



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

**Dated: 8 Feb, 2021**

**Subject: Monthly Weather Review for the month of Jan 2021 and Weather Outlook  
for the month of Feb 2021**

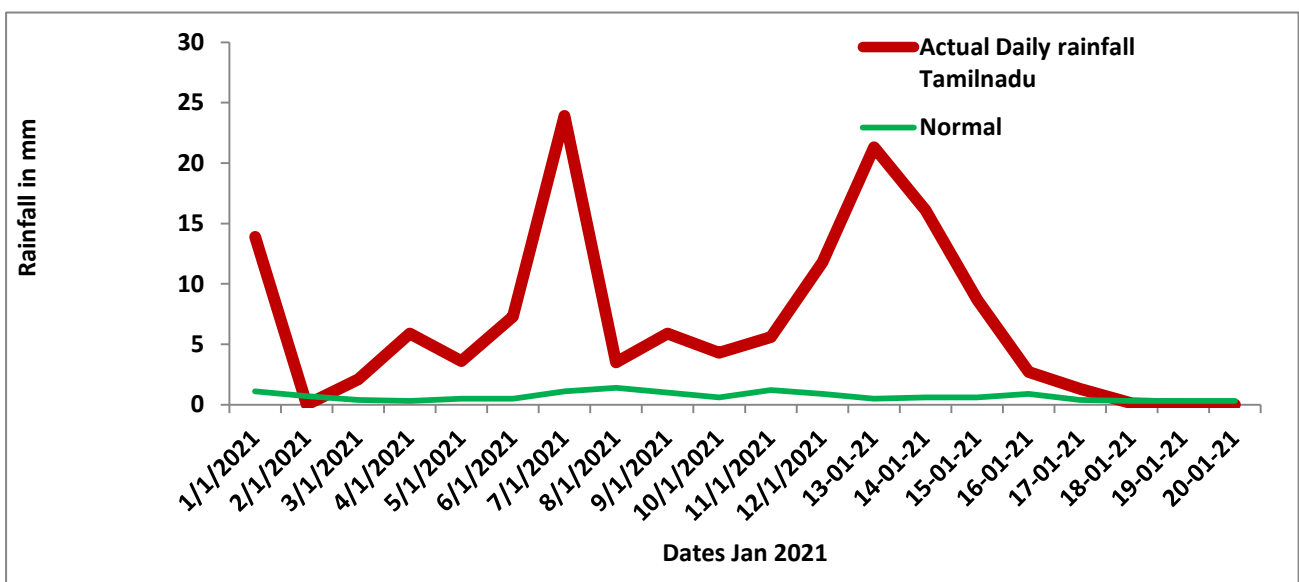
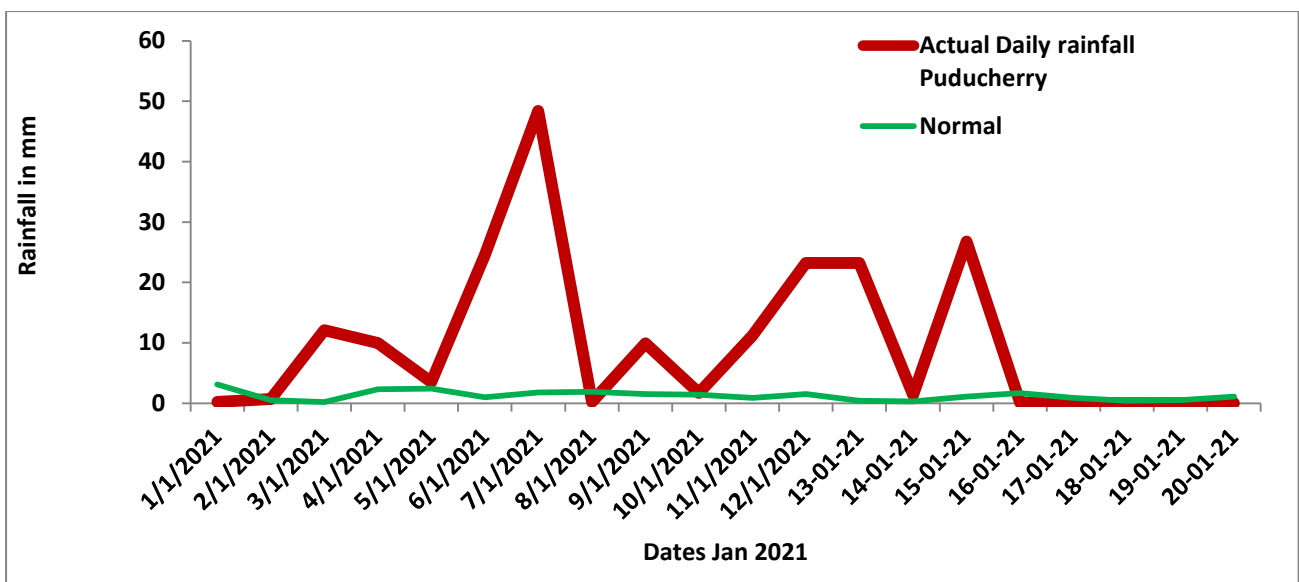
**1. Salient features of month of Jan 2021**

**(a) Monthly Rainfall Scenario over the country and about the unusual rainfall observed over southeast Peninsula India (01 to 31 Jan 2021):** Rainfall over the country as a whole for the month of January, 2021 shows that it has recorded 20.25 mm which is 17% more than its Long Period Average (LPA) of 17.3 mm with south Peninsula (458% above LPA) as shown in Table 1. Fig. 2 shows Meteorological subdivision-wise rainfall during Jan 2021. During this month, 11 sub-divisions received large excess, 2 excess, 4 normal while remaining 18 are deficient or large deficient rainfall and 1 (Saurashtra & Kutch) received no rain. **Fig 3 shows monthly total rainfall over peninsular India for the month of Jan during 1951-2021. It shows monthly Jan rainfall over the region was large excess and unusually high in Jan 2021 over the south peninsula during the period of 1951-2021, with actual rainfall realized 45.9mm against normal of 8.9mm (+433% above normal).**

**(b) Unusual daily rainfall spell over southeast Peninsula India including Tamilnadu and Puducherry during 1-17 Jan 2021:** A prolonged wet spell of around 17 days was observed over the state of Tamil Nadu and Puducherry & Karaikal during 1-17 Jan 2021 when rainfall distribution was scattered to fairly widespread in most dates. There were two peak periods rainfall activities i.e. 5-7 Jan when its north coastal districts and adjoining interior districts had report isolated extremely heavy rainfall (>20.4cm) and then during 11-13 Jan when its extreme southern parts of districts had reported similar higher amount of rainfall. Fig 1 a, b shows the actual daily area weighted rainfall and its normal over Puducherry and Tamil Nadu for Jan 2021 respectively for the period 1-20 Jan 2021 which cover this wet spell. It shows

that rainfall was much higher than normal during most of the dates till 16 Jan 2021. Similar higher than normal rainfall also occurred over other four met sub-divisions of southeast Peninsular India covering adjoining Coastal Andhra Pradesh, Rayalaseema, Kerala and south interior Karnataka. **Such enhanced rainfall activity was also noted in weekly by week rainfall distribution where one may note higher rainfall over the state of Tamil Nadu, Puducherry & Karaikal for week ending on 31 Dec 2019-6 Jan, 7-13 Jan and 14-20 Jan 2021 when rainfall departure are +807%, +1036% and +727% respectively during corresponding weeks.**

**c) Withdrawal of northeast monsoon:** Northeast Monsoon rains have ceased over Tamilnadu, Puducherry & Karaikal, Kerala & Mahe and adjoining areas of Andhra Pradesh and Karnataka from 19<sup>th</sup> January 2021.



**Fig 1 (a and b):** Daily area weighted actual rainfall and its normal over a) UT of Puducherry (top) and b) Tamil Nadu state for the period 1-20 Jan 2021

Table 1 Rainfall over India during Jan 2021

Regions	Actual Rainfall (mm)	Normal Rainfall (mm)	% Departure from LPA
Country as a whole	20.25	17.3	17.0%
Northwest India	28.41	33.6	-15.4%
Central India	3.88	7.5	-48.3%
South Peninsula	45.77	8.2	458.2%
East & northeast India	7.59	18.3	-58.5%

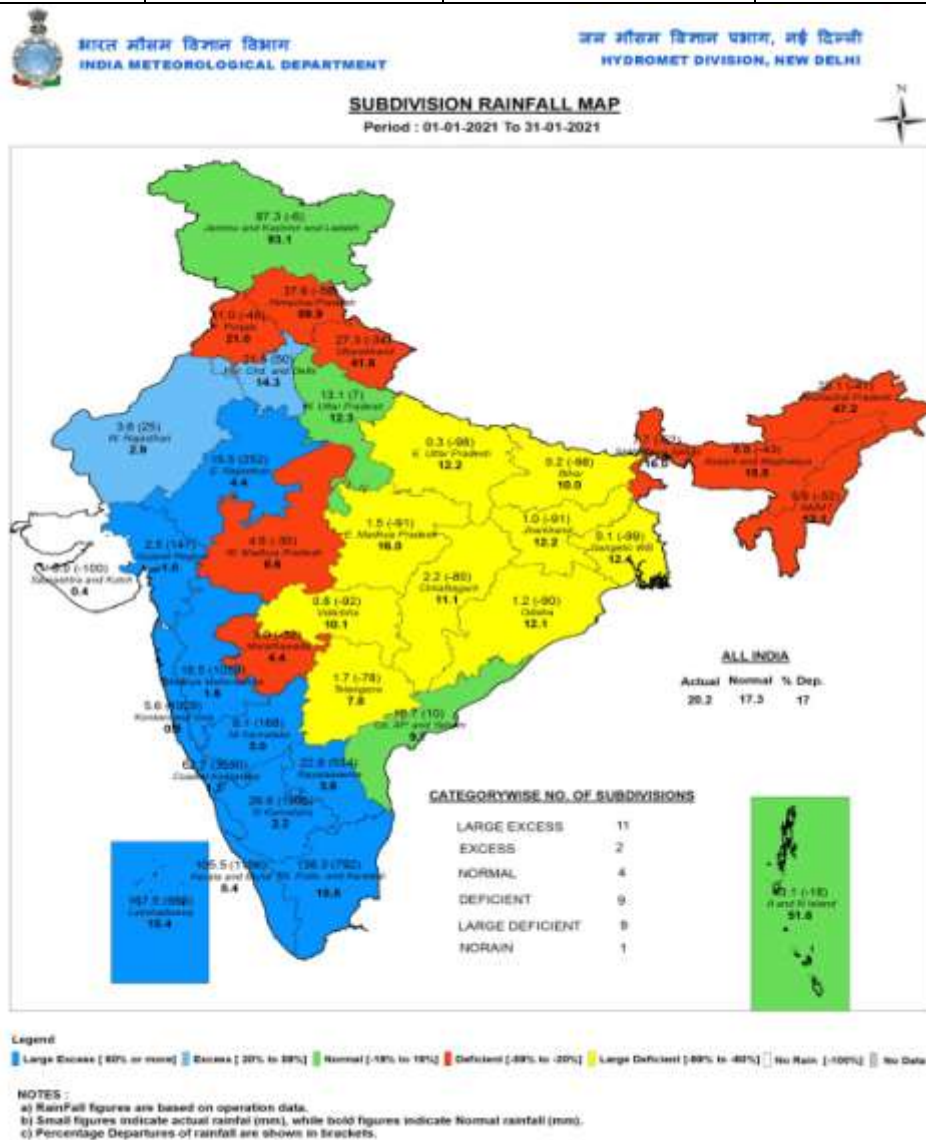
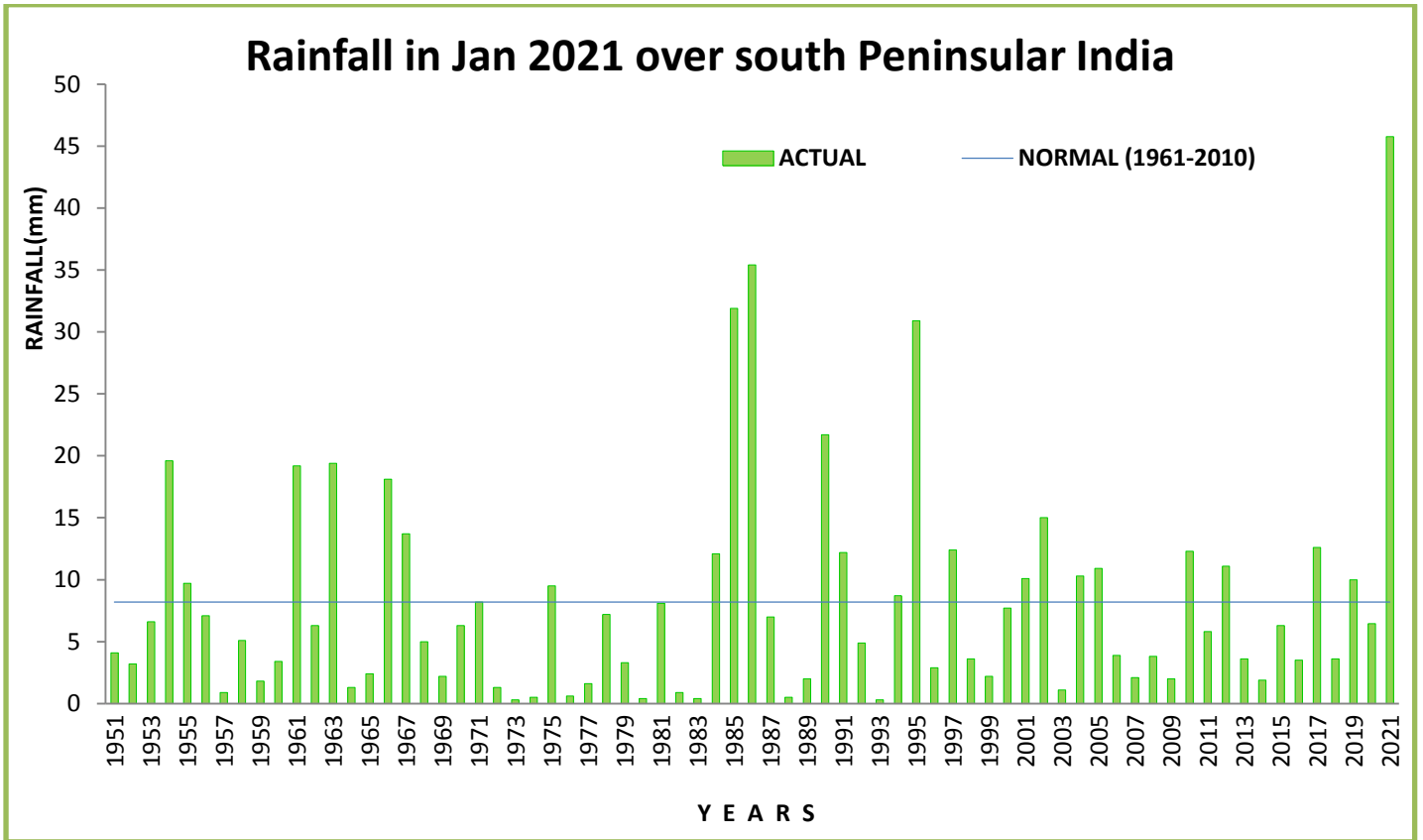


Fig. 2. Meteorological subdivision-wise rainfall during Jan 2021

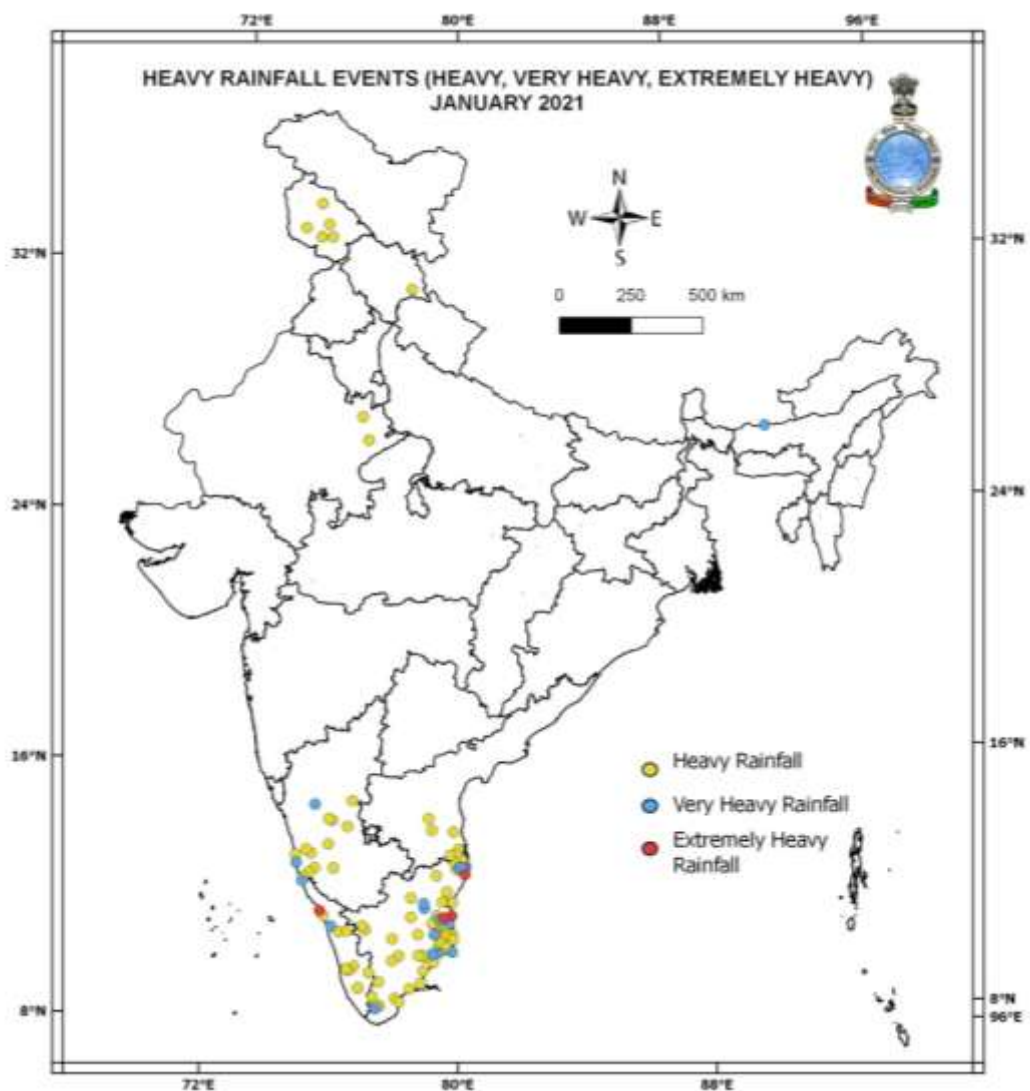


**Fig 3. Cumulative Monthly Area weighted rainfall of Jan, over the Peninsular India for the period 1951-2021.**

**(d) Wet Spell of 2-6 Jan over northwest India and its uniqueness:** A prolonged unusual wet spell and cloudy weather lasting about 5 days was observed during 2-6 Jan, 2021 over northwest(NW) India covering a larger areas of both plains and western Himalayan region and part of central India. This spell was unusual because of three major factors: i) in terms of duration of this wet spell which lasted for 5 days, ii) in terms of areas, this precipitation spell was covered in day to day and its persistence and iii) in terms of persistence and very slow movement of associated unique synoptic pattern during 3-5 Jan 2021 over the region where a deep middle altitude westerly trough at middle and upper level in associated with similar very slow moving active western Disturbance which was also observed at these levels over Central Pakistan & neighbourhood along with its induced cyclonic circulation over southwest Rajasthan & neighbourhood, with all these westerly system, interacted with a very large amplitude lower level north-south zone of wind confluence that was extended from North Punjab to Northeast Arabian Sea at lower levels. The latter system also provided ideal conditions for require Moisture feeding both from Arabian Sea and Bay of Bengal to sustain such unusual longer spell of precipitation over such a large areas of NW India latter to part of central India. This WD resulted in large excess rainfall over Northwest India for the week ending on 6 Jan 2021 with actual rainfall of 22.6mm against the normal of

5.2mm (+335% above long period average). However due to no further active WD thereafter the cumulative rainfall during January 2021 become normal with actual rainfall of 28.4mm against the normal of 33.6mm (15.4% below normal).

**(e) Frequency of Heavy Rainfall events:** The occurrences of heavy rainfall events are shown in the Fig 4. The heavy rainfall was confined to only extreme south peninsula covering Tamil Nadu, Puducherry, south Andhra Pradesh, Kerala and Karnataka and Jammu, Himachal Pradesh and east Rajasthan. While it was more frequent (8-10 days) over Tamil Nadu, is occurred for 3-6 days over other region of Peninsular India and one day over east Rajasthan and Jammu, Himachal Pradesh.



**Fig. 4. Locations reported Heavy rainfall events during Jan 2021**

### Heavy / Very Heavy Rainfall Warning Skill for Jan 2021:

No. of Heavy/Very Heavy Rainfall Events (>64.4 mm) and Warning Skill (correctness in %) of spatial distribution in issued warnings during the month is given below:

warning issued for	No. of Heavy/Very Heavy Rainfall Events (>64.4 mm):
	Percentage correct (in %) for Rainfall >64.4mm
Day1 / 24 Hours	30 98%
Day2 / 48 Hours	97%
Day3 / 72 Hours	98%

## **2. Characteristics of Temperatures, Cold Wave, Cold Days and Dense Fog conditions during Jan 2021**

### **2.1. Monthly Average Temperature features over the country and the northwest India**

The actual observed average maximum, average minimum and average temperature for the country as a whole during Jan 2021 are 25.8° C, 14.8° C and 19.9° C against normal of 25.6° C, 13.7 ° C and 19.6° C respectively. It shows respective temperatures were near normal except the minimum temperature which was higher than normal by about 1.0 ° C. Fig 6a shows all India average Minimum temperature time series for 1901-2021 for Jan month. **Analysis for 1901-2021 shows all India average Minimum temperature in Jan 2021 (14.78 ° C) is the warmest since 1958 (14.78 ° C) when both the years have recorded same average monthly minimum temperature in Jan while 1919 (15.0 ° C) remains as the warmest year in Jan. So Jan 2021 has also become the warmest in 62-years after 1958.**

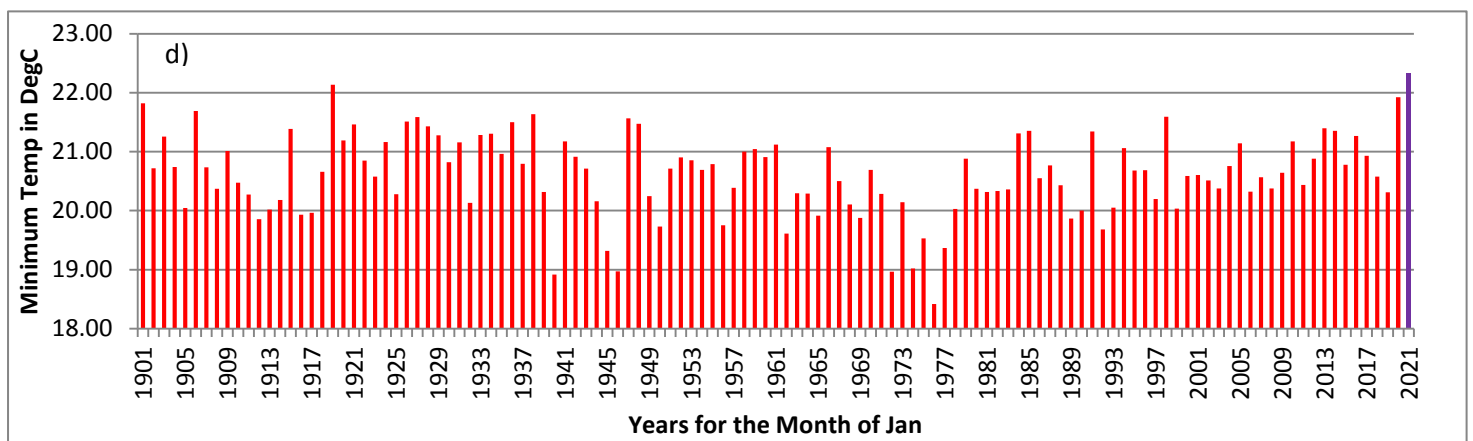
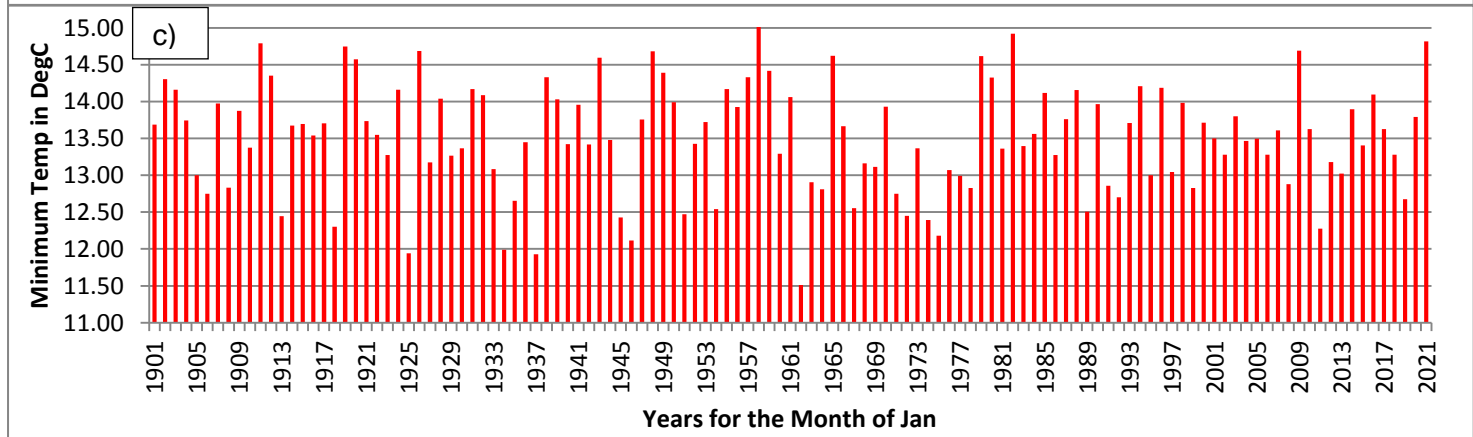
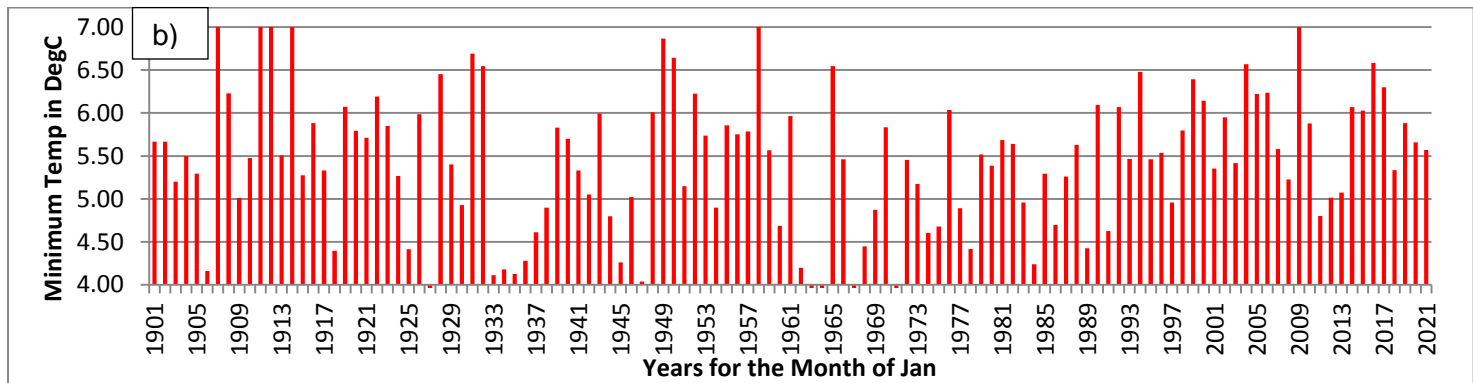
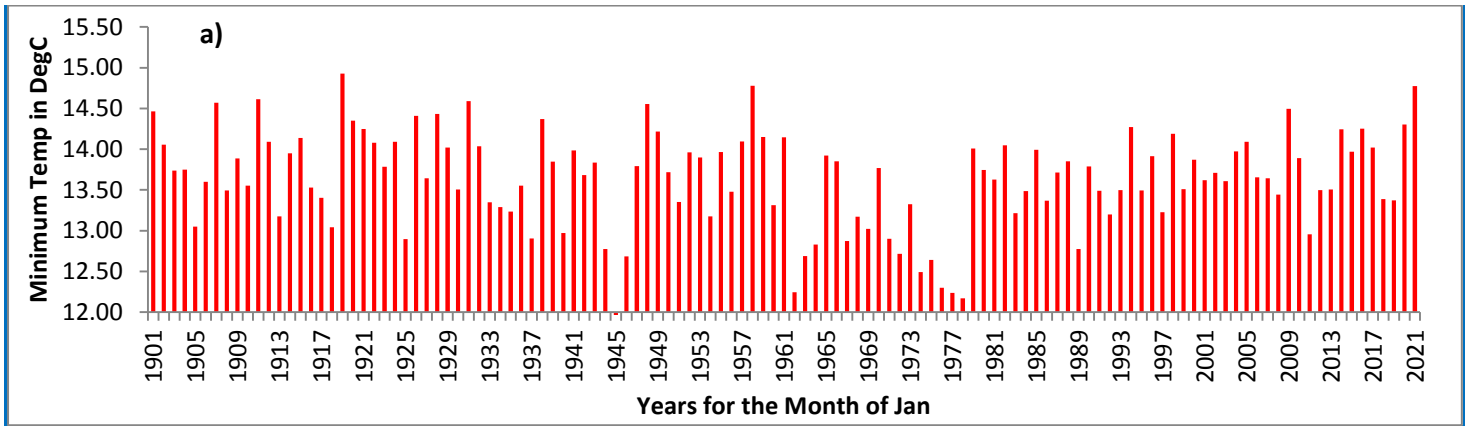
Analysis of minimum temperature averages over four homogenous region of the country also analyzed and it shows Central India(CI) and Peninsular India(PSI) in Jan 2021 had recorded significantly warmer than normal with average monthly minimum temperature as 14.82 and 22.33 which are 1.22 ° C and 1.73 ° C above normal respectively(Normal are 13.6 ° C and 20.6 ° C respectively). **However**, over Northwest India (NWI) know for most cold prone areas, it was near normal with 5.57 ° C (normal is 5.61 ° C) and departure from normal as -0.04 ° C while eastern and northeast India had 10.9 (normal of 9.96) with 0.94 above normal. Figs 6b, 6c and 6d show time series of average minimum temperature of Jan

for the period 1901-2021 over NWI, CI and PSI. It shows average monthly minimum temperature over NWI in Jan 2021 has been colder than 2019 and 2020, while over CI, it shows it has been warmest for Jan 2021 ( $14.82^{\circ}\text{C}$ ) in last 38 years, after 1982( $14.92^{\circ}\text{C}$ ) while 1958 is the warmest during the period, with  $15.06^{\circ}\text{C}$  among all years in 1901-2021. Fig 6d shows, **for PSI, Jan 2021 is the warmest month in record in 121 years, with  $22.33^{\circ}\text{C}$  followed by  $22.14^{\circ}\text{C}$  in Jan 1919 and  $21.93^{\circ}\text{C}$  in Jan 2020 as 2<sup>nd</sup> and 3<sup>rd</sup> warmest month for Jan.** Over NWI, where cold day conditions are also most prevalent in each winter, we have also analyzed monthly mean maximum temperature and monthly average mean temperature which are of  $17.93^{\circ}\text{C}$  and  $11.75^{\circ}\text{C}$  respectively against their Normal as  $18.33^{\circ}\text{C}$  and  $11.97^{\circ}\text{C}$  with  $-0.40$  and  $-0.22$  below normal respectively.

Fig 7 shows observed spatial temperature pattern of monthly average maximum, average minimum and average temperature over India and their departure from normal for the month of Jan 2021. **Spatial temperature pattern over India shows average monthly maximum temperatures in Jan 2021 were below normal by  $2-4^{\circ}\text{C}$  in Jan 2021 across Indo-Gangetic plain and pockets over south Punjab and north Haryana at its west and over Bihar at east had significantly below normal with  $3-4^{\circ}\text{C}$  lower than normal while it was above normal over eastern parts of central India and northeastern states.** Monthly average Minimum temperatures shows it was below normal by  $1-2^{\circ}\text{C}$  in Jan 2021 only over a smaller area of the country covering Saurashtra and Kutch area, Kashmiri and parts of west Rajasthan, while it was warmer over most parts of India.

## 2.2 Dense fog conditions

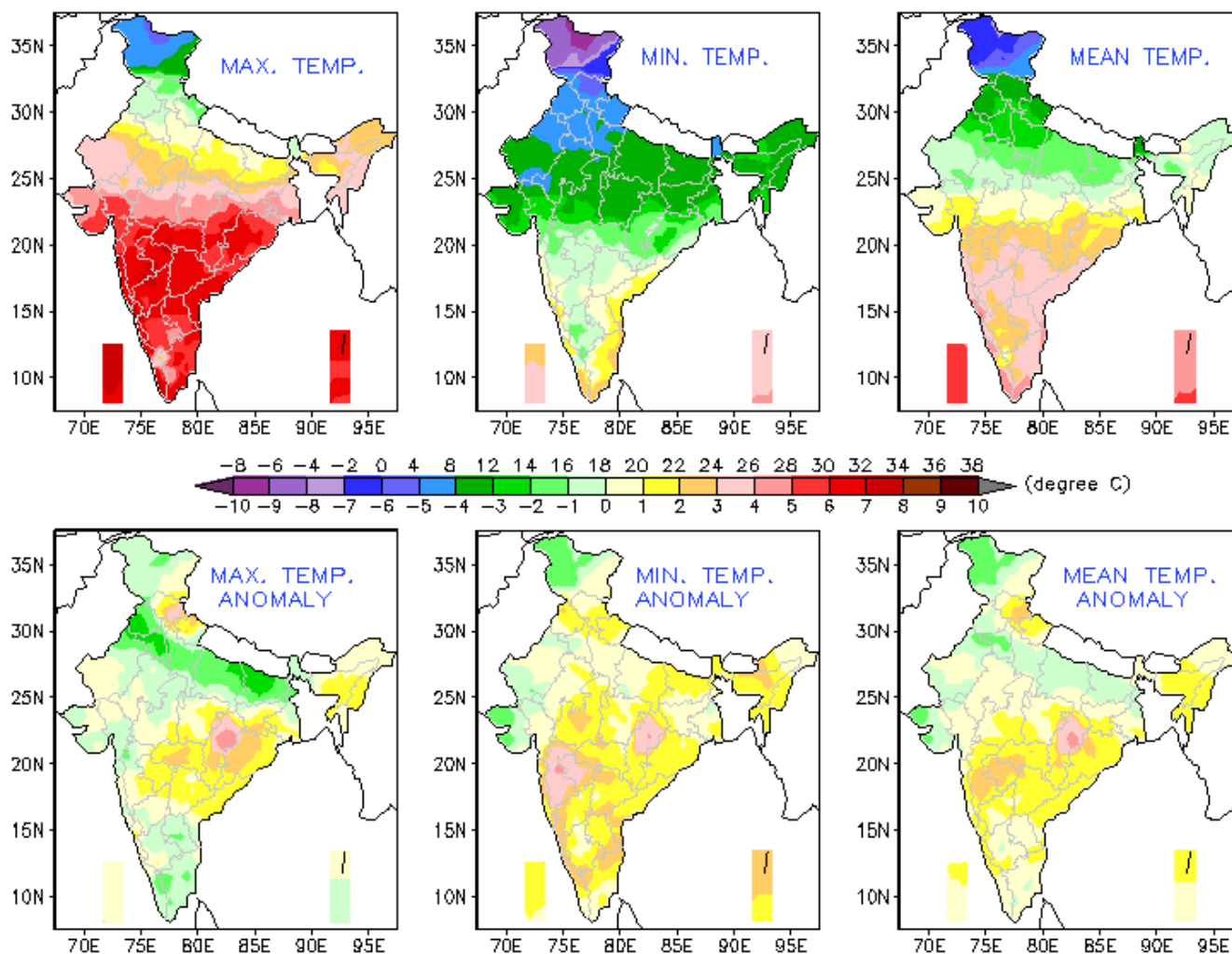
Dense to very dense fog conditions observed at isolated to few locations over Jammu division, Himachal Pradesh, Uttarakhand, Punjab, Haryana, Chandigarh & Delhi, Uttar Pradesh during 8-14 January, over Rajasthan- 3-6 and 8-12 January and over Sub-Himalayan West Bengal: 10-14 January. It was further intensified and was observed for longer duration day to day over many parts of Indo-Gangetic plains(IGP) in almost all dates during 15-21 Jan 2021 in many place to few places covering met sub-divisions of Rajasthan, Jammu division, Himachal Pradesh, Uttarakhand, Punjab, Haryana, Chandigarh & Delhi, Uttar Pradesh, Bihar and isolated pockets of west Bangal and Sikkim with Uttar Pradesh had some improvement during 18-19 Jan.



**Fig 6: Time series of a) All India monthly average minimum for the month of Jan during 1901-2021. b) Over northwest India c) Over Central India d) over Peninsular India**

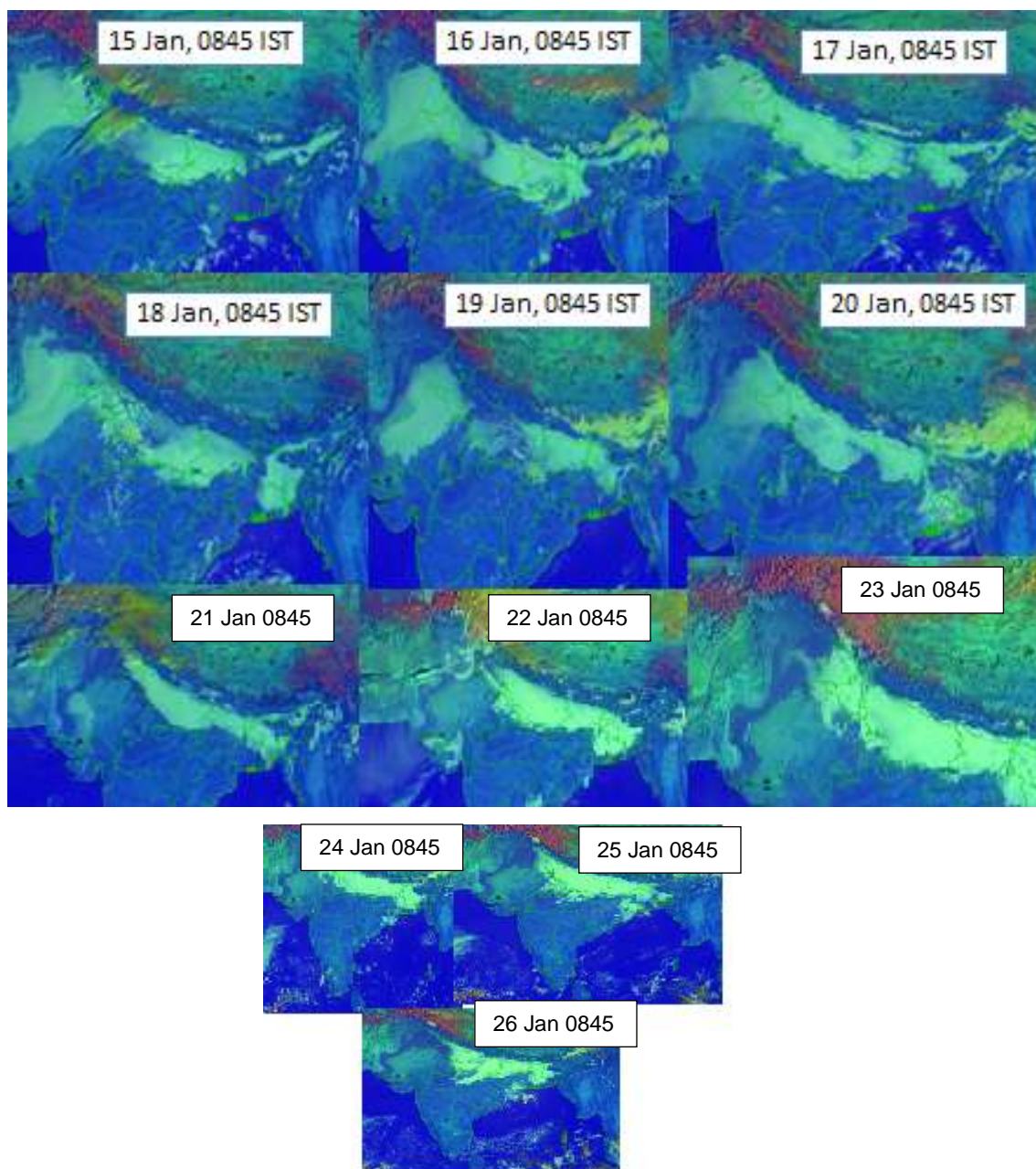


TEMPERATURE FOR THE MONTH JAN 2021 & ITS ANOMALY



**Fig 7: Observed spatial pattern of monthly average maximum, average minimum, and mean temperatures over India (top three from left to right) and their departure from normal for Jan 2021 lower three from left to right).**

The worst fog spell in this season occurred during 15-22 January when **Widespread day to day dense fog coverage across most parts of Indo-Gangetic plains**. By 23 Jan, Dense fog cover over Western parts of IGP region (covering met sub-divisions of Rajasthan, Jammu division, Himachal Pradesh, Uttarakhand, Punjab, Haryana, Chandigarh & Delhi) significantly weakened while **it continued over its central and eastern plain covering, East Uttar Pradesh & Bihar and Sub-Himalayan West Bengal & Sikkim during 23-28 Jan**. It affected flight, railway and surface transport services in the region during 2<sup>nd</sup> fortnight of Jan 2021 for which Impact forecast was issued.



**Fig 8: Widespread day to day dense fog coverage across Indo-Gangetic plains as captured by INSAT 3DR satellite images, daily at morning of 0845 hours IST, for the period 15-26 Jan 2021**

Then fresh spell of dense fog reported over some parts of Punjab, Delhi, Chandigarh & Haryana during 27-29 Jan and over north Madhya Pradesh on 23-24, 27-29 Jan and over Odisha, West Bengal on 22-23 Jan and over northern parts of Sub-Himalayan West Bengal & Sikkim, east Uttar Pradesh and Bihar during 28 Jan- 31- Jan 2021. Fig 8 shows daily morning 0845 hours IST dense fog coverage as captured by INSAT 3DR satellite for the period 15-26 Jan 2021.

## 2.2 Cold Wave and Cold Day conditions

Cold wave conditions were sub-due over central, western and parts of eastern India in Jan 2021 while over northern parts of India these events were mainly observed in the 2<sup>nd</sup> half of the month. The persistence of an active WD of 2-6 Jan for longer period which caused widespread rains and cloud coverage over north and Central parts of India followed by days with easterly wind pattern at southern and central India are the reason for lower number of cases of cold wave over central and western India during the month. Data shows Cold wave to severe cold wave conditions prevailed at some places over Punjab, Haryana and Chandigarh on 1-2, 13-14, 17-18, and 26-29 Jan; over Delhi on 1, 12-14 and 26; over Rajasthan during 12-16 and 25-29 Jan; over west Uttar Pradesh during 1-2, Uttar Pradesh during 15-18 and 25-29 Jan. Cold wave conditions at isolated places also occurred over north Madhya Pradesh 14-16, 20, 30-31 Jan; over Gangetic West Bengal and Odisha during 15-17 and 31 Jan; over Saurashtra & Kutch 5, 26 and 28-31 Jan,

Due to prominent dense fog coverage frequently reported during 10-28 Jan 2021 across IGP region of the month, cold and severe cold days were more frequently reported during this period. Cold day conditions to severe cold day conditions prevailed over some parts of Punjab, Haryana and Chandigarh on 1, 2, 8-16 and 23 Jan, over Delhi on 2, 10-12 and 25 Jan, over west Uttar Pradesh on 1 and 9 Jan, over whole Uttar Pradesh during 11-16 Jan and 21-25 Jan, over north Rajasthan on 1, 8, 11, 13 and 15-19 Jan, over Bihar during 14-18 Jan 2021 and again observed at a few places over Uttar Pradesh and Bihar during 23-28 Jan. It was also observed at isolated areas during 28-31 Jan over north Madhya Pradesh and during 28 Jan-1 Feb over northern parts of Uttar Pradesh and Bihar.

## 3. Large scale features in Dec 2020 and forecast

- Currently, moderate La Niña conditions are prevailing over equatorial Pacific and Sea Surface Temperatures (SSTs) are below normal over central and eastern equatorial Pacific Ocean. The latest Monsoon Mission Climate Forecasting System (MMCFS) forecast indicates that colder than normal SST anomaly is most likely to persist over Nino 3.4 region and La Niña conditions likely to continue during coming seasons.
- At present, neutral Indian Ocean Dipole (IOD) conditions are observed over Indian Ocean and the latest MMCFS forecast indicates neutral IOD conditions are likely to continue during the coming months.
- The Madden Julian Oscillation (MJO) index is in Western Pacific (Phase 7) with high amplitude. As per the latest projections, it is likely to be in same phase with high amplitude during next one week.

**Table 2: Date wise Lowest minimum temperature as recorded amongst all reported stations in the plains of the country during Jan 2021.**

Date	Min. Temp. (°C)	Place
01-01-21	-1.2	Hissar (Haryana)
02-01-21	1.1	Pantnagar (Uttarakhand)
03-01-21	5.4	Banda (West Uttar Pradesh)
04-01-21	4.3	Pilani (East Rajasthan)
05-01-21	7.8	Naliya (Saurashtra & Kutch)
06-01-21	5.6	Naliya (Saurashtra & Kutch)
07-01-21	5.2	Naliya (Saurashtra & Kutch)
08-01-21	4.4	Hissar (Haryana)
09-01-21	6.6	Bikaner (West Rajasthan)
10-01-21	4.8	Erinpura (West Rajasthan)
11-01-21	1.9	Churu (West Rajasthan)
12-01-21	1.5	Sikar (East Rajasthan)
13-01-21	0.2	Ganganagar (West Rajasthan)
14-01-21	1.8	Narnaul (Haryana)
15-01-21	3.4	Khajuraho (West Madhya Pradesh)
16-01-21	2.6	Churk (East Uttar Pradesh)
17-01-21	1.9	Churu (West Rajasthan)
18-01-21	3.5	Pantnagar (Uttarakhand)
19-01-21	5	Dehri (Bihar), Amritsar (Punjab)
20-01-21	4.4	Pilani (East Rajasthan), Amritsar (Punjab)
21-01-21	3.4	Amritsar (Punjab)
22-01-21	3.6	Una (Himachal Pradesh)
23-01-21	5.4	Gaya (Bihar)
24-01-21	4.4	Churk (East Uttar Pradesh)
25-01-21	3.2	Churk (East Uttar Pradesh)
26-01-21	0.5	Sikar (East Rajasthan)
27-01-21	1.4	Amritsar (Punjab)
28-01-21	1.8	Bhilwara (East Rajasthan)
29-01-21	1.2	Narnaul (Haryana)
30-01-21	0.5	Sikar (East Rajasthan)
31-01-21	2.0	Bhilwara (East Rajasthan)

The lowest minimum temperature of **-1.2°C** had been recorded at **Hissar (Haryana)** on **1<sup>st</sup> January 2021** over the plains of the country during the month.

## 7. Weather Outlook for Jan 2021

### 7.1 Temperature outlook

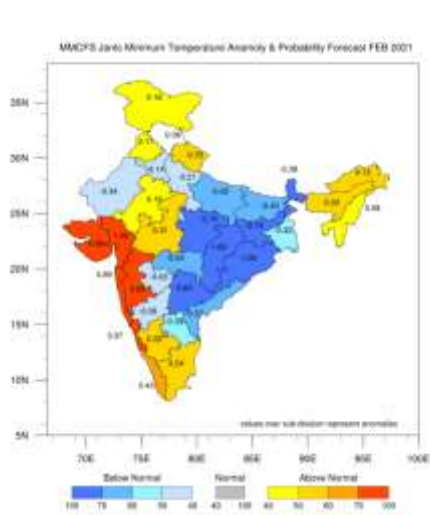


Fig9a. Probability forecast &Subdivision averaged Minimum Temperature Anomaly for February 2021

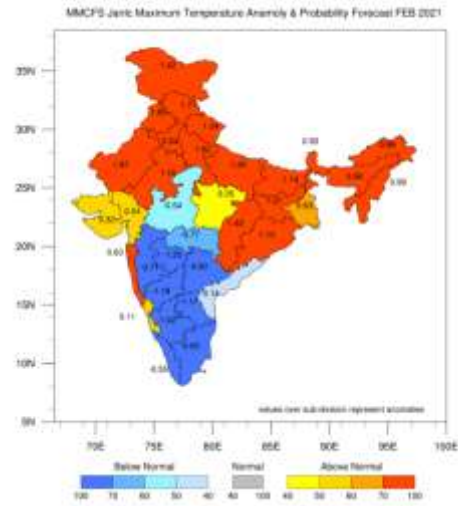


Fig9b. Probability forecast &Subdivision averaged Maximum Temperature Anomaly for February 2021

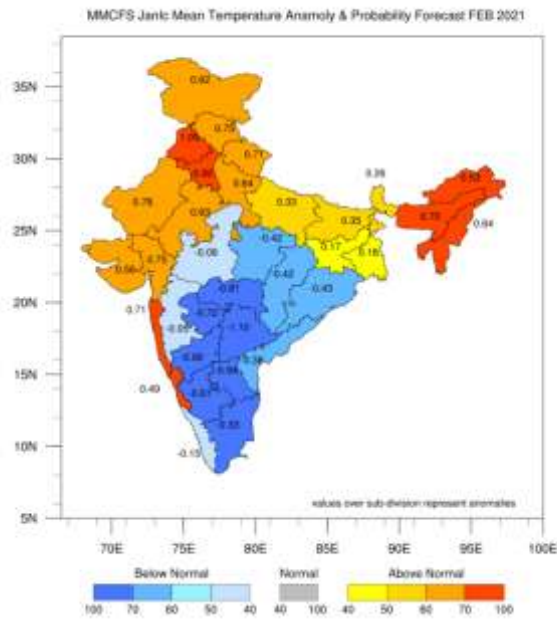


Fig.9(a, b, c) show predicted sub-divisional probability and the subdivision



averaged minimum, maximum and mean temperature anomalies (departures from the long term normal) respectively for the month of February 2021. The probability forecast for minimum temperature (Fig.9a) indicates that below normal minimum temperatures are likely to be over most subdivisions of north along the plains of Himalayas, east, adjoining central India and few subdivisions of northeast peninsular and northwest India and above normal minimum temperatures over most subdivisions of west coast, south Peninsular India, northeast India and few subdivisions of central and north India. Subdivision of Himachal Pradesh is likely to experience climatological probability for minimum temperature.

The probability forecast for maximum temperature (Fig.9b) indicates that above normal maximum temperature are likely to be over most subdivisions of northwest, north, east and northeast India and few subdivisions of central and western India. Most of the subdivisions of south peninsular India are likely to experience below normal maximum temperatures.

The probability forecast for mean temperature (Fig.9c) indicates above normal mean temperature over most subdivisions of north along the plains of Himalayas, northwest, west and northeast and east India. Rest of the country is likely to be experience below normal mean temperatures.

## 7.2 Rainfall Forecast for Feb 2021

### Weather systems & associated Precipitation during Week 1 ( till 10 February, 2021), Week 2 (11 to 17 February, 2021) and Week 3 (18 to 24 February, 2021)

#### **Rainfall for week 1: (till 10 February, 2021)**

- A fresh feeble Western Disturbance as a trough in mid & upper tropospheric westerlies with its axis at 5.8 km above mean sea level runs roughly along longitude 55°E to the north of latitude 31°N. Under its influence, isolated rainfall/snowfall likely over Jammu & Kashmir, Ladakh, Gilgit-Baltistan & Muzaffarabad on 08th & 09th; over Himachal Pradesh on 09th and over northern parts of Uttarakhand on 09th & 10th February, 2021.
- **Cumulatively, below normal rain very likely over northern parts of country including Western Himalayan Region during the week ending on 10 Feb 2021 (refer Fig 10 and 11).**

#### **Rainfall for week 2: (11 to 17 February, 2021)**

Due to the absence of any active Western Disturbance, below normal rain/snow likely over northern parts of country including Western Himalayan Region while central and eastern India likely to get normal rainfall during the week due to formation and eastward movement of a trough in the lower levels from central India toward Jharkhand-Odisha during 16-19 Feb (refer Fig 10 and 11).

#### **Rainfall for week 3: (18 to 24 February, 2021)**

Due to the absence of any active Western Disturbance, below normal rain/snow likely over northern parts of country including Western Himalayan Region (refer Fig 10 and 11).

## Fog

. Due to availability of moisture at lower levels and other favorable meteorological features, **Dense Fog in isolated pockets very likely over Punjab, Haryana, Chandigarh & Delhi and West Uttar Pradesh during 8-10 Feb 2021 and not likely there after due to higher night temperature**

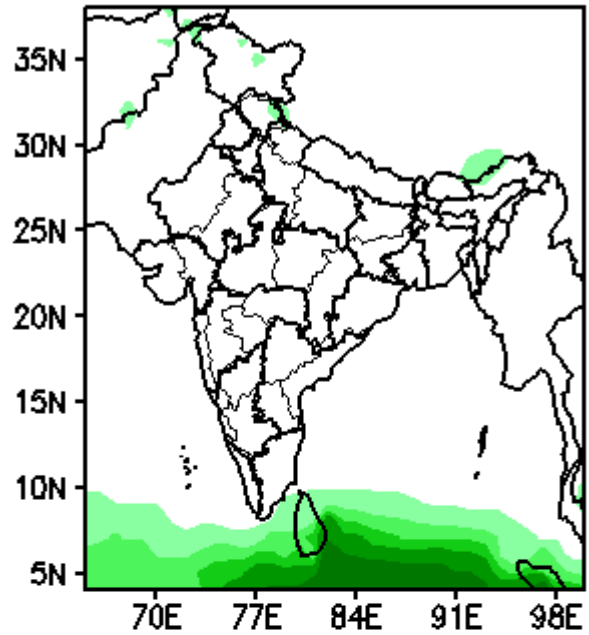
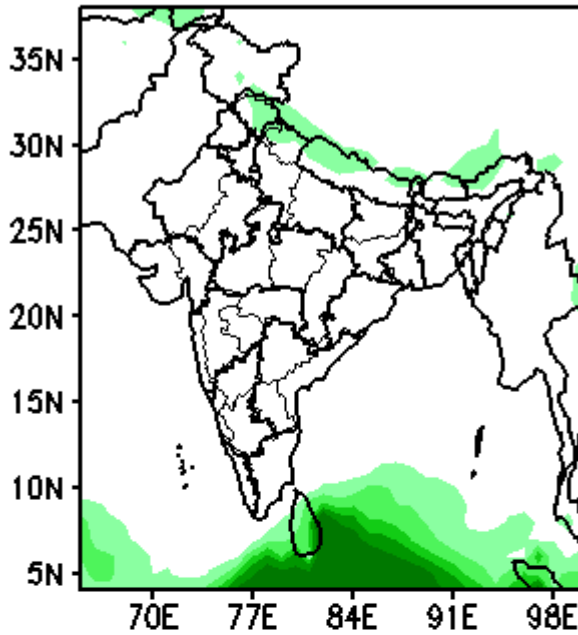
## Cyclogenesis:

- No cyclogenesis is likely over the north Indian Ocean during next two weeks.

## Forecast Rainfall (mm/day)

(Week1: 05Feb–11Feb)

(Week2: 12Feb–18Feb)



(Week3: 19Feb–25Feb)

(Week4: 26Feb–04Mar)

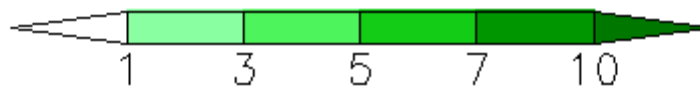
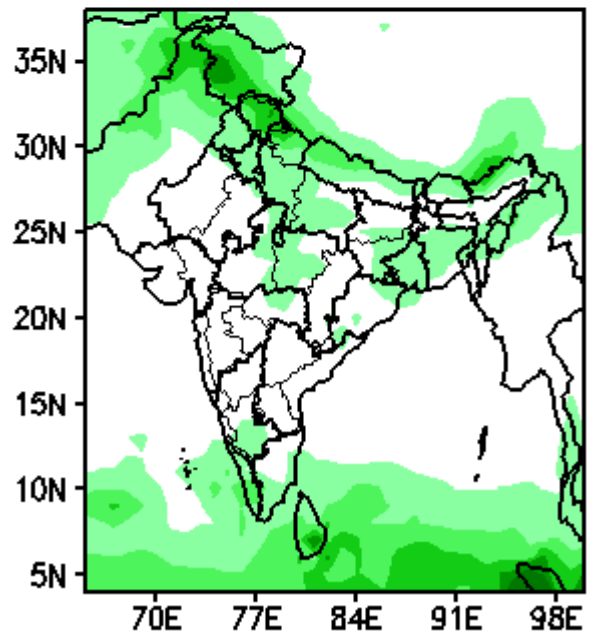
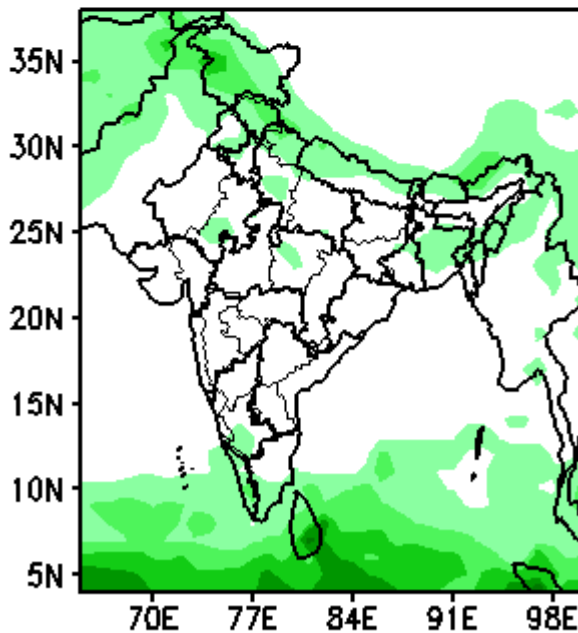
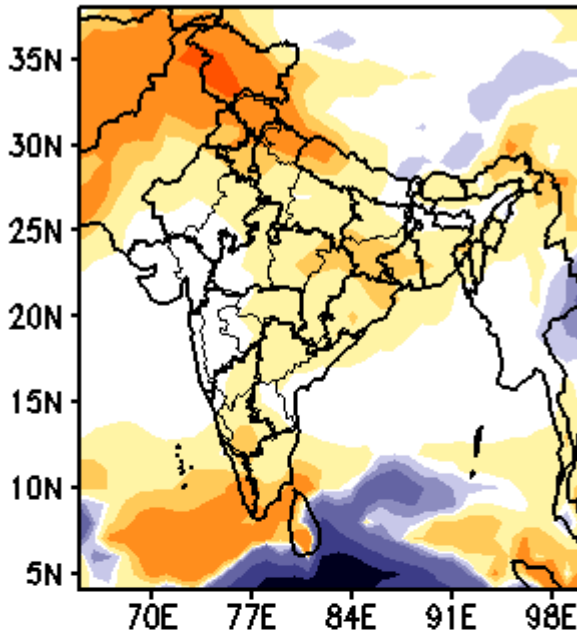


Fig 10: Rainfall forecast (Actual) in mm/day over the country for Feb 2021 (Week 1 to Week 4)

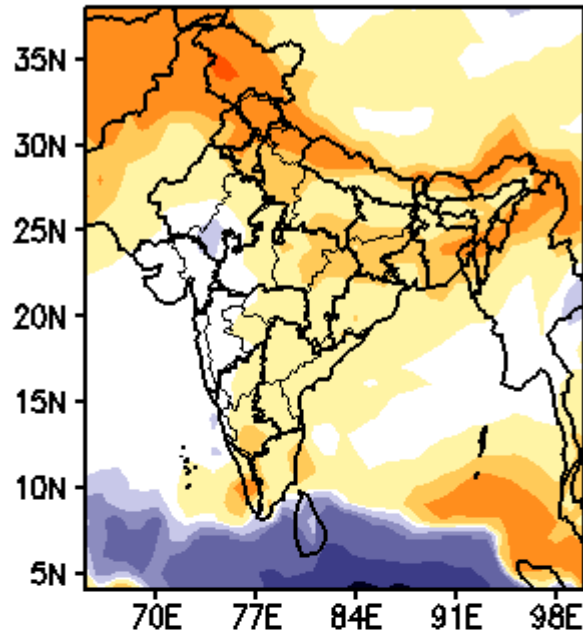


## Forecast Rainfall Anomaly (mm/day)

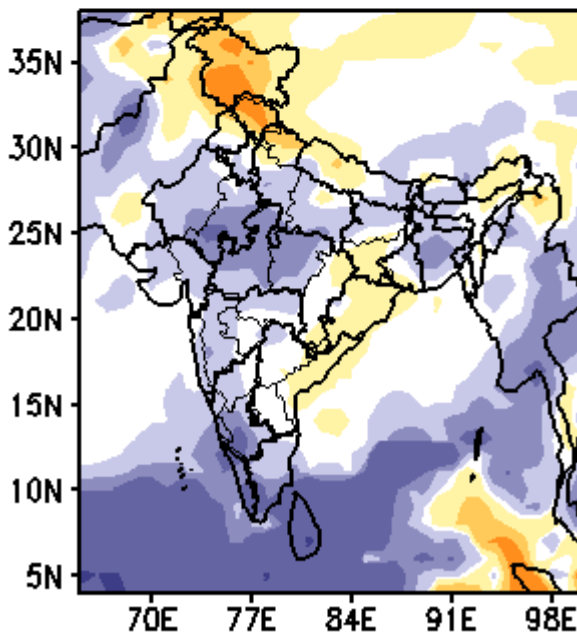
(Week1: 05Feb-11Feb)



(Week2: 12Feb-18Feb)



(Week3: 19Feb-25Feb)



(Week4: 26Feb-04Mar)

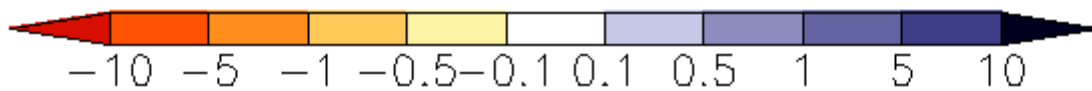
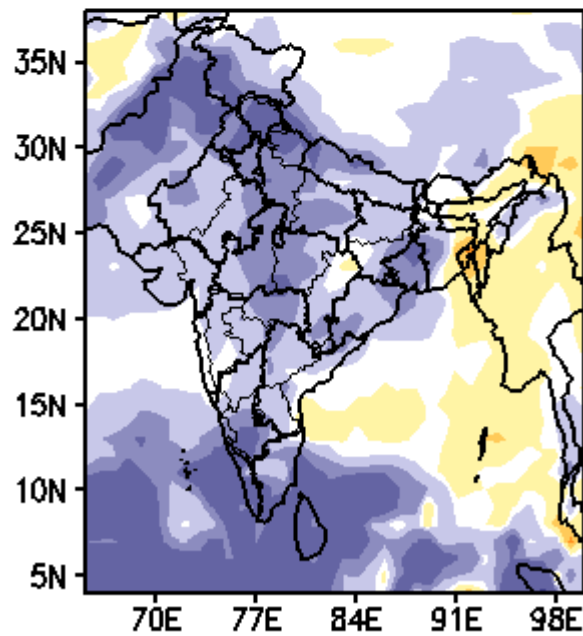


Fig 10: Rainfall forecast(in departure from normal) over the country for Feb (Week 1 to Week 4)