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

Climate Summary for Pre Monsoon (March- May) season 2022

1. Seasonal Rainfall Scenario for Pre Monsoon (March to May 2022)

Rainfall over the country as a whole for the Pre Monsoon season, 2022 shows that it has recorded 130.6 mm, which is 1% less than its Long Period Average (LPA) of 131.7mm. The observed Pre Monsoon season spatial rainfall for the year 2022, normal rainfall for the period 1961 to 2010 and its departures from normal is given in Figure 1.
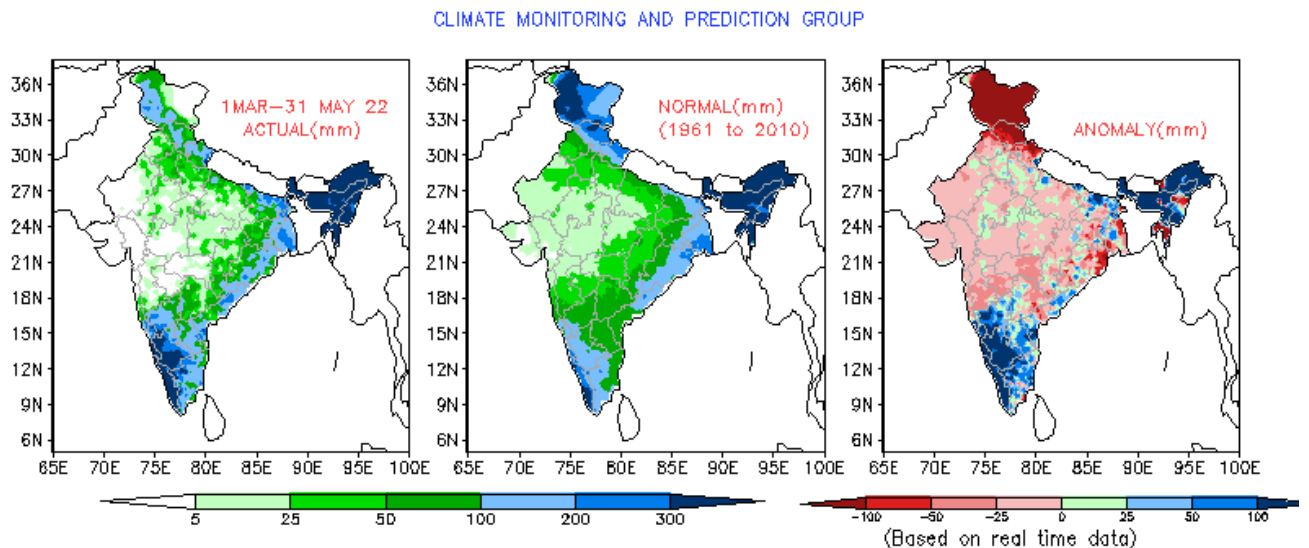

Fig 1: Observed spatial pattern of seasonal average Rainfall over India and their departure from normal (1961 to 2010 period) for Pre Monsoon 2022 season.

Detail information for the seasonal rainfall is given below:

Regions	Actual Rainfall (mm)	Normal Rainfall (mm)	% Departure from LPA
Country as a whole	130.6	131.7	-1.0
Northwest India	42.3	114.4	-63
Central India	22.8	37.5	-39.0
South Peninsula	198.2	121.3	63
East & northeast India	445.1	376.8	18

During this season, out of 36 meteorological subdivisions, 6 received large excess rainfall, 4 received excess rainfall, 8 received normal rainfall, 10 received deficient rainfall and 8 received large deficient rainfall.

Figure 2 shows time series of seasonal Rainfall over homogeneous region of South Peninsular India for the season of Pre-Monsoon during 1901-2022. It shows the seasonal rainfall for South Peninsular India (198.2 mm) is 5th highest since 1901 after the years 1990 (239.7 mm), 1943 (220.6 mm), 1955 (214.3 mm) and 1933 (205.1 mm).
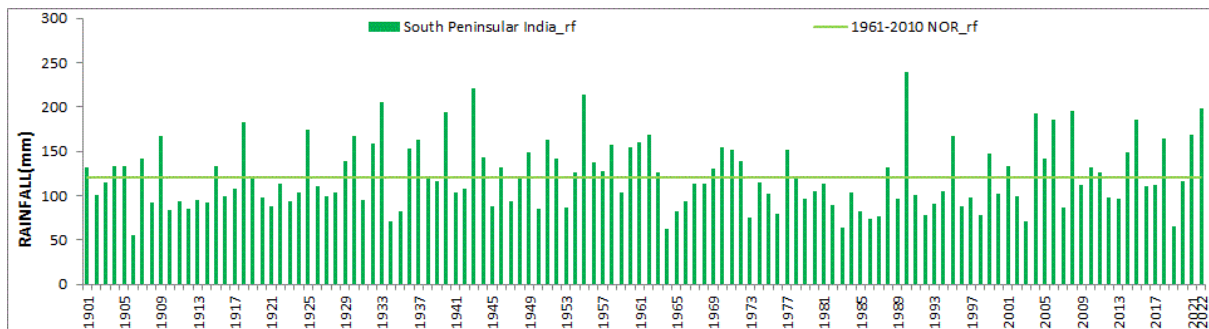

Fig 2: Time series of seasonal rainfall over South Peninsular India for the Pre-Monsoon season during 1901-2022.

Some stations received record rainfall (24 hour) during this season. The table below shows stations received 24-hour record rainfall and its previous record.

STATION	This Year RECORD RAINFALLmm)*	DATE	PREVIOUS RAINFALL RECORD(mm)	DATE
MAJBAT	77.5	26-03-2022	57.2	08-03-1976
ORAI	39	24-05-2022	37	31-05-1959
GURGAON	73.4	23-05-2022	58	02-05-1987
PATHANKOT	28	31-05-2022	4.4	20-05-2017
JAIPUR TEHSIL	8	24-05-2022	1.2	09-05-1981
KAVALI	124.2	12-05-2022	98	20-05-2010
HAKIMPET	61.2	04-05-2022	60.4	04-05-2015
CHAMARAJANAGAR	82.2	13-05-2022	54.8	25-05-2011
DAVANAGERE	87.6	19-05-2022	60.5	26-05-2008
SHIVAMOGGA	118.4	20-05-2022	93.8	31-05-1973
KOCHI	165.4	15-05-2022	119	13-05-2017

* Based on real time available data.

Chief synoptic features during Pre monsoon season 2022:

During the season in the month of March two deep depressions formed, one over Bay of Bengal (3- 6 March) and another over Andaman Sea (20-22). During May, one severe cyclonic storm ("ASANI") formed over Bay of Bengal (7 -12 May) and a depression formed over Gulf of Martaban and adjoining Myanmar (20 – 21 May). Tracks of these systems are shown in figure 3.
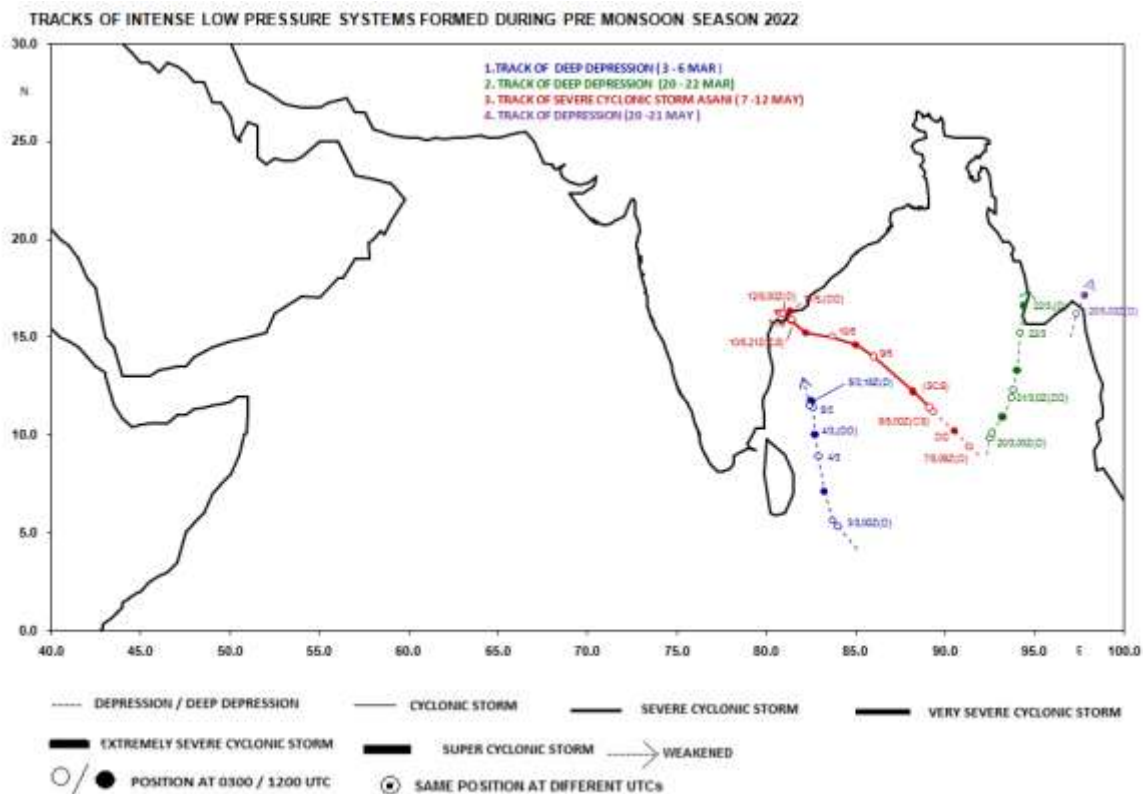

Figure 3: Tracks of Low-Pressure Systems formed during Pre Monsoon Season 2022.

2. Characteristics of Temperatures for the season of Pre-Monsoon 2022

The observed average maximum, average minimum and mean temperature for the country as a whole during Pre-Monsoon 2022 are 34.49 ºC, 22.86 ºC and 28.68 ºC respectively, against the normal of 33.45 ºC, 21.78 ºC and 27.61 ºC based on period 1981-2010. Thus, the seasonal average maximum, average minimum temperature and mean temperature are above normal by 1.04 ºC, 1.08 ºC, 1.06 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 2022 - normal temperature based on data of 1981-2010). Figure 4 shows time series of seasonal average maximum, average minimum and mean temperature over all India for the season of Pre-Monsoon during 1901-2022. It shows over the country as a whole during Pre-Monsoon, the seasonal average

maximum temperature is third highest with 34.49°C after the years 2010(34.82 °C), 2016(34.53 °C) since 1901 and mean temperature is second highest with 28.68 °C after the year 2010(28.89 °C) since 1901. The seasonal average minimum temperature is also second highest with 22.86 °C after the year 2010(22.96 °C) since 1901. The temperatures during Pre-Monsoon 2022 for all India and homogeneous regions with its ranks since 1901 is given in table 1 and the five extremes for temperature along with year of occurrence is given in table 2.
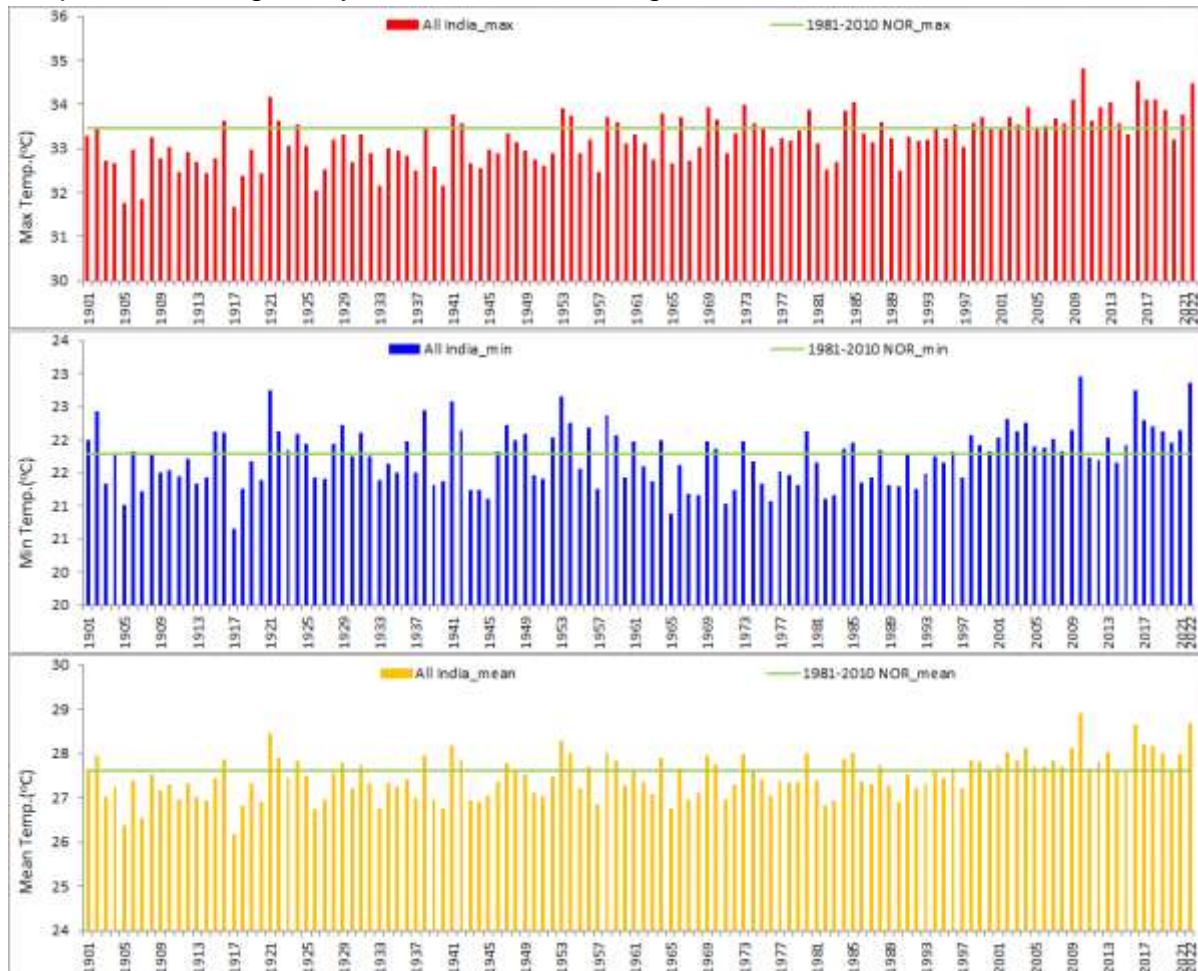

Fig 4: Time series of seasonal average maximum, average minimum and mean temperature over all India for the season of Pre-Monsoon during 1901-2022.

Figure 5 shows time series of seasonal average maximum, average minimum and mean temperature over Northwest India for the season of Pre-Monsoon during 1901-2022. Over Northwest India during Pre-Monsoon, the seasonal average maximum temperature is ever highest with 34.55 °C in last 122 years for the period 1901-2022 and it broken the earlier ever highest record of 34.28 °C which was in 2010 for the season of the Pre-Monsoon for the same period. The seasonal average mean temperature is ever highest with 26.98 °C since 1901 and it broken the earlier ever highest record of 26.86 °C which was in 2010 for the season of the Pre-Monsoon for the same period and minimum temperature is second highest 19.40 °C after the year 2010 (19.43 °C) since 1901.
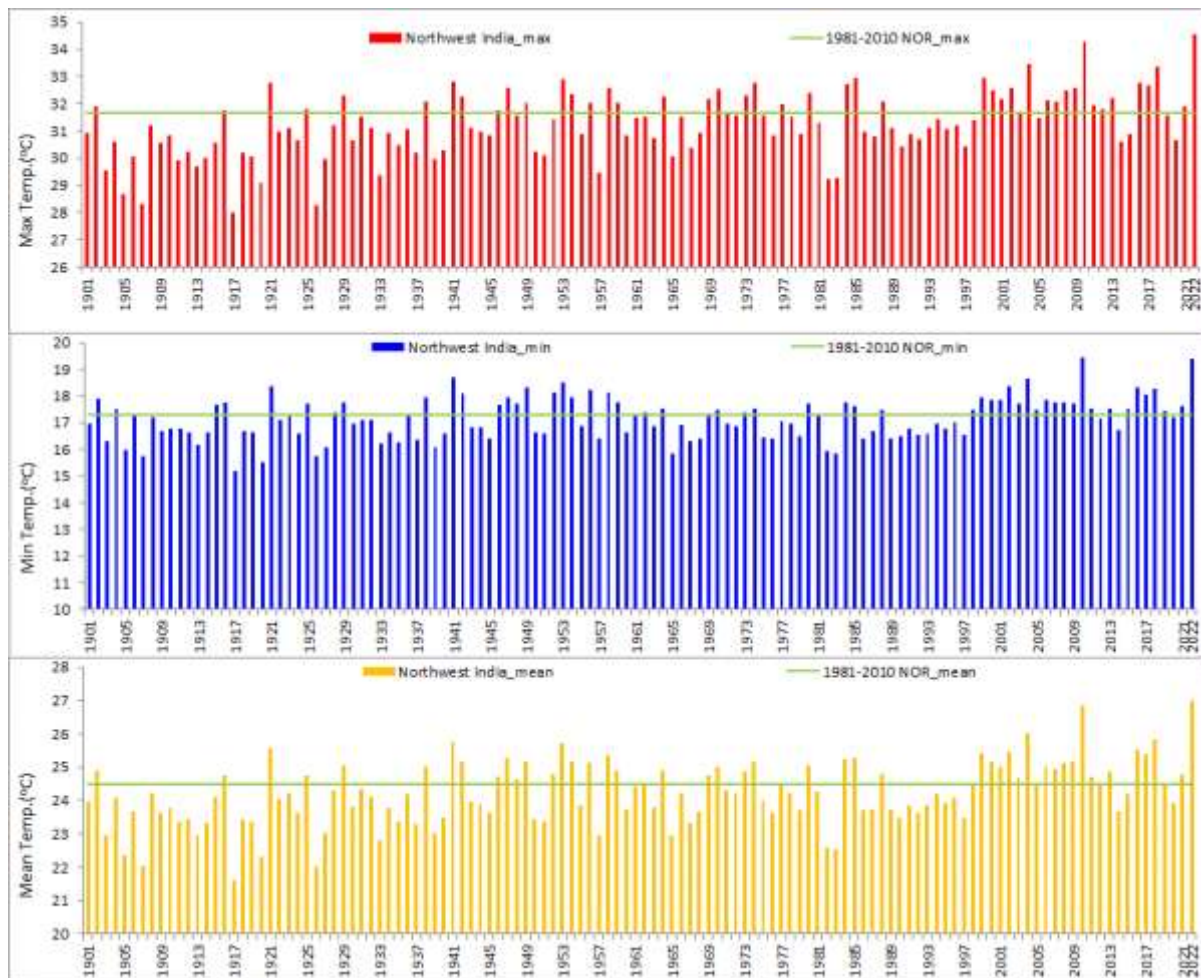
Fig 5: Time series of seasonal average maximum, average minimum and mean temperature over Northwest India for the season of Pre-Monsoon during 1901-2022.

Figure 6 shows time series of seasonal average maximum, average minimum and mean temperature over Central India for the season of Pre-Monsoon during 1901-2022. Over Central India during Pre-Monsoon, the seasonal average maximum temperature is second highest with 36.98 ⁰C after the year 2010 (37.10 ⁰C) since 1901. The seasonal average mean temperature is also second highest with 30.47 ⁰C after the year 2010 (30.59 ⁰C) since 1901. The seasonal average minimum temperature is third highest with 23.958 ⁰C after the years 2010 (24.09 ⁰C), 2016 (23.961 ⁰C) since 1901.
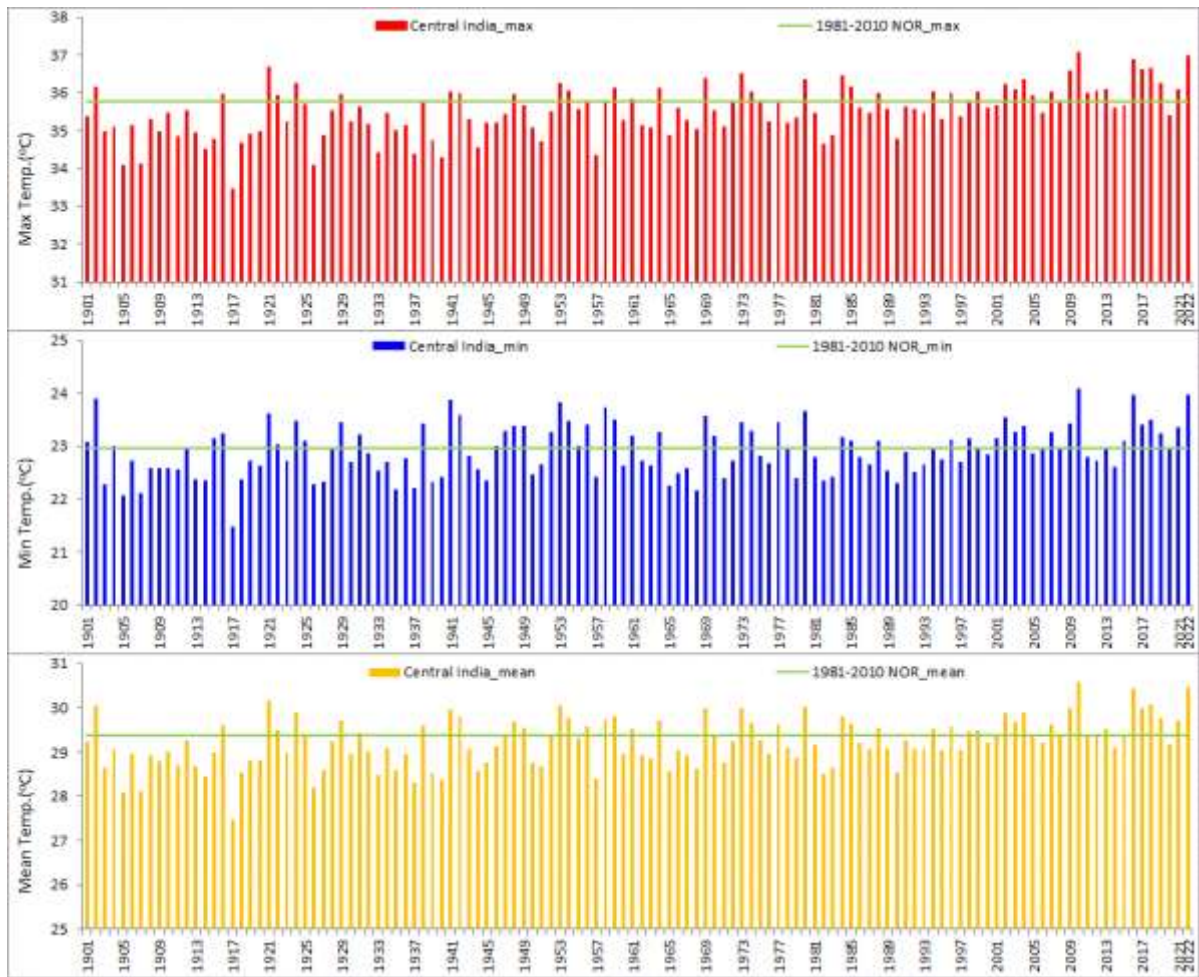
Fig 6: Time series of seasonal average maximum, average minimum and mean temperature over Central India for the season of Pre-Monsoon during 1901-2022.

Figure 7 shows time series of seasonal average minimum temperature over East & Northeast India for the season of Pre-Monsoon during 1901-2022. Over East & Northeast India during Pre-Monsoon, the seasonal average minimum temperature is ever highest with 21.02 ⁰C in last 122 years for the period 1901-2022 and it broken the earlier ever highest record of 20.95 ⁰C which was in 1953 for the season of the Pre-Monsoon for the same period.
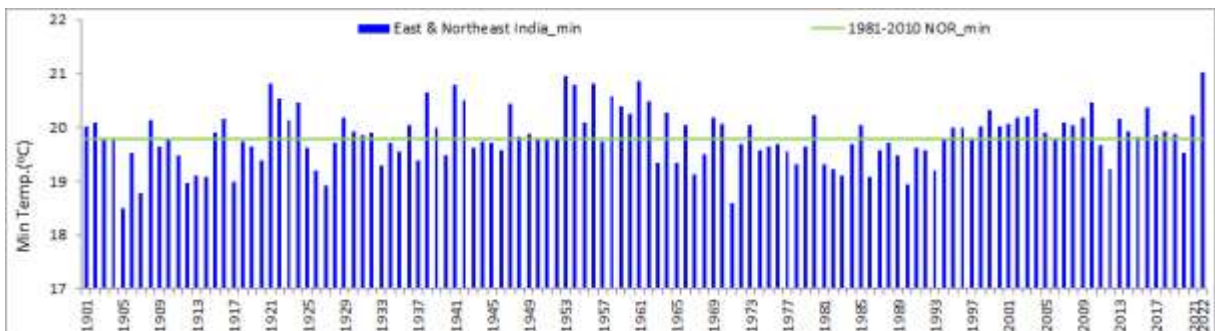

Fig 7: Time series of seasonal average minimum temperature over East & Northeast India for the season of Pre-Monsoon during 1901-2022.

PRE_MONSOON 2022		Max Temp (^{0}C)	Min Temp (^{0}C)	Mean Temp (^{0}C)
ALL INDIA	ACTUAL	34.49	22.86	28.68
	NORMAL	33.45	21.78	27.61
	ANOMALY	1.04	1.08	1.06
	TOP RANK	3	2	2
NORTHWEST INDIA	ACTUAL	34.55	19.40	26.98
	NORMAL	31.65	17.29	24.47
	ANOMALY	2.90	2.11	2.51
	TOP RANK	1	2	1
EAST & NORTHEAST INDIA	ACTUAL	32.41	21.02	26.71
	NORMAL	31.74	19.79	25.76
	ANOMALY	0.67	1.23	0.95
	TOP RANK	29	1	7
CENTRAL INDIA	ACTUAL	36.98	23.96	30.47
	NORMAL	35.77	22.96	29.36
	ANOMALY	1.21	1.00	1.10
	TOP RANK	2	3	2
SOUTH PENNINSULAR INDIA	ACTUAL	33.80	25.20	29.50
	NORMAL	33.93	24.80	29.37
	ANOMALY	-0.13	0.40	0.13
	TOP RANK	46	18	26

(Values are rounded off to nearest two decimal)

Table1: The Temperatures and its anomaly during Pre-Monsoon 2022 for All India and homogeneous regions with its ranks since 1901.

All India (Pre-Monsoon 2022)				
Year	TMax	Normal	Anomaly	Rank
2010	34.82	33.45	1.38	1
2016	34.53		1.08	2
2022	34.49		1.04	3
1921	34.17		0.72	4
2017	34.12		0.67	5

Northwest India (Pre-Monsoon2022)				
Year	TMax	Normal	Anomaly	Rank
2022	34.55	31.65	2.90	1
2010	34.28		2.64	2
2004	33.43		1.78	3
2018	33.35		1.70	4
1999	32.93		1.28	5

Central India (Pre-Monsoon 2022)				
Year	TMax	Normal	Anomaly	Rank
2010	37.10	35.77	1.33	1
2022	36.98		1.21	2
2016	36.90		1.13	3
1921	36.68		0.91	4
2018	36.67		0.90	5

All India (Pre-Monsoon 2022)				
Year	TMin	Normal	Anomaly	Rank
2010	22.96	21.78	1.19	1
2022	22.86		1.08	2
1921	22.754		0.975	3
2016	22.748		0.969	4
1953	22.66		0.88	5

Northwest India (Pre-Monsoon2022)				
Year	TMin	Normal	Anomaly	Rank
2010	19.43	17.29	2.13	1
2022	19.40		2.11	2
1941	18.71		1.42	3
2004	18.64		1.34	4
1953	18.53		1.24	5

Central India (Pre-Monsoon 2022)				
Year	TMin	Normal	Anomaly	Rank
2010	24.09	22.96	1.13	1
2016	23.961		1.002	2
2022	23.958		0.999	3
1902	23.91		0.95	4
1941	23.86		0.91	5

All India (Pre-Monsoon 2022)				
Year	TMean	Normal	Anomaly	Rank
2010	28.89	27.61	1.28	1
2022	28.68		1.06	2
2016	28.64		1.03	3
1921	28.46		0.85	4
1953	28.28		0.67	5

Northwest India (Pre-Monsoon2022)				
Year	TMean	Normal	Anomaly	Rank
2022	26.98	24.47	2.51	1
2010	26.86		2.39	2
2004	26.03		1.56	3
2018	25.82		1.35	4
1941	25.76		1.29	5

Central India (Pre-Monsoon 2022)				
Year	TMean	Normal	Anomaly	Rank
2010	30.59	29.36	1.23	1
2022	30.47		1.10	2
2016	30.43		1.06	3
1921	30.15		0.78	4
2018	30.08		0.72	5

East & Northeast India (Pre-Monsoon 2022)				
Year	TMin	Normal	Anomaly	Rank
2022	21.02	19.79	1.23	1
1953	20.95		1.16	2
1961	20.85		1.07	3
1921	20.81		1.02	4
1956	20.80		1.02	5

Table2: The five highest temperature records with corresponding ranks since 1901 along with year of occurrence for All India, Northwest India, Central India (TMean, TMax, TMin) and for East & Northeast India (TMin)

The observed spatial temperature pattern of seasonal average maximum, average minimum and mean temperature over India and their departures from normal (1981 to 2010 period) for pre monsoon season 2022 is given in Figure 8.

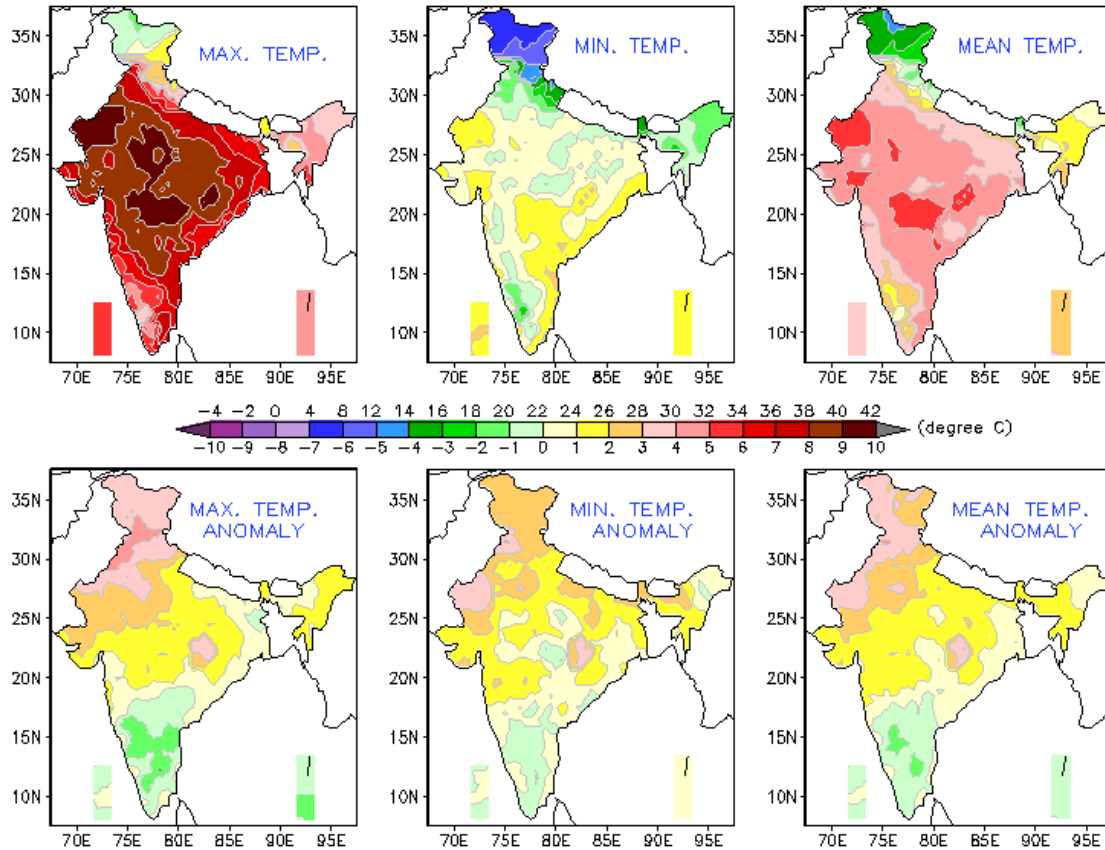(TEMPERATURE & ITS ANOMALY FOR PRE-MONSOON SEASON 2022)

Fig 8: Observed spatial temperature pattern of seasonal 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 pre monsoon season 2021(lower three from left to right).

Some stations reported record (highest) temperature during this season. The table below shows stations reported   highest temperature and its previous record.

STATION NAME	NEW RECORD. (^{0}C) #	DATE (PREMON 22)	PREVIOUS RECORD (^{0}C)	DATE
Cherrapunji	29.8	14-03-2022	28.3	21-03-2010
Dibrugarh	35.2	18-03-2022	34.5	19-03-2010
Passighat	34.8	19-03-2022	34	27-03-1973
Agra	42.5	31-03-2022	41.5	31-03-1994
Aligarh	40.6	31-03-2022	40.1	16-03-1977
Dehar Dun	36.1	31-03-2022	35.8	31-03-2017
Ambala	37.9	29-03-2022	37.6	25-03-2010
Karnal	38.4	30-03-2022	37.5	26-03-1977
Patiala	38.8	30-03-2022	37.6	24-03-2010
Shimla	26.3	17-03-2022	25.7	30-03-2017
Jammu	37.3	27-03-2022	36.5	24-03-2010
Srinagar	27.6	29-03-2022	27.3	27-03-1971

Bikaner	42.5	30-03-2022	42.2	29-03-2017
Ganganagar	42.2	29-03-2022	41.6	22-03-2010
Phalodi	43 @	17-03-2022	43	30-03-1999
Gwalior	41.8	31-03-2022	41.5	23-03-2004
Nowgong	42.6	31-03-2022	42.2	28-03-1977
Pendra	40.4	31-03-2022	40	26-03-2010
Sagar	41.3	31-03-2022	40.5	22-03-2004
Satna	42	31-03-2022	41.1	23-03-2004
Umaria	41.3	31-03-2022	41	31-03-1994
Akola	43.2 @	30-03-2022	43.2	31-03-2007
Chandrapur	44.2	30-03-2022	43.9	24-03-2010
Sholapur	42.8	30-03-2022	42.7	24-03-2004
Gopalpur	37.8 @	22-04-2022	37.8	12-04-1994
Daltonganj	46	30-04-2022	45.6	30-04-2009
Motihari	41.5	06-04-2022	41.4	16-04-1973
Allahabad	46.8	29-04-2022	46.6	30-04-1999
Jhansi	46.2 @	29-04-2022	46.2	17-04-2010
Lucknow	45.1	29-04-2022	45	30-04-1999
Ferozepur	43.7	28-04-2022	43.4	27-04-1970
Dharamsala	36.2	30-04-2022	35.6	18-04-2010
Alwar	45.8	08-04-2022	45.1	28-04-1979
Jaisalmer	45.9	30-04-2022	45.8	29-04-2009
Panchmarhi	39.8	21-04-2022	38.9	27-04-1970
Medikeri	34.8	20-04-2022	34.2	07-04-1998
Minicoy	35 @	28-04-2022	35	21-04-1993
Ratlam	46	09-05-2022	45.5	13-05-1970
Naliya	46.1	14-05-2022	44.2	23-05-2018
Karwar	37.6	03-05-2022	37.4	10-05-2010

Based on real time available data   @ Equals previous record

3. Significant Weather Events for Pre Monsoon Season (March to May) 2022:

During the season, total 231 persons reportedly claimed dead, 105 persons injured, 11 persons missing & 1234 livestock perished. The details of causalities given below, which are based on real time media reports and other state government agencies.
Fig. No.9 shows significant weather events during the month. (Based on real time media reports.)

Floods, Heavy Rains & Landslide: Total 81 persons reportedly claimed dead, 15 persons injured, 11 persons missing & 1151 livestock perished, during the season, because of Floods, Heavy Rains & Landslide. The details of the area effected by the events are summarized and given in the table below:

DATE	DEATH	INJURED	MISSING	LIVESTOCK	DISTRICT (STATE) AFFECTED
13, 15 to 25, 27, 29 May	35		10	1151	Cachar, Darrang, Dima-Hasao, Hojai, Lakhimpur, Nagaon, Udalguri (Assam)
23 May	12	3			Agra, Ghazipur, Kaushambi, Pratapgarh, Varanasi (Uttar Pradesh)
17 Apr.; 15 to 17	11	8	1		Itanagar, Kurung Kumey (Arunachal Pradesh)

May				
4 Apr.; 14, 16, 19 May	6	2		East Khasi Hills, Ri-Bhoi (Meghalaya)
17, 18, 20 May	4			Ernakulam, Idukki, Kozikode, Thrissur (Kerala)
22 & 29 May	4			Kangra, Mandi, Shimla, Sirmaur (Himachal Pradesh)
14 Apr.; 18 & 19 May	3	2		Bangalore Urban, Hassan, Koppal (Karnataka)
19 to 21 May	3			Darbhanga, Katihar, Kishanganj (Bihar)
23 May	3			Dimapur, Kohima, Peren (Nagaland)

Lightning: Total 76 persons reportedly claimed dead, 36 persons injured & 77 livestock perished, during 1st March to 31st May, because of Lightning. The details of the area effected by the events are summarized and given in the table below;

DATE	DEATH	INJURED	LIVESTOCK	DISTRICT (STATE) AFFECTED
19 & 20 May	34			Araria, Banka, Begusarai, Bhagalpur, Jamui, Jehanabad, Lakhisarai, Munger, Muzaffarpur, Nalanda, Purnia, Saran, Vaishali (Bihar)
4, 21, 23 May	10	10		Aligarh, Amroha, Banda, Bijnor, Lakhimpur Kheri, Meerut, Shahjahanpur (Uttar Pradesh)
16 Apr.; 1, 4, 17 May	8	7	33	Bidar, Chitradurga, Gadag, Gulbarga, Mandya (Karnataka)
13 Apr.	6			Kallakurichi, Virudhunagar (Tamil Nadu)
14, 17, 29 Apr.	5	5	8	Dhemaji, Dhubri, Dibrugarh, Goalpara, Jorhat, Kokrajhar (Assam)
7, 9 Mar.; 6 Apr.	4	4	34	Dhule, Nashik (Maharashtra)
4 May	3		2	Chittoor, Guntur (Andhra Pradesh)
8 Apr.	2	8		Seoni (Madhya Pradesh)
14 Apr.	1			Budgam (Union Territory-Jammu & Kashmir)
4 May	1	1		Siddipet (Telangana)
22 May	1	1		Sirmaur (Himachal Pradesh)
28 May	1			Ganjam (Odisha)

Thunderstorm : Total 35 persons reportedly claimed dead, 54 person injured & 6 livestock perished, during the season, due to Thunderstorm. The details of the area effected by the events are summarized and given in the table below;

DATE	DEATH	INJURED	LIVESTOCK	DISTRICT (STATE) AFFECTED
14 to 29 Apr.; 18 & 19 May	30	3	6	Baksa, Barpeta, Bongaigaon, Chirang, Dibrugarh, Dhubri, Goalpara, Jorhat, Morigaon, Nagaon, Sonitpur, Tinsukia (Assam)
22 Apr.	2	1		Pune (Maharashtra)
17 Apr.	2	50		Cooch Behar (West Bengal)
21 Apr.	1			Durg (Chhattisgarh)

Dust Storm: Total 22 persons reportedly claimed dead on 23rd May 2022 due to dust storm in Amethi, Ambedkar Nagar, Ayodhya/Faizabad, Ballia, Barabanki, Chitrakoot, Firozabad, Gonda, Jaunpur, Kaushambi, Muzaffarnagar, Sitapur, Varanasi of Uttar Pradesh State.

Heat Wave: Total 15 person reportedly claimed dead, during 1st March to 31st May, because of Heat Wave. The details of the area effected by the events are summarized and given in the table below;

DATE	DEATH	INJURED	MISSING	LIVESTOCK	DISTRICT (STATE) AFFECTED
29 to 31 Mar.; 1 to 6 Apr., 26, 28, 30 Apr.; 10 May	13				Akola, Jalgaon, Nagpur, Nashik, Osmanabad (Maharashtra)
27 Apr.	1				Raigarh (Chhattisgarh)
29 Apr.	1				Palamu (Jharkhand)

Gale: One person reportedly claimed dead on 12th May 2022 due to gale in Kamrup Metro of Assam state.

Snowfall: One person reportedly claimed dead, on 26th April 2022 because of Snowfall in Kargil district of Ladakh.
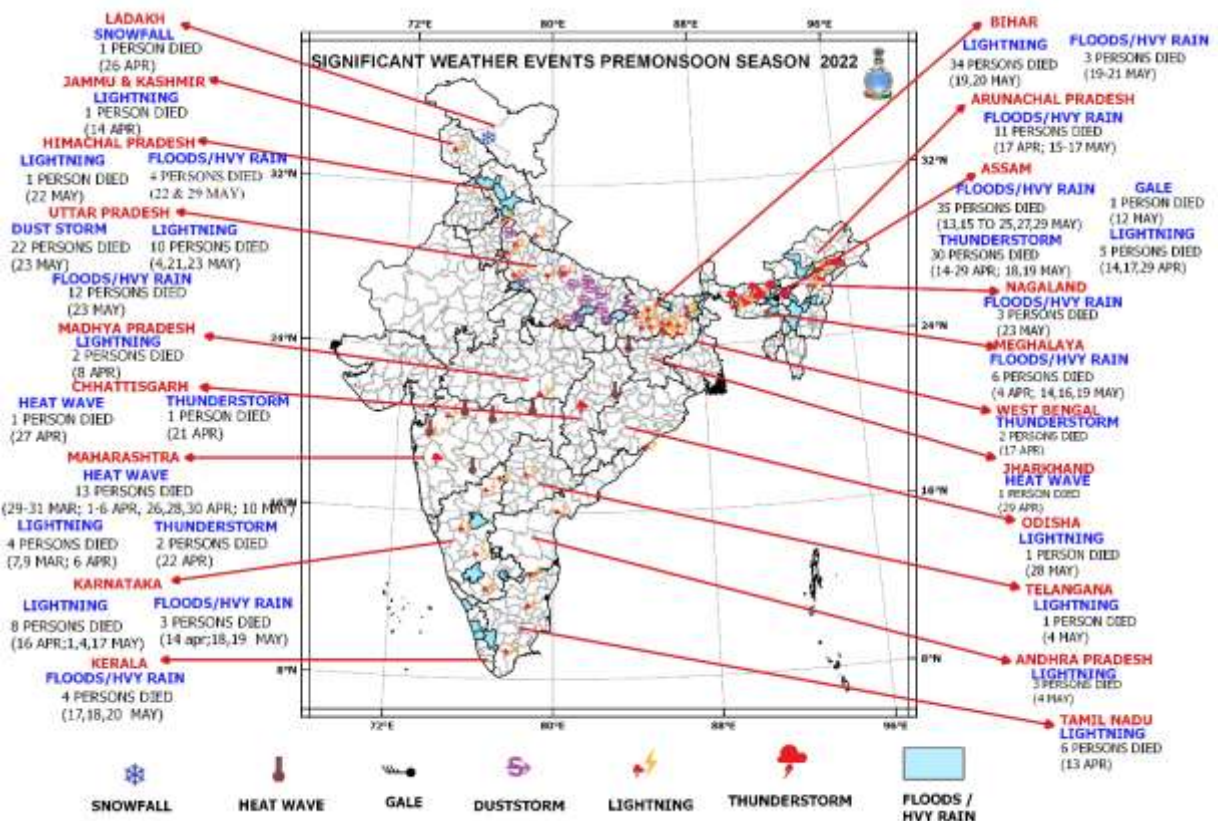

Fig 9: Significant weather events during Pre Monsoon season 2022 (Based on real-time media report and other state government agencies).

4. Seasonal temperature outlook Verification for March to May 2022 (issued on 1 March 2022)
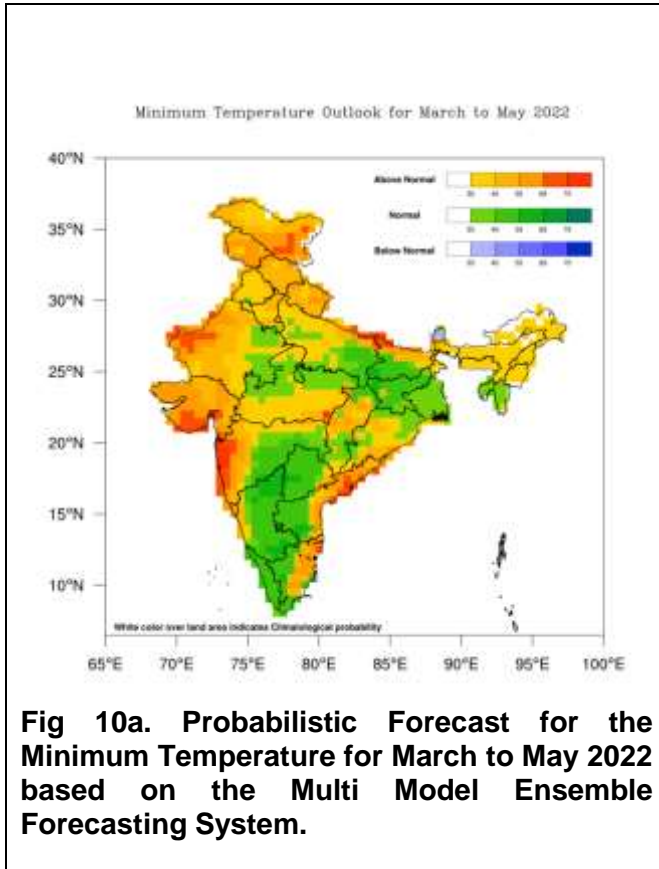

Fig 10a. Probabilistic Forecast for the Minimum Temperature for March to May 2022 based on the Multi Model Ensemble Forecasting System.
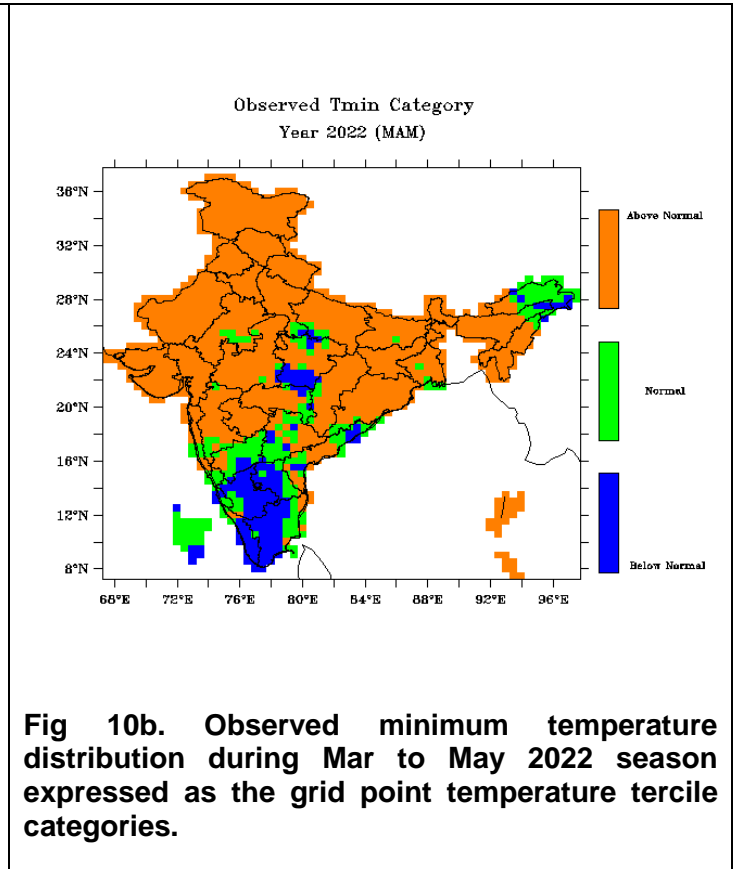
Fig 10b. Observed minimum temperature distribution during Mar to May 2022 season expressed as the grid point temperature tercile categories.

The outlook for minimum temperature for the season March to May (MAM) 2022 showed in Fig.10a suggested normal to above-normal minimum temperature over most parts India. Especially, the outlook suggested above normal minimum temperature over north and northwest India. Fig. 10b shows the observed minimum temperature distribution during the MAM 2022 season expressed in terms of tercile categories. It was seen that above normal minimum temperature was observed over most parts of India except parts of peninsular India and northeast India, which was matched well with the forecast. The normal to below normal minimum temperature over the parts of peninsular India also matched with the forecast.

The seasonal outlook for maximum temperature for the March to May 2022 showed in Fig.11a suggested normal to above-normal maximum temperature over north and northwest India and southcentral India. However, below normal maximum temperature was forecasted over peninsular India, along the foothills of Himalaya and over central east India. Fig. 11b shows the observed maximum temperature distribution during the MAM2022 season expressed in terms of tercile categories. It was seen that above normal maximum temperature was observed over most parts of north and northwest India was matched well with the forecast. The below normal maximum temperature over peninsular India also matched with the forecast. However, there were differences between the observed and forecasted maximum temperature patterns over the foothills of Himalaya and central-east northeast regions of South Asia, where below normal maximum temperature was forecasted.
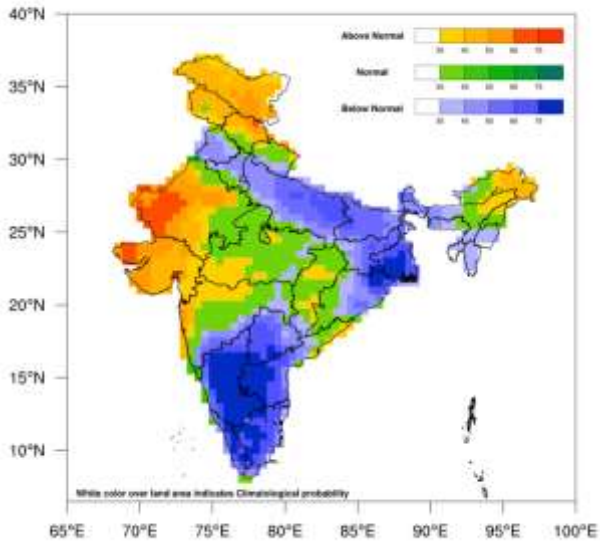
Fig 11a. Probabilistic Forecast for the Maximum Temperature for March to May 2022 based on the Multi Model Ensemble Forecasting System.
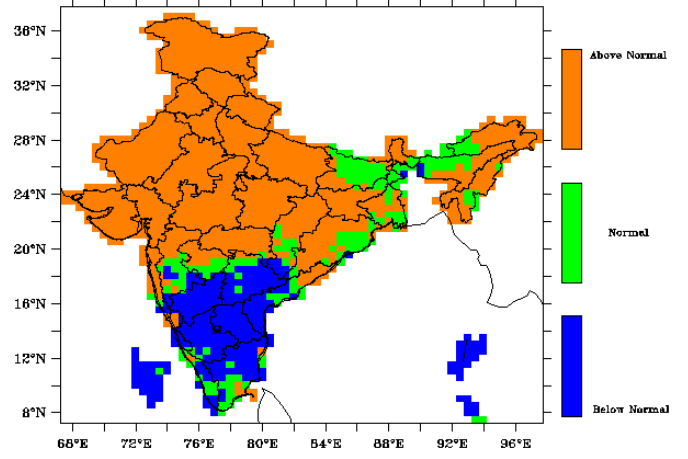

Fig 11b. Observed maximum temperature distribution during Mar to May 2022 season expressed as the grid point temperature tercile categories.