



**Ministry of Earth Sciences (MoES)
India Meteorological Department
Welcomes You All for the Press Release
on**

**Rainfall Forecast for second half of the Monsoon season and rainfall
and temperature during August 2023**

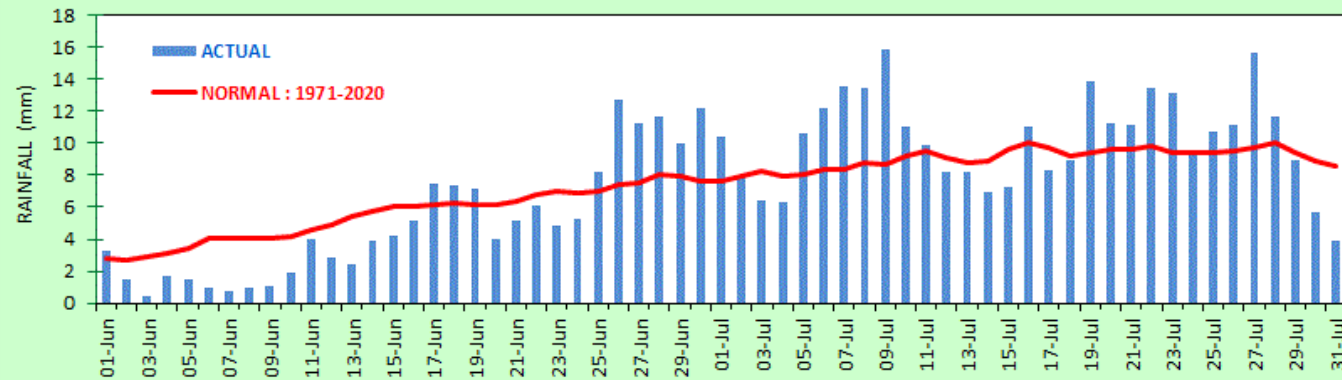
31st July 2023

**भारत मौसम विज्ञान विभाग
INDIA METEOROLOGICAL DEPARTMENT**

Current Status of Monsoon (31 July 2023)

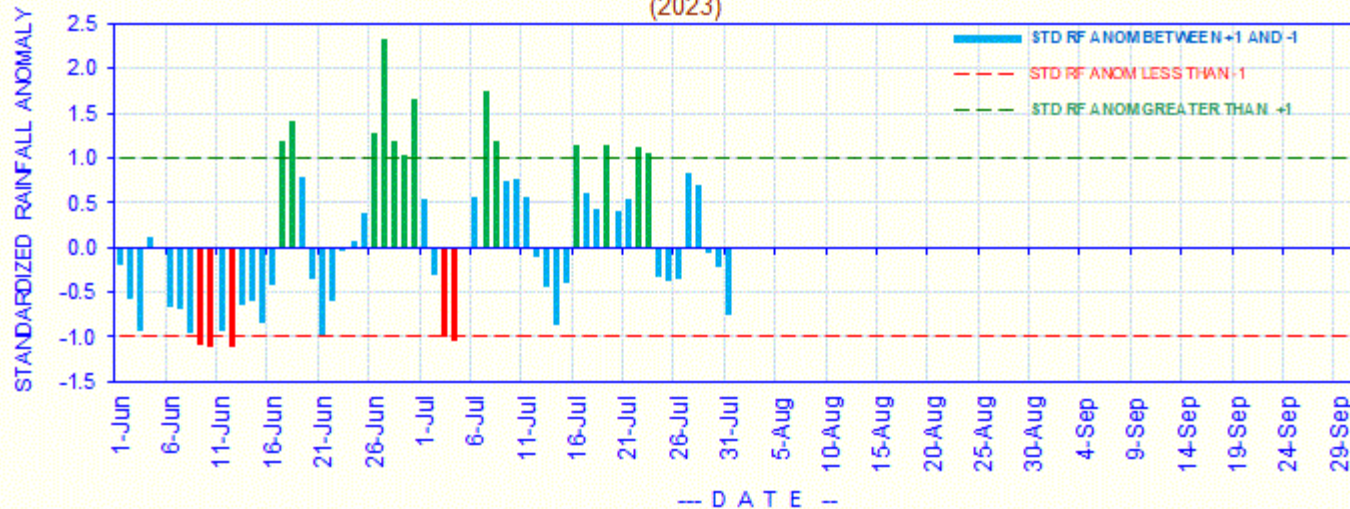
All India Summer Monsoon Rainfall

DAILY MEAN RAINFALL (mm) OVER THE COUNTRY AS A WHOLE (2023)



Rainfall Anomaly over Core Monsoon Zone

STANDARDIZED RAINFALL ANOMALY OVER THE CORE MONSOON ZONE REGION (2023)

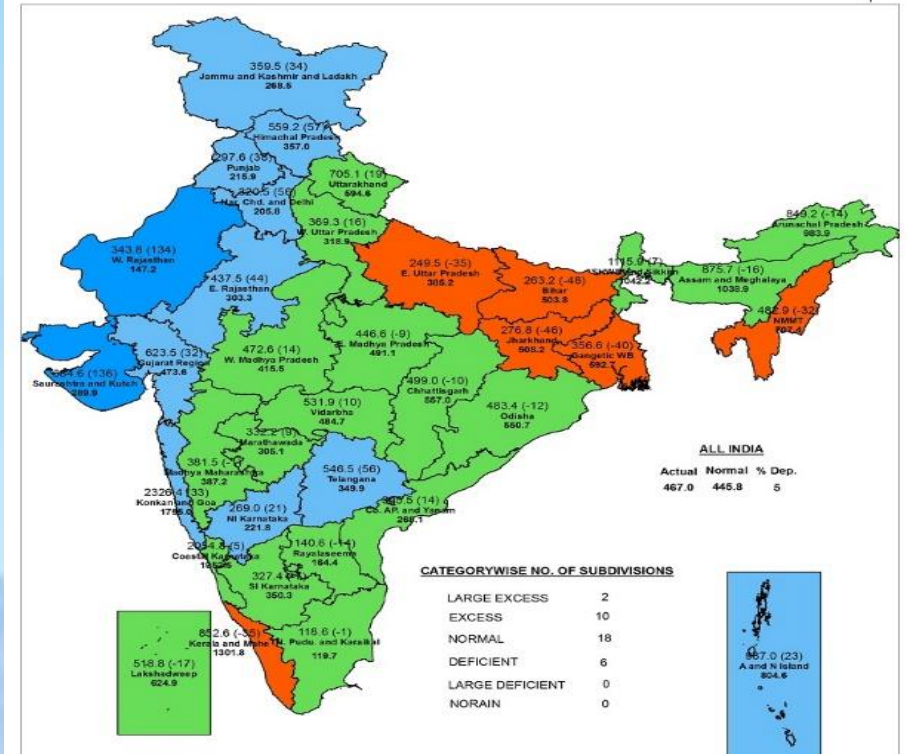


भारत मौसम विज्ञान विभाग
INDIA METEOROLOGICAL DEPARTMENT

जन मौसम विज्ञान प्रभाग, नई दिल्ली
HYDROMET DIVISION, NEW DELHI

SUBDIVISION RAINFALL MAP

Period : 01-06-2023 To 31-07-2023



Legend
Large Excess [60% or more] Excess [20% to 59%] Normal [-19% to 19%] Deficient [-59% to -20%] Large Deficient [-60% to -99%] No Rain [-100%] No Data

NOTES :
a) Rainfall figures are based on operation data.
b) Small figures indicate actual rainfall (mm), while bold figures indicate Normal rainfall (mm).
c) Percentage Departures of rainfall are shown in brackets.

- ✓ East UP, Bihar, Jharkhand, Gangetic West Bengal, Kerals, NMMT had deficient rainfall.
- ✓ All other Sub-divisions had normal to excess rainfall



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INDIA METEOROLOGICAL DEPARTMENT



RAINFALL STATISTICS - MONSOON 2023

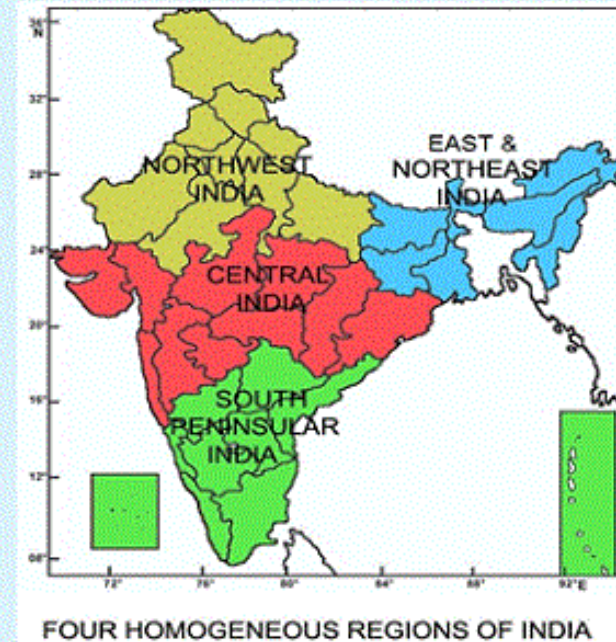
JUNE 2023	1-Jun	TO	30-Jun
REGION	ACTUAL	NORMAL	% DEP
COUNTRY AS A WHOLE	151.2	165.3	-9.0
NORTHWEST INDIA	115.0	78.1	47.0
EAST & NORTHEAST INDIA	278.4	328.4	-15.0
CENTRAL INDIA	160.4	170.3	-6.0
SOUTH PENINSULA	88.7	161.0	-45.0

JULY 2023	1-Jul	TO	31-Jul
REGION	ACTUAL	NORMAL	% DEP
COUNTRY AS A WHOLE	315.9	280.5	13.0
NORTHWEST INDIA	261.4	209.7	25.0
EAST & NORTHEAST INDIA	286.8	424.1	-32.0
CENTRAL INDIA	391.4	321.3	22.0
SOUTH PENINSULA	295.5	204.5	45.0

CUMULATIVE SEASONAL RAINFALL	1-Jun	TO	31-Jul
REGION	ACTUAL	NORMAL	% DEP
COUNTRY AS A WHOLE	467.0	445.8	5.0
NORTHWEST INDIA	376.5	287.8	31.0
EAST & NORTHEAST INDIA	565.2	752.5	-25.0
CENTRAL INDIA	551.8	491.6	12.0
SOUTH PENINSULA	383.9	365.5	5.0



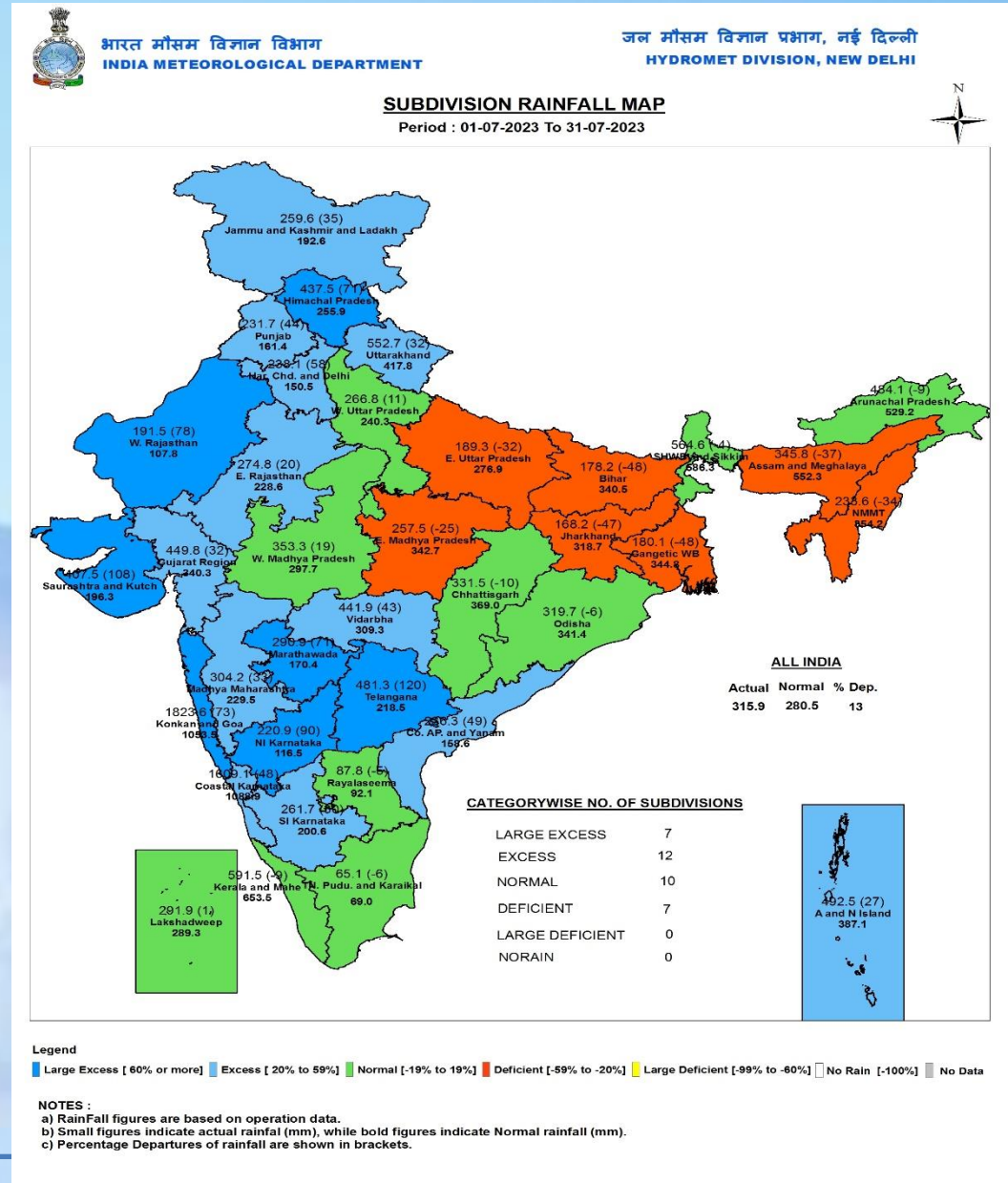
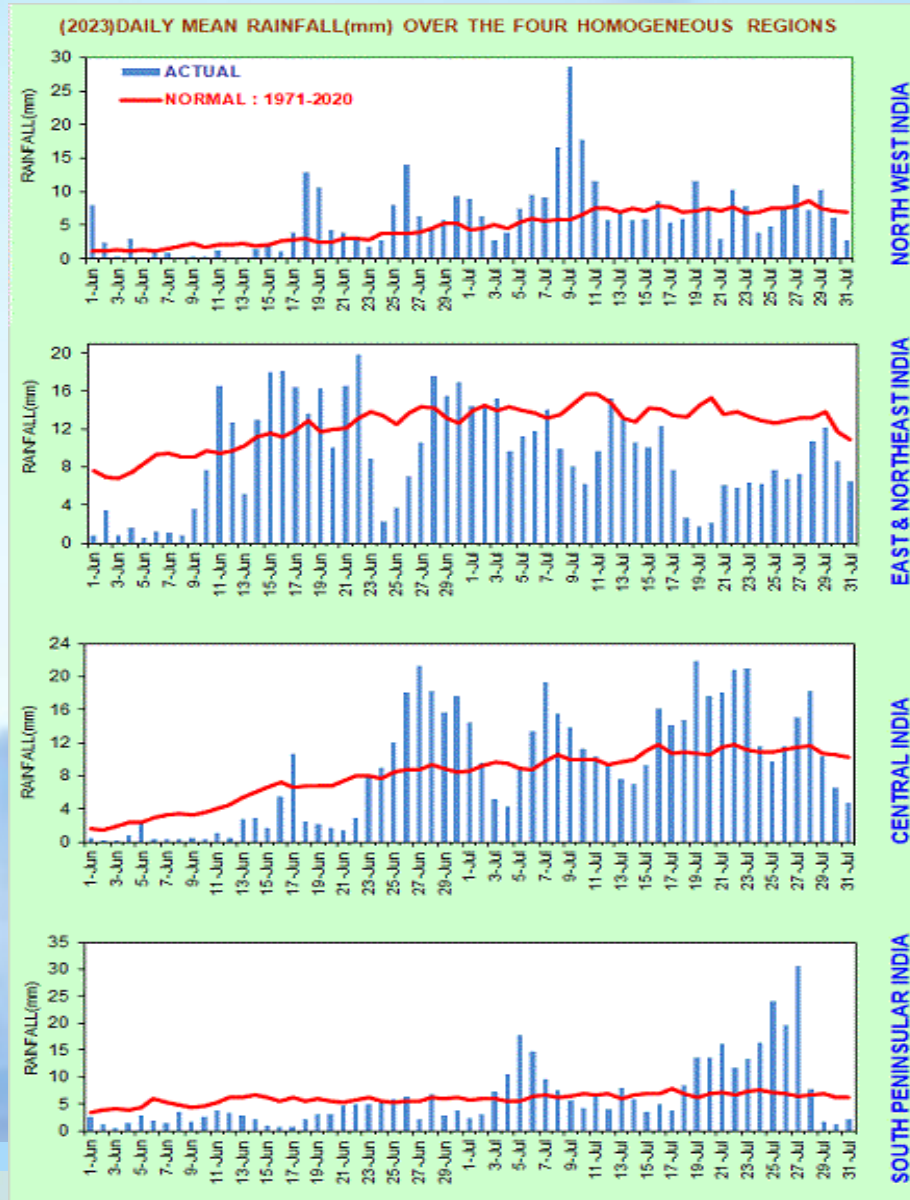
(Based on real time data)



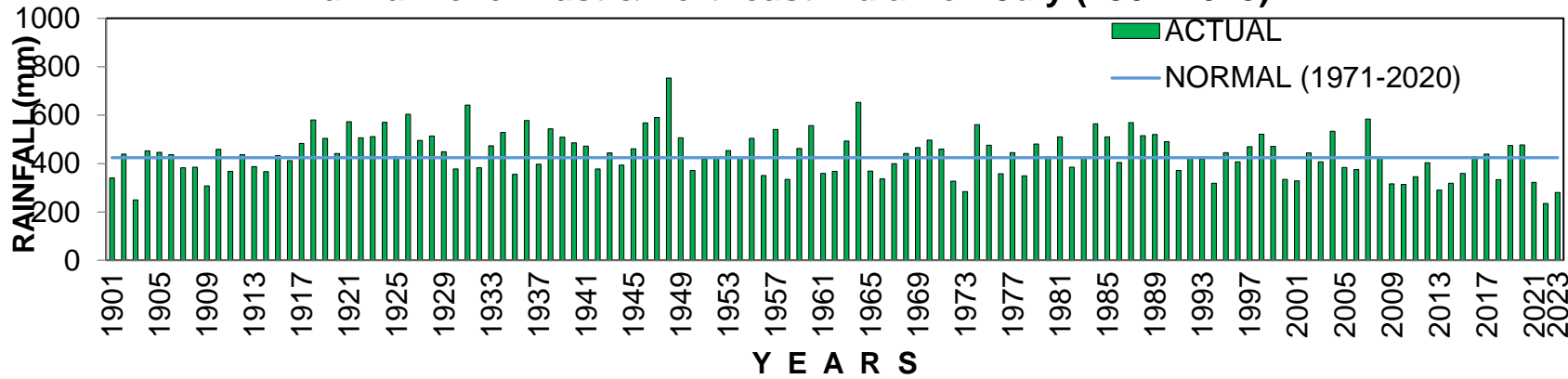
Current Status of Monsoon (31 July 2023)

Rainfall July 2023

Rainfall over Homogeneous Region

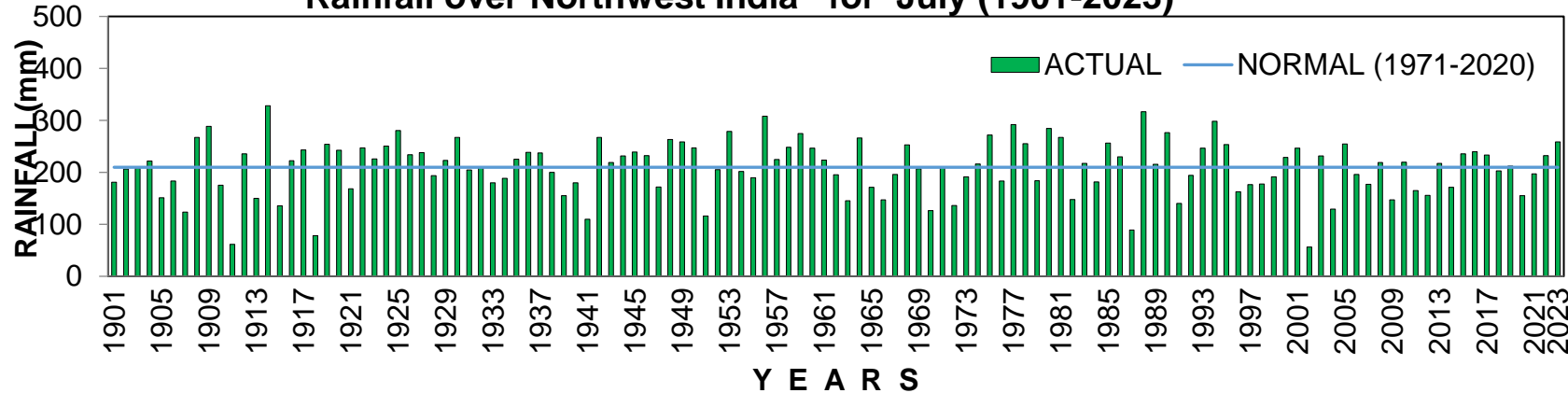


Rainfall over East & northeast India for July (1901-2023)



- Rainfall over homogeneous region of East and northeast India (280.9 mm) was third lowest since 1901. Prior lowest rainfall years were 2022 (234.8 mm) and 1903 (249.5 mm).

Rainfall over Northwest India for July (1901-2023)

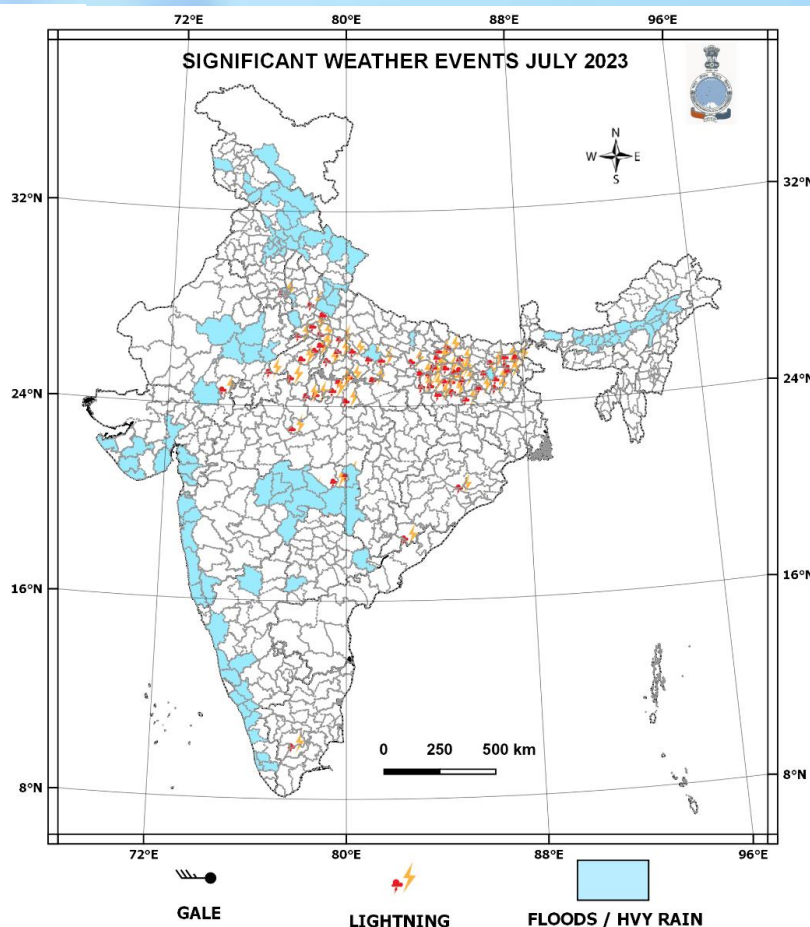
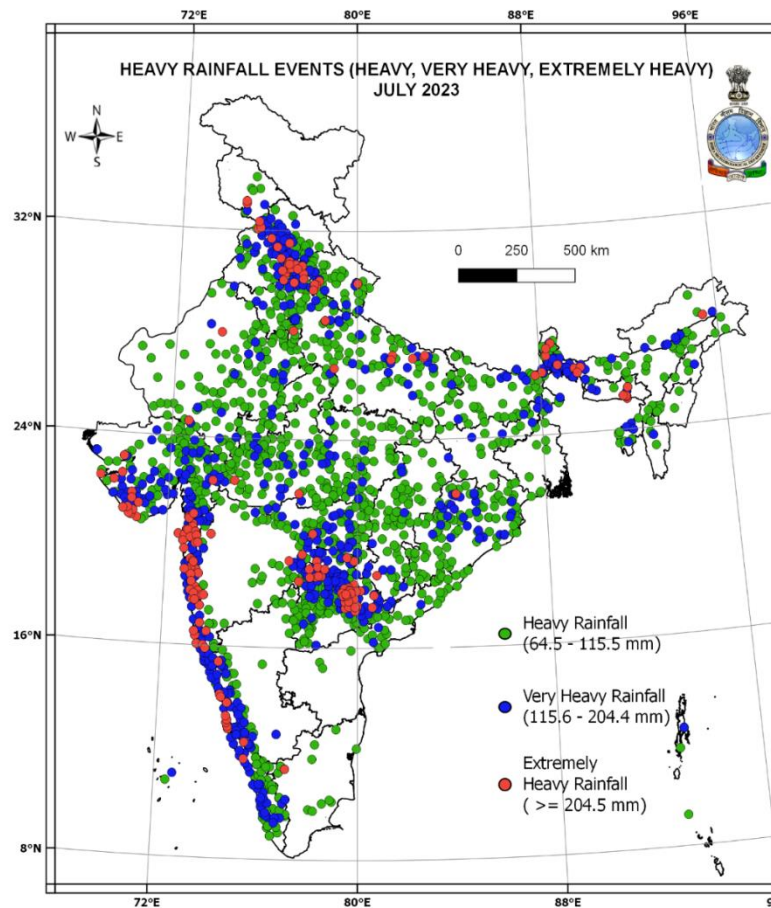


- Rainfall over homogeneous region of Northwest India (258.6 mm) was highest since 2001.

Heavy Rainfall Events occurred in JUL 2023

Location of Heavy Rainfall events occurred in JUL 2023.

Number of very Heavy/Ext. Heavy Rainfall events occurred in the month of JUL during last 5 years.



YEAR	Rainfall Category	Number of stations
2019	V. Heavy (115.6 to 204.5)	753
	Ext Heavy (more than 204.5)	161
2020	V. Heavy (115.6 to 204.5)	447
	Ext Heavy (more than 204.5)	90
2021	V. Heavy (115.6 to 204.5)	638
	Ext Heavy (more than 204.5)	121
2022	V. Heavy (115.6 to 204.5)	723
	Ext Heavy (more than 204.5)	127
2023	V. Heavy (115.6 to 204.5)	1113
	Ext Heavy (more than 204.5)	205



Major extremely heavy rainfall spell

- Extremely Heavy rainfall Event over Western Himalayan region and adjoining plains of northwest India 8-13 July
- Extremely heavy rainfall spell over Gujarat, Maharashtra (including over Mumbai), Goa and Karnataka during 18-28 July
- Extremely heavy rainfall spell over Peninsular India(Telangana and Andhra Pradesh) during 26-28 July

Exceptional heavy rainfall

- **9 July 2023** –Chandigarh IMD(Dist Chandigarh)-**30cm** and adjoining Haryana and HP- many stations breaking the all time records-Main city experienced flash flood. HP has high losses
- **18 July-** Saurashtra: Sutrapada (dist Gir Somnath) **54**, Veraval (dist Gir Somnath) 52-736 evacuated and 358 rescued, 12 highways shut
- **20 July-** Konkan: Raigad (Matheran: **40cm**)- Raigada landslide
- **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)- one village completely submerged and Army rescued villagers by Helicopter.



Some Record breaking rainfall over HP during 8-12 July 2023 (in mm)

Stations	District	New All Time Record		Previous record	
		Rainfall	Date	Rainfall	Date
Manali	Kullu	131.3	9 July 2023	105.1	09 July, 1971
Solan	Solan	107	9 July 2023	105	17 July, 2015
Rohru	Shimla	185	9 July 2023	170	25 July, 1966
Ghamroor	Kangra	166	9 July 2023	164.8	19 July, 2021
Pachhad	Sirmaur	220	10 July 2023	189.2	26 July, 1973
Nadaun	Hamirpur	160.5	9 July 2023	146	30 July, 1996
Keylong	Lahaul & Spiti	83*	9 July 2023	78	28 July, 1951

Five Highest Rainfall Records of 24-hour rainfall in the month of July for New Delhi (Safdarjung) during 1958-2023

Year	Date	Rain (in mm)	Rank
1958	20th-21st July	266.2	1st
1982	25th-26th July	169.9	2nd
2023	08th-09th July	153	3rd
2003	09th-10th July	133.4	4th
2009	27th-28th July	126	5th

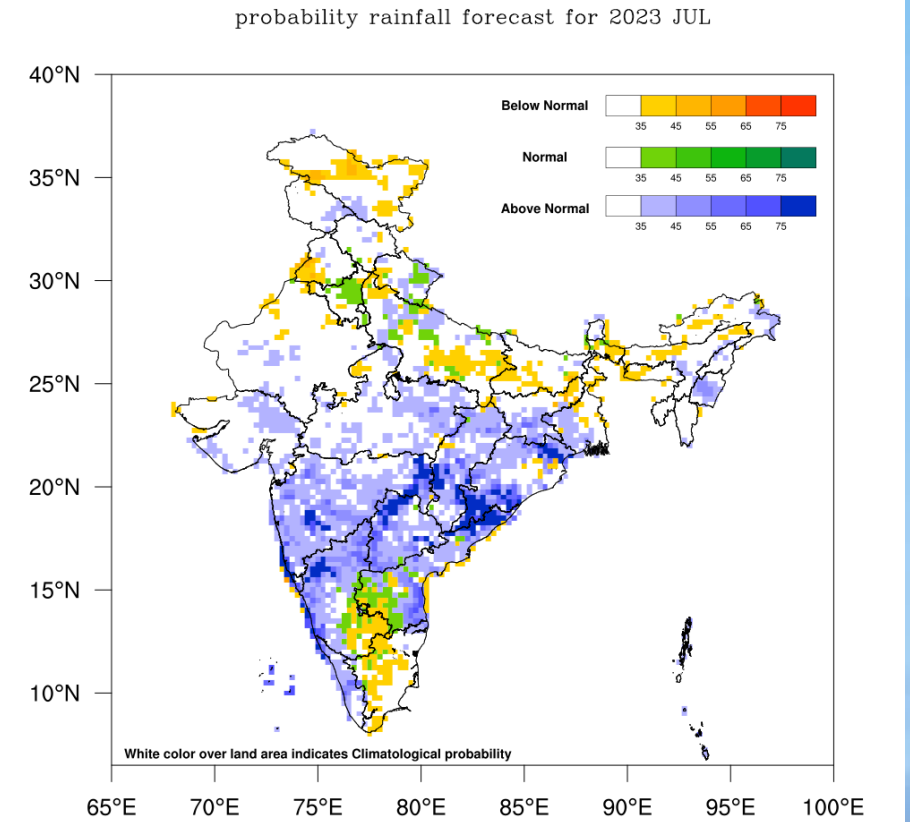
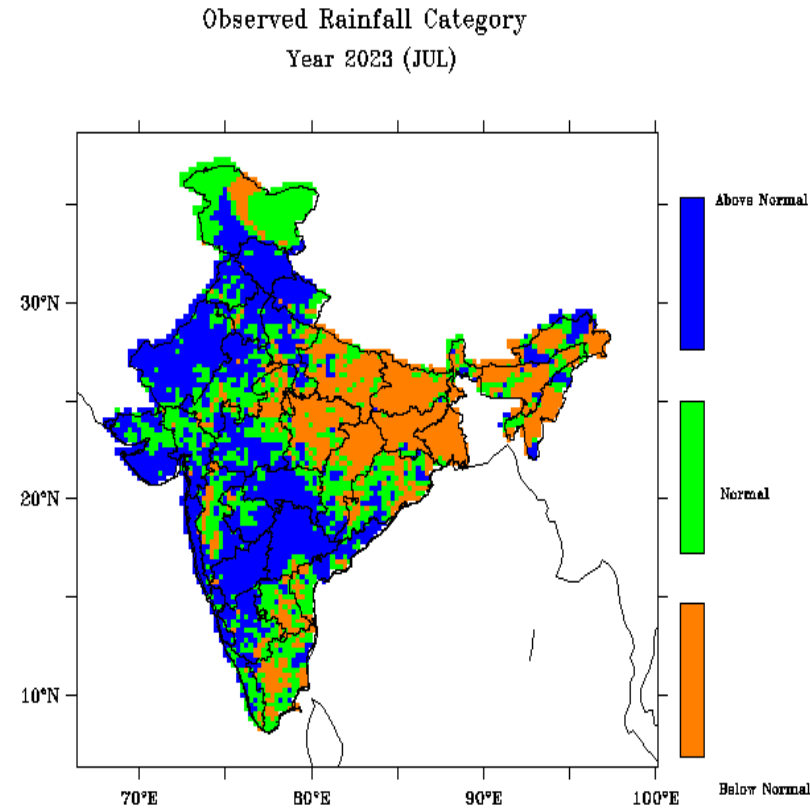
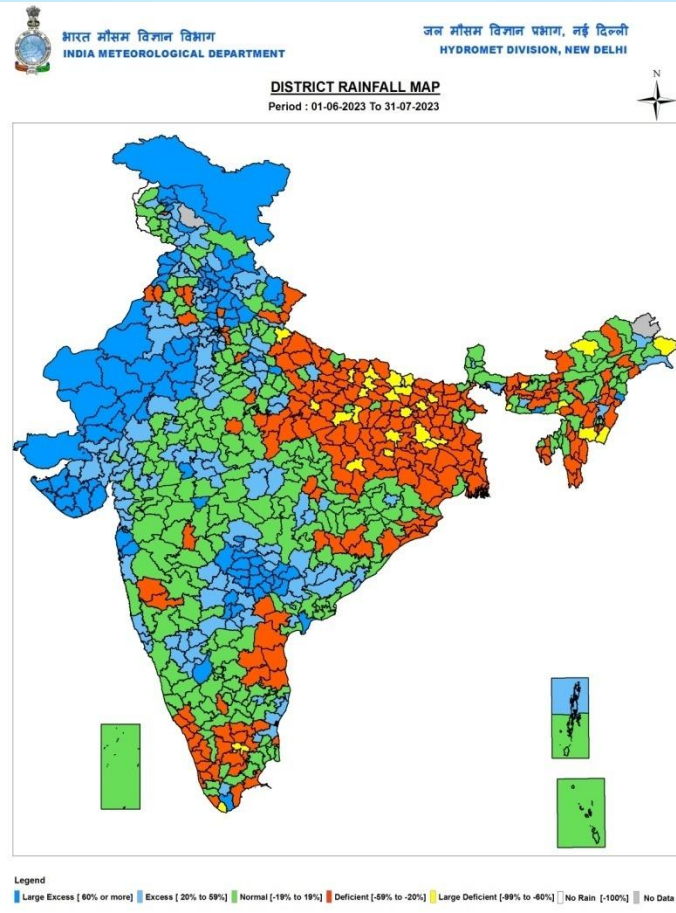
State	Station	All time Record (mm)in July	Previous Record(mm) in July
Chandigarh	Chandigarh City	302.2 (09.07.2023)	120.8(28.07.2017)
	Chandigarh Airport	286.0(09.07.2023)	262.0(17.07.2000)
Haryana	Ambala	224.1(09.07.2023)	206.7(16.07.2001)



Verification of JUL 2023 rainfall forecast

Observed Rainfall Category (Jul 2023)

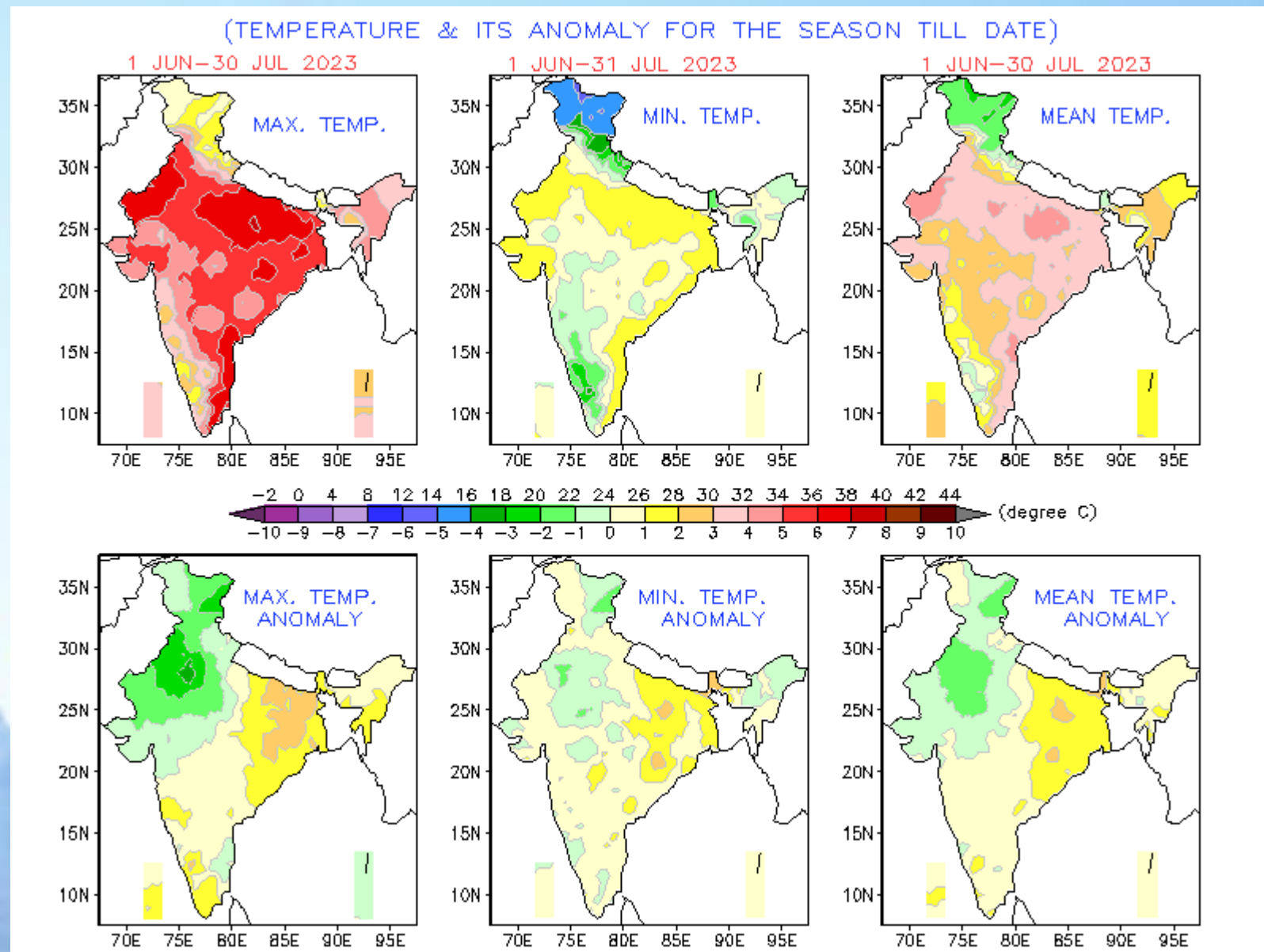
Rainfall forecast for Jul Month
(issued on 30 June 2023)



- Above normal rainfall over many parts of west Central and Peninsular India and some areas of Northwest India were correctly predicted.
- Below normal rainfall over many regions of the Northeast India and southeast Peninsular India and east UP and Bihar also correctly predicted.



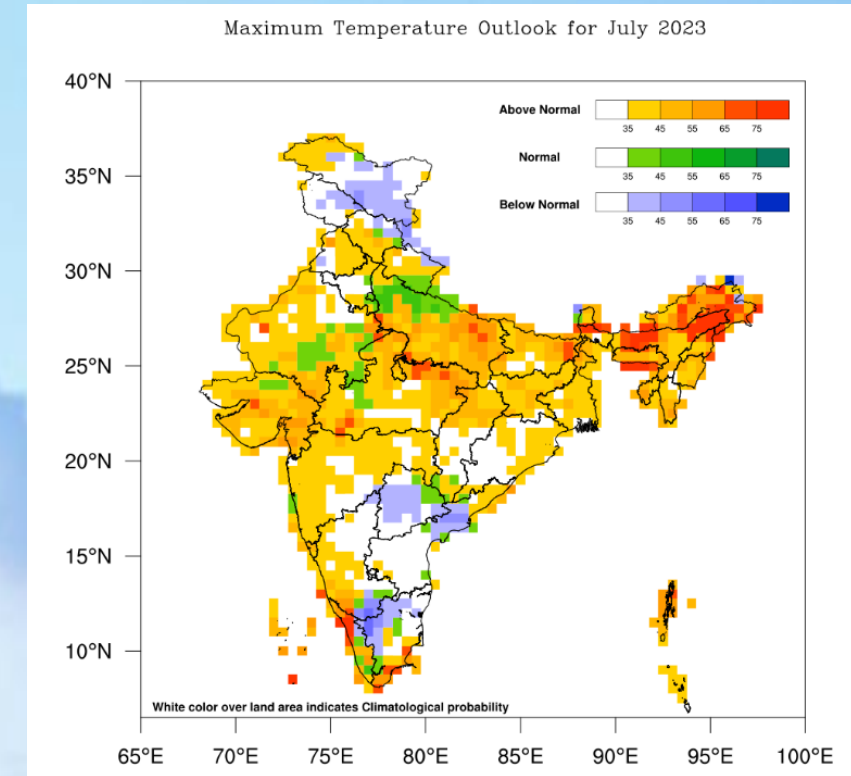
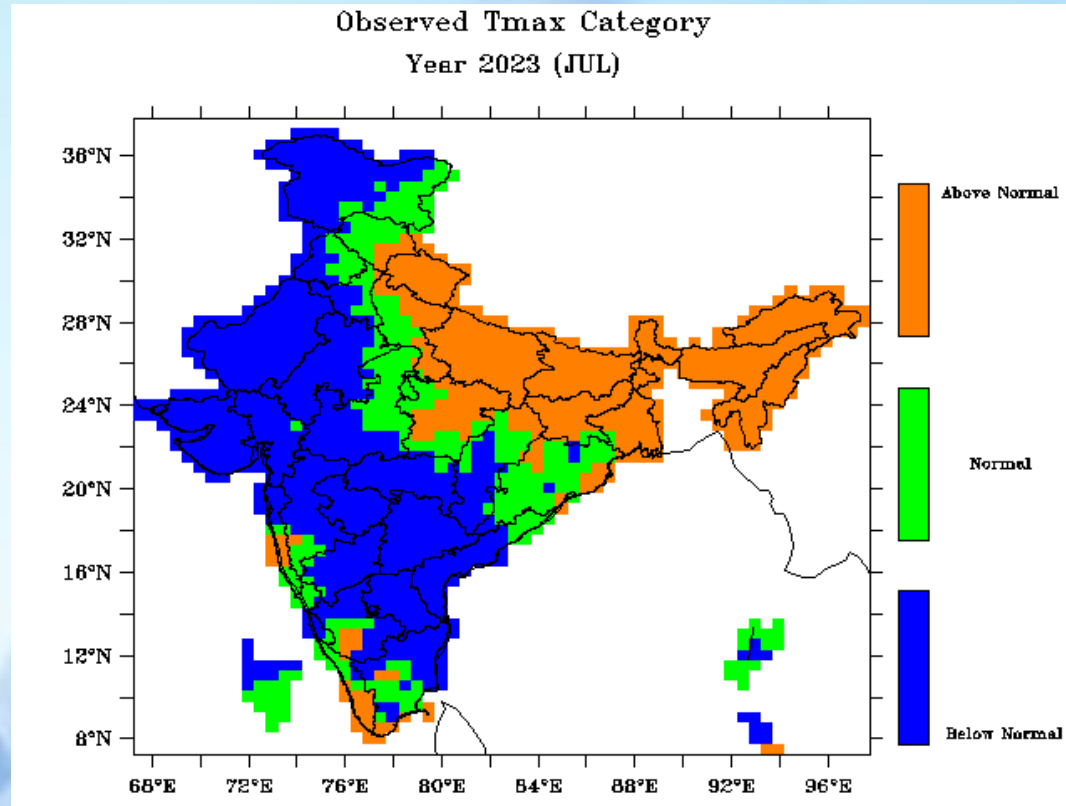
Observed Temperature during JULY 2023



Verification of Jul 2023 Maximum Temperature

Observed Temperature (Tmax) Category (Jul 2023)

Maximum Temperature forecast for Jul Month
(issued on 30 June 2023)



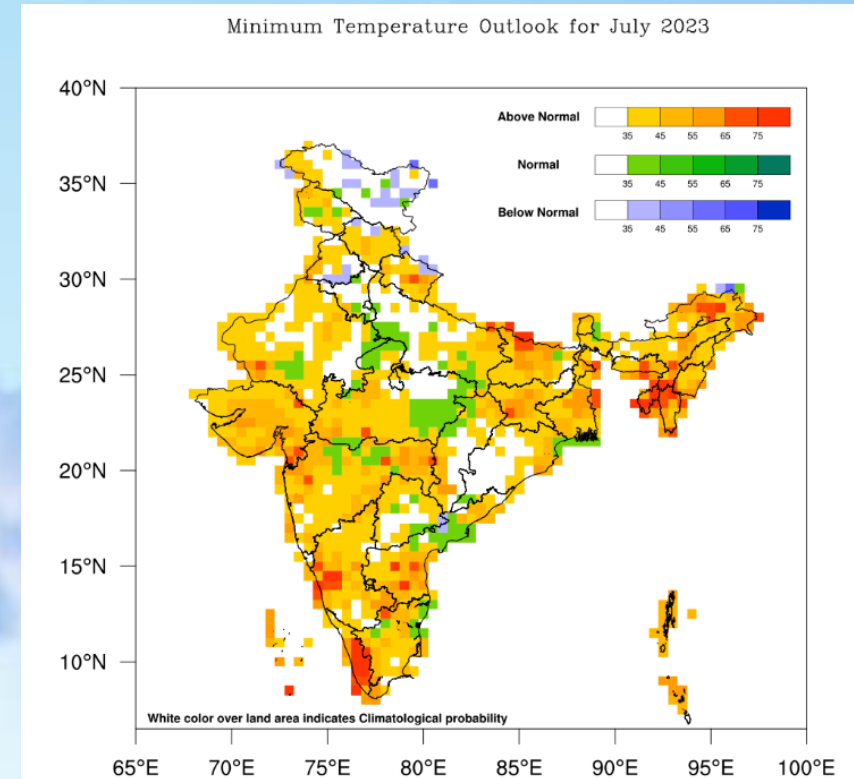
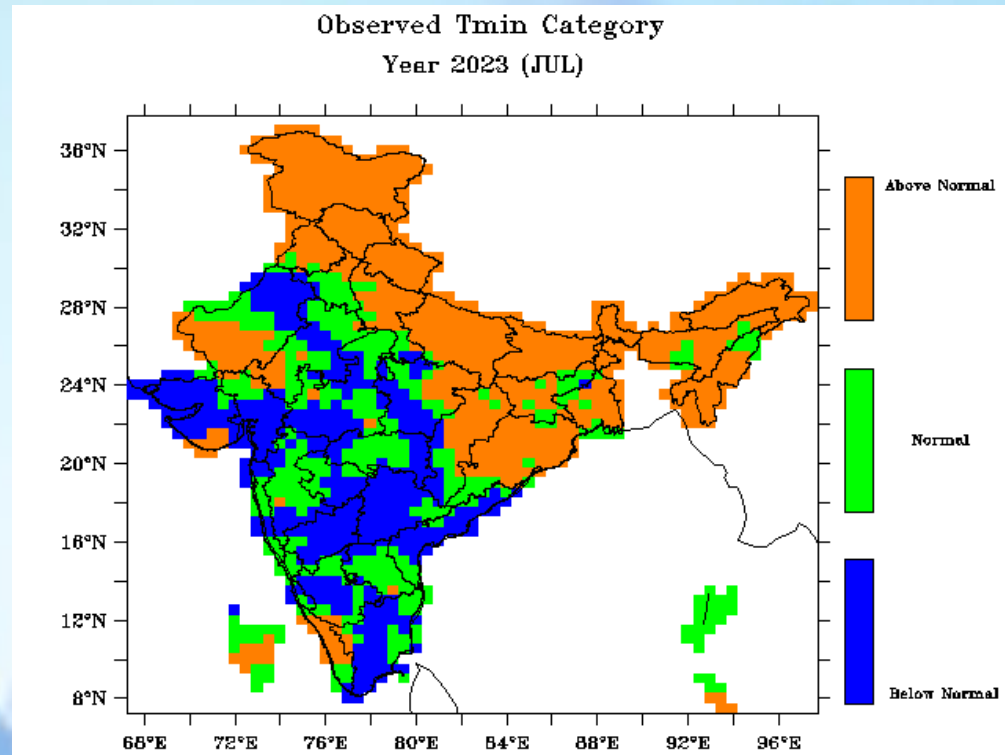
- Above normal Maximum Temperature over many regions along the Gangetic plains and Northeast India were correctly predicted.
- However, Below normal Maximum Temperature observed over many regions over the Northwest, Central and peninsular India could not be predicted correctly.



Verification of July 2023 Minimum Temperature

Observed Temperature (Tmin) Category (July 2023)

Minimum Temperature forecast for July Month
(issued on 30 June 2023)



- Normal to above normal Minimum Temperatures observed over some parts of the Northeast, east central and northwest India and Kerala were correctly predicted.
- However, Below normal temperature observed over westcentral and major parts of peninsular India, Ladakh could not be correctly predicted.



Temperature records in July 2023

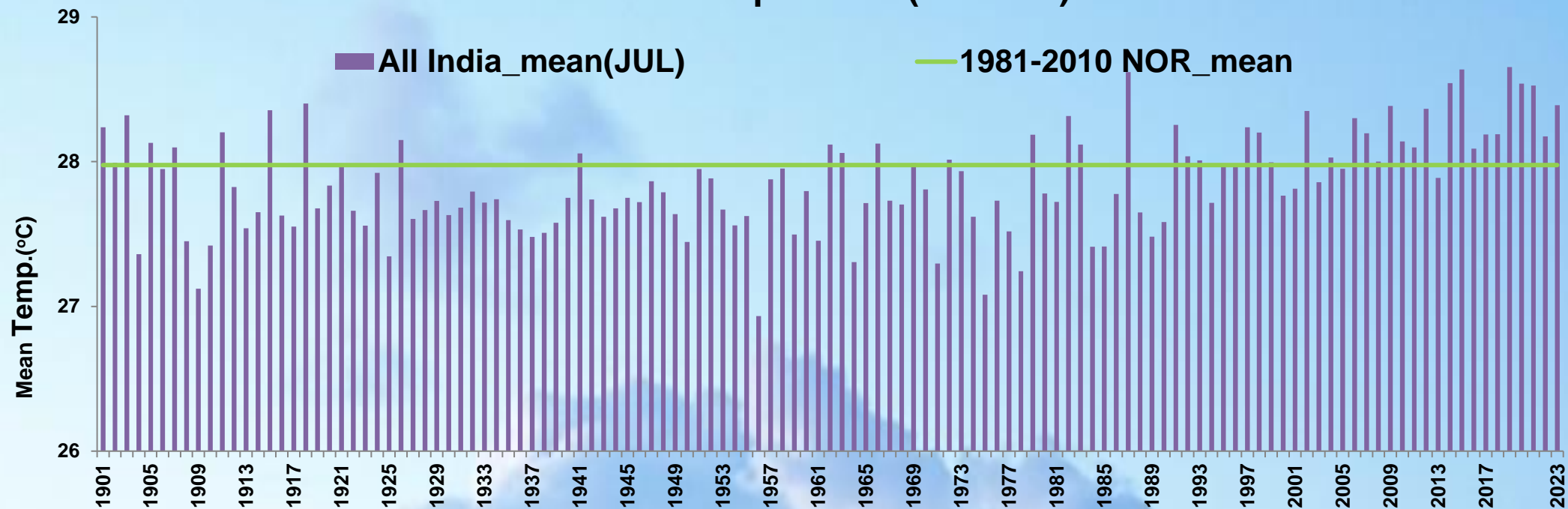
JUL 2023		Max Temp (°C)	Min Temp (°C)	Mean Temp (°C)
ALL INDIA	ACTUAL	31.88	24.90	28.39
	NORMAL	31.62	24.33	27.98
	ANOMALY	0.26	0.57	0.41
	TOP RANK since 1901	20	2	8
NORTHWEST INDIA	ACTUAL	32.11	23.98	28.05
	NORMAL	32.85	23.56	28.20
	ANOMALY	-0.74	0.42	-0.16
	TOP RANK since 1901	94	13	67
EAST & NORTHEAST INDIA	ACTUAL	33.14	25.53	29.34
	NORMAL	31.45	24.41	27.93
	ANOMALY	1.69	1.13	1.41
	TOP 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
	TOP RANK since 1901	34	8	25
SOUTH PENINSULAR INDIA	ACTUAL	31.53	25.06	28.30
	NORMAL	31.20	24.54	27.87
	ANOMALY	0.33	0.523	0.43
	TOP RANK since 1901	14	7	9

➤ Average temperature over Indian region during Jul 2023 is 8th warmest and Minimum Temperature is 2nd warmest since 1901

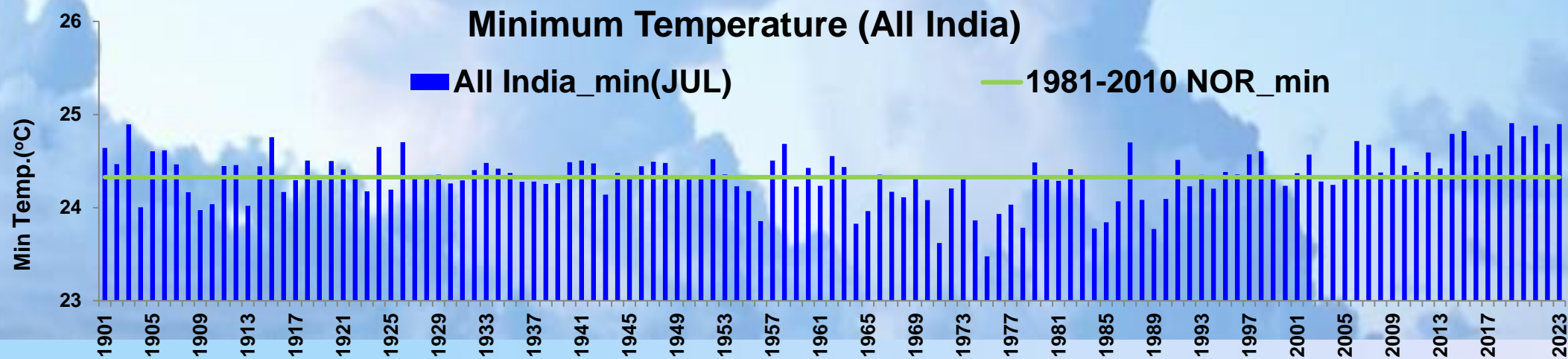
➤ East & Northeast India observed warmest minimum temperature since 1901.



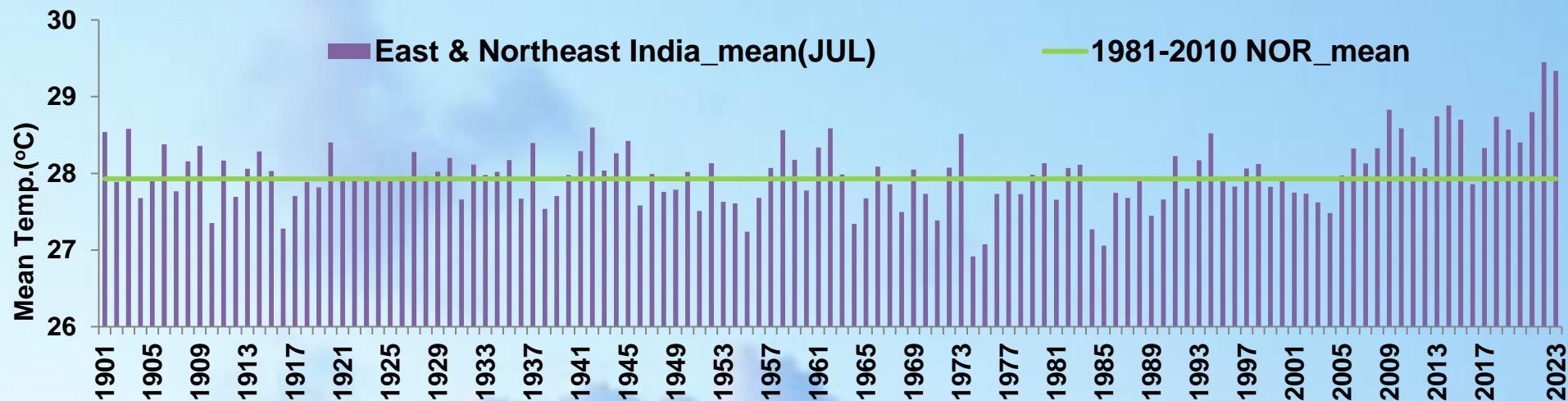
Mean Temperature (All India)



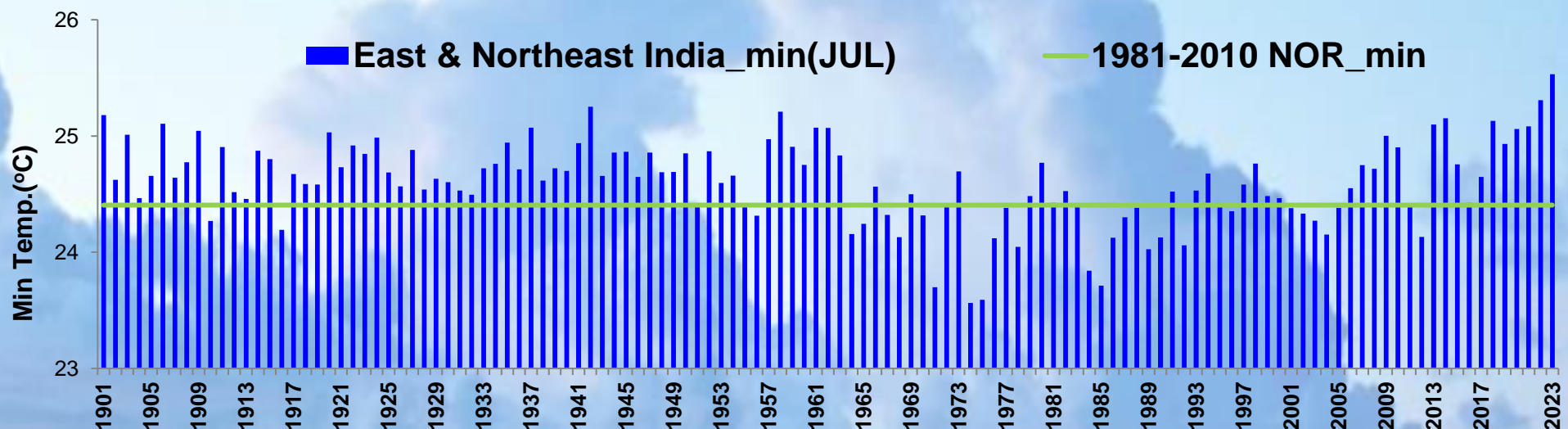
Minimum Temperature (All India)



Mean Temperature (East & Northeast India)



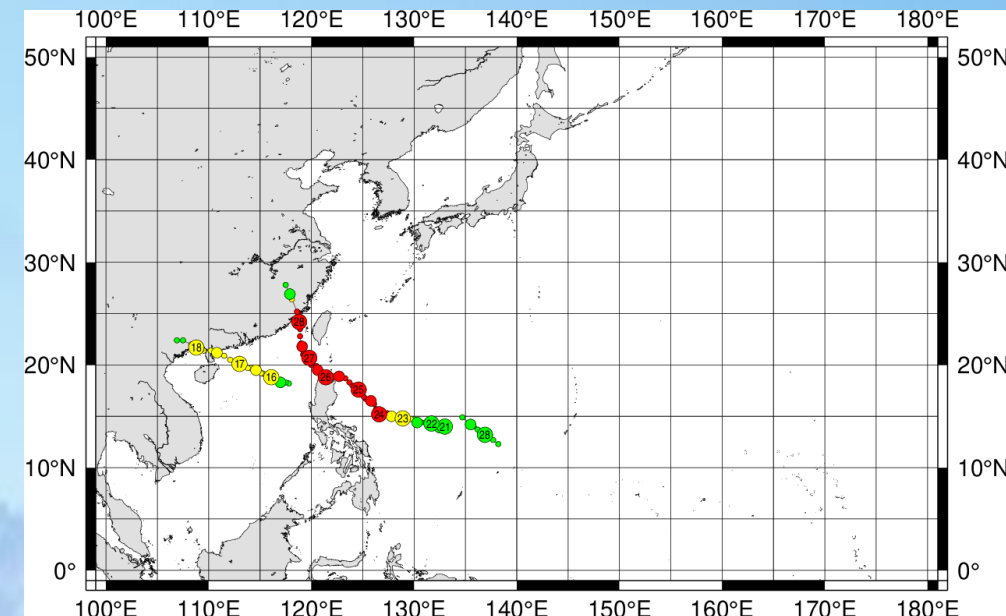
Minimum Temperature (East & Northeast India)



Factors for good rainfall activity during July Month

- Atmosphere did not respond to warm ocean temperature (ElNino condition).
- Southern Oscillation Index (SOI) is in neutral range. so no impact of El Nino.
- Indian Ocean Dipole Mode Index (DMI) was neutral (slightly positive)
- Madden Julian Oscillation (MJO) was in favourable phase on many days to cause enhanced convective activity.
- Western Disturbance helped to get good rainfall over Northwest India.
- Formation of four low pressure system (LPS) , one Land depression (10-11 Jul), Four over Bay of Bengal (16-17 Jul, 20-22 Jul, and (24-28 Jul, 29-31 July).
- These LPS helped to get good rainfall over central Indian region and west coast of India.
- Total number of LPS days was 15 against normal of 13.5 days in July

West Pacific Storm Tack :JUL 2023



Year	Depression	Low	Total LPS	LPS days
2017	1	5	6	12
2018	1	2	3	19
2019	-	4	4	15
2020	-	2	2	7
2021	-	4	4	15
2022	1	3	4	22
2023	-	4	4	14
climatology	1.45	1.83	3.27	13.56

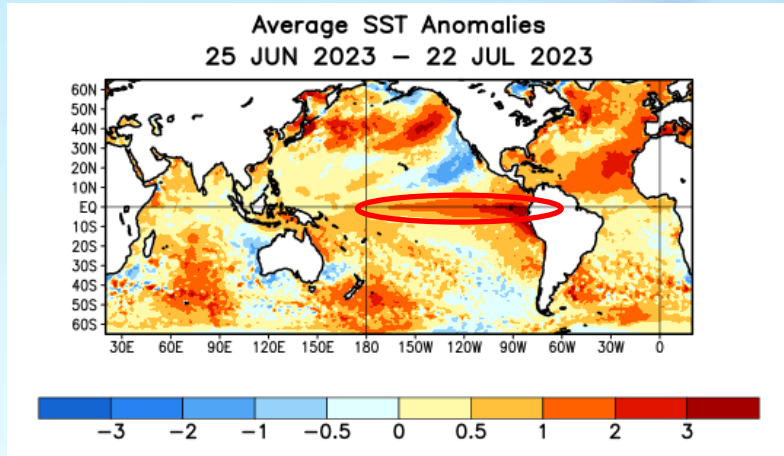


Major Synoptic Systems

- ✓ Formation of four low pressure system (LPS) , one Land depression (10-11 Jul), Four over Bay of Bengal (16-17 Jul, 20-22 Jul, and (24-28 Jul, 29-31 July).
- ✓ Monsoon Trough lay to the south of its normal position on many days favouring rainfall over central and peninsular India
- ✓ East-West shear zone was seen and persisted 17-28 July in the week while oscillating roughly within Lat. 17° N to Lat 20° N between 3.1 & 7.6 km above mean sea level tilting southwards with height.
- ✓ Off-shore trough was seen very shorter period DURING July 2023 along west coast: Only seen during 1-8 July from Gujarat coast- Kerala coasts and then off south Maharashtra coast to Kerala coast on 13-15 July
- 4 WDs affected north India(with 1 WD of 5-11 July interacted with monsoonal systems, 13-18, 20-23 and 28-31 July 2023)



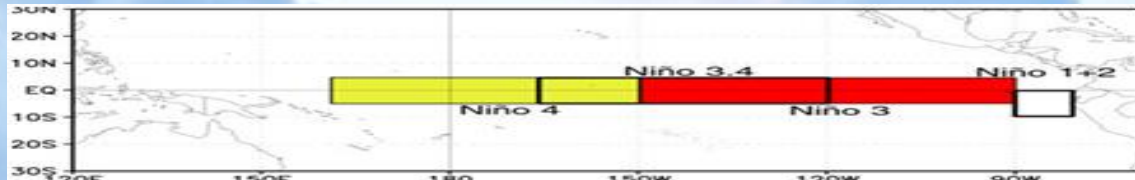
Latest Global SST Departures (°C) and ENSO Conditions over Pacific



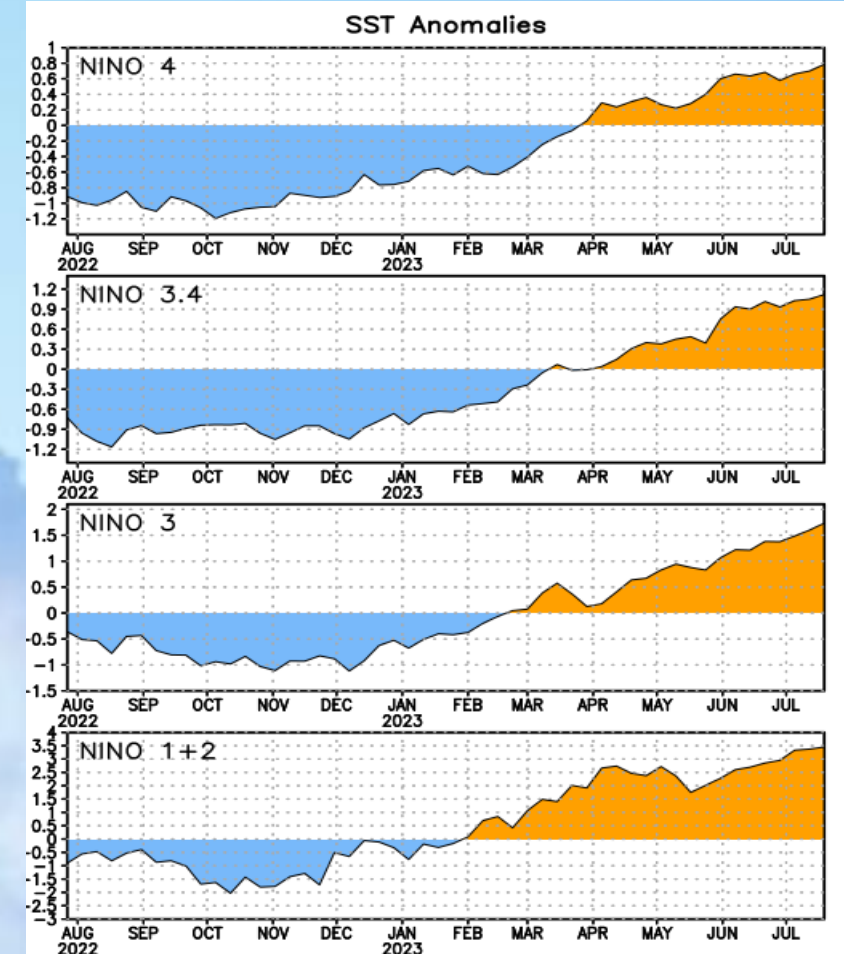
The latest weekly SST departures are:

Niño 4	0.8°C
Niño 3.4	1.1°C
Niño 3	1.7°C
Niño 1+2	3.5°C

Data source **CPC, USA**



Recent evolution of NINO SSTs



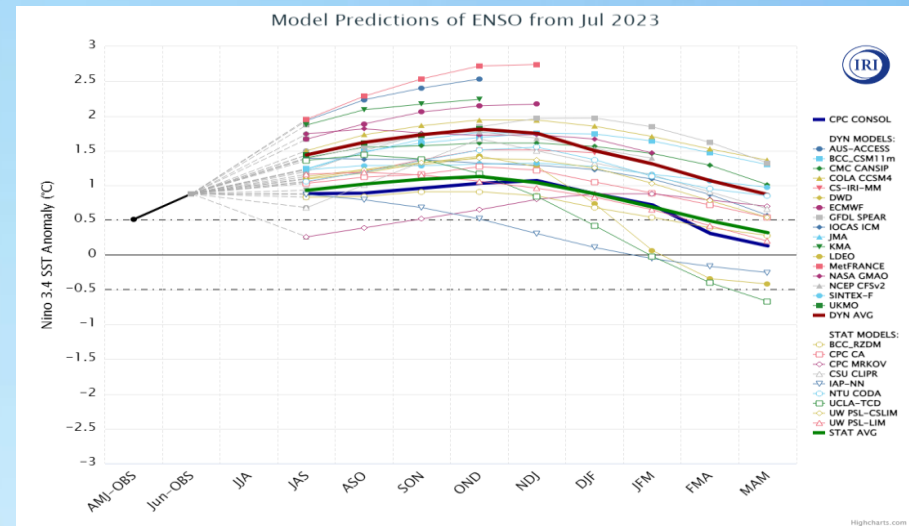
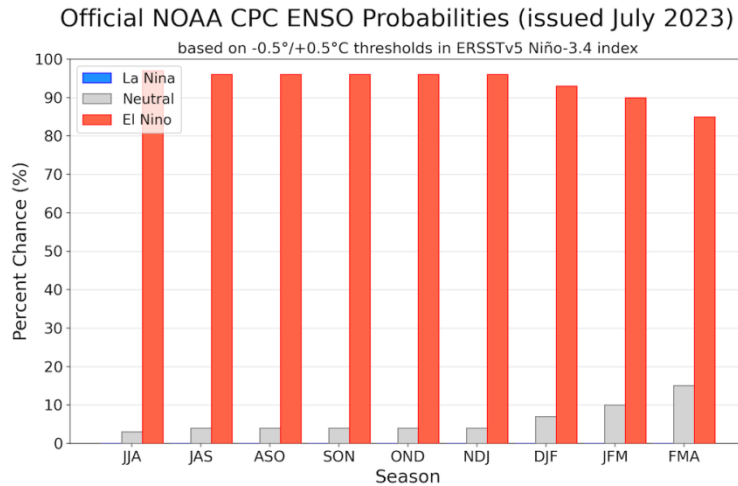
Data source
CPC, USA

Equatorial SSTs were above average across most of the Pacific Ocean and over parts of Indian and Atlantic Oceans.



Latest ENSO & IOD Forecast : July 2023

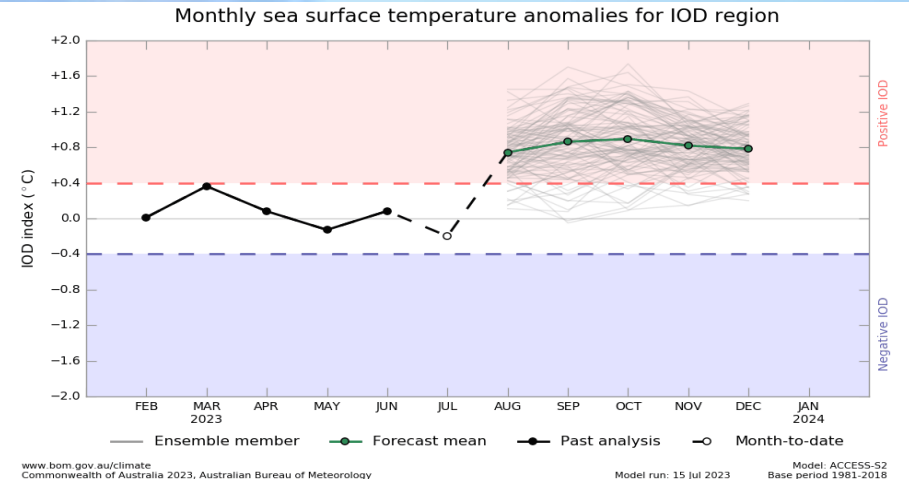
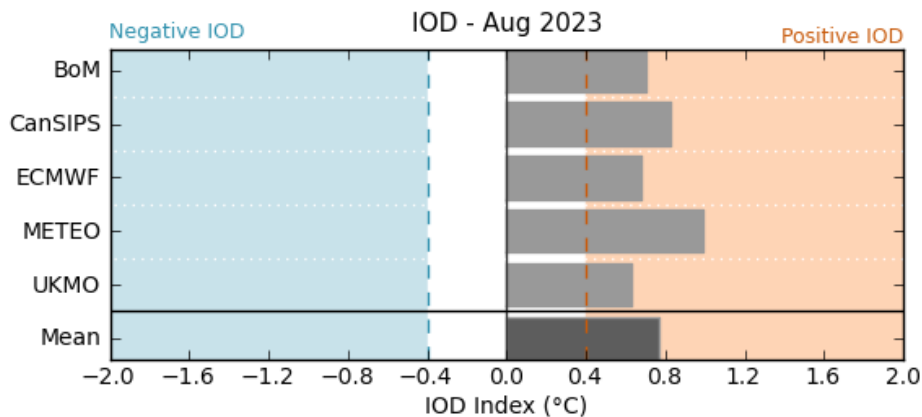
ENSO



El Niño is favored through Northern Hemisphere winter 2023-24, with chances exceeding 90% for most of the period.

Nearly all models indicate that El Niño will persist into the Northern Hemisphere winter 2023-24.

IOD



Climate models indicate development of positive IOD during 2023 monsoon season

Bureau of Meteorology model also indicate development of positive IOD.



New Strategy for Long Range Forecast

1st Stage Forecast

April

All India averaged Season (June – September) Rainfall

Spatial pattern of probability forecast for the Season Rainfall over the country

2nd Stage Forecast

May

Update for the April forecast for the All India averaged Season Rainfall and spatial pattern of probabilistic forecast over the country

Forecast for Season Rainfall: for the Four Homogeneous Regions & Monsoon Core Zone (MCZ)

Monthly Forecast

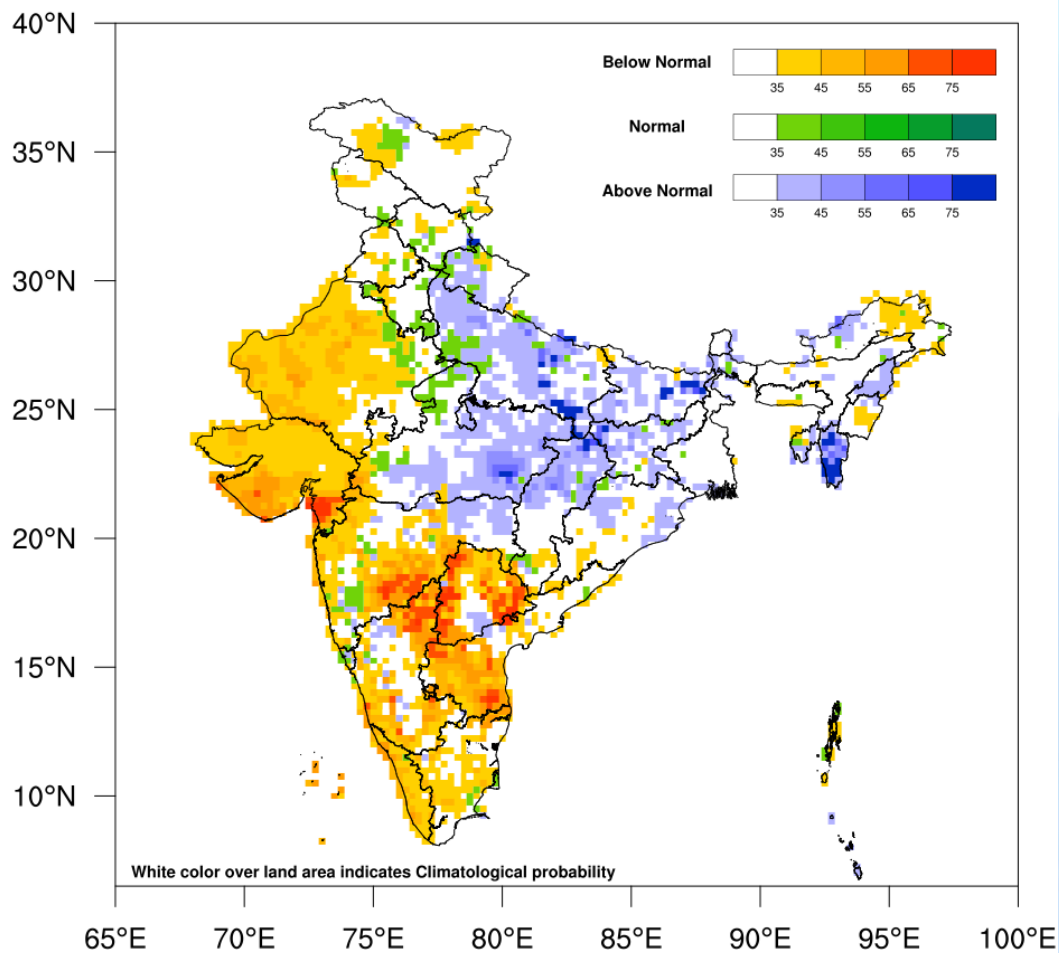
End of May, June, July & August for subsequent one month

Probabilistic Forecast for Monthly rainfall



Probabilistic Forecast for rainfall during August to September, 2023

probability rainfall forecast for 2023 Aug+Sep

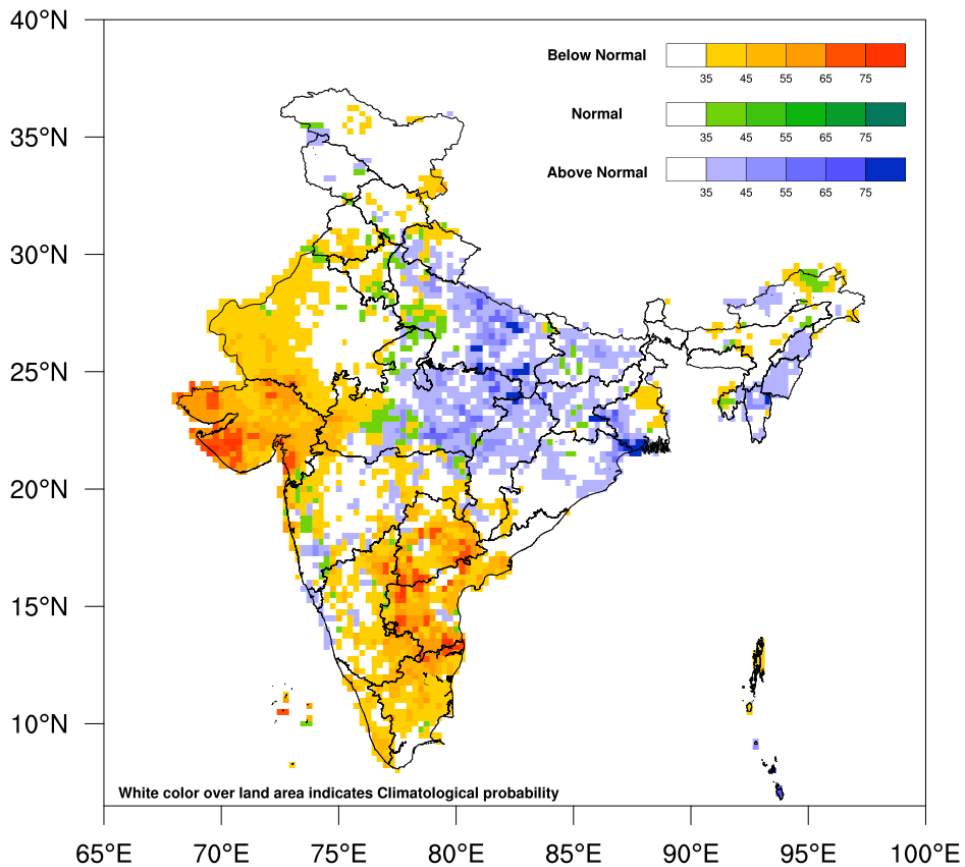


- Rainfall over the country as a whole during the second half of monsoon season (August to September, 2023), is most likely to be normal (94 to 106% of Long Period Average (LPA)), most preferably on the negative side of the normal.
- LPA of the August to September rainfall over the country as a whole based on data of 1971-2020 is 422.8 mm.
- Normal to above normal rainfall is very likely over east central India, many parts of east and northeast India and most subdivisions along the Himalayas .
- Below normal rainfall is most likely over most parts of Peninsular India, and western parts of northwest and central India
- White shaded areas within the land region represent climatological probabilities, as there is no preferred signal from the model.



Probabilistic Forecast for rainfall during August, 2023

probability rainfall forecast for 2023 August



1. Rainfall averaged over the country as a whole during August, 2022 is most likely to be below normal (<94% of Long Period Average (LPA)).
2. LPA of rainfall over the country as a whole during August based on data of 1971-2020 is 254.9 mm
3. Normal to above normal rainfall is very likely over most parts of subdivisions adjacent to / along the Himalayas, east central India, and many parts of east and northeast India.
4. Below normal rainfall is most likely over most parts of Peninsular India, and many areas of western parts of northwest and central India.
5. White shaded areas within the land region represent climatological probabilities.

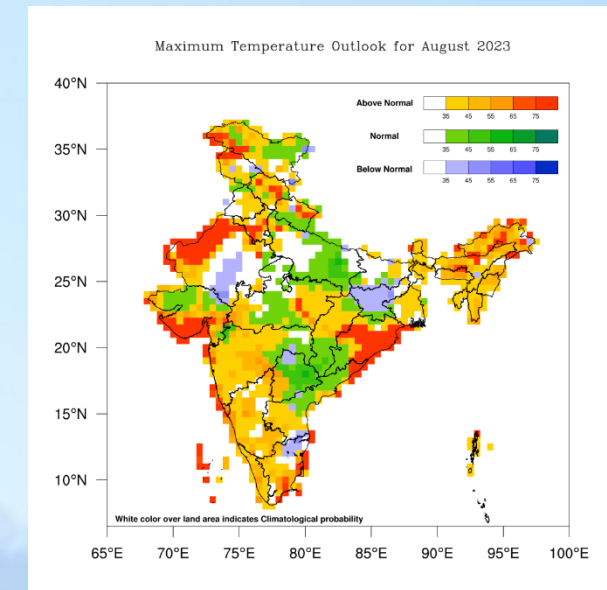


Probabilistic Forecast of Temperatures over the Country during August 2023

Maximum Temperature:

- During August, 2023, above normal monthly maximum temperatures are very likely over most parts of south Peninsula, east and northeast India, and some parts of northwest and central India.
- Normal to below normal maximum temperatures are very likely over some areas of north peninsular India, east central India and Gangetic plains.

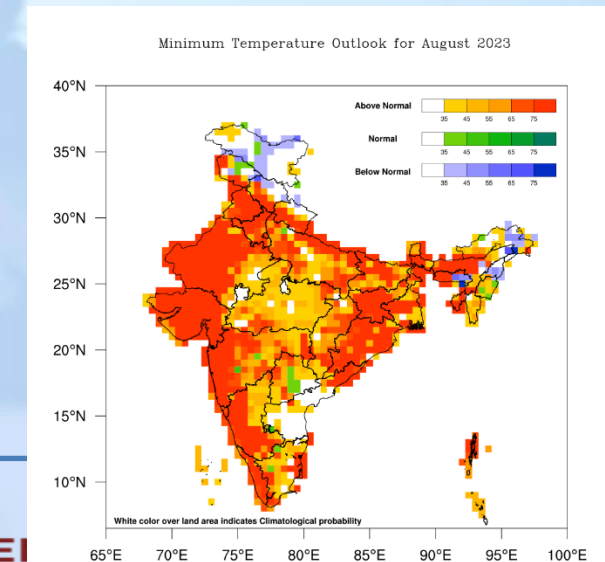
Maximum Temperature



Minimum Temperature :

- Above normal minimum temperatures are very likely over most parts of India except some parts of the northwest and northeast India where normal to below normal minimum temperatures are likely

Minimum Temperature



Summary

➤ Rainfall during Aug-Sep, 2023

- Rainfall over the country as a whole during second half of the monsoon season (Aug. to Sept.), 2023 is most likely to be **normal (94 to 106% of Long Period Average (LPA))**, most preferably on negative side of normal.
- Normal to above normal rainfall is very likely over east central India, many parts of east and northeast India and most subdivisions adjacent to / along the Himalayas . Below normal rainfall is very likely over most parts of Peninsular India, and western parts of northwest and central India. .

➤ Rainfall during Aug. 2023

- Monthly rainfall over the country as a whole for August 2023 is most likely to be **below normal (< 94 % of Long Period Average (LPA))** with a tendency to be in the negative side of the normal.
- Normal to above normal rainfall is most likely over most parts of subdivisions adjacent to the Himalayas, east central India, and many parts of east and northeast India. Below normal rainfall is most likely over most parts of South Peninsula, and many areas of western parts of northwest and central India.

➤ Temperature during Aug. 2023

- Above normal monthly maximum temperatures are very likely over most parts of south Peninsula, east and northeast India, and some parts of northwest and central India. Normal to below normal maximum temperatures are most likely over some areas of north peninsular India, east central India and Gangetic plains.
- Above normal minimum temperatures are most likely over most parts of India except some parts of the northwest India where below normal minimum temperatures are likely

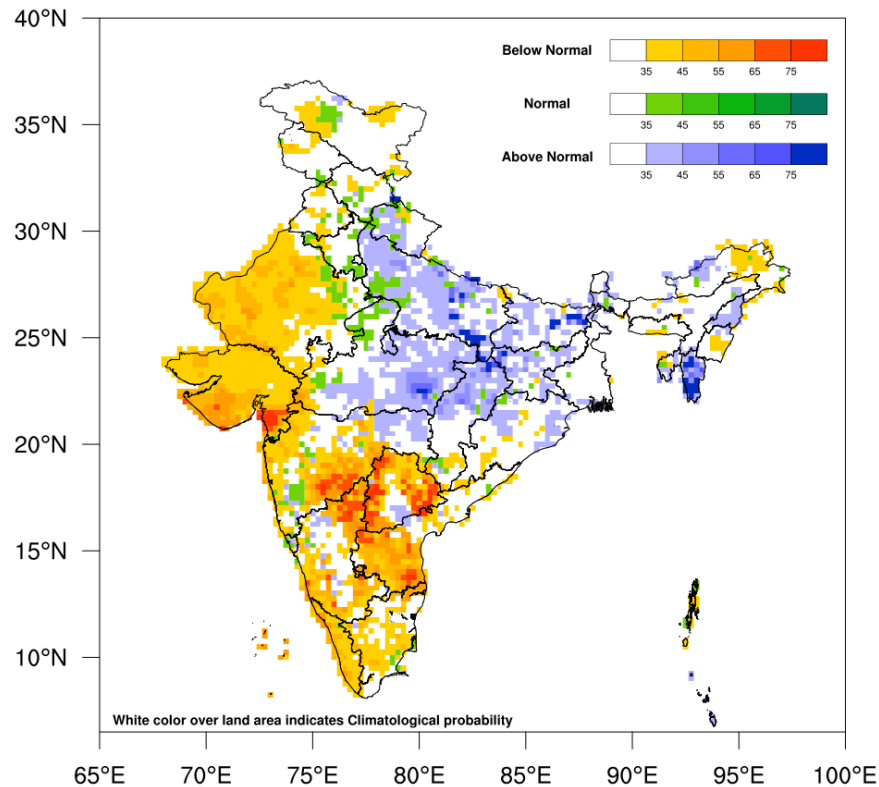
➤ ElNino and IOD condition

- El Niño conditions are likely to intensity further and continue upto early next year. Neutral IOD conditions may be replaced with positive IOD conditions during remaining part of the monsoon season.

मौसम की दूसरे अर्ध के लिए 2023 के दौरान भारत में वर्षा की संभावना का पूर्वानुमान

Probabilistic Forecast of rainfall during AUG+SEP, 2023

probability rainfall forecast for 2023 Aug+Sep



❖ दक्षिण-पश्चिम मानसून सीजन, 2023 के दूसरे अर्ध (अगस्त से सितंबर की अवधि) के दौरान पूरे देश में वर्षा सामान्य (दीर्घकालिक औसत (एलपीए) का 94 से 106%) होने की संभावना है, संभवतः सामान्य के नकारात्मक पक्ष की ओर।

❖ 1971-2020 की अवधि के लिए पूरे देश में अगस्त से सितंबर की अवधि की वर्षा का एलपीए 422.8 मिमी है।

❖ 2023 दक्षिण-पश्चिम मानसून सीजन के दूसरे अर्ध के दौरान, हिमालय से सटे उपखंडों के अधिकांश हिस्सों, पूर्व मध्य भारत और पूर्व और उत्तर-पूर्व भारत के कुछ हिस्सों में सामान्य से लेकर सामान्य से अधिक वर्षा होने की संभावना है। प्रायद्वीपीय भारत के अधिकांश हिस्सों और उत्तर-पश्चिम और मध्य भारत के पश्चिमी हिस्सों में सामान्य से नीचे वर्षा होने की संभावना है।

❖ भूमि क्षेत्र के भीतर सफेद छायांकित क्षेत्र जलवायु संबंधी संभावनाओं का प्रतिनिधित्व करते हैं।

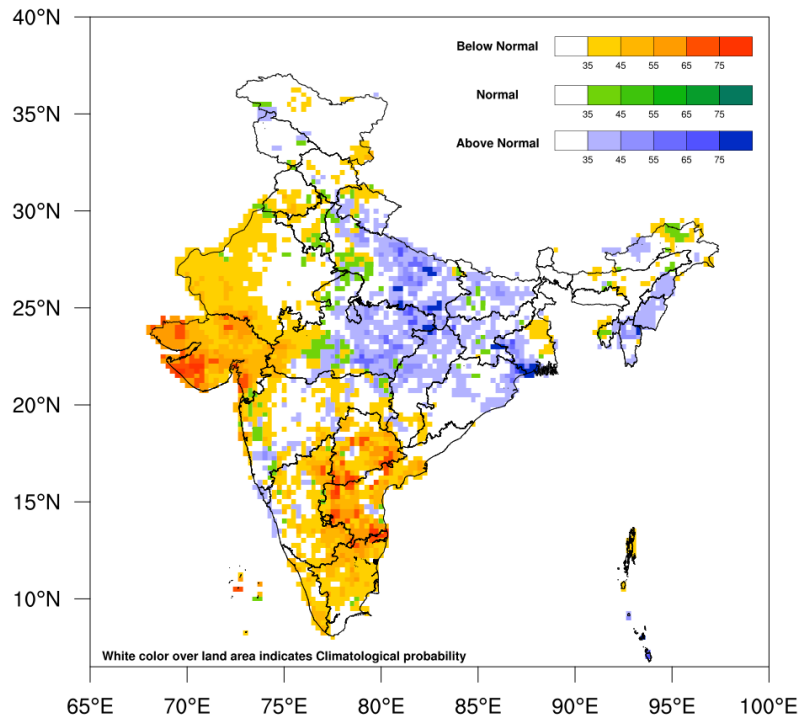
अगस्त से सितंबर की अवधि 2023 के दौरान भारत में वर्षा के लिए टर्सिल श्रेणियों * (सामान्य से नीचे, सामान्य और सामान्य से अधिक) की संभावना का पूर्वानुमान। यह आंकड़ा सबसे संभावित श्रेणियों के साथ-साथ उनकी संभावनाओं को भी दर्शाता है।

*(टर्सिल श्रेणियों में प्रत्येक की 33.33% की समान जलवायु संभावनाएं हैं।

अगस्त 2023 के दौरान भारत में वर्षा की संभावना का पूर्वानुमान

Probabilistic Forecast of rainfall during August, 2023

probability rainfall forecast for 2023 August



- ❖ अगस्त, 2023 के दौरान पूरे देश में औसत वर्षा सामान्य से कम (<94% एलपीए) होने की संभावना है
- ❖ 1971-2020 के आंकड़ों के आधार पर की अवधि के लिए पूरे देश में अगस्त की वर्षा का एलपीए 254.9 मिमी है ।
- ❖ अगस्त 2023 के दौरान, हिमालय से सटे उपखंडों के अधिकांश हिस्सों, पूर्वी मध्य भारत और पूर्व और उत्तर-पूर्व भारत के कुछ हिस्सों में सामान्य से लेकर सामान्य से अधिक वर्षा होने की संभावना है। दक्षिण प्रायद्वीप के अधिकांश हिस्सों और उत्तर-पश्चिम और मध्य भारत के पश्चिमी हिस्सों के कई भागों में सामान्य से कम वर्षा होने की संभावना है।
- ❖ भूमि क्षेत्र के भीतर सफेद छायांकित क्षेत्र जलवायु संबंधी संभावनाओं का प्रतिनिधित्व करते हैं।

अगस्त 2023 के दौरान भारत में वर्षा के लिए टर्सिल श्रेणियों * (सामान्य से नीचे, सामान्य और सामान्य से अधिक) की संभावना का पूर्वानुमान । यह आंकड़ा सबसे संभावित श्रेणियों के साथ-साथ उनकी संभावनाओं को भी दर्शाता है ।

*(टर्सिल श्रेणियों में प्रत्येक की 33.33% की समान जलवायु संभावनाएं हैं ।

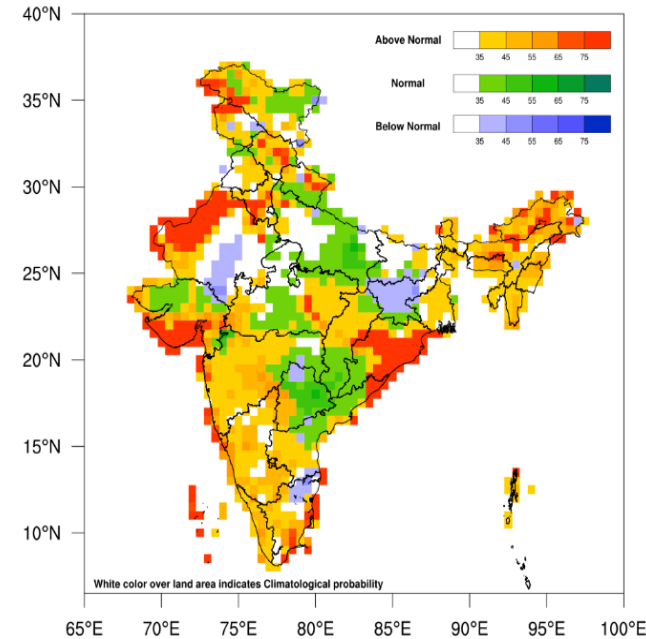


अगस्त 2023 के दौरान देश भर में तापमान का संभावित पूर्वानुमान

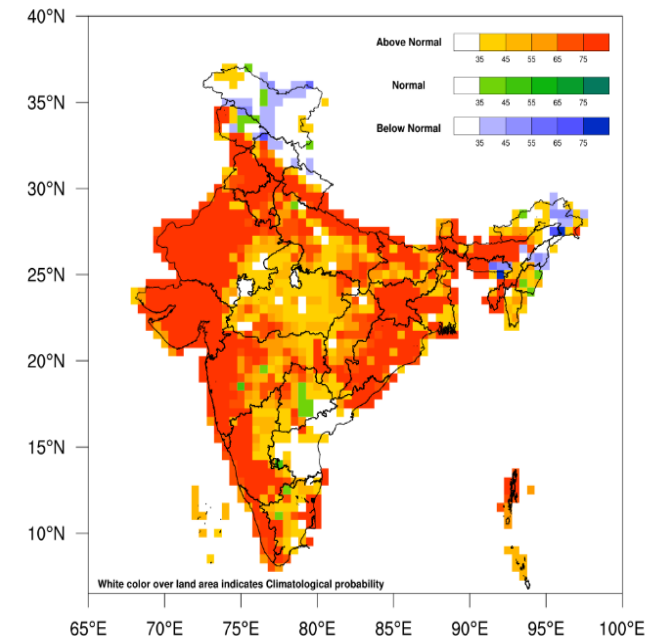
अधिकतम तापमान :

- अगस्त, 2023 के दौरान, दक्षिण प्रायद्वीप, पूर्व और उत्तर-पूर्व भारत के अधिकांश हिस्सों और उत्तर-पश्चिम और मध्य भारत के पश्चिमी हिस्सों के कई क्षेत्रों में मासिक अधिकतम तापमान सामान्य से अधिक रहने की संभावना है।
- उत्तरी प्रायद्वीपीय भारत के कुछ क्षेत्रों, पूर्वी मध्य भारत और हिमालय के मैदानी इलाकों में अधिकतम तापमान सामान्य से लेकर सामान्य से नीचे रहने की संभावना है

Maximum Temperature



Minimum Temperature



न्यूनतम तापमान :

अगस्त के दौरान, भारत के अधिकांश हिस्सों में न्यूनतम तापमान सामान्य से ऊपर रहने की संभावना है केवल उत्तर पश्चिम भारत के कुछ हिस्सों को छोड़कर, जहां सामान्य से कम न्यूनतम तापमान होने की संभावना है।

Extended Range Rainfall Forecast (27 Jul 2023 IC)

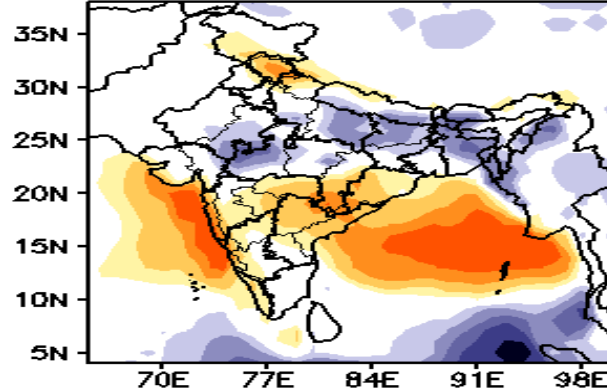
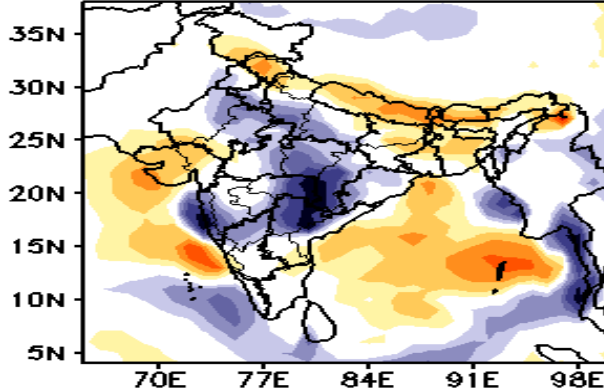
IMD

NCMRWF

Forecast Rainfall Anomaly (mm/day)

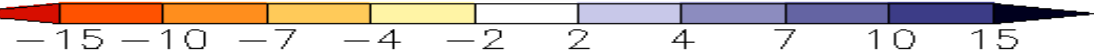
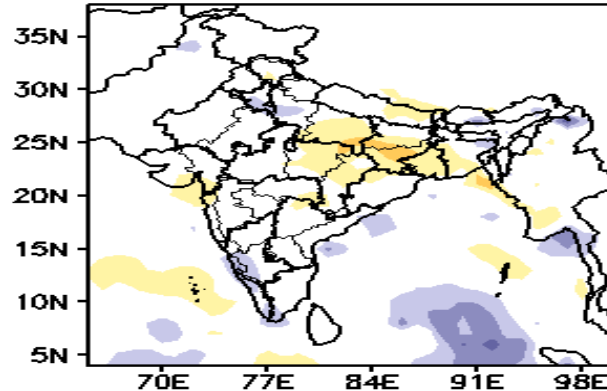
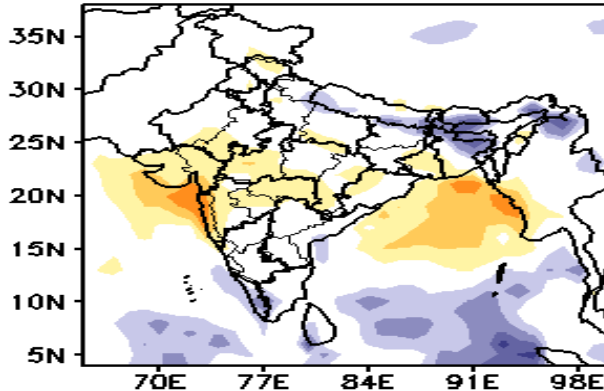
(Week1: 28Jul-03Aug)

(Week2: 04Aug-10Aug)



(Week3: 11Aug-17Aug)

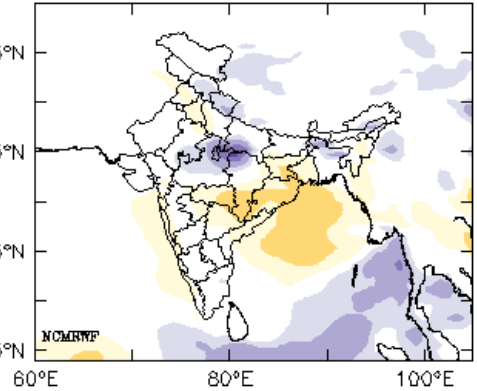
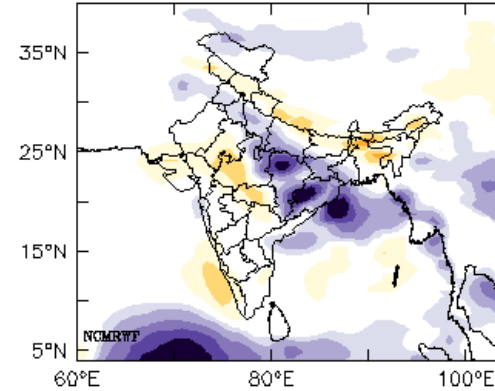
(Week4: 18Aug-24Aug)



NCMRWF CNCUM Extended Range Forecasts-20230727
Precipitation Anomaly (mm/day)

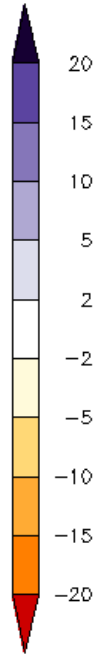
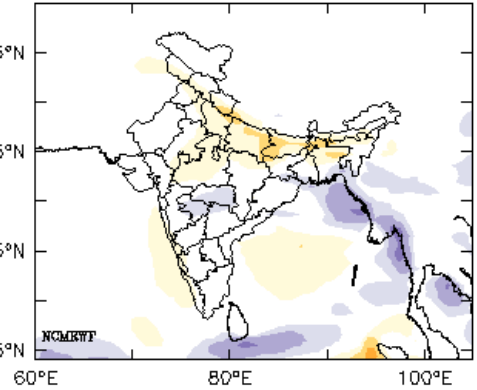
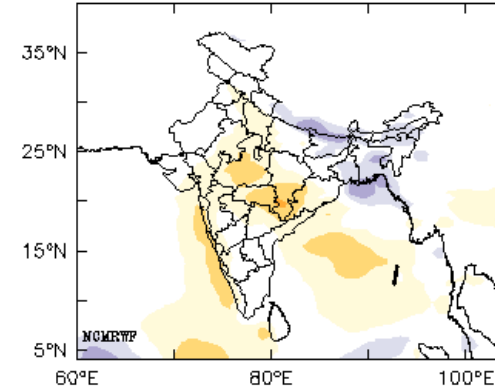
(Week1: 28JUL-03AUG)

(Week2: 04AUG-10AUG)



(Week3: 11AUG-17AUG)

(Week4: 18AUG-24AUG)



भारत मौसम विज्ञान विभाग
INDIA METEOROLOGICAL DEPARTMENT





Thank you

