भारतसरकार
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 December 2023

1. Monthly Rainfall Scenario (01 to 31 Dec. 2023)

The rainfall over the country as a whole for the month of December 2023 has been recorded at 25.5 mm, which is 60% more than its Long Period Average (LPA) of 15.9 mm. All India Rainfall (25. 5 mm) was 12th highest since 1901 and highest since 2001.Rainfall over East & Northeast India (26. 9 mm) was 9th highest since 1901 and highest since 2001. Rainfall in south peninsular India (72.2 mm) was 11th highest since 1901 and highest since 2001.

Daily variation of the rainfall over the country as a whole during the month of December 2023 along with normal (1971-2020) and All India rainfall percentage departure from normal for December during 1901-2023 is shown in the figure 1(a) and 1(b) respectively.

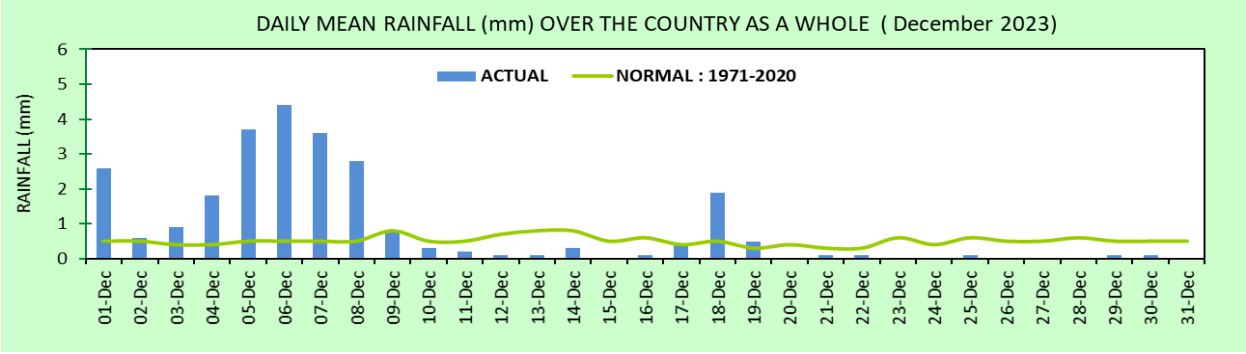


Fig.1 (a): Daily variation of rainfall over the country as a whole during December 2023.

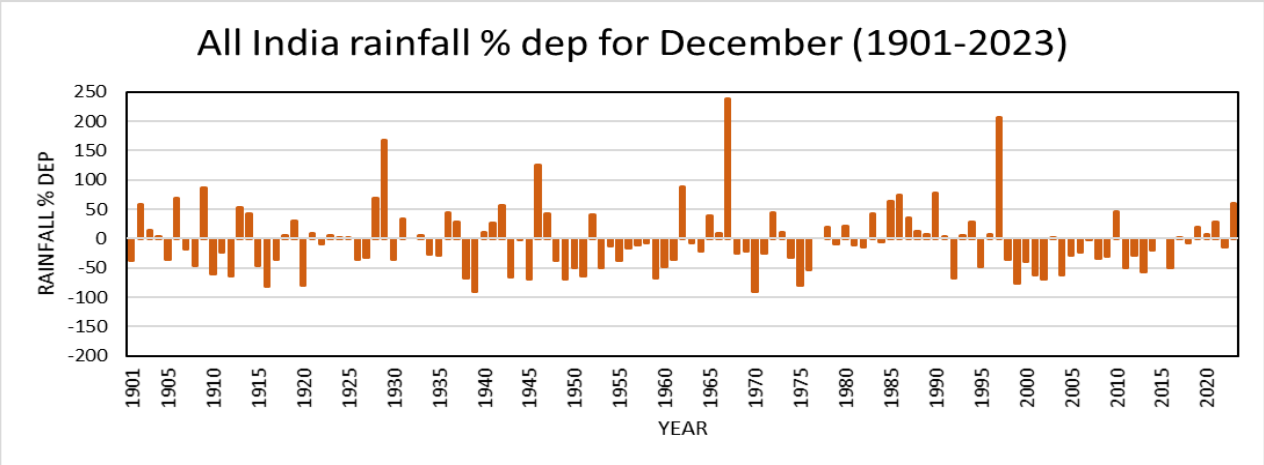


Fig 1(b). All India monthly rainfall percentage departure from normal (1971-2020) for December from 1901-2023.

The time series of actual rainfall since 1901-2023 for All India, East & Northeast India and south peninsular India are given in Fig. 2(a), 2(b) and 2(c) respectively

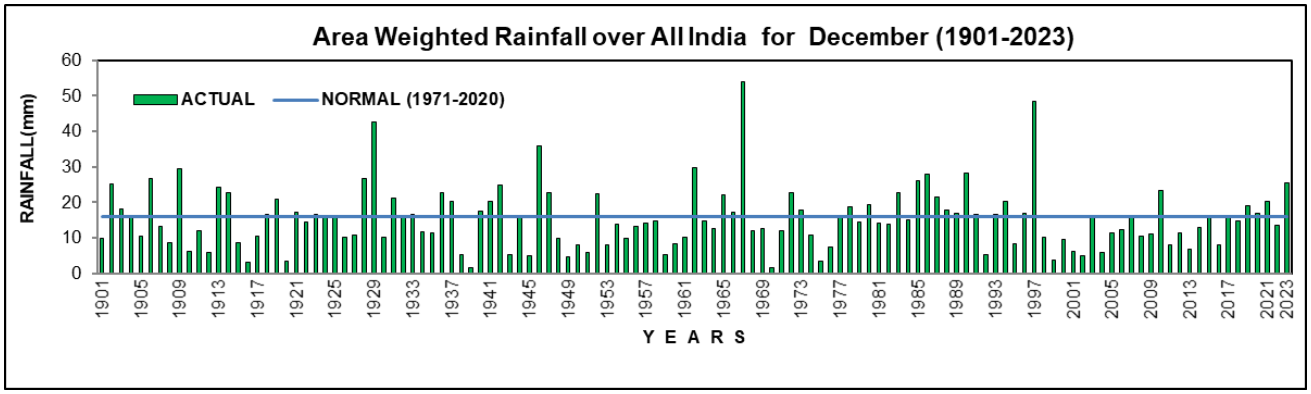


Fig.2 (a): Time series of area weight averaged rainfall over All India for December (1901 -2023)

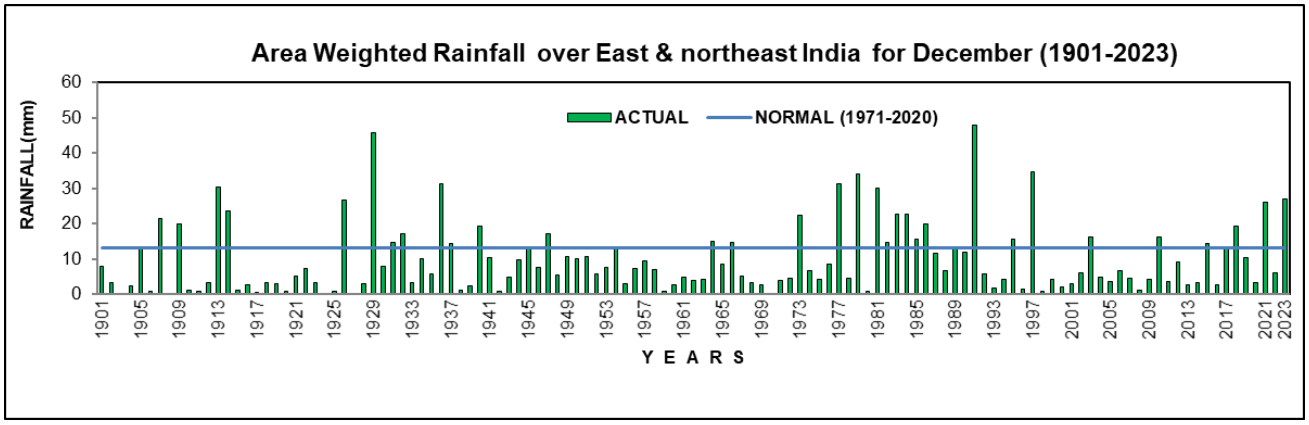


Fig.2 (b): Time series of area weight averaged rainfall over East & northeast India for December (1901 - 2023)

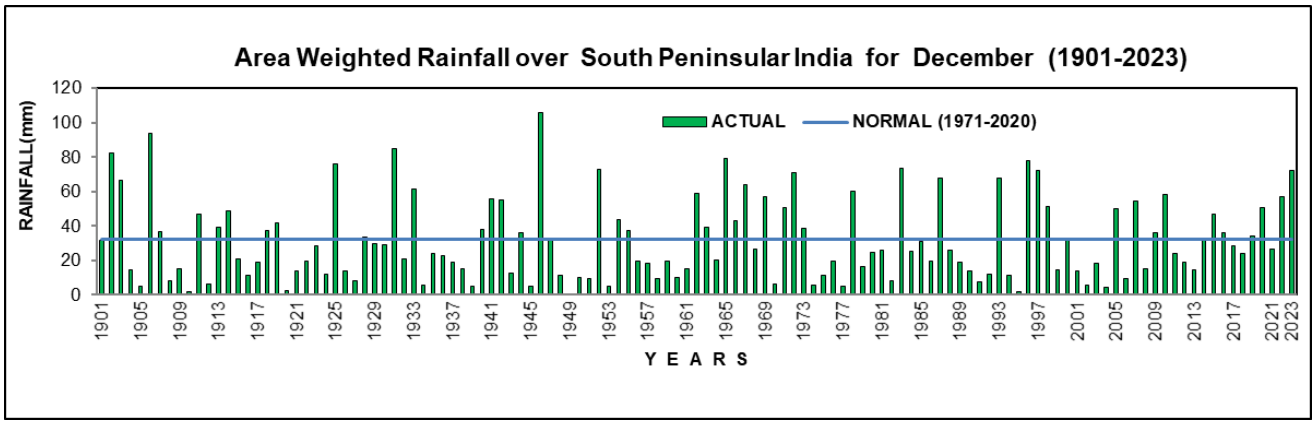


Fig.2 (c): Time series of area weight averaged rainfall over South Peninsular India for December (1901 - 2023)

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

Regions	Actual Rainfall (mm)	Normal Rainfall (mm)	% Departure from LPA
Country as a whole	**25.5**	**15.9**	**60.0**
Northwest India	**6.6**	**18.9**	**-65.0**
Central India	**14.8**	**5.1**	**191.0**
South Peninsula	**77.2**	**32.0**	**126.0**
East & northeast India	**26.9**	**13.1**	**105.0**

During this month, 15 Sub-divisions received large excess, 7 received excess, 3 received normal, 4 received deficient, 6 received large deficient rainfall and one sub-division (Konkan & Goa) did not receive any rain. Fig 3 shows Subdivision-wise rainfall distribution for December 2023.

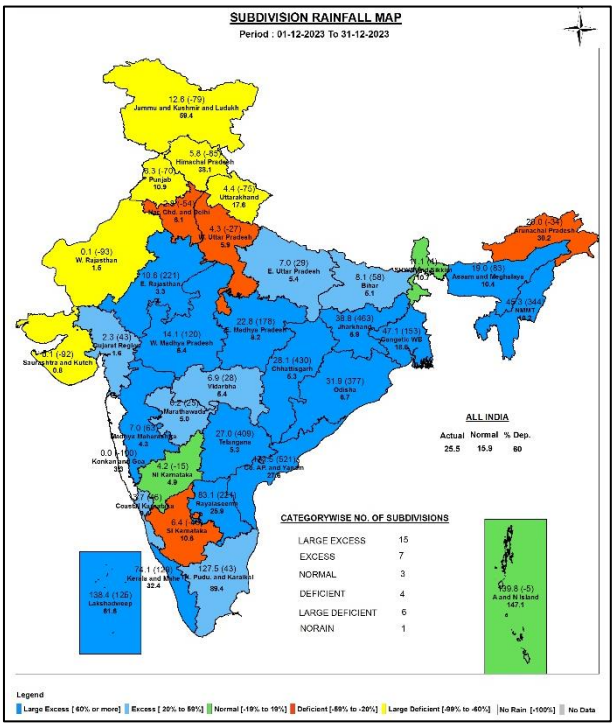


Fig 3: Subdivision-wise rainfall distribution for December 2023.

The observed spatial distribution of rainfall during December 2023, normal rainfall based on data of 1971 to 2020 and rainfall departures from normal during December 2023 are given in Fig.4.

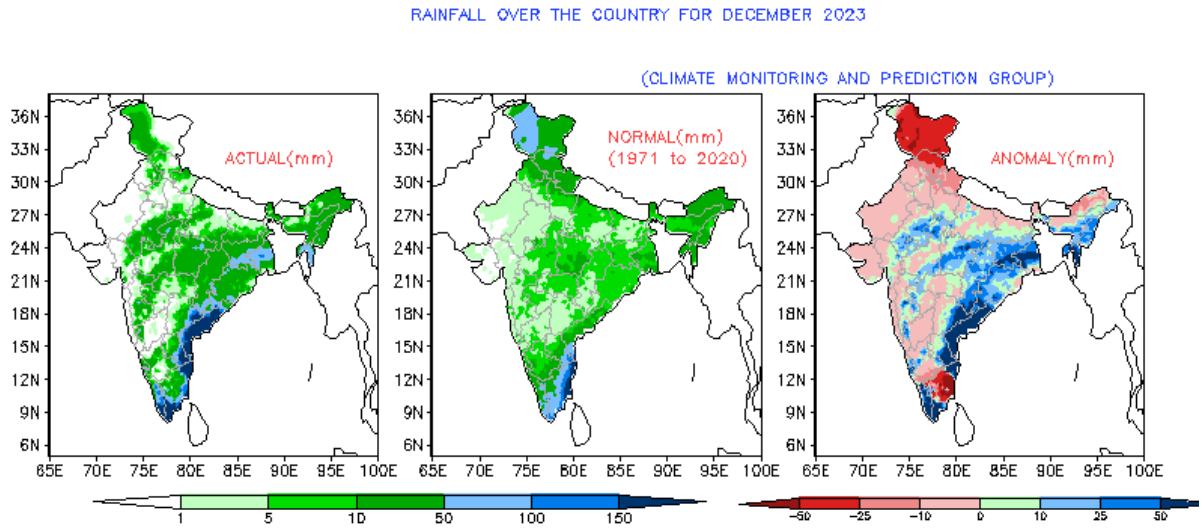


Fig 4: Observed spatial Rainfall pattern for the month of December2023 over India and their departure from normal (1971 to 2020 period).

2. Northeast Monsoon rainfall

The Northeast (NE) monsoon rainfall over the core zone comprising of five sub-divisions (coastal Andhra Pradesh, Rayalaseema, Tamil Nadu, south Interior Karnataka and Kerala) was 98.5 mm and was the 10th highest since 1901. The time series of actual rainfall since 1901 is given in Fig. 5.

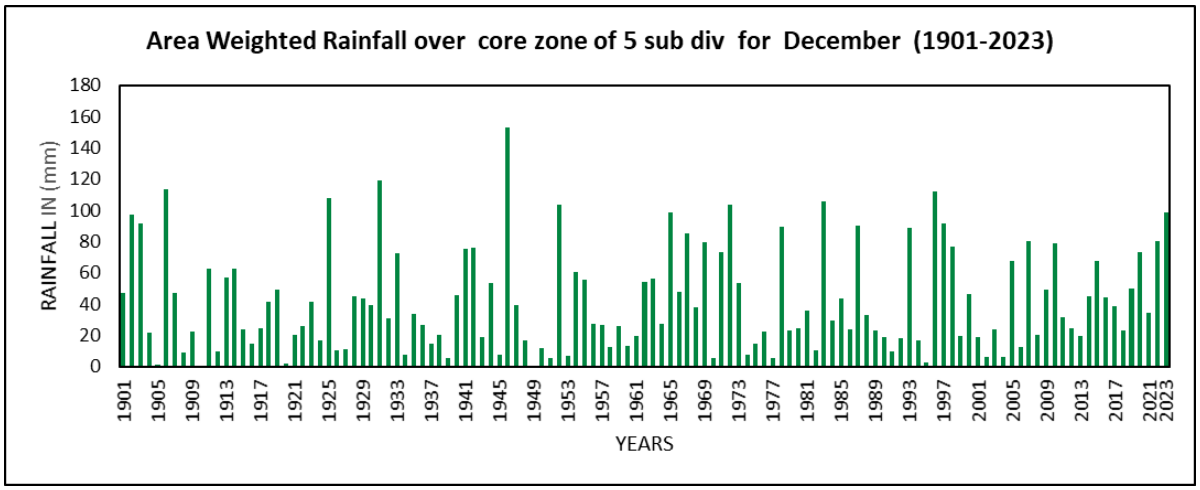


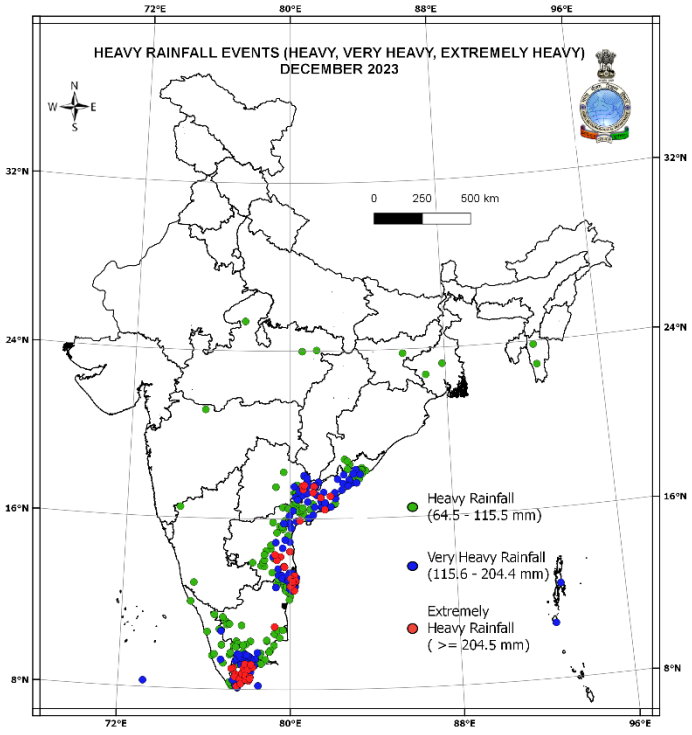
Fig. 5: Time series of area weight averaged rainfall over NE monsoon core zone for December (1901 - 2023)

3. Frequency of Heavy Rainfall events

December 2023 witnessed extremely heavy rainfall events (> 204.4 mm of rainfall) mainly over Tamil Nadu and Coastal Andhra Pradesh. The location of occurrences of heavy, very heavy and extremely heavy rainfall events is shown in the Figure 6.

Out of total 286 events, 50 events were extremely heavy rainfall (>204.4 mm), 110 events were very heavy rainfall (115.6 to 204.4mm) and 126 events were heavy rainfall (64.5 to 115.5 mm of rainfall) during this month.

Stations namely Kayalpattinam (946 mm), Tiruchendur (689 mm), Srivaikuntam (621 mm) and Kovilpatti (525 mm) from Tamil Nadu received more than 500 mm of rainfall on 18 December.



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

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

During December 2023 some stations received record 24 hours accumulated rainfall. The table below shows the list of stations which received 24-hour record rainfall alongwith its previous record

STATION	24 HOUR RECORD RAINFALL IN December 2023(mm)#	DATE	PREVIOUS RAINFALL RECORD(mm)	DATE	STATE
KOHIMA	26.8	8	21.3	1-12-1988	Arunachal Pradesh
KORAPUT	67.2	6	57.4	18-12-2018	Odisha
BHIND-AWS	28.0	1	3.3	10-12-1972	Madhya Pradesh
SHEOPUR-AWS	52.0	4	27.2	12-12-1987	Madhya Pradesh
BILASPUR	24.4	6	18.6	9-12-2010	Chhattisgarh
KAKINADA	137.7	6	130.3	1-12-1882	Andhra Pradesh
TUNI	124.2	6	99.2	16-12-2003	Andhra Pradesh
NANDIGAMA	115.2	6	50	16-12-2003	Andhra Pradesh
KAVALI	145.1	5	113.4	6-12-2018	Andhra Pradesh

NELLORE	218.1	5	189.2	16-12-1902	Andhra Pradesh
NARSAPURAM	213.2	6	100.3	7-12-2010	Andhra Pradesh
VALPARAI PTO	53.0	8	51.0	8-12-2021	Tamil Nadu
KANYAKUMARI	173.5	18	130.5	7-12-1980	Tamil Nadu
PALAYAMKOTTAI	442.0	18	200.7	10-12-1931	Tamil Nadu

based on real time available data

4. Chief Synoptic weather features observed during December2023.

During December 2023, one **Severe Cyclonic Storm (SCS) "MICHAUNG"** formed over Bay of Bengal during (1 – 6 Dec.).The system developed as **Low Pressure area** over South Andaman Seaon 27th November at 0530 hours IST and intensified into **Depression c**ategory on 1st December 2023. It further intensified in to a **Deep Depression** over Southwest Bay of Bengal on 2nd December and became a **Cyclonic storm** on 3rd December 2023. The system further intensified in to **Severe Cyclonic storm** over West central & adjoining Southwest Bay of Bengal off south Andhra Pradesh & adjoining north Tamil Nadu coasts. The Severe Cyclonic storm crossed south Andhra Pradesh coast between Nellore and Machilipatnam, close to south of Bapatlaon 5th December between 1230 to 1430 hours IST with maximum sustained wind speed of 90-100 kmph gusting to 110 kmph. Fig 7 shows track of the **Severe cyclonic storm**.

During December, there was below normal Western Disturbances activity over Northwest India resulted below normal rainfall over the region.

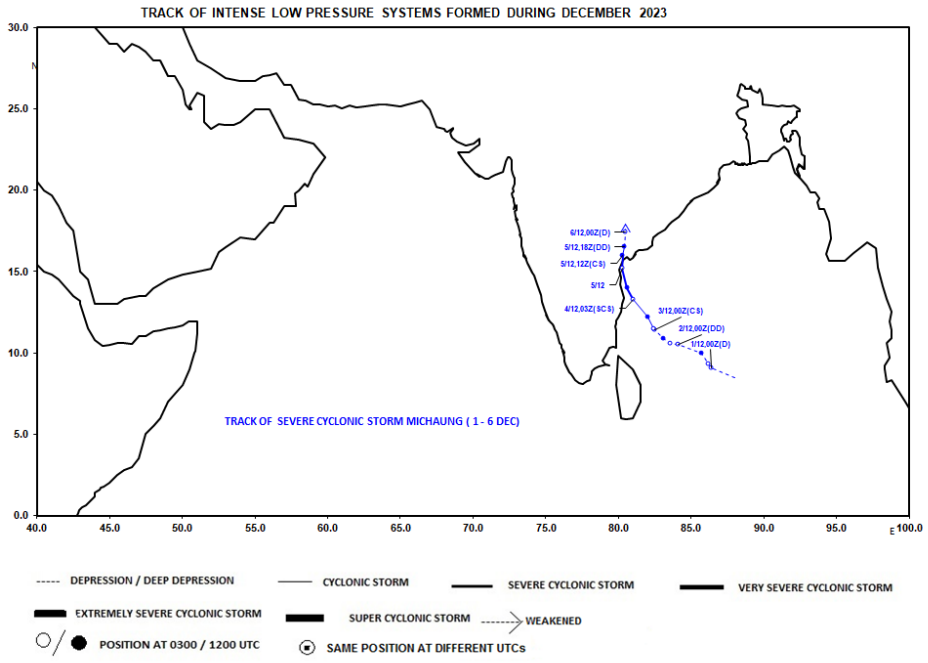


Fig 7: Track of Severe Cyclonic Storm, "MICHAUNG" formed during December 2023

5. Characteristics of Temperatures for the month of December 2023

The average maximum, minimum and mean temperature for the country as a whole during December 2023 were 27.04ºC, 16.16ºC and 21.60ºC respectively, against the normal of 26.53ºC, 14.44ºC and 20.49ºC based on period of 1981-2010. Thus, the average maximum temperature, minimum temperature and mean temperature were above normal by 0.51ºC, 1.71ºC and 1.11ºC 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 December 2023 is shown in the Figures 8(a) and (b).

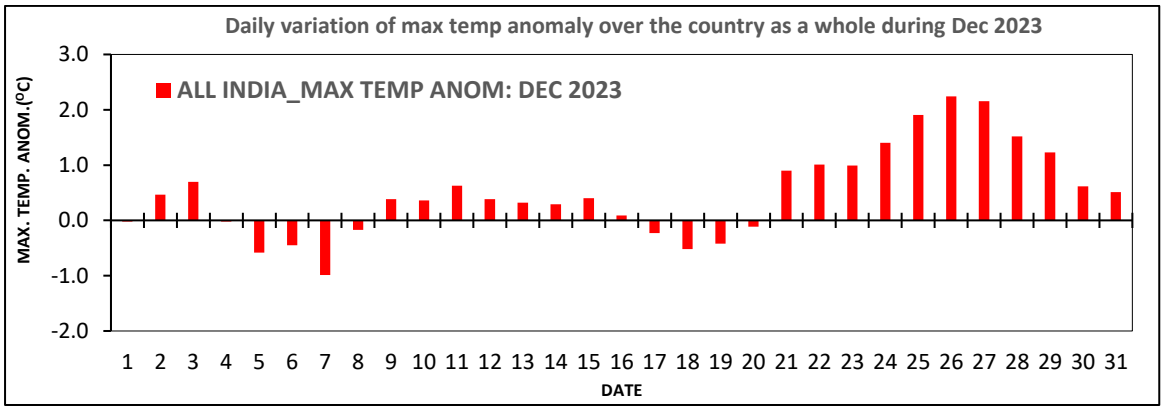


Fig 8(a): Daily variation of maximum temperature anomaly over the country as a whole for December 2023.

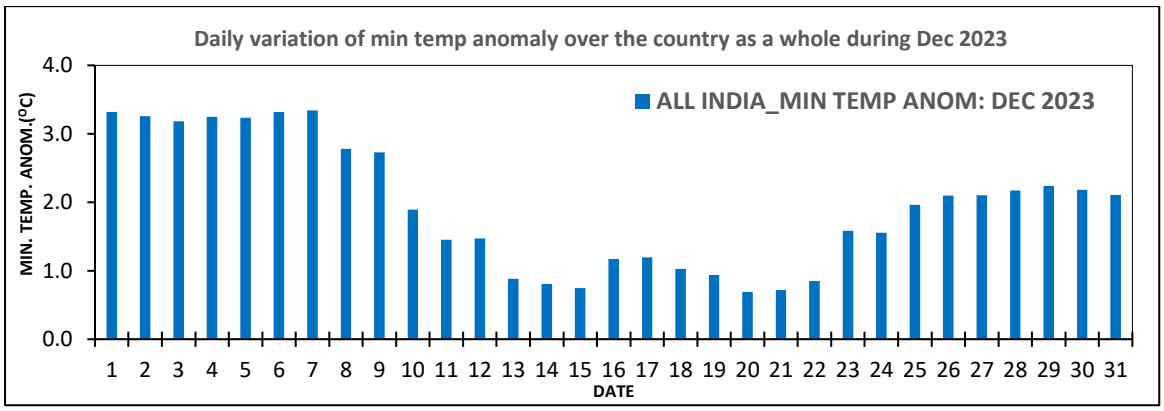


Fig 8(b): Daily variation of minimum temperature anomaly over the country as a whole for December 2023.

Figure 9 shows time series of monthly average maximum, minimum and mean temperature over the country as a whole for the month of December from 1901 to 2023. December 2023, the average maximum temperature over the country was 7th highest (27.04ºC with an anomaly of 0.51ºC) since 1901. The average minimum temperature was highest at 16.16ºC since 1901 against the earlier record of 15.69ºC in 2008. The mean temperature was highest at 21.60ºC since 1901 against the earlier record of 21.49ºC in 2022.

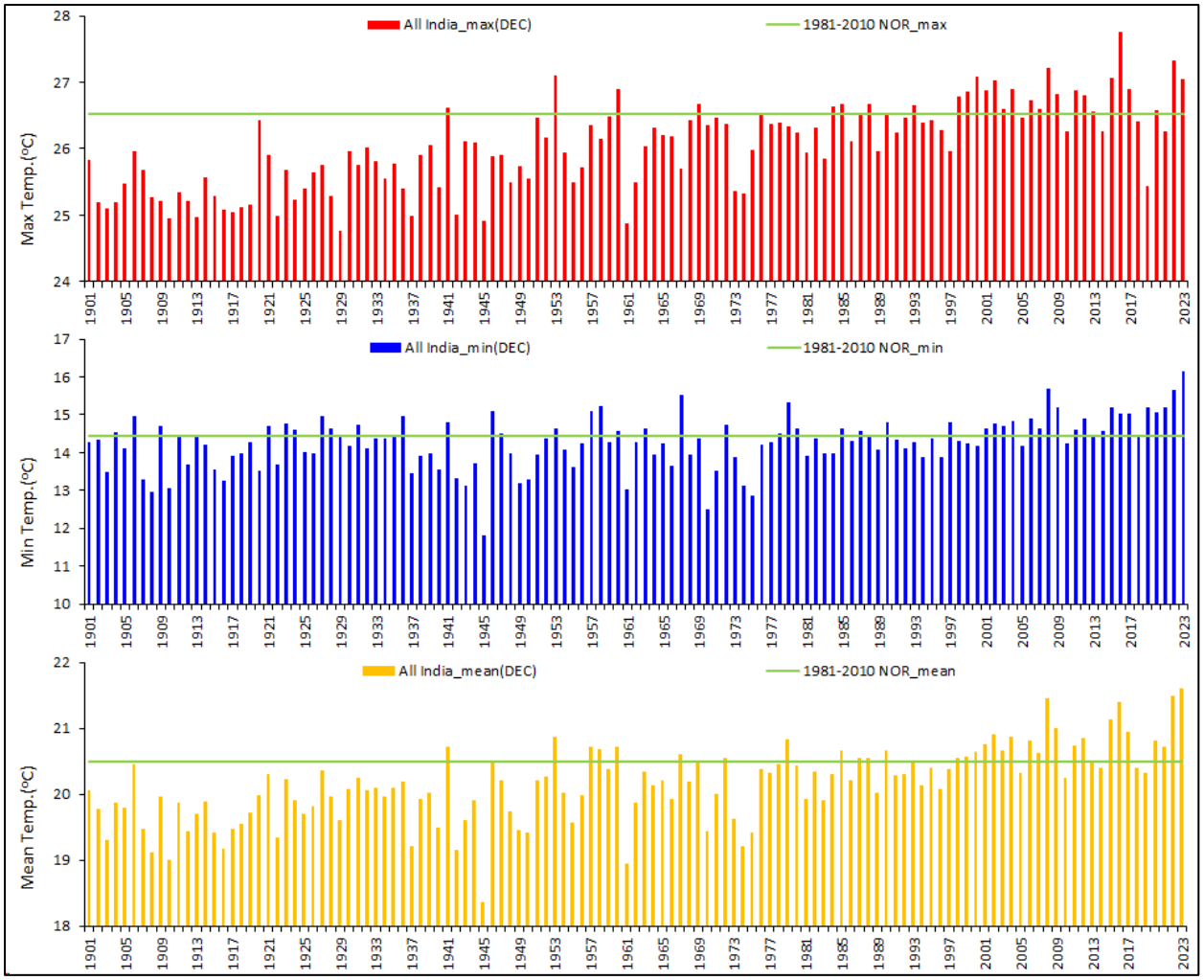


Fig 9: Time series of monthly average maximum, average minimum and mean temperature over the country as a whole for the month of December from 1901 to 2023.

Figure 10 shows time series of monthly average maximum, minimum and mean temperature over the East & Northeast India for the month of December from 1901 to2023. Over East & Northeast India during December, the average maximum temperature was 2nd highest (25.71ºC with an anomaly of 1.30ºC) after the year 2022 (25.85ºC) since 1901. The average minimum temperature was highest at 13.16ºC since 1901 against the earlier record of 12.70ºC in 2008. The mean temperature was highest at 19.44ºC since 1901 against the earlier record of 19.11ºC in 2022.

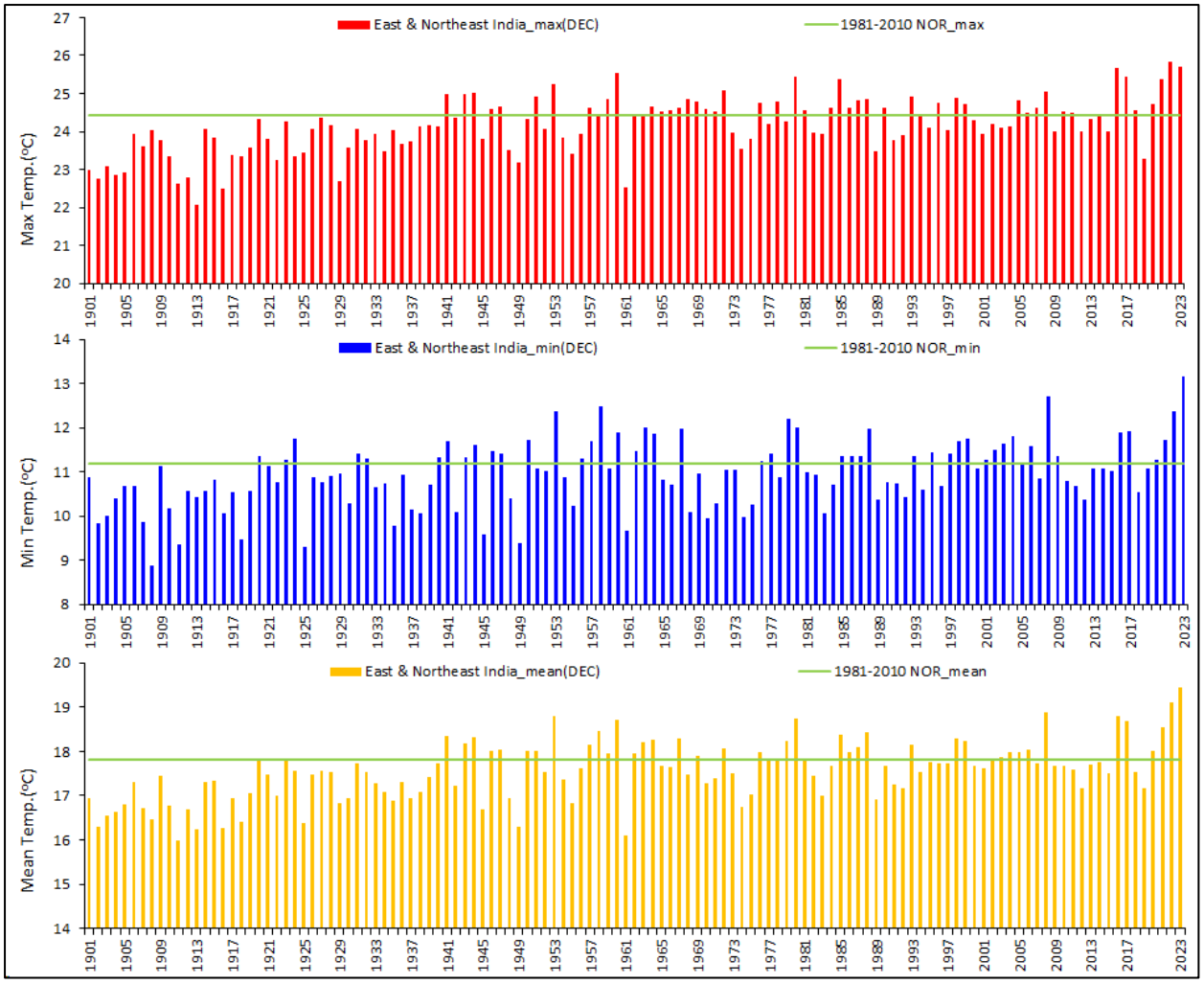


Fig 10: Time series of monthly average maximum, average minimum and mean temperature over East & Northeast India for the month of December 1901-2023.

Figure 11 shows time series of monthly average maximum, minimum and mean temperature over the South Peninsular India for the month of December from 1901 to 2023. Over South Peninsular India, during December, the average maximum temperature was 4th highest (30.59ºC with an anomaly of 0.80ºC) after the years 2015(31.03ºC), 2012(30.87ºC), 2016(30.71ºC) since 1901. The average minimum temperature was highest at 22.85ºC with an anomaly of 1.88ºC since 1901 against the earlier record of 22.66ºC in 2015. The mean temperature was 2nd highest (26.72ºC with an anomaly of 1.34ºC) after the year 2015 (26.85ºC) since 1901.

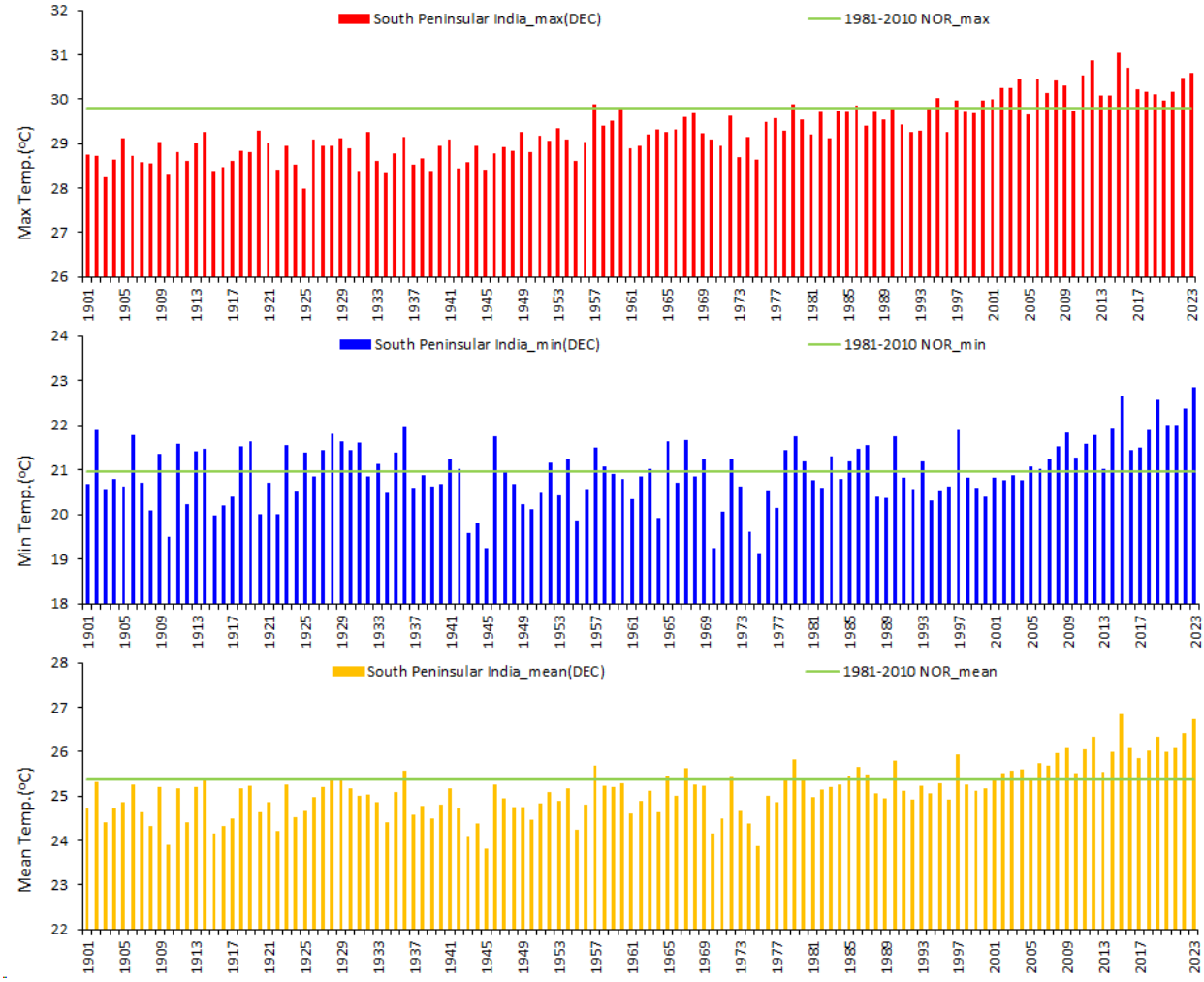


Fig 11: Time series of monthly average maximum, average minimum and mean temperature over South Peninsular India for the month of December 1901-2023.

Figure12 shows time series of monthly average minimum temperature and mean temperature over the Central India for the month of December from 1901 to 2023. Over Central India, during December, the average minimum temperature was 2nd highest (16.25ºC with an anomaly of 2.12ºC) after the year 1967(16.50ºC) since 1901. The mean temperature was 3rd highest (22.36ºC with an anomaly of 0.92ºC) after the years 2022(22.69ºC), 2008(22.62ºC) since 1901.

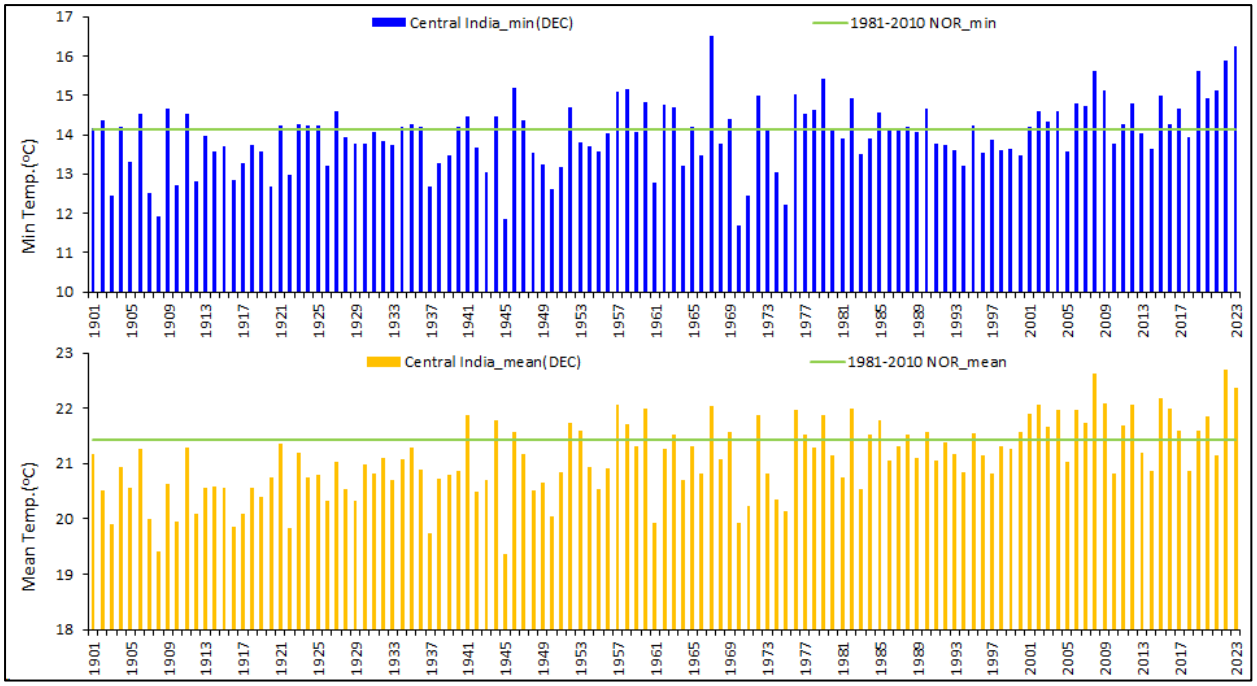


Fig 12: Time series of monthly average minimum and mean temperature over Central India for the month of December from 1901 to 2023.

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

DEC 2023		Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)
ALL INDIA	ACTUAL	27.04	16.16	21.60
	NORMAL	26.53	14.44	20.49
	ANOMALY	0.51	1.71	1.11
	Rank since 1901	7	1	1
NORTHWEST INDIA	ACTUAL	20.96	7.63	14.30
	NORMAL	20.72	6.81	13.77
	ANOMALY	0.24	0.81	0.53
	Rank since 1901	26	12	10
EAST & NORTHEAST INDIA	ACTUAL	25.71	13.16	19.44
	NORMAL	24.42	11.19	17.80
	ANOMALY	1.30	1.97	1.64
	Rank since 1901	2	1	1
CENTRAL INDIA	ACTUAL	28.47	16.25	22.36
	NORMAL	28.74	14.13	21.44
	ANOMALY	-0.28	2.12	0.92
	Rank since 1901	45	2	3
SOUTH PENNINSULAR INDIA	ACTUAL	30.59	22.85	26.72
	NORMAL	29.79	20.97	25.38
	ANOMALY	0.80	1.88	1.34
	Rank since 1901	4	1	2

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, Central India (TMin, TMean) and East & Northeast India, South Peninsular India (TMax, TMin, TMean) are given in the table below;

All India (December 2023)				
Year	TMin	Normal	Anomaly	Rank
2023	16.16	14.44	1.71	1
2008	15.69		1.25	2
2022	15.65		1.21	3
1967	15.53		1.09	4
1979	15.32		0.87	5

All India (December 2023)				
Year	TMean	Normal	Anomaly	Rank
2023	21.60	20.49	1.11	1
2022	21.49		1.00	2
2008	21.46		0.97	3
2016	21.40		0.91	4
2015	21.13		0.64	5

East & Northeast India (December 2023)				
Year	TMax	Normal	Anomaly	Rank
2022	25.85	24.42	1.43	1
2023	25.71		1.30	2
2016	25.69		1.27	3
1960	25.53		1.11	4
1980	25.46		1.04	5

South Peninsular India (December 2023)				
Year	TMax	Normal	Anomaly	Rank
2015	31.03	29.79	1.24	1
2012	30.87		1.08	2
2016	30.71		0.92	3
2023	30.59		0.80	4
2011	30.52		0.73	5

East & Northeast India (December 2023)				
Year	TMin	Normal	Anomaly	Rank
2023	13.16	11.19	1.97	1
2008	12.70		1.51	2
1958	12.47		1.28	3
2022	12.37		1.18	4
1953	12.36		1.18	5

South Peninsular India (December 2023)				
Year	TMin	Normal	Anomaly	Rank
2023	22.85	20.97	1.88	1
2015	22.66		1.69	2
2019	22.58		1.61	3
2022	22.37		1.40	4
2020	22.02		1.04	5

East & Northeast India (December 2023)				
Year	TMean	Normal	Anomaly	Rank
2023	19.44	17.80	1.64	1
2022	19.11		1.31	2
2008	18.88		1.07	3
1953	18.80		1.00	4
2016	18.79		0.99	5

South Peninsular India (December 2023)				
Year	TMean	Normal	Anomaly	Rank
2015	26.85	25.38	1.46	1
2023	26.72		1.34	2
2022	26.42		1.04	3
2019	26.34		0.96	4
2012	26.33		0.95	5

Central India (December 2023)				
Year	TMin	Normal	Anomaly	Rank
1967	16.50	14.13	2.37	1
2023	16.25		2.12	2
2022	15.88		1.75	3
2019	15.63		1.50	4
2008	15.62		1.49	5

Central India (December 2023)				
Year	TMean	Normal	Anomaly	Rank
2022	22.69	21.44	1.25	1
2008	22.62		1.18	2
2023	22.36		0.92	3
2015	22.18		0.74	4
2009	22.10		0.66	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 December 2023 is given in Figure 13.

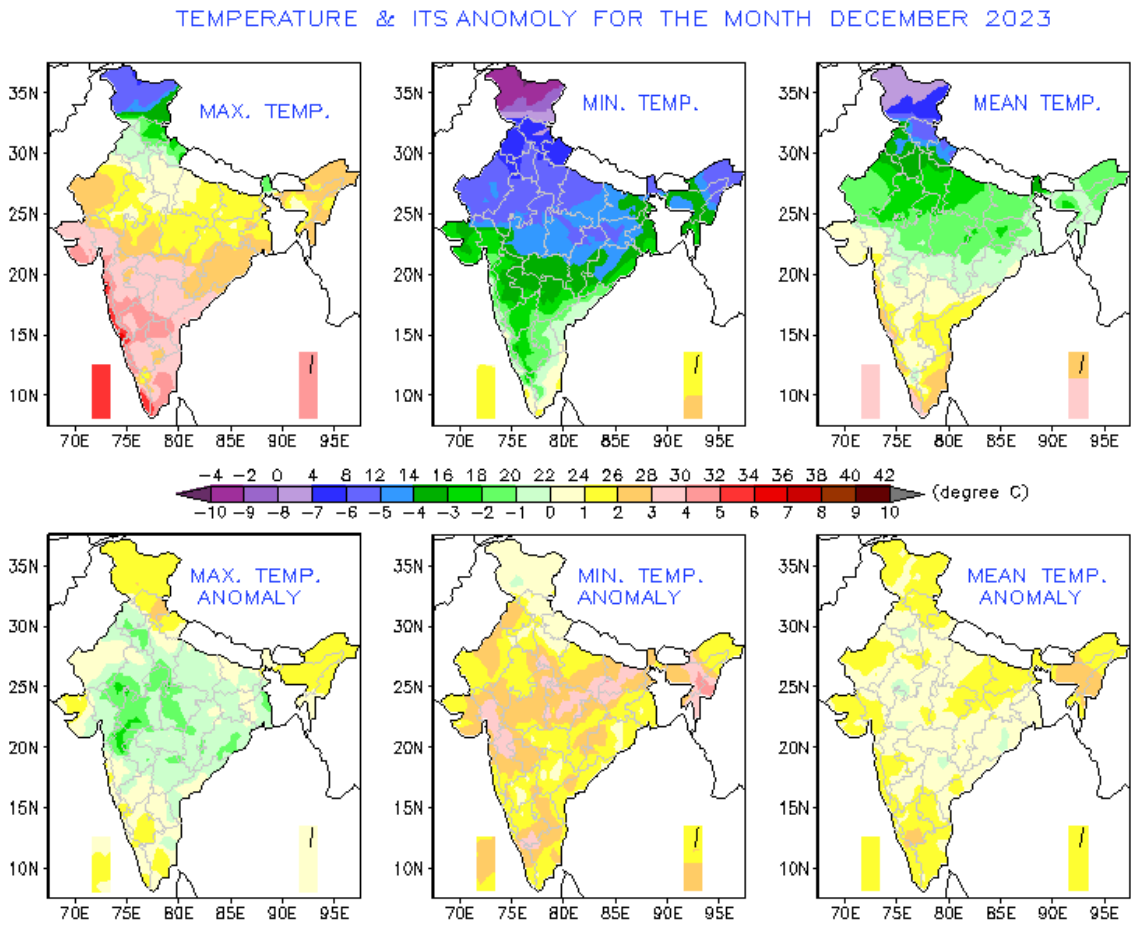


Fig13: Observed spatial temperature pattern of monthly average maximum, minimum and mean temperature over India (top three from left to right) and their departure from normal (1981 to 2010 period) for December 2023 (lower three from left toright).

6. Significant Weather Events

During December, a total of 34 persons reportedly claimed dead & 40 livestock perished. **Severe Cyclonic Storm, "MICHAUNG"** claimed 24 lives, while Floods & Heavy Rains claimed the lives of 10 persons. Figure 14 shows significant weather events during December 2023. (Based on real time media reports and other state government agencies)

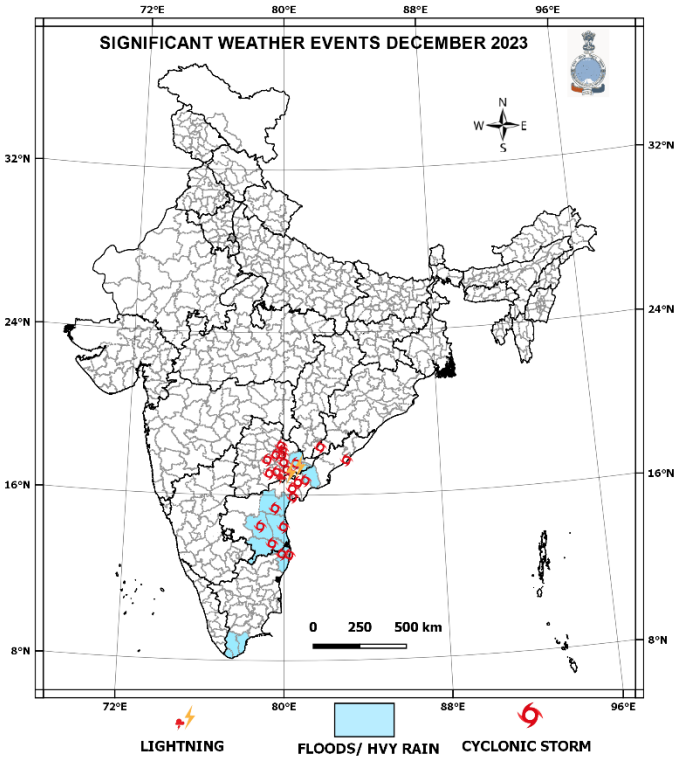


Fig. 14: Significant weather events during December 2023 which affected population (Based on real-time media report)