresponding ranks since 1901 along with year occurrence for All India (TMin) and East & Northeast India (TMax, TMin, TMean) are given in the table below;

East & Northeast India (July 2023)

Year	TMax	Normal	Anomaly	Rank
2022	33.59	31.45	2.14	1
2023	33.23		1.78	2
2009	32.66		1.21	3
2015	32.64		1.19	4
2014	32.62		1.17	5

All India (July 2023)

Year	TMin	Normal	Anomaly	Rank
2019	24.91	24.33	0.58	1
2023	24.90		0.57	2
1903	24.89		0.57	3
2021	24.88		0.56	4
2015	24.82		0.50	5

East & Northeast India (July 2023)

Year	TMin	Normal	Anomaly	Rank
2023	25.53	24.41	1.13	1
2022	25.31		0.90	2
1942	25.25		0.85	3
1958	25.21		0.80	4
1901	25.18		0.77	5

East & Northeast India (July 2023)

Year	TMean	Normal	Anomaly	Rank
2022	29.45	27.93	1.52	1
2023	29.38		1.45	2
2014	28.89		0.96	3
2009	28.83		0.90	4
2021	28.80		0.87	5

The observed spatial temperature pattern of monthly average maximum, average minimum and mean temperature over India and their departures from normal (1981 to 2010 period) for the month of July 2023 is given in Figure 10.

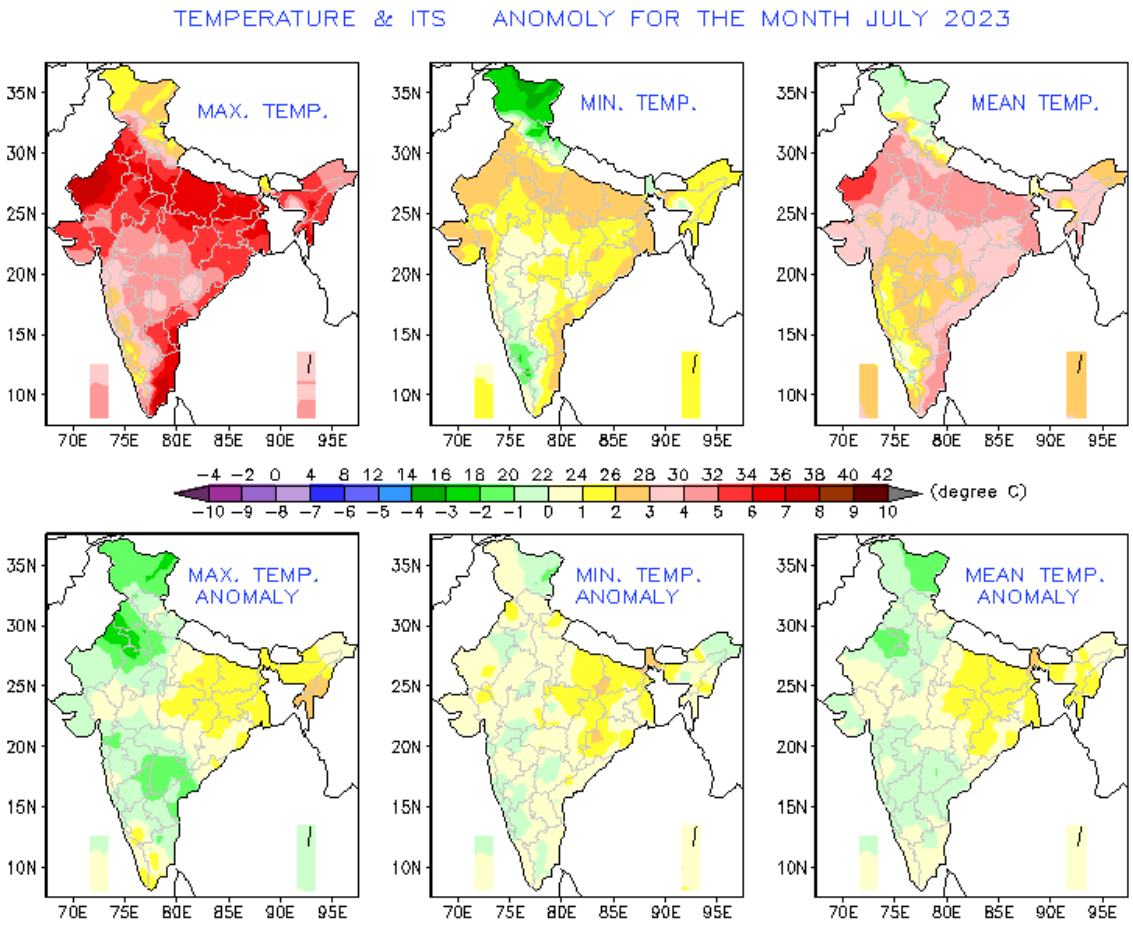


Fig 10: Observed spatial temperature pattern of monthly average maximum, average minimum, and mean temperature over India (top three from left to right) and their departure from normal (1981 to 2010 period) for July 2023 (lower three from left to right).

6. Significant Weather Events for the month July 2023:

During July, total 420 persons are reportedly claimed dead, more than 95 persons injured, more than 55 persons missing & more than 40 livestock perished due to various severe weather events. Fig.11 shows significant weather events during July 2023 as per real time media reports. Out of this, as per media data, a total around 170 persons reportedly claimed dead, 46 persons injured & more than 20 livestock perished, during July, because of Lightning.

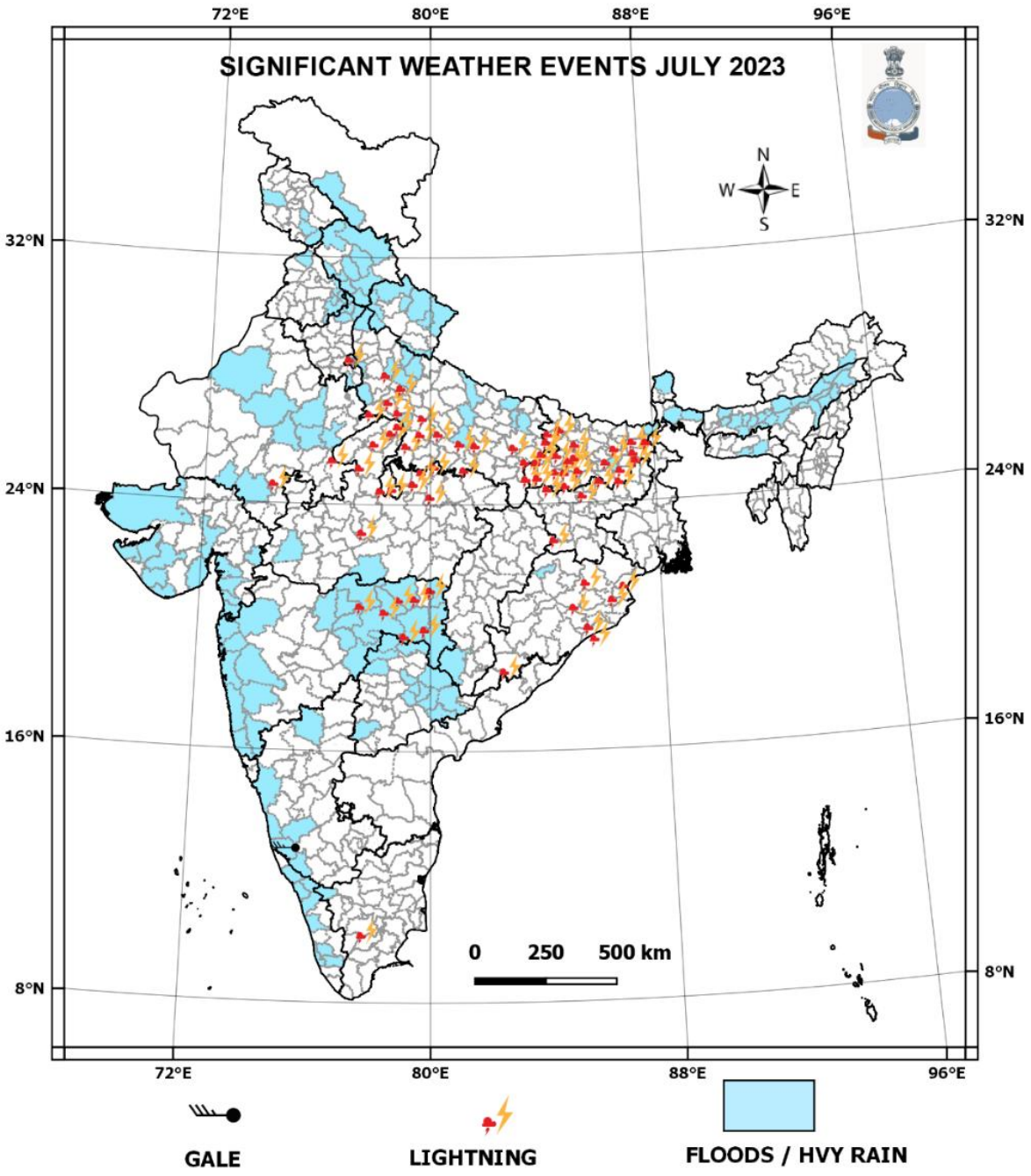


Fig. 11: Significant weather events during July 2023 (Based on real-time media report)-