



**Government of India
Earth System Science Organization
Ministry of Earth Sciences
India Meteorological Department**

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Sub: Monthly Climate Summary for October 2023

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

Rainfall over the country as a whole for the month of October 2023 shows that it has recorded 50.8 mm rainfall, which is 33% less than its Long Period Average (LPA) of 75.4 mm.

The daily variation of the rainfall over the country as a whole during the month of October 2023, along with normal (1971-2020) is shown in Figure 1(a). Additionally, Figure 1(b) displays the All India rainfall percentage departure from normal for October during the period from 1901-2023. Rainfall over homogeneous region of South Peninsular India (61.8 mm) was fifth lowest since 1901. Prior lowest rainfall years are 1918 (47.9 mm), 1988 (50.6 mm), 1965 (53.9mm) and 2016 (55.1mm).

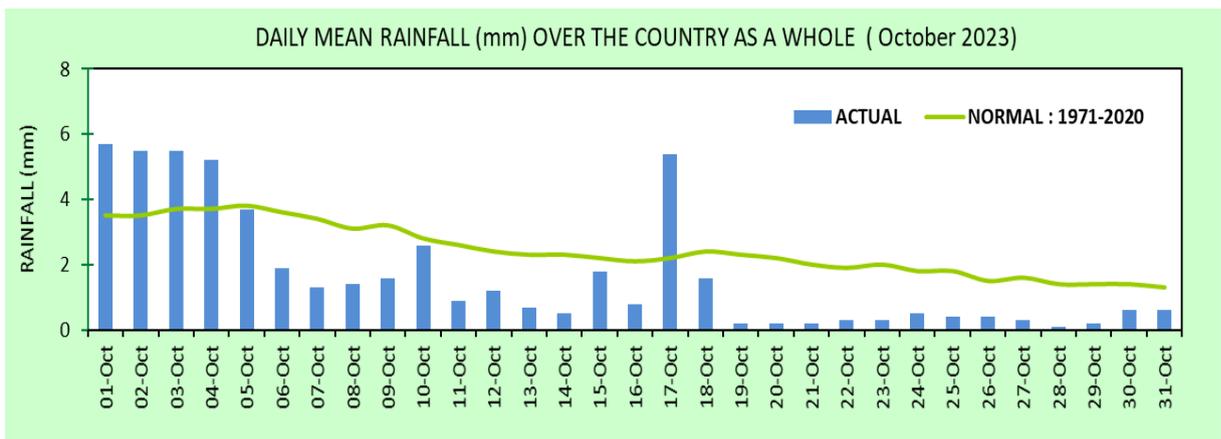


Fig.1 (a): Daily variation of rainfall over the country as a whole during October 2023.

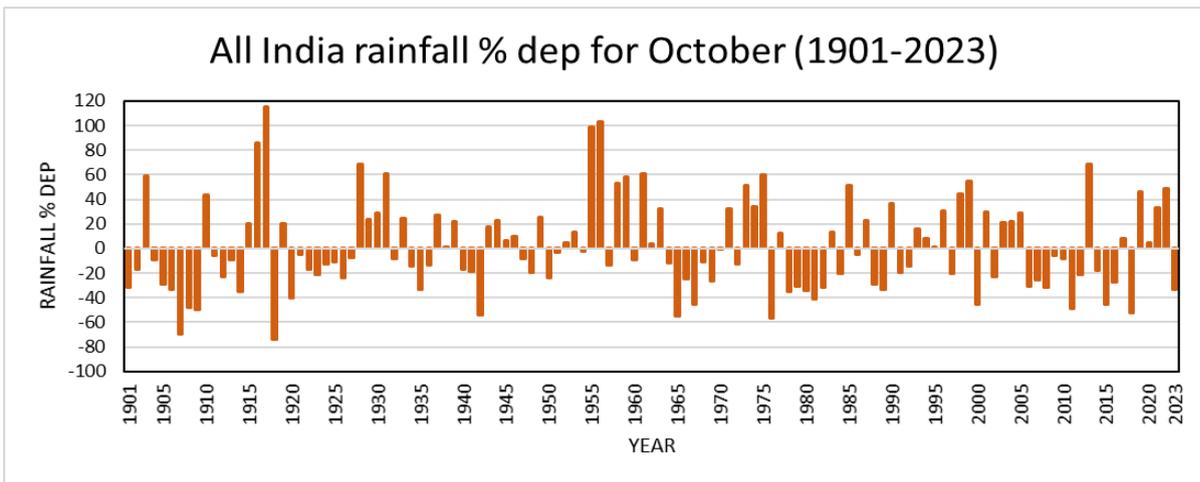


Fig 1(b). All India monthly rainfall percentage departure from normal (1971-2020) for October from 1901-2023.

The time series of actual rainfall since 1901 for South Peninsular India is given in Fig. 2.

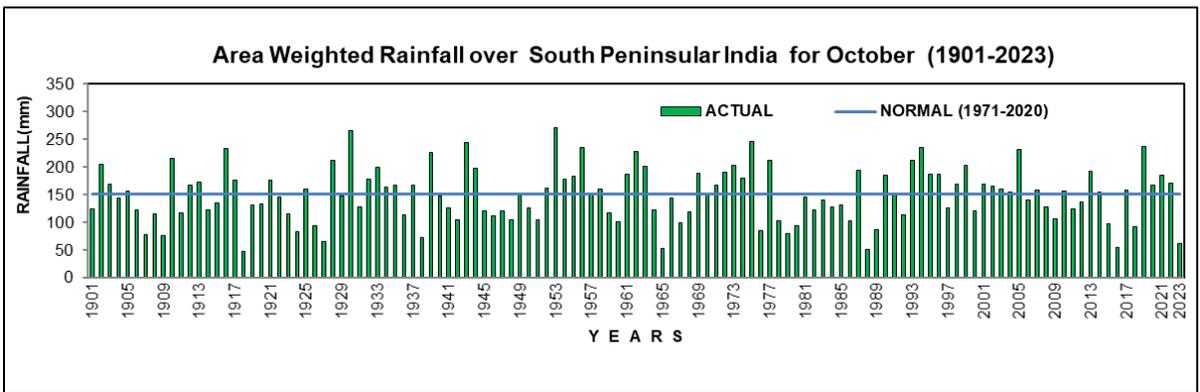


Fig.2: Time series of area weight averaged rainfall over South Peninsular India for October (1901 - 2023)

2. Withdrawal of southwest monsoon from the country

The Southwest Monsoon withdrew from entire country on 19th October, 2023 delayed by 4 days from its normal withdraw of 15th October. The withdrawal of the Southwest monsoon from the country normally started on 17 September. However, this year it commenced on 25th September. Hence, the duration of monsoon withdrawal from country this year was 25 days against normal of 28 days. The withdrawal dates of the Southwest monsoon season 2023 with its normal dates are shown in Fig.3. Commencement of Northeast monsoon over South Peninsula was on 21st October.

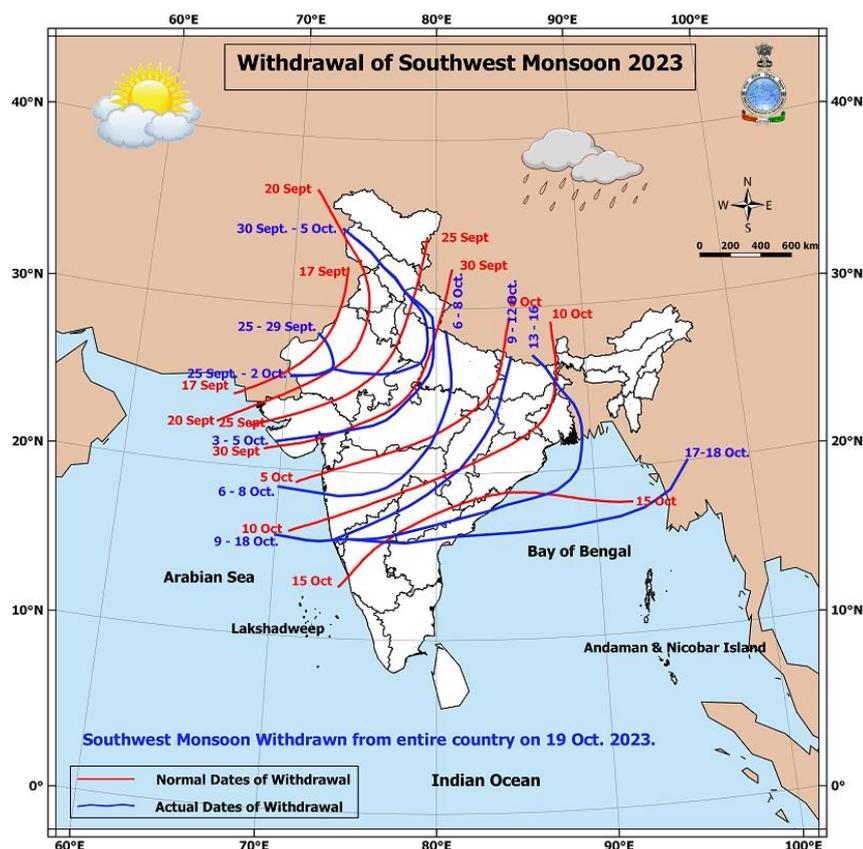


Fig 3: Isochrones of withdrawal of Southwest Monsoon 2023

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

Regions	Actual Rainfall (mm)	Normal Rainfall (mm)	% Departure from LPA
Country as a whole	50.8	75.4	-33.0
Northwest India	31.2	21.6	44.0
Central India	22.8	57.0	-60.0
South Peninsula	61.8	152.3	-59.0
East & northeast India	134.4	123.2	9.0

During this October 2023, 5 sub division received large excess, 2 received excess, 8 normal, 10 received deficient, 11 received large deficient rainfall. The rainfall distribution expressed in percentage departure is given in Fig. 4.

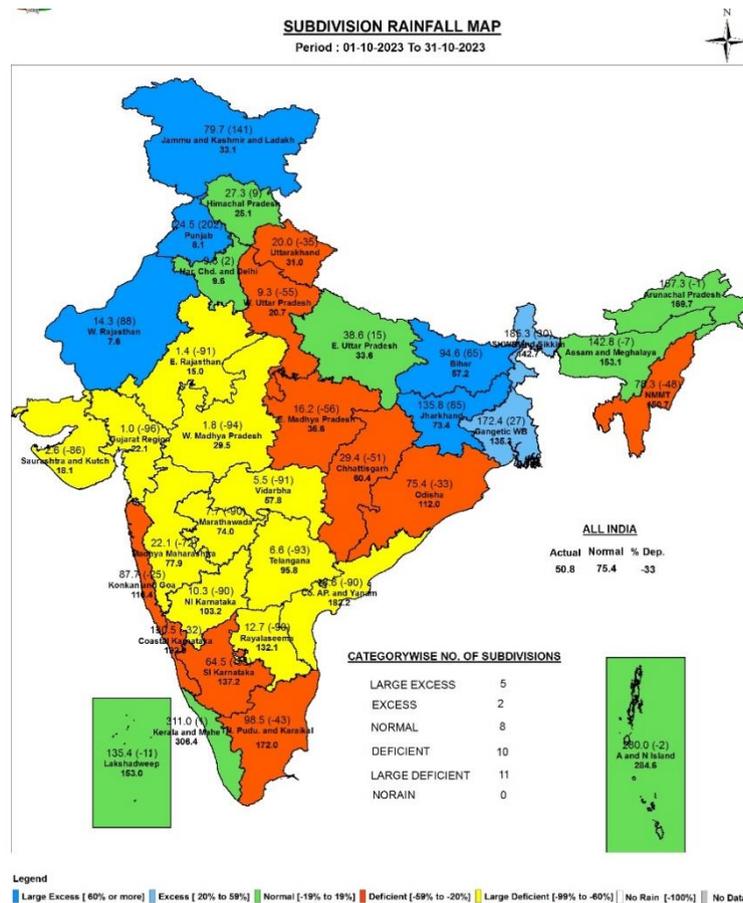


Fig 4: Subdivision-wise rainfall distribution for October 2023.

The observed spatial distribution of rainfall during October 2023, normal rainfall based on data of 1971 to 2020 and rainfall departures from normal during October 2023 are given in Fig. 5.

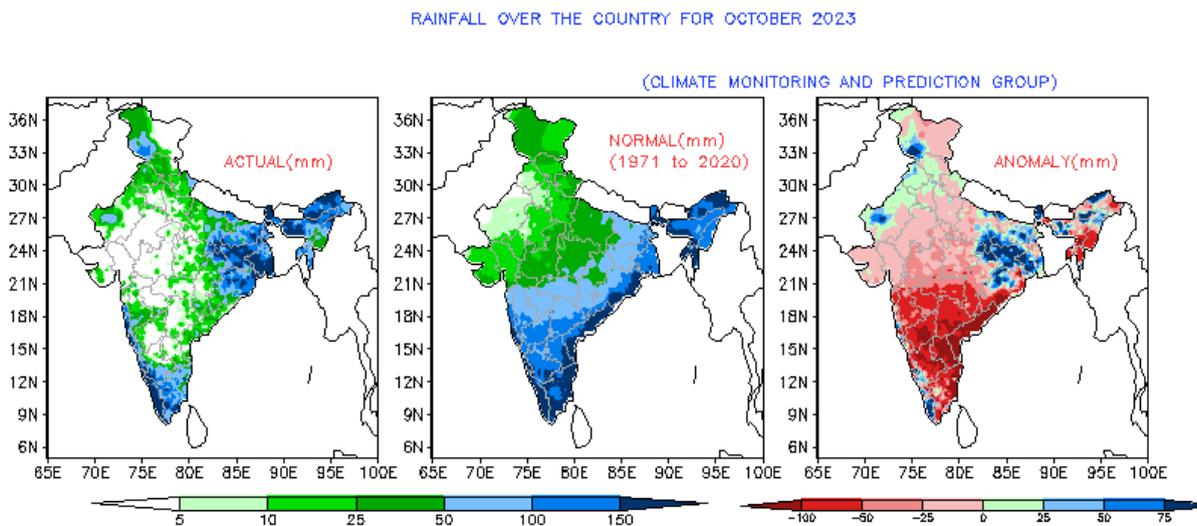
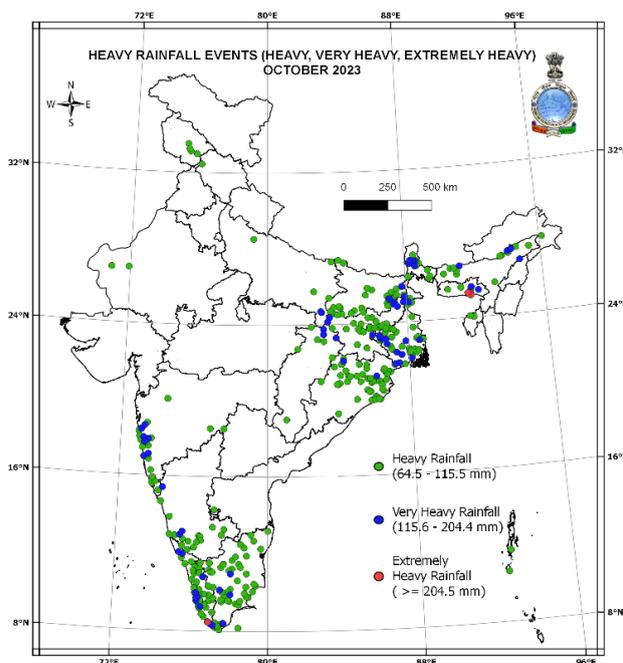


Fig 5: Observed spatial Rainfall pattern for the month of October 2023 over India and their departure from normal (1971 to 2020 period).

3. Frequency of Heavy Rainfall events

The October 2023 witnessed extremely heavy rainfall events (> 204.4 mm of rainfall) mainly over Assam & Meghalaya and Kerala & Mahe. The location of occurrences of heavy and very heavy rainfall events is shown in the Figure 6.

Out of total 369 events, 5 were extremely heavy rainfall (> 204.4 mm), 70 were very heavy rainfall (115.6 to 204.4 mm) and 294 were heavy rainfall (64.5 to 115.5 mm) events during this month.



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

Fig 6: The location of occurrences of heavy rainfall events in the month October 2023.

During October 2023, some stations received record 24 hours accumulated rainfall. The table below shows stations received 24-hour record rainfall and its previous record.

STATION	24 hours record rainfall in OCTOBER 2023(mm)#	DATE	PREVIOUS RAINFALL RECORD(mm)	DATE	STATE
ITANAGAR	103.4	3	94.1	8-10-2009	Arunachal Pradesh
CHURK	161.4	3	128	4-10-2001	Uttar Pradesh
BANIHAL	77.4	17	63.7	20-10-2015	Jammu Kashmir
JAISALMER	84.2	17	23.6	4-10-2019	Rajasthan
K.PARAMATHI	139	15	125.6	26-10-2001	Tamil Nadu
TRIVANDRUM	211.4	15	175.2	17-10-1977	Kerala

based on real time available data

Chief Synoptic weather features observed during October 2023.

Interestingly, it was twice in the month, when twin-low pressure systems observed over

the Indian Region-Once during 1st week and then in 4th Week of the month. First twin system formed during 1-5 October, a Depression (1-3 Oct), over East central Arabian Sea off south Konkan-Goa coasts which crossed south Konkan coast between Panjim (Goa) & Ratnagiri (Maharashtra) on night of 30th Sept-1st Oct and another Well Marked Low-pressure (WML) system recurved very slowly from Jharkhand to Gangetic West Bengal during 1-5 Oct and then its remnant moved over to Sub-Himalayan West Bengal & adjoining Bangladesh during 5-11 Oct.

Second Twin system formed During 20-25 October 2023, with one Extremely Severe Cyclonic Storm (ESCS) “TEJ”, formed over Arabian sea during 20 – 25 October. This ESCS TEJ moved northwestwards towards YEMEN coast. Beside this ESCS, one Very Severe Cyclonic Storm “HAMOON” formed over Bay of Bengal during 21 - 25 October. Fig 7 shows tracks of these cyclonic storms.

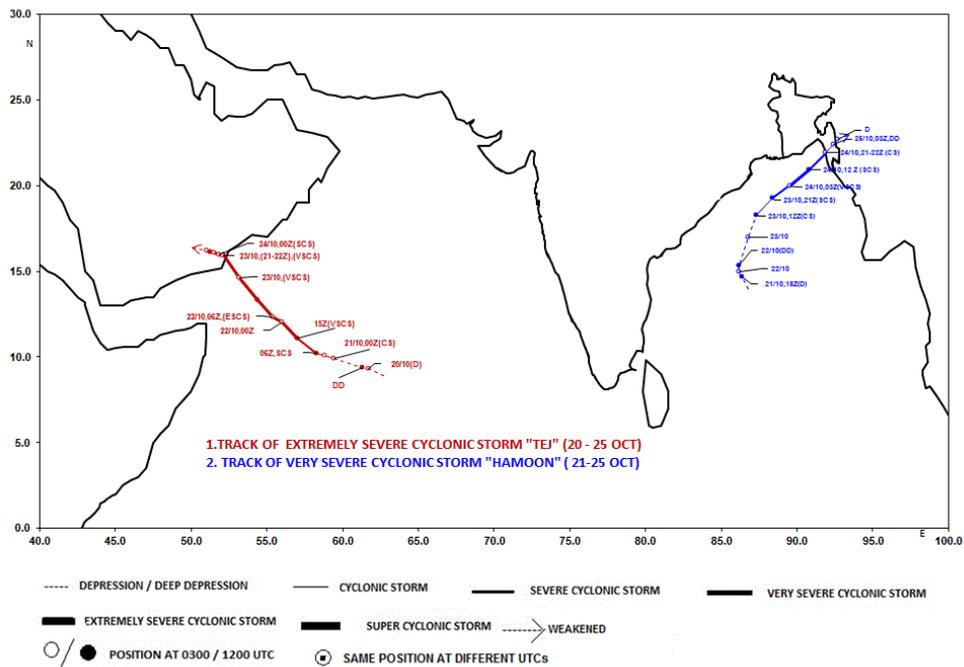


Fig 7: Tracks of intense low-pressure systems formed during October 2023.

In addition, 7 Western Disturbances (WDs) passed through northern part of the country (1-5 Oct, 8-17 Oct, 13-17 Oct, 15-19 Oct, 20-24 Oct, 24-27 Oct and 28-30 Oct 2023). All WDs moved north of 30° N except only one WD during 15-17 Oct which caused rain/snow over North India

5. Characteristics of Temperatures for the month of October 2023

The average maximum, minimum and mean temperature for the country as a whole during October 2023 were 32.09 °C, 21.62 °C and 26.85 °C respectively, against the normal of 31.16 °C, 20.88 °C and 26.02 °C based on period of 1981-2010. Thus, the average maximum temperature, minimum temperature and mean temperature were above normal by 0.93 °C, 0.73 °C and 0.83 °C 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 October 2023 is shown in the figure 8(a) and (b).

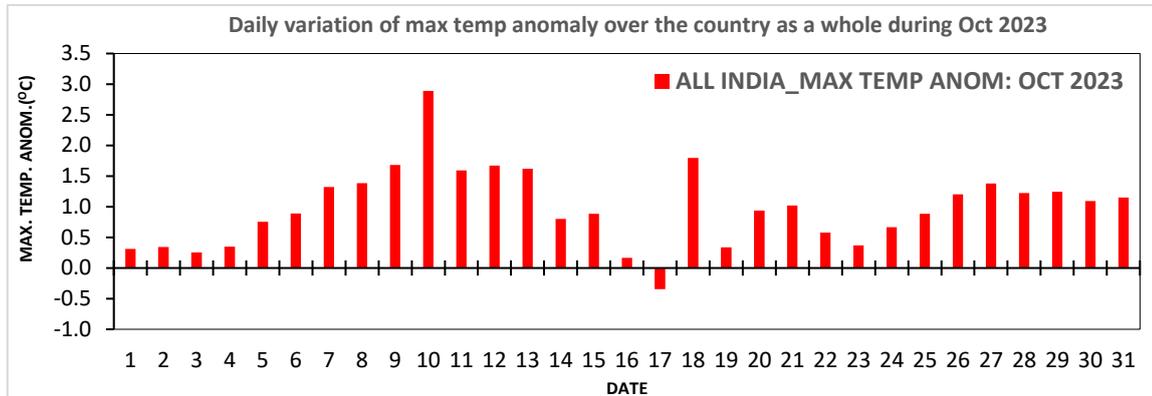


Fig 8(a): Daily variation of maximum temperature anomaly over the country as a whole for October 2023.

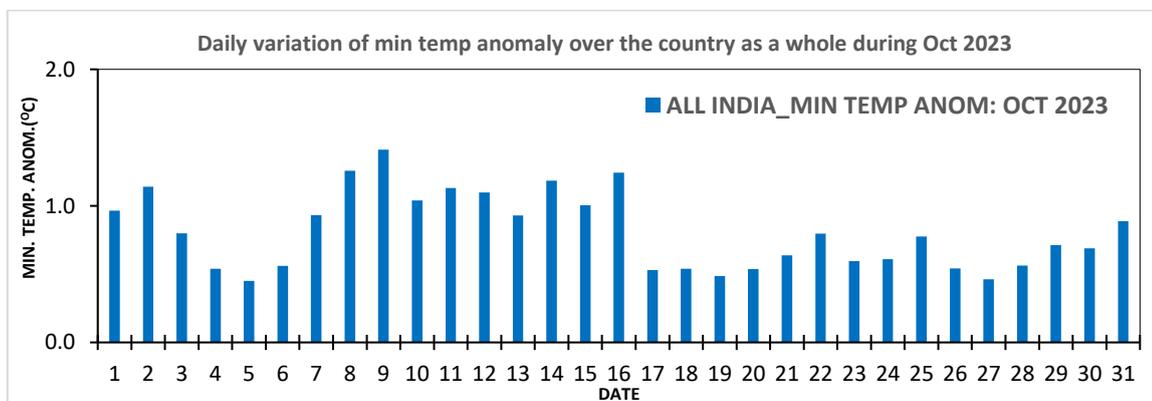


Fig 8(b): Daily variation of minimum temperature anomaly over the country as a whole for October 2023.

Figure 9 shows time series of monthly average maximum, minimum and mean temperature over the country as a whole for the month of October 1901-2023. Over the country during October, the average maximum temperature was 3rd highest (32.09°C with an anomaly of 0.93°C) after the years 2015(32.37°C), 2017(32.25°C) since 1901. The average minimum temperature was 10th highest (21.62°C with an anomaly of 0.73°C) since 1901. The mean temperature was 5th highest (26.85°C with an anomaly of 0.83°C) after the years 2017(27.04°C), 2015(27.03°C), 2020(26.96°C) and 1951(26.95°C) since 1901.

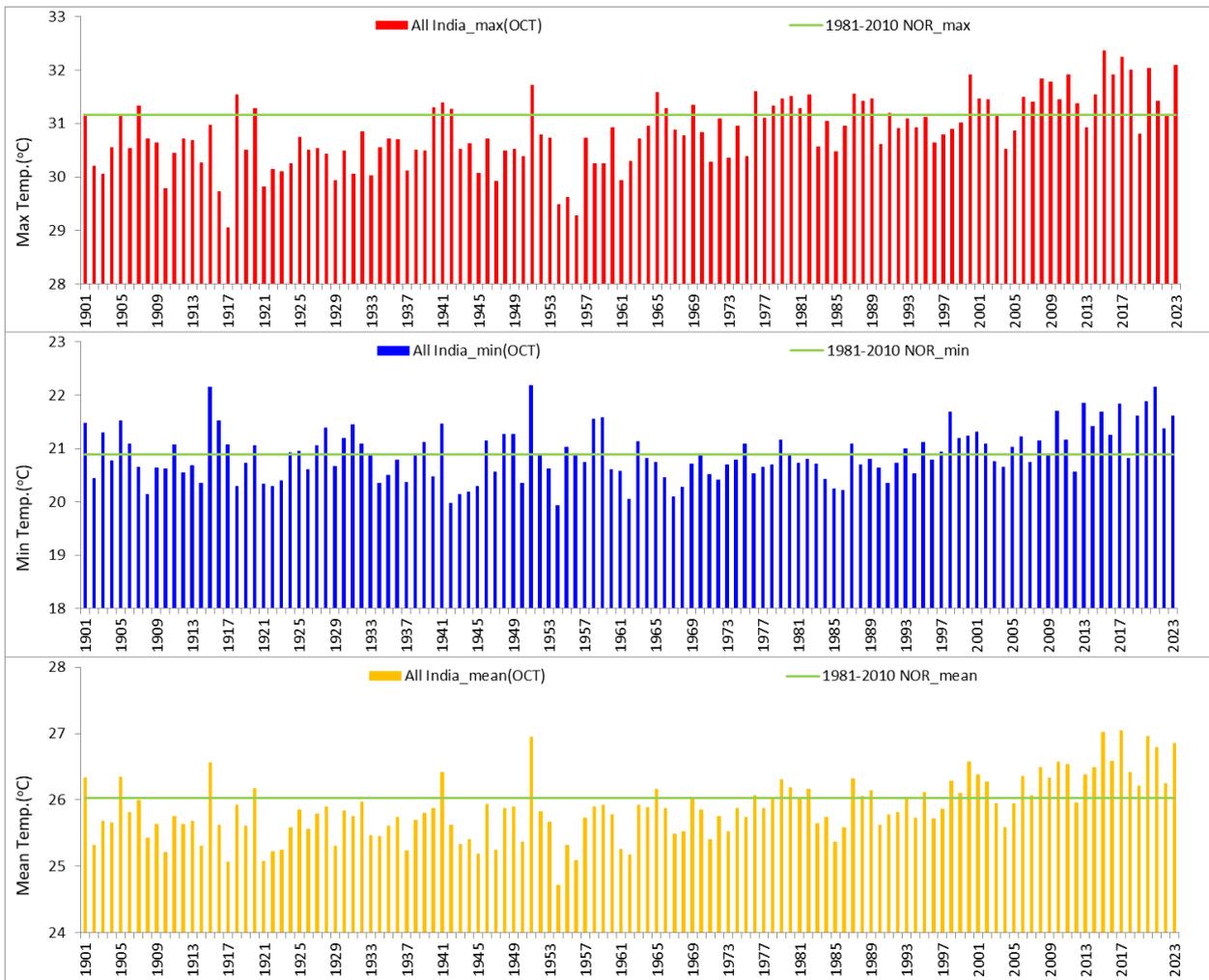


Fig 9: Time series of monthly average maximum, average minimum and mean temperature over the country as a whole for the month of October 1901-2023.

Figure 10 shows time series of monthly average maximum, minimum and mean temperature over the South Peninsular India for the month of October 1901-2023. Over South Peninsular India during October, the average maximum temperature was highest at 31.02°C since 1901 against the earlier record of 32.20°C in 2015. The average minimum temperature was 6th highest (24.15°C with an anomaly of 0.55°C) since 1901. The mean temperature was highest at 28.30°C since 1901 against the earlier record of 28.29°C in 2015.

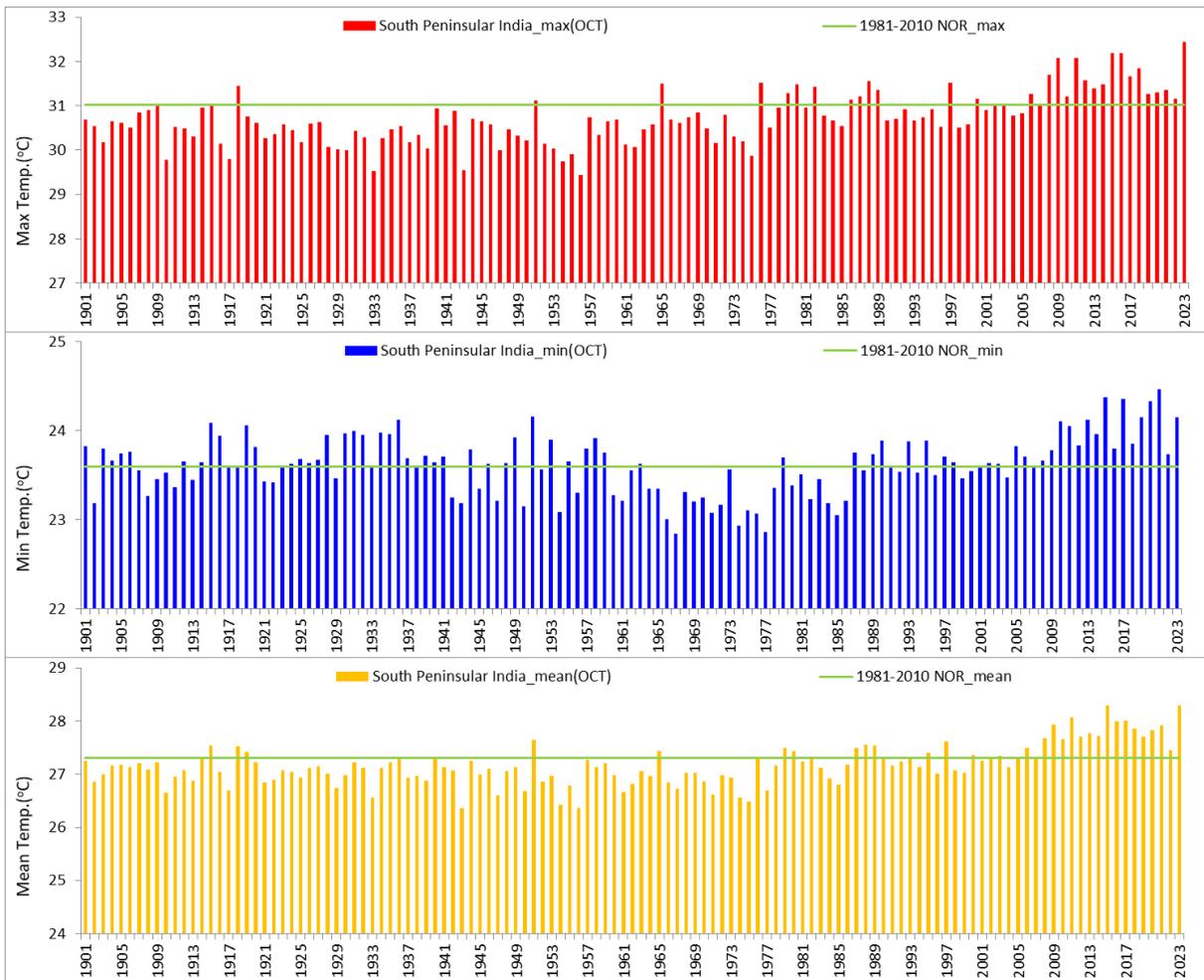


Fig 10: Time series of monthly average maximum, minimum and mean temperature over South Peninsular India for the month of October 1901-2023.

The temperatures during October 2023 for all India and homogeneous regions with its top ranks since 1901 are given below;

October 2023		Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)
ALL INDIA	ACTUAL	32.09	21.62	26.85
	NORMAL	31.16	20.88	26.02
	ANOMALY	0.93	0.73	0.83
	Rank since 1901	3	10	5
NORTHWEST INDIA	ACTUAL	30.56	17.32	23.94
	NORMAL	30.33	16.06	23.19
	ANOMALY	0.23	1.26	0.75
	Rank since 1901	38	10	16
EAST & NORTHEAST INDIA	ACTUAL	31.42	21.39	26.41
	NORMAL	30.58	20.87	25.72
	ANOMALY	0.84	0.52	0.68
	Rank since 1901	7	27	11
CENTRAL INDIA	ACTUAL	33.54	22.07	27.80
	NORMAL	32.69	21.47	27.08
	ANOMALY	0.85	0.60	0.72
	Rank since 1901	9	18	7
SOUTH PENINSULAR INDIA	ACTUAL	32.44	24.15	28.30
	NORMAL	31.02	23.60	27.31
	ANOMALY	1.43	0.554	0.99
	Rank since 1901	1	6	1

Note: Values are rounded off to nearest two decimal

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

All India (October 2023)					South Peninsular India (October 2023)				
Year	TMax	Normal	Anomaly	Rank	Year	TMax	Normal	Anomaly	Rank
2015	32.37	31.16	1.20	1	2023	32.44	31.02	1.43	1
2017	32.25		1.09	2	2015	32.20		1.18	2
2023	32.09		0.93	3	2016	32.18		1.17	3
2020	32.03		0.87	4	2011	32.08		1.062	4
2018	32.01		0.84	5	2009	32.07		1.059	5

All India (October 2023)					South Peninsular India (October 2023)				
Year	TMean	Normal	Anomaly	Rank	Year	TMean	Normal	Anomaly	Rank
2017	27.04	26.02	1.02	1	2023	28.30	27.31	0.99	1
2015	27.03		1.00	2	2015	28.29		0.98	2
2020	26.96		0.94	3	2011	28.07		0.76	3
1951	26.95		0.93	4	2017	28.01		0.70	4
2023	26.85		0.83	5	2016	27.99		0.69	5

The observed spatial temperature pattern of monthly average maximum, minimum and mean temperature over India and their departures from normal (1981 to 2010 period) for the month of October 2023 is given in Figure 11. It indicates that the maximum temperature, minimum temperature and mean temperatures were above normal over many parts of the country during October 2023.

TEMPERATURE & ITS ANOMOLY FOR THE MONTH OCTOBER 2023

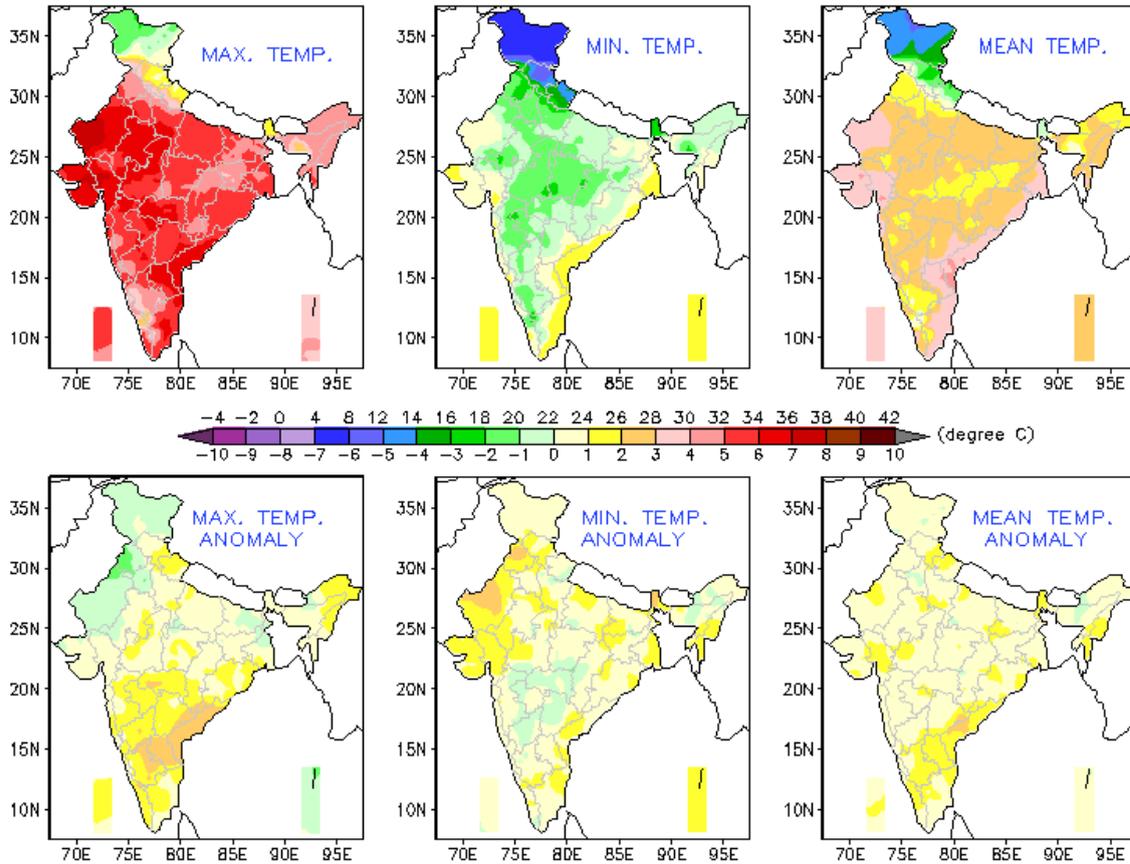


Fig 11: Observed spatial temperature pattern of monthly average maximum, minimum, and mean temperature over India (top three from left to right) and their departure from normal (1981 to 2010 period) for October 2023 (lower three from left to right).