

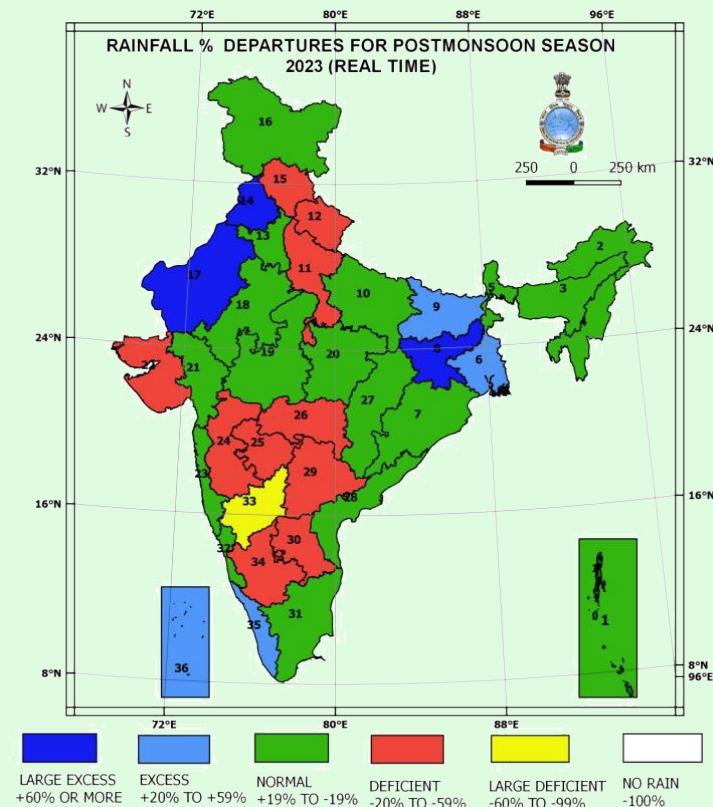


**भारत सरकार / GOVERNMENT OF INDIA**  
**पृथ्वी विज्ञान मंत्रालय / MINISTRY OF EARTH SCIENCES**  
**पृथ्वी प्रणाली विज्ञान संगठन / EARTH SYSTEM SCIENCE ORGANIZATION**  
**भारत मौसम विज्ञान विभाग / INDIA METEOROLOGICAL DEPARTMENT**

# भारत का जलवायु नैदानिक बुलेटीन CLIMATE DIAGNOSTICS BULLETIN OF INDIA

# उत्तर पूर्व मानसून क्रक्तु 2023 POST MONSOON SEASON 2023

# वास्तविक समय के आंकड़ो पर आधारित विश्लेषण NEAR REAL - TIME ANALYSES



द्वारा जारी : जलवायु निगरानी एवं प्राणकृति समूह  
ISSUED BY : Climate Monitoring & Prediction Group

## **मानसूनपश्चात् ऋतु (उत्तर-पूर्व मानसून)**

(अक्टूबर-दिसम्बर 2023) (सारांश)

### **ऋतु की मुख्य विशेषताएं**

#### **प्रमुख बिंदु:**

ऋतु में पुरे भारत का माध्य तापमान ( $24.24^{\circ}\text{से}$ ) 1901 से सबसे अधिक रहा। पुरे भारत का अधिकतम तापमान ( $29.59^{\circ}\text{से}$ ) 1901 से तिसरा सबसे अधिक रहा। पुरे भारत का न्युनतम तापमान ( $18.89^{\circ}\text{से}$ ) 1901 से सबसे अधिक रहा। पूर्व और उत्तर-पूर्व भारत का अधिकतम तापमान ( $28.87^{\circ}\text{से}$ ) और न्युनतम तापमान ( $17.08^{\circ}\text{से}$ ) 1901 से सबसे अधिक रहा। दक्षिणी प्रायद्विप का अधिकतम तापमान ( $31.41^{\circ}\text{से}$ ) 1901 से दुसरा सबसे अधिक रहा और न्युनतम तापमान ( $23.58^{\circ}\text{से}$ ) 1901 से सबसे अधिक रहा। मध्य भारत का न्युनतम तापमान ( $19.2^{\circ}\text{से}$ ) 1901 से दुसरा सबसे अधिक रहा। उत्तर-पश्चिम भारत का न्युनतम तापमान ( $12.45^{\circ}\text{से}$ ) 1901 से सबसे अधिक रहा।

#### **उत्तर-पूर्व मानसून वर्षा की गतिविधि:**

उत्तर-पूर्व मानसून वर्षा तटीय आंध्र प्रदेश और यानम, रायलसीमा, तामिलनाडु, पुदुचेरी और करायकल, दक्षिणी आंतरिक कर्नाटक, केरल और माहे मे एल.पी.ए. का 94% रही।

#### **शीत लहर/कोहरे की स्थितियाँ :**

ऋतु मे दिसम्बर माह मे शीत लहर दुसरे पखवाडे मे पंजाब के कुछ भागो मे एक दिन दिखाइ दिये। उत्तर-पूर्व भारत और उत्तर भारत मे पुरे दिसम्बर महीने मे घने कोहरे का अनुभव हुआ।

#### **वर्षा की विशेषताएं :**

ऋतु की वर्षा एल.पी.ए. का 91% रही। 36 मौसम उप मंडलों मे से 3 मे अत्यधिक, 4 मे अधिक, 18 मे सामान्य और 10 मे सामान्य से कम, 1 मे सामान्य से काफी कम वर्षा हुई (आकृती 1)। तालिका 1 मे अक्टूबर-दिसंबर, 2023 के उप मंडल-वार वर्षा के आँकडे (मि. मी.) मे दर्शाए गए हैं।

आकृती 2(ए) मे ऋतु के दौरान देश के विभिन्न भाग मे हुई वर्षा (मि. मी. मे) दर्शायी गयी है। आकृती 2(बी) मे ऋतु के दौरान हुई वर्षा की विसंगति (मि. मी.) मे दर्शायी गयी है। आकृती 3(ए) मे ऋतु के पूरे देश के साप्ताहिक क्षेत्र भारित संचित वर्षा के प्रतिशत विचलन दर्शाए गए हैं। संचयी साप्ताहिक वर्षा पहले सप्ताह को छोड़कर पूरे ऋतु के दौरान ऋणात्मक रही। आकृती 3(बी) मे ऋतु के उत्तर-पूर्व मानसून वर्षा वाले क्षेत्र के साप्ताहिक क्षेत्र भारित संचित वर्षा के प्रतिशत विचलन दर्शाए गए हैं। आकृती 3(सी) मे ऋतु के उत्तर-पूर्व मानसून वर्षा वाले क्षेत्र की वर्षा की 1901 से अब तक श्रृंखला दर्शाई गई है।

आकृती 4(ए) मे वर्ष 1951 से अब तक के सम्पूर्ण भारत और चार समरूपी क्षेत्रों की भारित वर्षा की श्रृंखला दर्शाई गई है। ऋतु की वर्षा भारत के उत्तर-पश्चिम भारत मे एल.पी.ए. का 99%, मध्य भारत मे एल.पी.ए. का 78%, पूर्व और उत्तर-पूर्व भारत मे एल.पी.ए. का 110% तथा दक्षिण प्रायद्विप मे एल.पी.ए. का 87% रही।

#### **मानकीकृत वर्षण सूचकांक (एस.पी.आई.):**

मानकीकृत वर्षण सूचकांक अनावृष्टि मापने का एक सूचकांक है जो केवल वर्षा पर आधारित होता है। यह सूचकांक शुष्क स्थिति मे ऋणात्मक और आर्द्र स्थिति मे धनात्मक होता है। जब शुष्क या आर्द्र मौसम की स्थिति अधिक तीव्र होती है, तब सूचकांक अधिक ऋणात्मक या धनात्मक होता है। आकृती 5(ए,बी) मे

अक्तूबर-दिसम्बर, 2023 (3 माह के संचित) तथा जनवरी-दिसम्बर, 2023 (12 माह के संचित) के मानकीकृत वर्षण सूचकांक दर्शाएं गए हैं।

ऋतु के दौरान उप हिमालयीन पश्चिम बंगाल और सिक्किम, गांगीय पश्चिम बंगाल, ओडिशा, झारखण्ड, बिहार, पूर्वी उत्तर प्रदेश, पंजाब, जम्मु कश्मीर और लदाख, पश्चिमी राजस्थान, पूर्वी मध्य प्रदेश, छत्तीसगढ़, तामिलनाडु पुदुचेरी और करायकल, केरल और माहे के कुछ भागों में अत्यंत आर्द्ध / प्रचंड आर्द्ध स्थितियाँ रहीं, जबकि अरुणाचल प्रदेश, नागालैंड मणिपुर मिझोराम, त्रिपुरा, जम्मु कश्मीर और लदाख, विदर्भ, आंध्र प्रदेश राज्य, तेलंगणा, उत्तरी और दक्षिणी आंतरिक कर्नाटक के कुछ भागों में अत्यंत शुष्क / प्रचंड शुष्क स्थितियाँ दिखाई पड़ीं।

**दाब :** आकृती 6(ए) तथा 6(बी) क्रमशः माध्य समुद्र तल दाब तथा इसकी विसंगति दर्शाते हैं। अधोरेखा द्वारा ऋणात्मक मान दर्शाएं गए हैं।

**पवन :** आकृती 7(ए) तथा 7(बी), 8(ए) तथा 8(बी), 9(ए) तथा 9(बी) में क्रमशः पवन का 850, 500 और 250 एच.पी.ए. स्तरों पर माध्य परिसंचरण स्वरूप तथा इसकी विसंगति को दर्शाते हैं।

### **वेग विभव तथा धारा कृत्य (स्ट्रीम फंक्शन और वेलोसिटी पोटेन्शियल):**

आकृती 10(ए) तथा 10(बी) में 250 एच.पी.ए. स्तर पर माध्य वेग विभव तथा इसकी विसंगति को दर्शाया गया है। इसी प्रकार आकृती 11(ए) तथा 11(बी) में माध्य धारा कृत्य तथा इसकी विसंगति को दर्शाते हैं। अधोरेखा द्वारा ऋणात्मक मान दर्शाये गए हैं।

### **बहिर्गमी दीर्घतरंग विकिरण (ओ.एल.आर.):**

भारत के क्षेत्रों तथा आसपास की बहिर्गमी दीर्घतरंग विकिरण ( $\text{वॉट}/\text{मी}^2$ ) आकृती 12 में दर्शाई गई है।

**तापमान:** माध्य मासिक अधिकतम तथा न्युनतम तापमान विसंगति आकृती 13(ए) तथा 13(बी) में दर्शाई गई हैं।

### **उष्ण दिनों / शीत रात्रियों का प्रतिशत :**

आकृती 14(ए) तथा 14(बी) में अधिकतम (न्युनतम) तापमान जब 90वें (10वें) पर्सेटाइल से अधिक(कम) वाले दिनों का प्रतिशत दर्शाया गया है।

आकृती 15 में पूरे देश में मानसून पश्चात ऋतु में 1971 से अब तक के माध्य तापमान दर्शाये गए हैं। 5 वर्ष के चल औसत भी दर्शाये गए हैं। इस ऋतु में माध्य तापमान 24.24 से. (तापमान विसंगती  $1.0^{\circ}\text{से.}$ ) रहा। आकृती 16(ए) तथा 16(बी) में चारों समरूपी क्षेत्रों के वर्ष 1971 से अब तक के मानसून पश्चात ऋतु के दौरान रहे अधिकतम और न्युनतम तापमानों की श्रृंखला दर्शाई गई है। तालिका 2 में ऋतु के दौरान की तापमान विसंगति दर्शाई गयी है।

### **निम्न दाब प्रणालियाँ:**

इस ऋतु में अक्तूबर में अरब सागर में एक बहुत तीव्र चक्रवाती तुफान तेज (20-25 अक्तूबर) और बंगाल की खाड़ी में अती तीव्र चक्रवाती तुफान हामुन (21-25 अक्तूबर) बने। नवंबर माह में बंगाल की खाड़ी में चक्रवाती तुफान मिथीली बना। दिसम्बर माह में बंगाल की खाड़ी में तीव्र चक्रवाती तुफान मिचांग बना। इसके अलावा दिसम्बर माह में अरब सागर में एक निम्न दाब क्षेत्र बना। इन निम्न दाब प्रणालियों के मार्ग आकृती 17 में दर्शाये गए हैं। आकृती 18 में 1951 से अब तक बंगाल की खाड़ी पर बने चक्रवाती तूफान और अवदाब की बारंगारता दर्शायी गयी है।

**आपत्कालीन मौसम घटनाएँ :** आकृती 19 में आपत्कालीन मौसम घटनाएँ दर्शाता है।

**POST- MONSOON SEASON - 2023**  
**North East Monsoon Season (October-December) 2023**  
**MAIN FEATURES OF THE SEASON**

**Highlights:**

During Post-Monsoon season, over the country the mean temperature was  $24.24^{\circ}\text{C}$  with an anomaly of  $1.0^{\circ}\text{C}$  and it was highest since 1901. Over the country as a whole the maximum temperature was 3<sup>rd</sup> highest ( $29.59^{\circ}\text{C}$  with an anomaly of  $0.68^{\circ}\text{C}$ ) and the minimum temperature was highest ( $18.89^{\circ}\text{C}$  with an anomaly of  $1.31^{\circ}\text{C}$ ) since 1901.

Among the four homogeneous regions, over East & Northeast India the maximum temperature was highest ( $28.87^{\circ}\text{C}$  with an anomaly of  $1.28^{\circ}\text{C}$ ) and the minimum temperature was also highest ( $17.08^{\circ}\text{C}$  with an anomaly of  $1.20^{\circ}\text{C}$ ) since 1901. Over South Peninsular India the maximum temperature was 2<sup>nd</sup> highest ( $31.41^{\circ}\text{C}$  with an anomaly of  $1.01^{\circ}\text{C}$ ) and the minimum temperature was highest ( $23.58^{\circ}\text{C}$  with an anomaly of  $1.28^{\circ}\text{C}$ ) since 1901. The minimum temperature was 2<sup>nd</sup> highest ( $19.20^{\circ}\text{C}$  with an anomaly of  $1.46^{\circ}\text{C}$ ) over Central India and highest ( $12.45^{\circ}\text{C}$  with an anomaly of  $1.25^{\circ}\text{C}$ ) over Northwest India since 1901.

**Northeast Monsoon Activity :**

The southwest monsoon withdrew from the entire country on 19<sup>th</sup> October and northeast monsoon rains commenced from 21<sup>st</sup> October. Rainfall activity over core region of the South Peninsular India (comprising of 5 subdivisions viz. Coastal Andhra Pradesh, Rayalaseema, Tamil Nadu, Puducherry and Karaikal, South Interior Karnataka and Kerala & Mahe) during the season as a whole was 94% of its LPA. It was 46% of its LPA during October, 117% of its LPA during November and 229% of its LPA during December

**Rainfall Features:**

Rainfall realized over the country as a whole during the season was 91% of LPA. Most of the subdivisions received large excess / excess / normal rainfall, except a few from south peninsula, West Uttar Pradesh, Uttarakhand, Himachal Pradesh and Saurashtra & Kutch from remaining parts. During the season, out of 36 meteorological subdivisions, 3 received large excess rainfall, 4 received excess rainfall, 18 received normal rainfall, 10 received deficient rainfall and one sub division received large deficient rainfall (Fig.1). Table 1 shows the subdivision-wise rainfall statistics (mm) for the post-monsoon season 2023.

Fig. 2(a) and 2(b) show the spatial pattern of rainfall (mm) received during the season and its anomaly respectively. Parts of Arunachal Pradesh, Assam & Meghalaya, Sub Himalayan West Bengal & Sikkim, Rayalaseema, Tamilnadu, Puducherry & Karaikal, Kerala & Mahe and both the islands received more than 300 mm of rainfall. Parts of Arunachal Pradesh, Sub Himalayan West Bengal & Sikkim, Rayalaseema, Tamilnadu, Puducherry & Karaikal, Kerala & Mahe and both the islands received more than 400 mm of rainfall. Rainfall anomaly was more than 100 mm over parts of Arunachal Pradesh, Assam & Meghalaya, Sub Himalayan West Bengal & Sikkim, Gangetic West Bengal, Jharkhand, Bihar, East Uttar Pradesh, Tamilnadu, Puducherry & Karaikal Kerala & Mahe, South Interior Karnataka and both the islands. Magnitude of negative rainfall anomaly was more than 100 mm over parts of Odisha, Coastal Andhra Pradesh, Telangana, Rayalaseema, North Interior Karnataka and South Interior Karnataka.

Fig. 3(a) shows the area weight averaged cumulative weekly rainfall percentage departure during the season for the country as a whole. Cumulative rainfall departure was negative during all the weeks of the season except first week. At the end of the post-monsoon season 2023, the rainfall for the

country as a whole was 91.5 % of its LPA. Fig. 3(b) shows the area weight averaged cumulative weekly rainfall percentage departure during the season for the northeast monsoon region of south peninsula. At the end of the post-monsoon season 2023, the rainfall over the northeast monsoon region of south peninsula was 94 % of its LPA.

Similarly, Fig. 3(c) shows the area weight averaged rainfall series for the season since 1901 over the northeast monsoon region of south peninsula.

Fig. 4 shows area weight averaged rainfall series for post-monsoon season over all India and four homogeneous regions since 1951. Rainfall realized over the country as a whole was 91.5% of its LPA during the season. It was 99% of its LPA over northwest India, 78 % of its LPA over central India, 110% of its LPA over east & northeast India and 87% of its LPA over south peninsula.

### **Standardized Precipitation Index:**

The Standardized Precipitation Index (SPI) is an index used for measuring drought and is based only on precipitation. This index is negative for dry and positive for wet conditions. As the dry or wet conditions become more severe, the index becomes more negative or positive. Fig 5 (a & b) give the SPI values for the northeast monsoon season (October to December 2023 i.e. 3 months cumulative) and the year (January-December 2023, i.e. 12 months cumulative) respectively.

Cumulative SPI values of the past three months indicate extremely wet-severely wet conditions over parts of Bihar, Chhattisgarh, Jharkhand, West Rajasthan, Odisha, Tamil Nadu, East Madhya Pradesh, East Uttar Pradesh, Jammu & Kashmir, Kerala, Punjab, S.H. West Bengal & Sikkim and Gangetic West Bengal while extremely dry-severely dry conditions were observed over parts of North Interior Karnataka, South Interior Karnataka, Andhra Pradesh state, Vidarbha, Telangana, Arunachal Pradesh, Jammu & Kashmir, Nagaland, Manipur and Mizoram & Tripura.

Cumulative SPI values of the past twelve months indicate extremely wet-severely wet conditions over parts of Uttar Pradesh state, Rajasthan state, West Madhya Pradesh, Saurashtra & Kutch, Coastal Andhra Pradesh, Haryana, Chandigarh & Delhi, Chhattisgarh, Tamil Nadu, Telangana, A & N Islands, Himachal Pradesh and Uttarakhand while extremely dry-severely dry conditions were observed over parts of East Uttar Pradesh, Bihar, South Interior Karnataka, Chhattisgarh, Madhya Maharashtra, Coastal Karnataka, Arunachal Pradesh, Assam & Meghalaya, Kerala, Nagaland, Manipur, Mizoram & Tripura.

### **Pressure & Wind:**

Figs. 6(a) & 6(b) show the mean sea level pressure & its anomaly respectively. The pressure anomaly was positive over most parts of country, except some parts of Gangetic West Bengal, West Rajasthan, and some parts of peninsula. The positive pressure anomaly was generally within 0.5 to 1.5 hPa over most parts of the country.

Figs. 7(a) & 7(b), 8(a) & 8(b) and 9(a) & 9(b), show the mean circulation pattern and its anomaly at 850, 500 & 250 hPa levels respectively. Wind anomaly at 850 hPa shows an anomalous anticyclonic circulation over western parts of peninsula and adjoining Arabian Sea. At 500 hPa level, an anomalous cyclonic circulation was observed over central India and adjoining Arabian Sea and Bay of Bengal. At 250 hPa level, an anomalous cyclonic circulation was observed over central India and adjoining Arabian Sea and Bay of Bengal.

## **Velocity Potential & Stream Function:**

Figs. 10(a) & 10(b) show the 250 hPa mean Velocity Potential & its anomaly. Similarly, Figs. 11(a) & 11(b) show the mean Stream Function & its anomaly at 850 hPa level. Negative values are indicated by dashed lines. Anomaly in velocity potential at 250 hPa level was negative throughout the country, except eastern parts of peninsula. Anomaly in the stream function at 850 hPa level was positive throughout the country.

## **Outgoing Longwave Radiation (OLR):**

OLR anomaly ( $\text{W/m}^2$ ) over the Indian region and neighbourhood is shown in Fig. 12. OLR anomaly was negative over entire country and both the adjoining seas, except some pockets over Coastal Andhra Pradesh and eastern part of Bay of Bengal. OLR anomaly was less than  $-10 \text{ W/m}^2$  over most parts of the region.

## **Temperature:**

Mean seasonal maximum and minimum temperature anomaly is shown in Figs. 13(a) & 13(b) respectively. Maximum temperature was above normal over most parts of the country, except some parts of northwest India, central India and east India. Maximum temperature anomaly was more than  $2^\circ\text{C}$  over parts of Ladakh state, Himachal Pradesh, Uttarakhand, Assam & Meghalaya, Andhra Pradesh state and South Interior Karnataka. Maximum temperature anomaly was less than  $-1^\circ\text{C}$  over parts of Punjab, Rajasthan state, Uttar Pradesh state, Madhya Pradesh state and Gangatic West Bengal.

Minimum temperature was above normal over most parts of the country, except some parts of northwest India and central India. Minimum temperature anomaly was more than  $3^\circ\text{C}$  over parts of Punjab, Bihar, Jharkhand, Manipur, Gujarat region, Tamil Nadu, Puducherry & Karaikal and South Interior Karnataka. Minimum temperature anomaly was less than  $-1^\circ\text{C}$  over parts of West Uttar Pradesh.

## **Percentage of Warm days/Cold nights:**

Fig 14(a) & 14(b) show the percentage of days when maximum (minimum) temperature was more (less) than 90<sup>th</sup> (10<sup>th</sup>) percentile. Over parts of Assam & Meghalaya, Uttarakhand, West Uttar Pradesh, Coastal Andhra Pradesh, Telangana, Kerala & Mahe, South Interior Karnataka and both the islands maximum temperature was greater than 90<sup>th</sup> percentile for more than 50% of the days of the season. For minimum temperature no such significant distribution was observed.

Fig. 15 shows the mean temperature time series for the country as a whole for Post-Monsoon since 1971. Five year moving average values are also shown. The mean temperature for season this year over the country as a whole was  $24.24^\circ\text{C}$  with an anomaly of  $1.0^\circ\text{C}$  and highest since 1901. Over East & Northeast India the mean temperature was highest ( $22.98^\circ\text{C}$  with an anomaly of  $1.24^\circ\text{C}$ ), South Peninsular India the mean temperature was also highest ( $27.49^\circ\text{C}$  with an anomaly of  $1.15^\circ\text{C}$ ) and Central India the mean temperature was 2<sup>nd</sup> highest ( $25.21^\circ\text{C}$  with an anomaly of  $0.92^\circ\text{C}$ ) since 1901.

Fig. 16(a) & 16(b) show, the maximum and minimum temperature series respectively for the country as a whole and the four homogeneous regions during Post-Monsoon 2023 since 1971. Both the maximum and minimum temperatures were above normal over all the homogeneous regions except Northwest India, the maximum temperature was normal. Among the four homogeneous regions, over East & Northeast India the maximum temperature was highest ( $28.87^\circ\text{C}$  with an anomaly of  $1.28^\circ\text{C}$ ) and the minimum temperature was also highest ( $17.08^\circ\text{C}$  with an anomaly of  $1.20^\circ\text{C}$ ) since 1901. Over South Peninsular India the maximum temperature was 2<sup>nd</sup> highest ( $31.41^\circ\text{C}$  with an anomaly of  $1.01^\circ\text{C}$ ) and the minimum temperature was highest ( $23.58^\circ\text{C}$  with an anomaly of  $1.28^\circ\text{C}$ ) since 1901. The

minimum temperature was 2<sup>nd</sup> highest (19.20°C with an anomaly of 1.46°C) over Central India and highest (12.45°C with an anomaly of 1.25°C) over Northwest India since 1901.

Over the country as a whole the maximum temperature was 3<sup>rd</sup> highest (29.59°C with an anomaly of 0.68°C) and the minimum temperature was highest (18.89°C with an anomaly of 1.31°C) since 1901. Table 2 gives temperature anomalies over India and four homogeneous regions during the season.

### **Low Pressure Systems:**

During the season, six low pressure systems (1ESCS, 1 VSCS, 1SCS, 1 CS and 2 low pressure area) were formed. The frequency and place of origin of these low pressure systems formed over the Indian region during the post monsoon season is shown in the table below.

Month /Systems	CS and above	DD	D	WML	LPA
<b>October</b>	1 (BOB), 1(AS)				
<b>November</b>	1 (BOB)				1(AS)
<b>December</b>	1 (BOB)				1(AS)
	<b>(AS: Arabian Sea)</b>			<b>(BOB: Bay of Bengal)</b>	

During October 2023 one Extremely Severe Cyclonic Storm (ESCS) “**TEJ**” formed over Arabian Sea during (20 – 25 October). This ESCS TEJ moved northwestwards towards YEMEN coast. Besides this ESCS one Very Severe Cyclonic Storm “**HAMOON**” formed over Bay of Bengal during (21 - 25 October). During November 2023 one Cyclonic Storm (CS) “**MIDHILI**” formed over Bay of Bengal during (15 - 18 November) and one low pressure area formed over Arabian Sea. During December one Severe Cyclonic Storm “**MICHAUNG**” formed over Bay of Bengal during (1 – 6 December) Fig. 17 shows tracks of these systems formed during season.

Fig. 18 shows the number of depressions & storms formed over Bay of Bengal during the post - monsoon season (1951-2023).

### **Significant Weather Events during Post Monsoon Season 2023:**

Fig.19 shows significant weather events during the season (Based on real time media reports). During Post Monsoon Season, a total of 208 persons were reportedly claimed dead, more than 75 persons were injured, more than 75 persons were missing & more than 31,600 livestock were perished. The details of causalities given below, which are based on real time media reports.

### **Heavy Rains, Floods & Landslide:**

A total of 139 persons were reportedly claimed dead, 26 persons were injured, more than 75 persons were missing & more than 31,500 livestock were perished during Post Monsoon season because of heavy rains, floods & Landslide. The details of the area affected by the events are summarized and given in the table below

DATE	DEATH	INJURED	MISSING	LIVESTOCK	DISTRICT (STATE) AFFECTED
4 Oct.	104	26	77	31512	Gangtok / East Sikkim, Mangan / North Sikkim, Namchi / South Sikkim, Pakyong (Sikkim)
1, 2, 3 Oct.	11				Bokaro, Dhanbad, Giridih, East Singhbhum, Palamu, Ranchi (Jharkhand)
18 & 19 Dec.	10				Kanyakumari, Thoothukudi/Tuticorin, Tirunelveli, Tenkasi (Tamil Nadu)
8 Oct.	7				Pithoragarh (Uttarakhand)
8 Oct.	4				West Jaintia Hills (Meghalaya)
26 Nov.	1				Mehsana (Gujarat)
7 Nov.	1				Chikmagalur (Karnataka)
5 Nov.	1				Idukki (Kerala)

While,

- a) Ernakulam, Thiruvananthapuram districts of Kerala also affected on 14 & 15 October.
- b) Ahmedabad, Amreli, Bharuch, Kheda, Panchmahal, Morbi, Surendranagar, Surat, Tapi districts of Gujarat also affected on 26 November.
- c) Chatrapati Sambhajinagar / Aurangabad, Dhule, Hingoli, Nandurbar, Nashik, Pune districts of Maharashtra also affected on 26 & 27 November.
- d) Darjeeling, Jalpaiguri, Kalimpong districts of West Bengal also affected during 4 to 6 October.
- e) Annamayya, Bapatla, Cuddapah, Eluru, Nellore, Tirupati, West Godavari districts of Andhra Pradesh, East Khasi Hills district of Meghalaya, Chennai, Chinglepet, Coimbatore, Kanchipuram, Tiruvallur districts of Tamil Nadu, Bhadrari Kothagudem districts of Telangana West Midnapore district of West Bengal also affected due to extremely heavy rains.

**Lightning:** A total of 45 persons were reportedly claimed dead, more than 50 persons were injured & more than 140 livestock were perished, during Post Monsoon season 2023, because of Lightning. The details of the area affected by the events are summarized and given in the table below;

DATE	DEATH	INJURED	MISSING	LIVESTOCK	DISTRICT (STATE/UT) AFFECTED
26 Nov.	24	23		71	Ahmedabad, Amreli, Anand, Banaskantha, Bharuch, Botad, Dahod, Devbhoomi Dwarka, Kheda, Mehsana, Panchmahal, Patan, Sabarkantha, Surendranagar, Surat, Tapi (Gujarat)
1 Oct.; 26, 27 Nov.	7	2		9	Chandrapur, Hingoli, Jalgaon, Nandurbar, Nashik, Yavatmal (Maharashtra)
1, 2 Oct.	5				Jamtara, Ranchi (Jharkhand)
26 Nov.	4	1			Barwani, Dhar, Jhabua (Madhya Pradesh)
3 Nov.	2	18			Madurai (Tamil Nadu)
3 Oct.; 5 Dec.	1	4		41	Bhadrari Kothagudem, Khammam, Suryapet (Telangana)
3 Oct.	1				Balangir (Odisha)
10 Nov.	1	1		20	Rajouri, Udhampur (Jammu & Kashmir)
23 Oct.		1			Thrissur (Kerala)
8 Nov.		1			North Goa (Goa)

Also, damage to an ancient Shiv Temple - Ranbirashwar Temple in Jammu district of Jammu & Kashmir reported on 17 October.

### **Cyclonic Storm:**

A total of 24 persons were reportedly claimed dead during December, because of Severe Cyclonic Storm MICHAUNG. The details of the area effected by the events are summarized and given in the table below;

DATE	DEATH	INJURED	MISSING	LIVESTOCK	DISTRICT (STATE/UT) AFFECTED
1 to 6 Dec.	17				Chennai (Tamil Nadu)
1 to 6 Dec.	4				Cuddapah, Eluru, Tirupati (Andhra Pradesh)
1 to 6 Dec.	3				Khammam, Mulugu (Telangana)

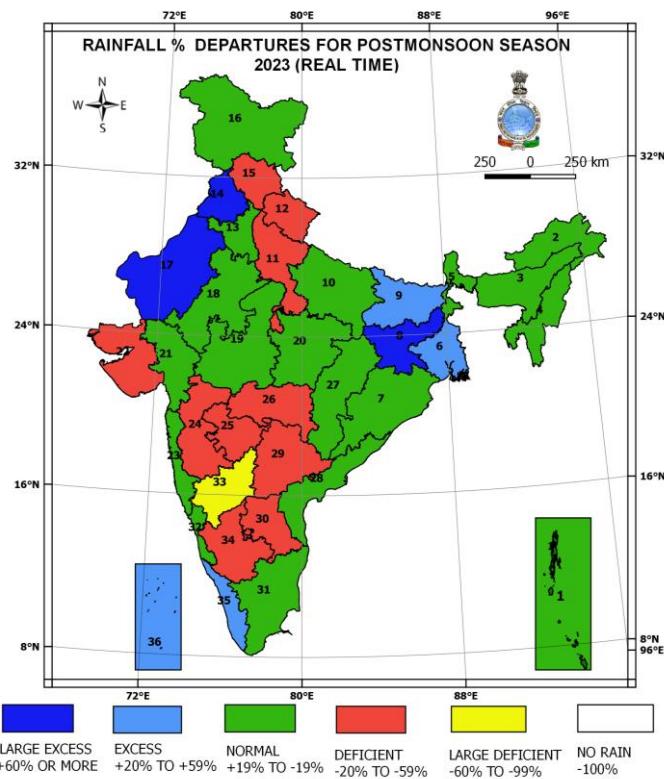
While,

- a) Tiruvallur district of Tamil Nadu also affected due to Severe Cyclonic Storm "MICHAUNG".
- b) Bapatla, Guntur, Krishna, Nellore, Prakasam, Vishakhapatnam districts of Andhra Pradesh also affected due to Severe Cyclonic Storm "MICHAUNG".
- c) Bhadrari Kothagudem, Jayashankar Bhupalpally, Jangaon, Mahabubabad, Nalgonda, Suryapet, Warangal Urban / Hanumakonda, Warangal Rural districts of Telangana also affected due to Severe Cyclonic Storm "MICHAUNG".
- d) Malkangiri district of Odisha also affected due to Severe Cyclonic Storm "MICHAUNG".
- e) Damage to more than 345 houses reported from all the districts of Tripura Viz. Dhalai, Gomati, Khowai, North Tripura, Sepahijala, South Tripura, Unakoti, West Tripura due to Cyclonic Storm "MIDHILI" during 15 to 18 November.

### **Hailstorm:**

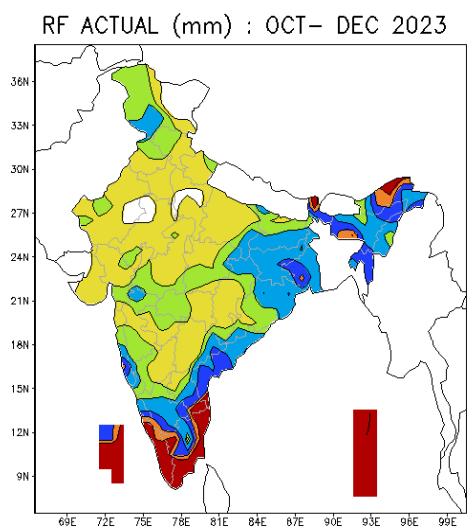
Due to hailstorm,

- a) Bandipora, Kulgam, Shopian districts of Jammu & Kashmir affected on 15<sup>th</sup> October.
- b) Ahmednagar & Nashik districts of Maharashtra affected on 26<sup>th</sup> November.
- c) Nizamabad & Kamareddy districts of Telangana affected on 28<sup>th</sup> November.

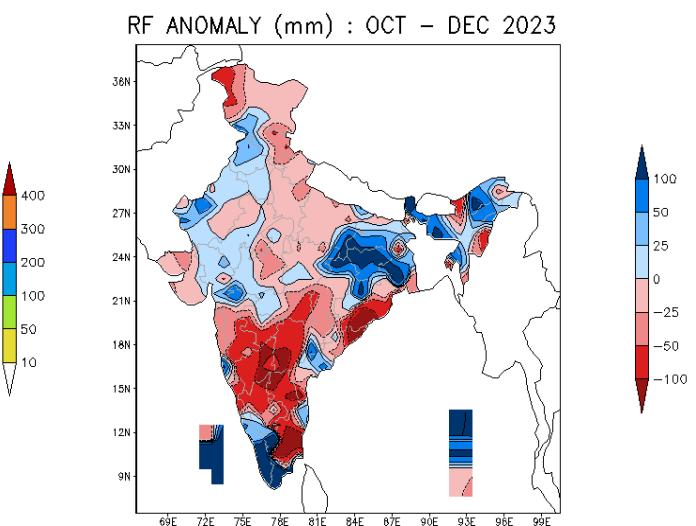


**आकृती १: उत्तर-पूर्व मानसून २०२३ के लिए वर्षा प्रतिशत विचलन**

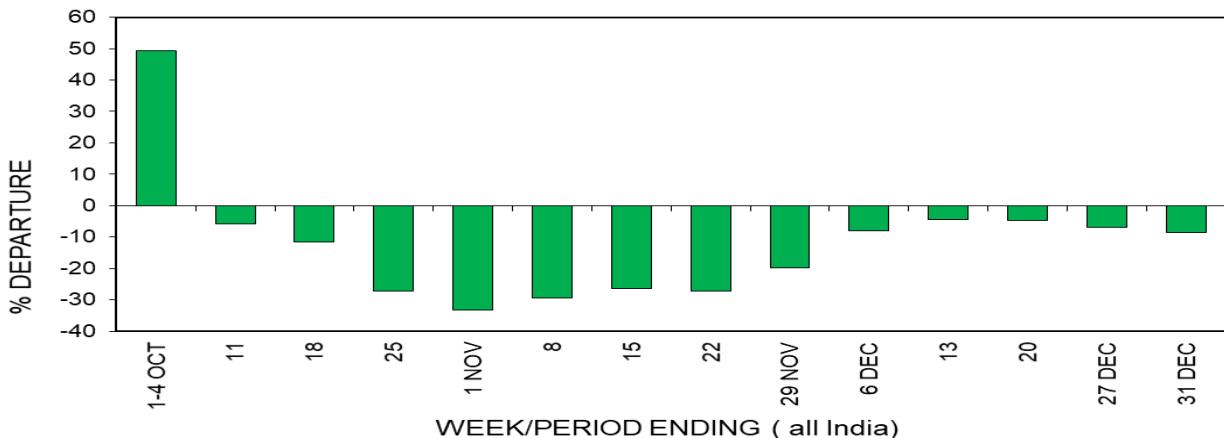
**FIG. 1 : SUBDIVISIONWISE RAINFALL PERCENTAGE DEPARTURE FOR POST-MONSOON SEASON 2023**



**आकृती २(ए): उत्तर-पूर्व मानसून वर्षा (मिमी)**  
**FIG. 2(a): SEASONAL RAINFALL (mm)**

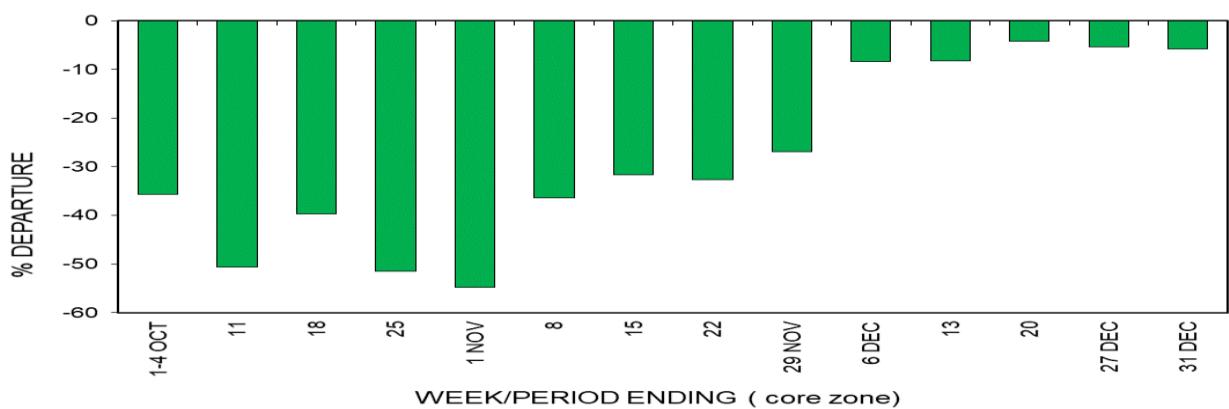


**आकृती २(बी): उत्तर-पूर्व मानसून वर्षा विसंगति (मिमी)**  
**FIG. 2(b): SEASONAL RAINFALL ANOMALY (mm)**



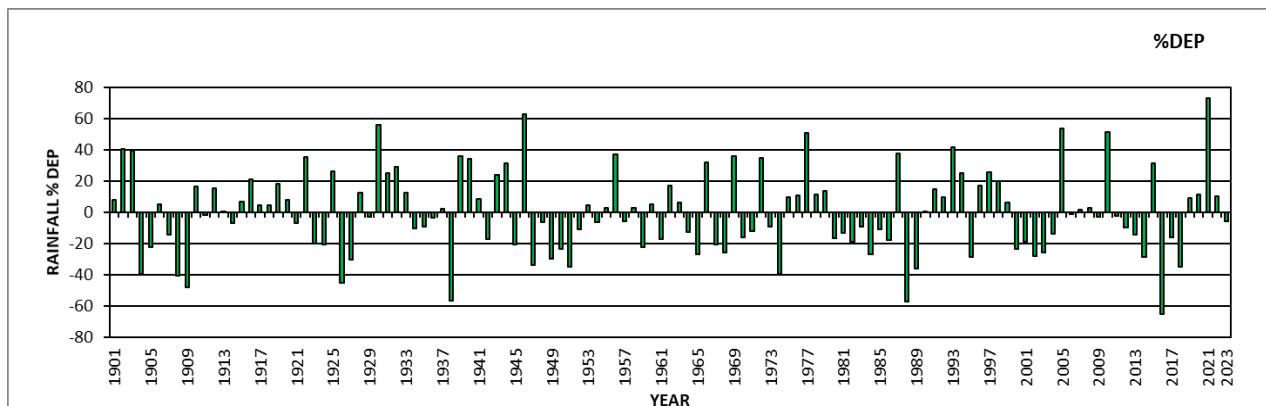
आकृती 3(ए): पूरे देश में उत्तर-पूर्व मानसून २०२३ (अक्टूबर-दिसंबर) के लिए क्षेत्र भारित संचयी वर्षा का संचित प्रतिशत विचलन

FIG. 3(a): ACCUMULATED PERCENTAGE DEPARTURE OF AREA WEIGHT AVERAGED CUMULATIVE RAINFALL FOR POST-MONSOON (OCTOBER - DECEMBER) OVER THE COUNTRY AS A WHOLE



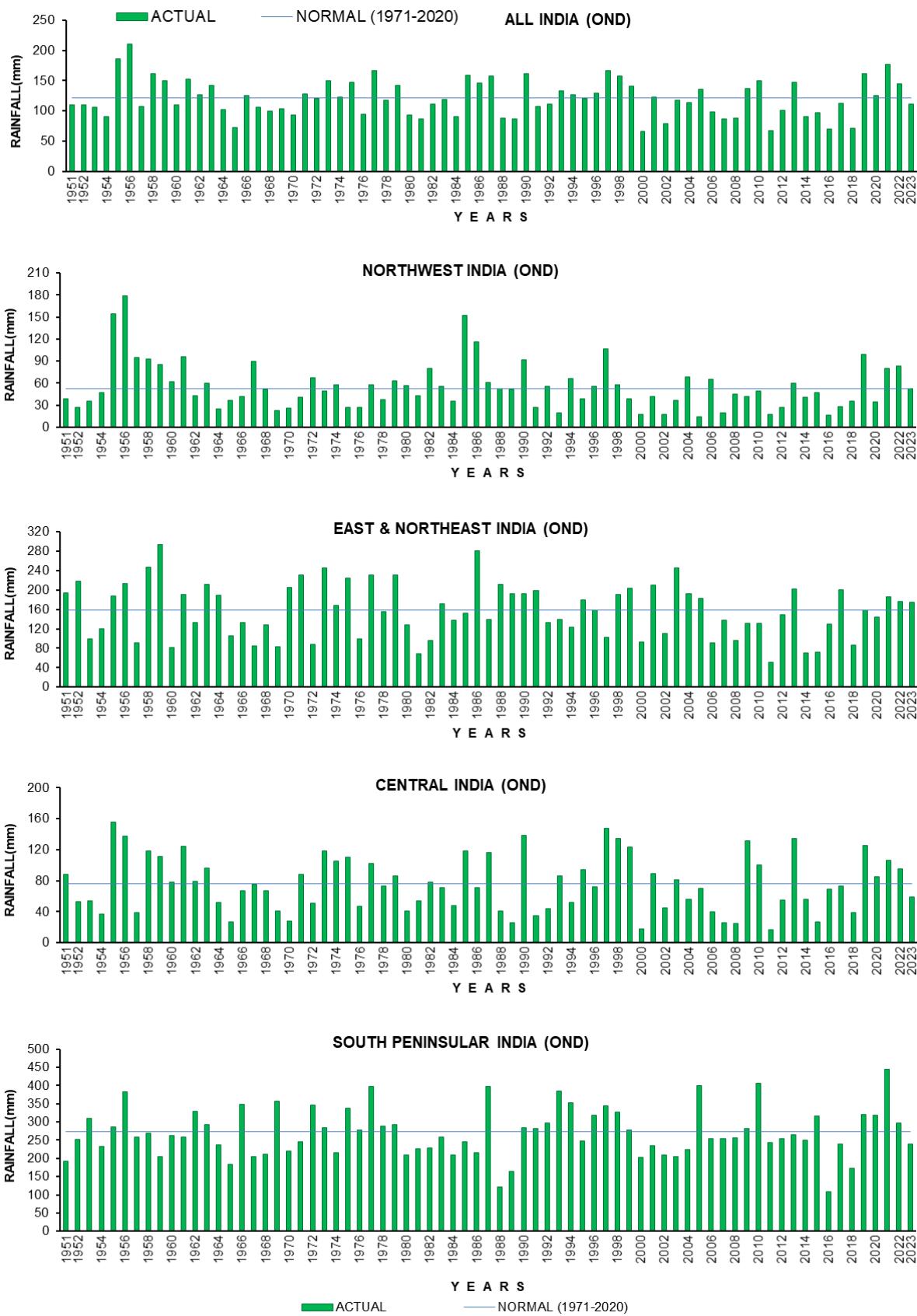
आकृती 3(बी): प्रायद्वीप के कोर क्षेत्र में उत्तर-पूर्व मानसून २०२३ (अक्टूबर-दिसंबर) के लिए भारित संचयी वर्षा क्षेत्र का संचित प्रतिशत विचलन

FIG. 3(b): ACCUMULATED PERCENTAGE DEPARTURE OF AREA WEIGHT AVERAGED CUMULATIVE RAINFALL FOR POST-MONSOON (OCTOBER - DECEMBER) OVER THE CORE ZONE OF PENINSULA



आकृती 3(सी): क्षेत्र भारित उत्तर-पूर्व मानसून (अक्टूबर-दिसंबर) की समय शृंखला (१९०१-२०२३)  
पूरे देश में वर्षा (कोर क्षेत्र)

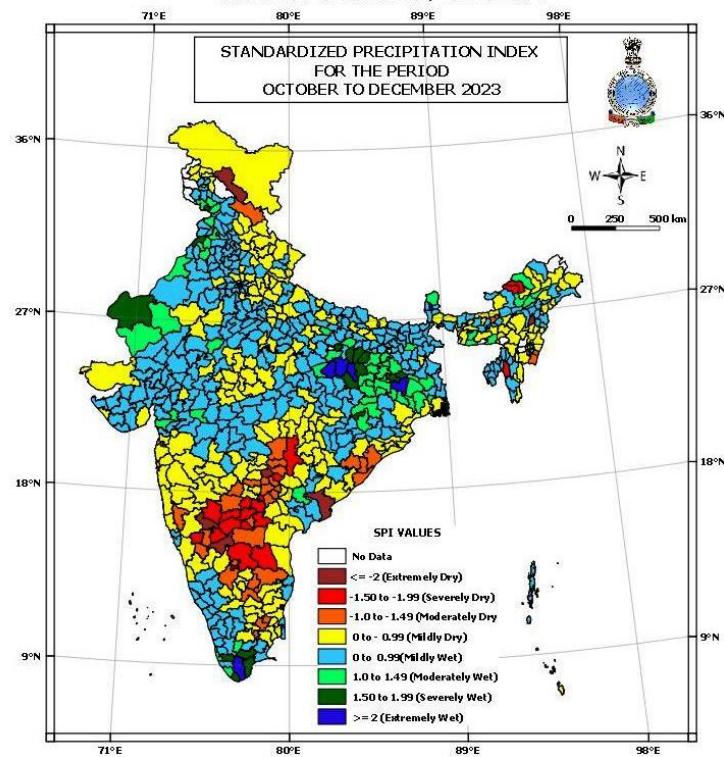
FIG. 3(c): TIME SERIES OF AREA WEIGHT AVERAGED POST - MONSOON (OCTOBER - DECEMBER)  
(1901-2023) RAINFALL OVER THE CORE ZONE OF PENINSULA



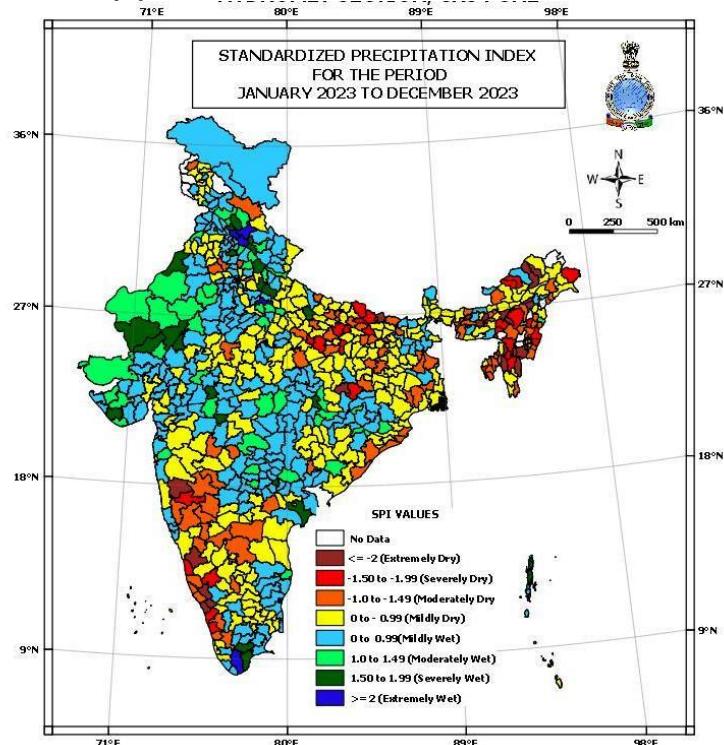
आकृती ४: १९५१-२०२३ की अवधि के दौरान उत्तर-पूर्व मानसून के लिए पुरे भारत और चार समरूप क्षेत्रों में क्षेत्र भारित वर्षा की समय शृंखला

FIG. 4: TIME SERIES OF AREA WEIGHT AVERAGED RAINFALL OVER ALL INDIA AND FOUR HOMOGENEOUS REGIONS FOR POST - MONSOON SEASON (1951 - 2023)

**(a) OCTOBER - DECEMBER 2023**



**(b) JANUARY – DECEMBER 2023**

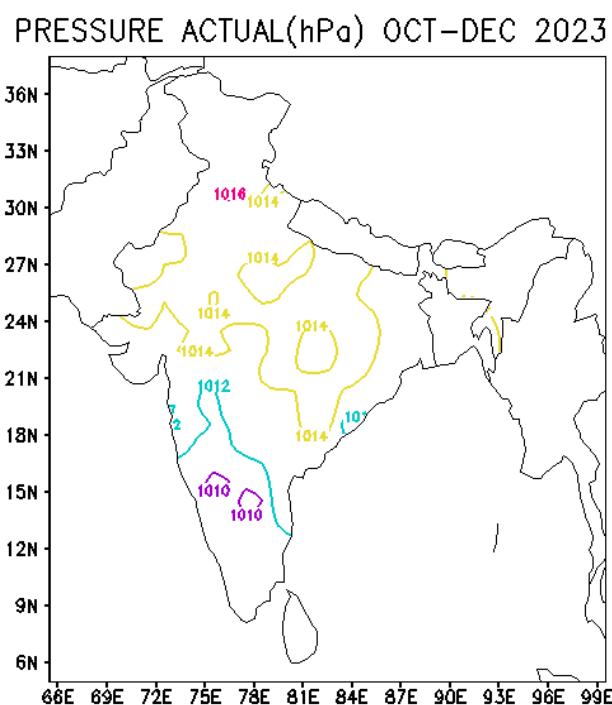


आकृति ५: मानकीकृत वर्षण सूचकांक (एसपीआई)

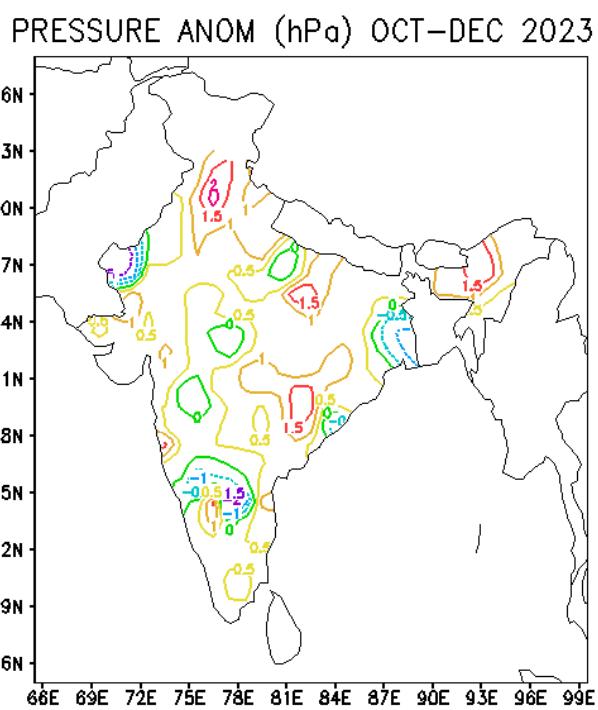
(ए) अक्टूबर से दिसंबर (तीन महीने) (बी) जनवरी से दिसंबर (बारह महीने)

**FIG. 5: STANDARDIZED PRECIPITATION INDEX (SPI) FOR  
(a) THREE MONTHS (b) TWELVE MONTHS**

**(a) MEAN SEA LEVEL PRESSURE (MSLP)**



**(b) MSLP Anomaly**



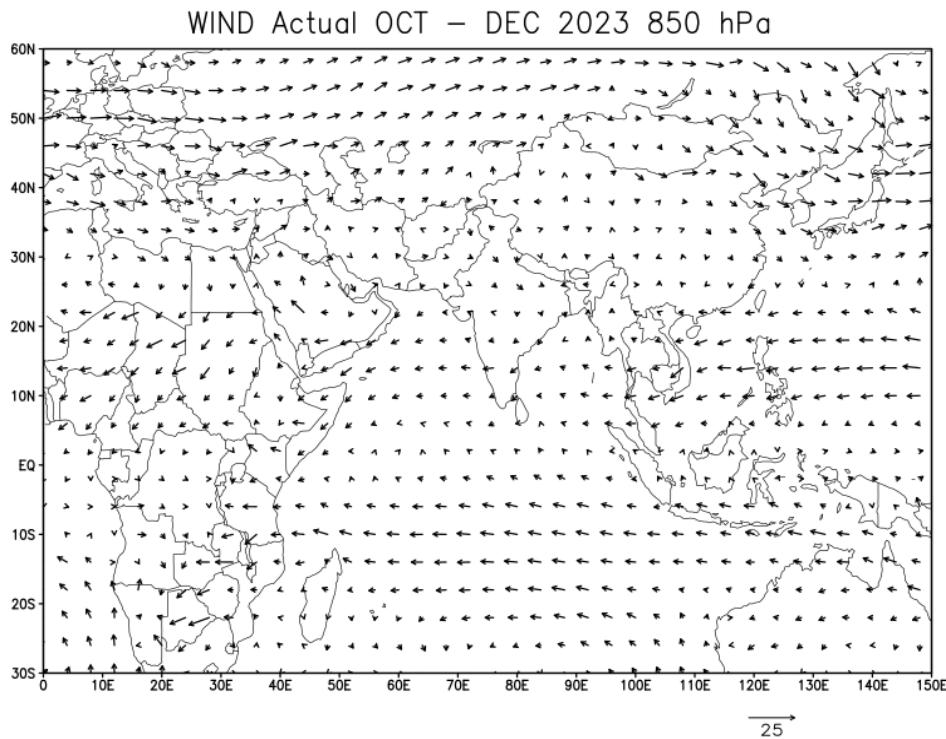
आकृति ६: उत्तर-पूर्व मानसून २०२३ के लिए औसत समुद्र स्तर दबाव (एचपीए)

(ए) माध्य (बी) विसंगति (१९८१-२०१० सामान्य पर आधारित)

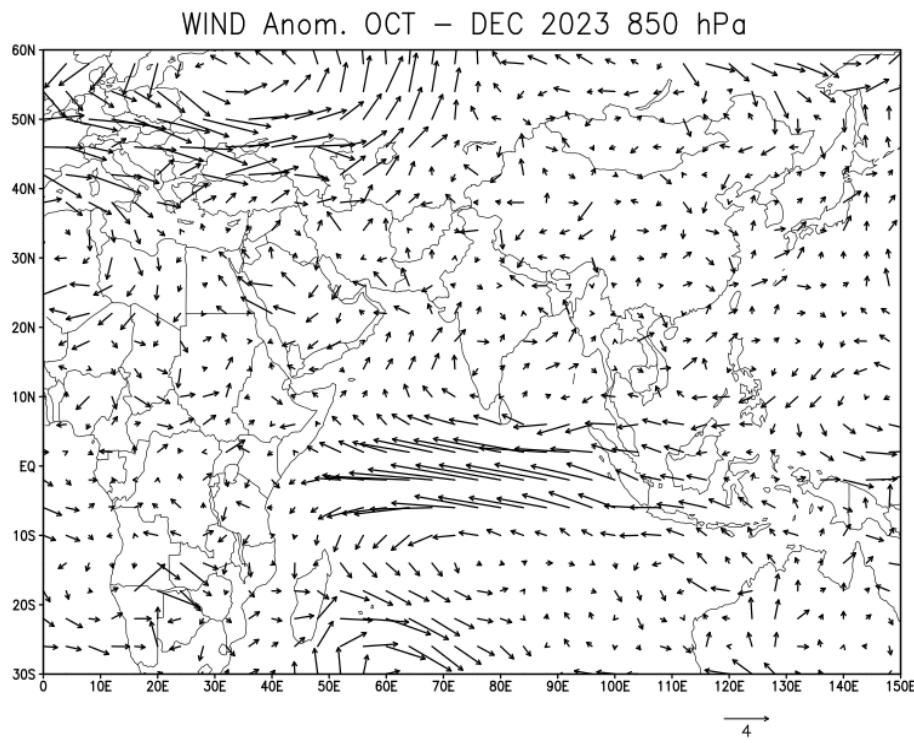
FIG. 6: MEAN SEA LEVEL PRESSURE (hPa) FOR POST-MONSOON 2023

(a) MEAN (b) ANOMALY  
(BASED ON 1981 - 2010 NORMALS)

**(a) MEAN WIND: 850 hPa**



**(b) WIND ANOMALY: 850 hPa**



आकृति ७: उत्तर-पूर्व मानसून २०२३ के लिए पवन (मि /से)

(ए) माध्य (बी) विसंगति ८५० एचपीए स्तरपर

**FIG. 7: SEASONAL WIND (m/s) FOR POST-MONSOON 2023**

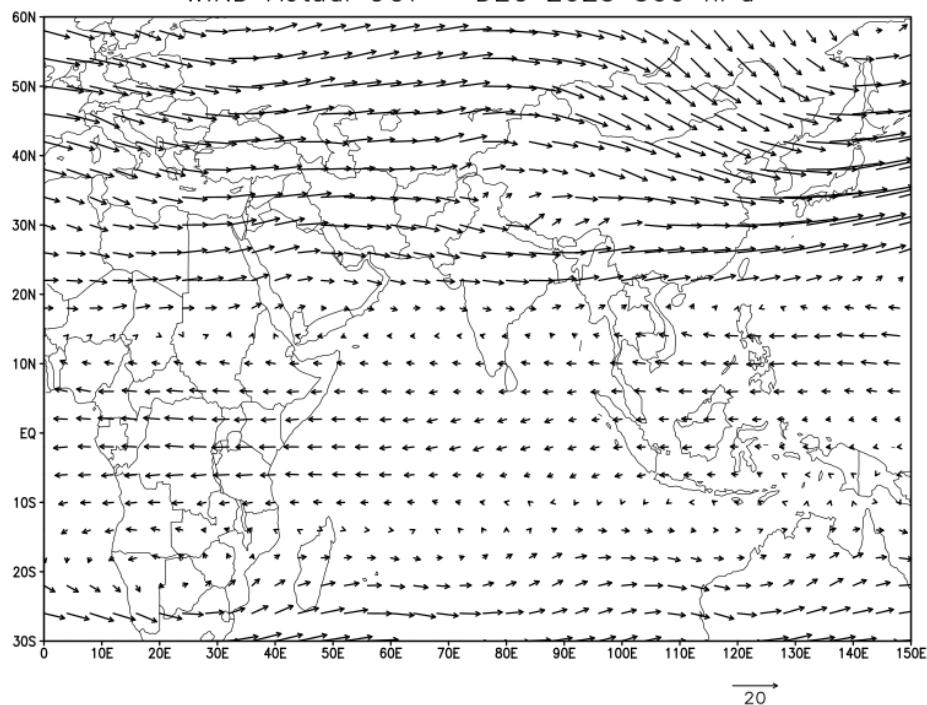
**(a) MEAN (b) ANOMALY AT 850 hPa**

(OPERATIONAL NWP ANALYSIS OF IMD GFS T-574)

(ANOMALY IS BASED ON 2000-2018 Climatology, Source: NCMRWF)

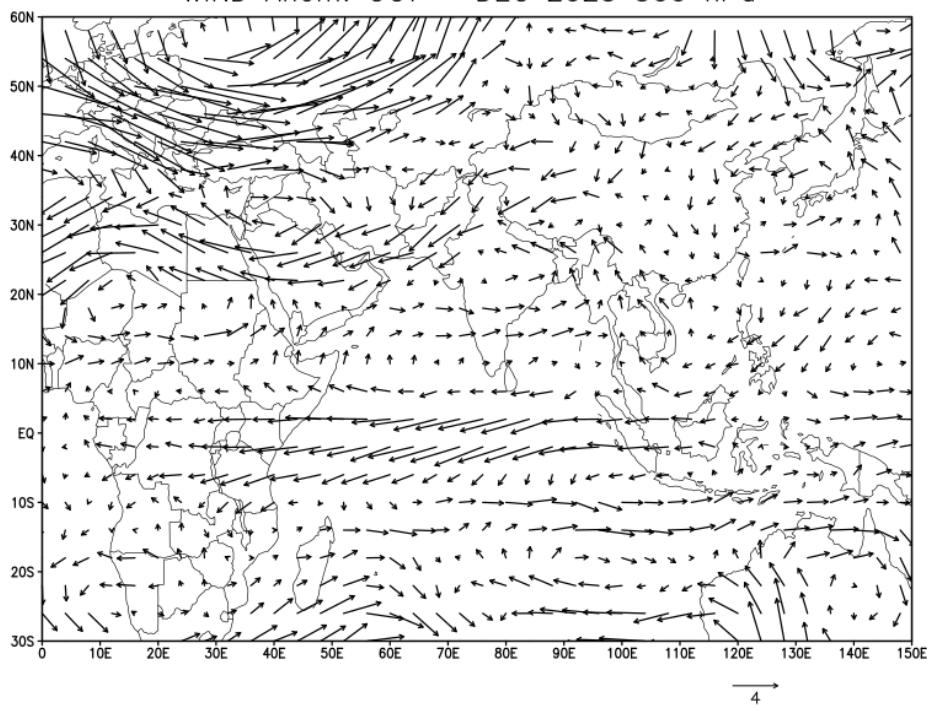
**(a) MEAN WIND: 500 hPa**

WIND Actual OCT – DEC 2023 500 hPa



**(b) WIND ANOMALY: 500 hPa**

WIND Anom. OCT – DEC 2023 500 hPa



आकृति ८: उत्तर-पूर्व मानसून २०२३ के लिए पवन (मि /से)

(ए) माध्य (बी) विसंगति ५०० एचपीए स्तरपर

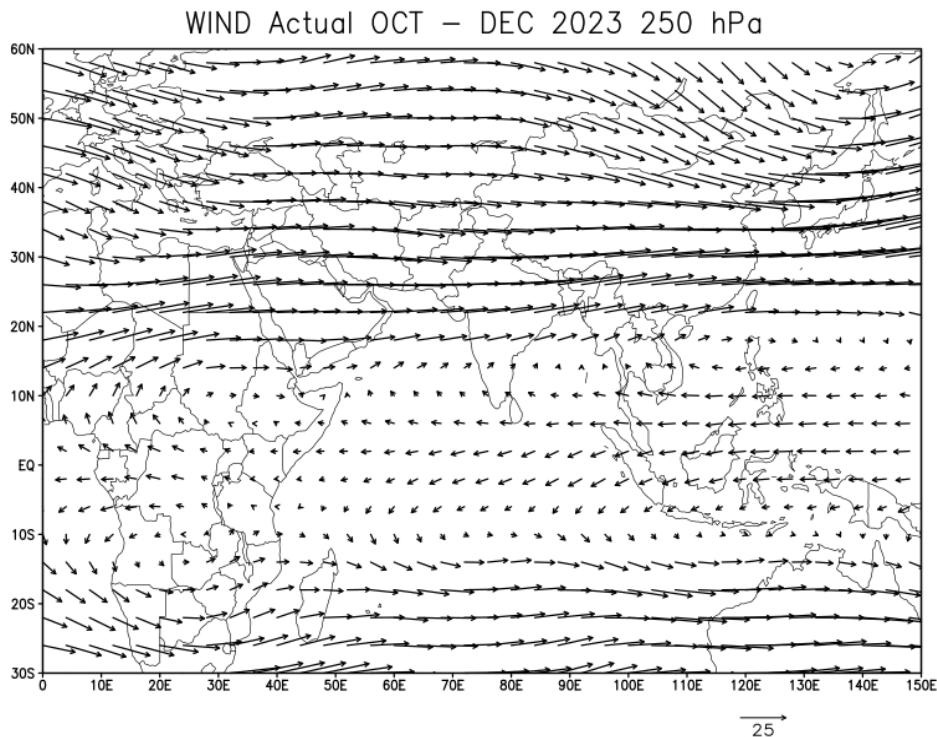
FIG. 8: SEASONAL WIND (m/s) FOR POST-MONSOON 2023

(a) MEAN (b) ANOMALY AT 500 hPa

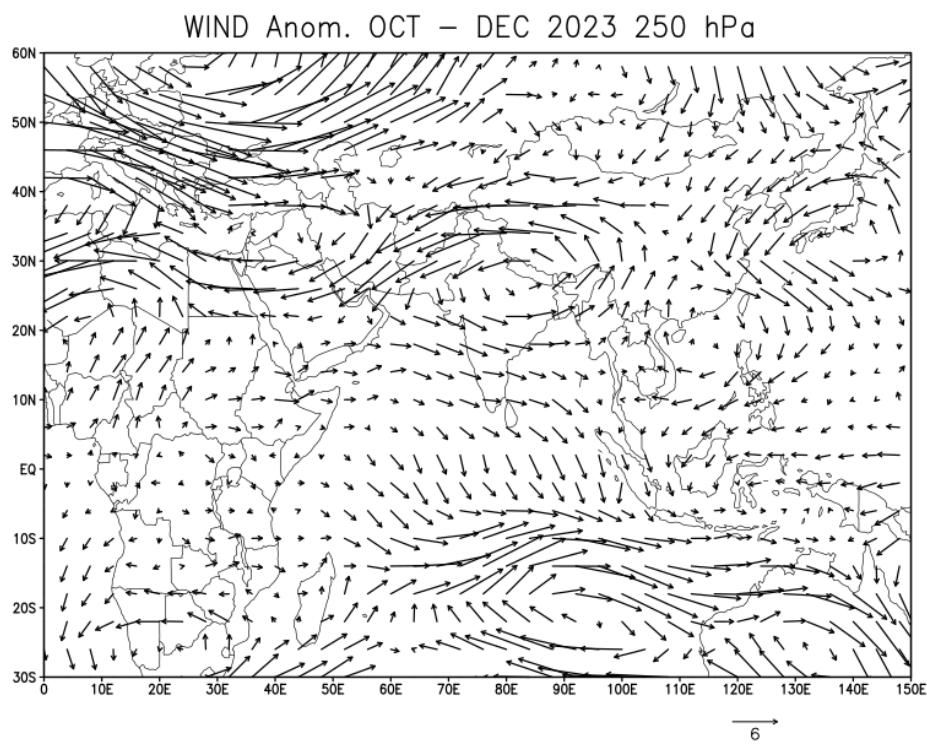
(OPERATIONAL NWP ANALYSIS OF IMD GFS T-574)

(ANOMALY IS BASED ON 2000-2018 Climatology, Source: NCMRWF)

**(a) MEAN WIND: 250 hPa**



**(b) WIND ANOMALY: 250 hPa**



आकृति ९: उत्तर-पूर्व मानसून २०२३ के लिए पवन (मि /से)

(ए) माध्य (बी) विसंगति २५० एचपीए स्तरपर

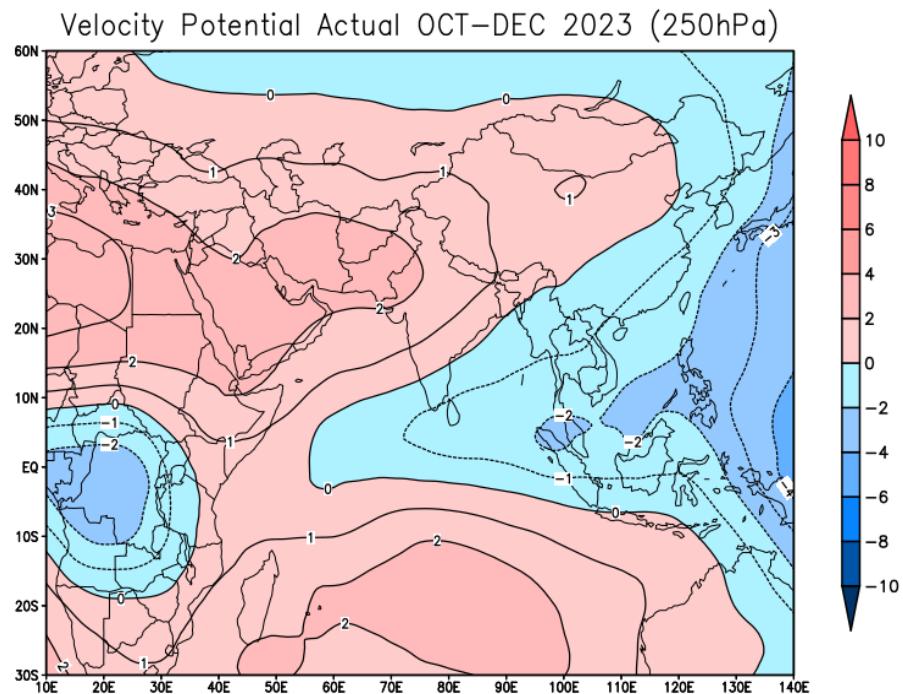
FIG. 9: SEASONAL WIND (m/s) FOR POST-MONSOON 2023

(a) MEAN (b) ANOMALY AT 250 hPa

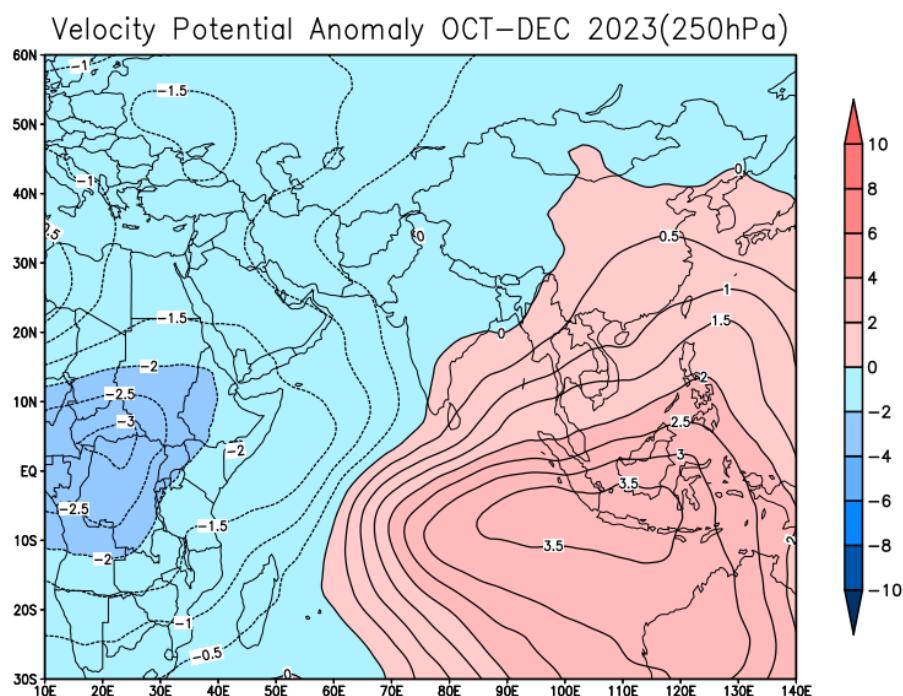
(OPERATIONAL NWP ANALYSIS OF IMD GFS T-574)

(ANOMALY IS BASED ON 2000-2018 Climatology, Source: NCMRWF)

### (a) VELOCITY POTENTIAL: 250 hPa



### (b) VELOCITY POTENTIAL ANOMALY: 250 hPa



आकृति १०: उत्तर-पूर्व मानसून २०२३ के लिए वेग विभव ( $10^6 \text{मीटर}^2/\text{सेकंड}$ )

(ए) माध्य (बी) विसंगति २५० एचपीए स्तरपर

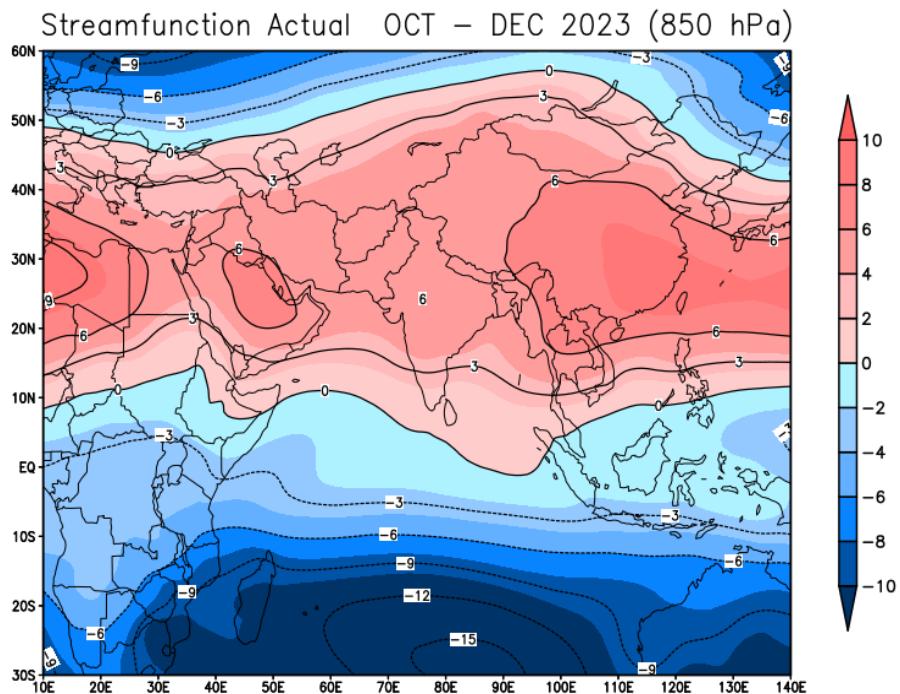
FIG. 10: VELOCITY POTENTIAL ( $10^6 \text{m}^2/\text{s}$ ) FOR POST-MONSOON 2023

(a) MEAN (b) ANOMALY AT 250 hPa

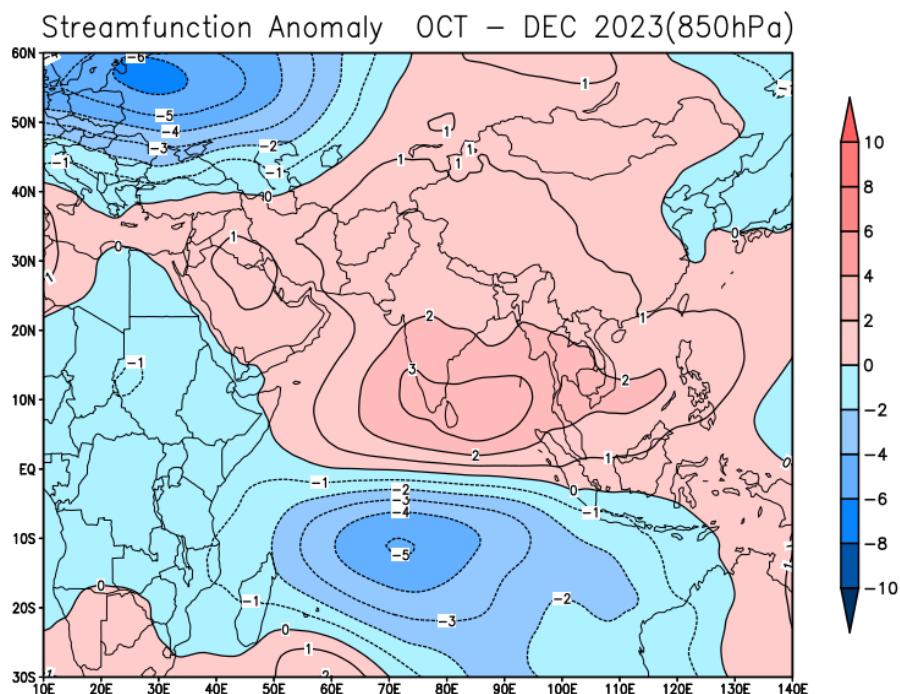
(OPERATIONAL NWP ANALYSIS OF IMD GFS T-574)

(ANOMALY IS BASED ON 2000-2018 Climatology, Source: NCMRWF)

**(a) STREAM FUNCTION: 850 hPa**



**(a) STREAM FUNCTION ANOMALY: 850 hPa**



आकृति ११: उत्तर-पूर्व मानसून २०२३ के लिए धारा कृत्य ( $10^6 \text{ मीटर}^2/\text{सेकंड}$ )

(क) माध्य (ख) विसंगति ८५० एचपीए स्तरपर

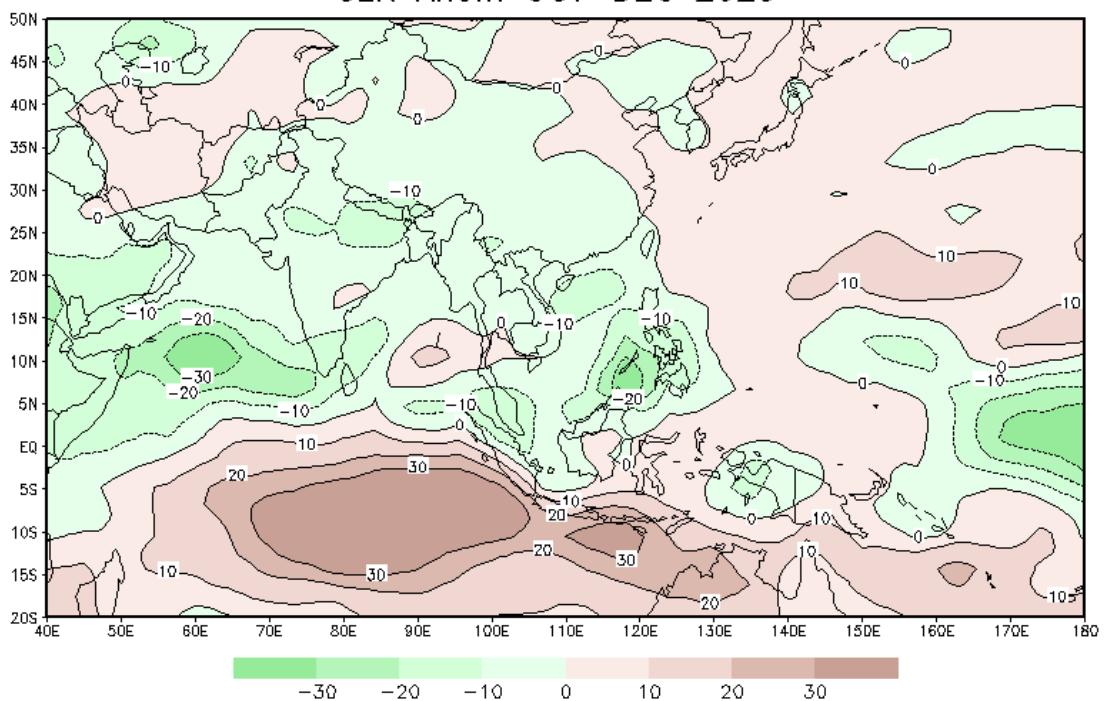
**FIG. 11: STREAM FUNCTION ( $10^6 \text{ m}^2/\text{s}$ ) FOR POST-MONSOON 2023**

**(a) MEAN (b) ANOMALY AT 850 hPa**

*(OPERATIONAL NWP ANALYSIS OF IMD GFS T-574)*

*(ANOMALY IS BASED ON 2000-2018 Climatology, Source: NCMRWF)*

OLR Anom OCT–DEC 2023



आकृती १२: उत्तर-पूर्व मानसून २०२३ के लिए ओ एल आर विसंगति ( $\text{वॅट} / \text{मी}^2$ )

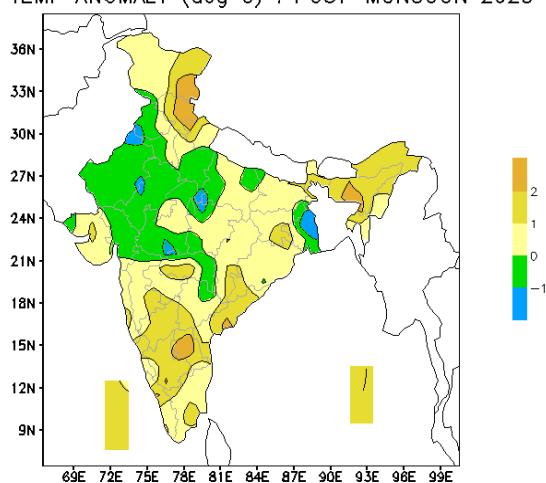
**FIG. 12: OLR ANOMALY ( $\text{W/m}^2$ ) FOR POST-MONSOON 2023**

(DATA SOURCE: CDC / NOAA, USA)

(BASED ON 1991 - 2020 CLIMATOLOGY)

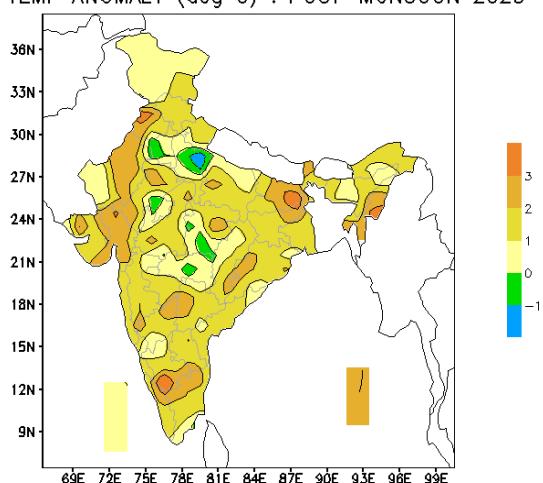
**(a) MAXIMUM TEMPERATURE ANOMALY**

MAX TEMP ANOMALY (deg C) : POST-MONSOON 2023



**(b) MINIMUM TEMPERATURE ANOMALY**

MIN TEMP ANOMALY (deg C) : POST-MONSOON 2023



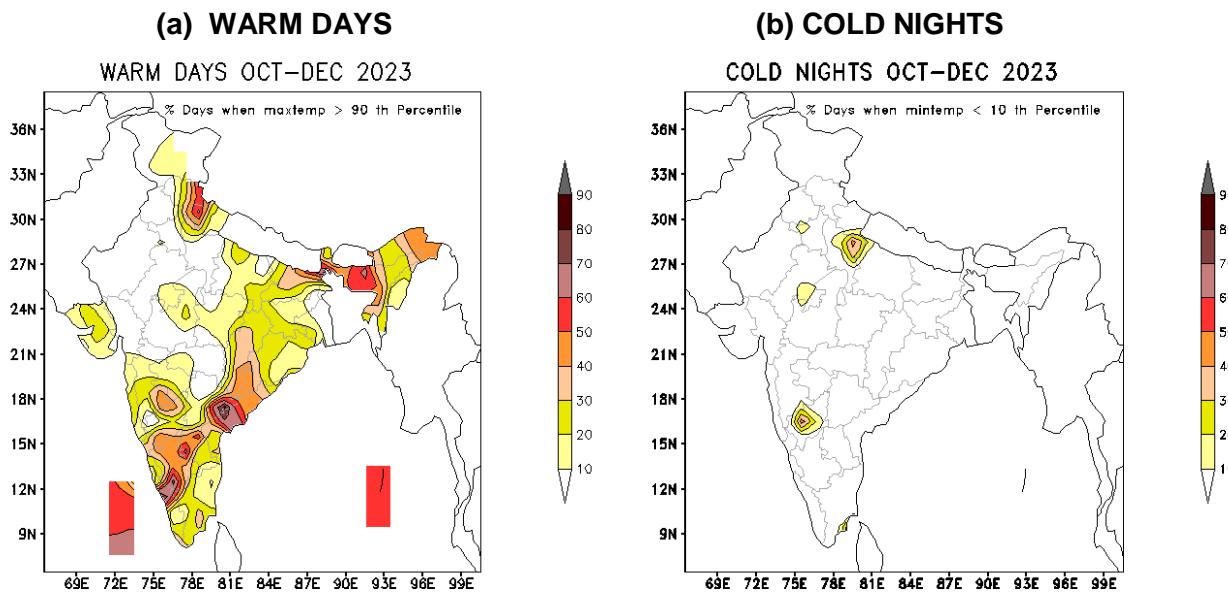
आकृती १३: उत्तर-पूर्व मानसून २०२३ के लिए औसत तापमान विसंगतियां (डिग्री सेल्सियस)

(ए) अधिकतम (बी) न्यूनतम

**FIG. 13: MEAN SEASONAL TEMPERATURE ANOMALIES ( $^{\circ}\text{C}$ ) FOR POST-MONSOON 2023**

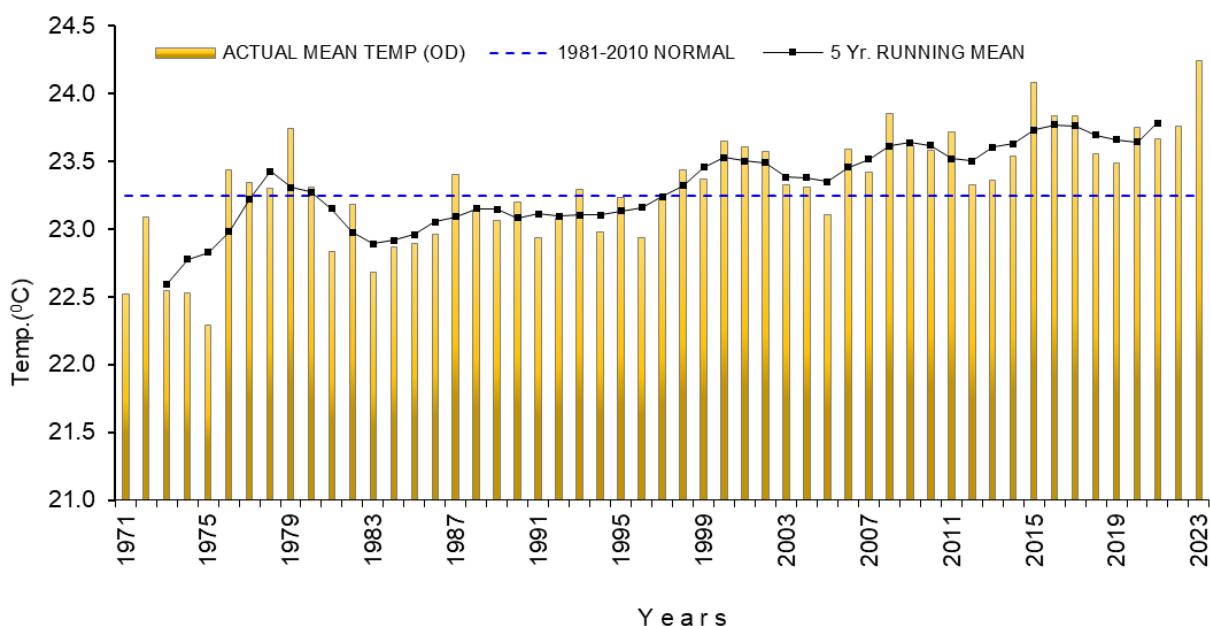
**(a) MAXIMUM (b) MINIMUM**

(BASED ON 1981-2010 NORMALS)



आकृति १४: (a) उन दिनों का प्रतिशत जब अधिकतम तापमान  $> 90$  वें प्रतिशत  
(b) उन दिनों का प्रतिशत जब न्यूनतम तापमान  $< 10$  वें प्रतिशत

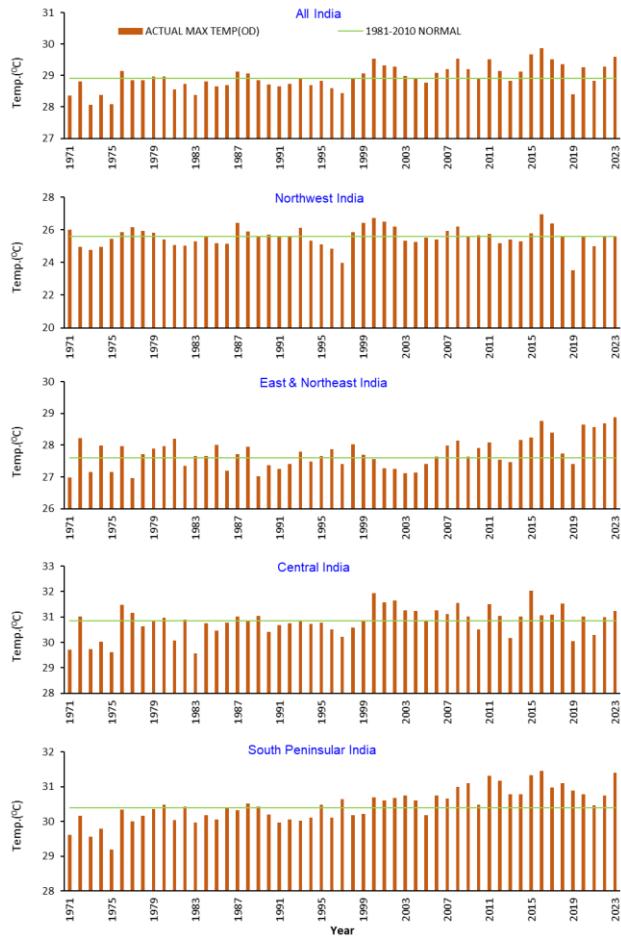
FIG. 14: (a)PERCENTAGE OF DAYS WHEN MAXIMUM TEMPERATURE  $> 90$ TH PERCENTILE  
(b)PERCENTAGE OF DAYS WHEN MINIMUM TEMPERATURE  $< 10$ TH PERCENTILE



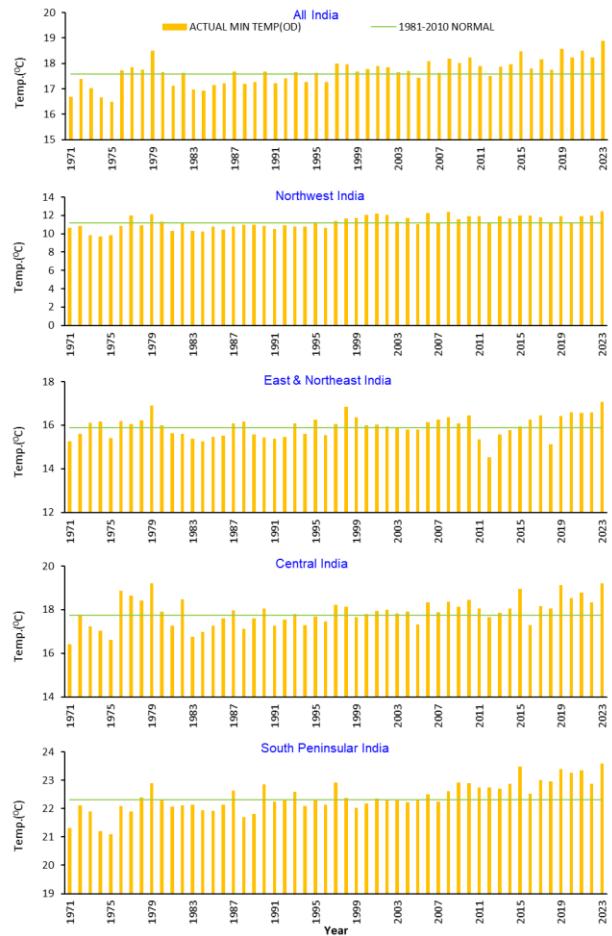
आकृति १५: १९७१-२०२३ की अवधि के दौरान उत्तर-पूर्व मानसून के लिए भारत में औसत तापमान की समय श्रृंखला ऊर्ध्वाधर छड़े और पांच साल चलने वाली माध्य (निरंतर रेखा)

FIG. 15: TIME SERIES OF MEAN TEMPERATURE AVERAGED OVER INDIA (VERTICAL BARS AND FIVE-YEAR RUNNING MEAN (CONTINUOUS LINE) FOR THE POST-MONSOON DURING THE PERIOD 1971-2023.

**(a) MAXIMUM**

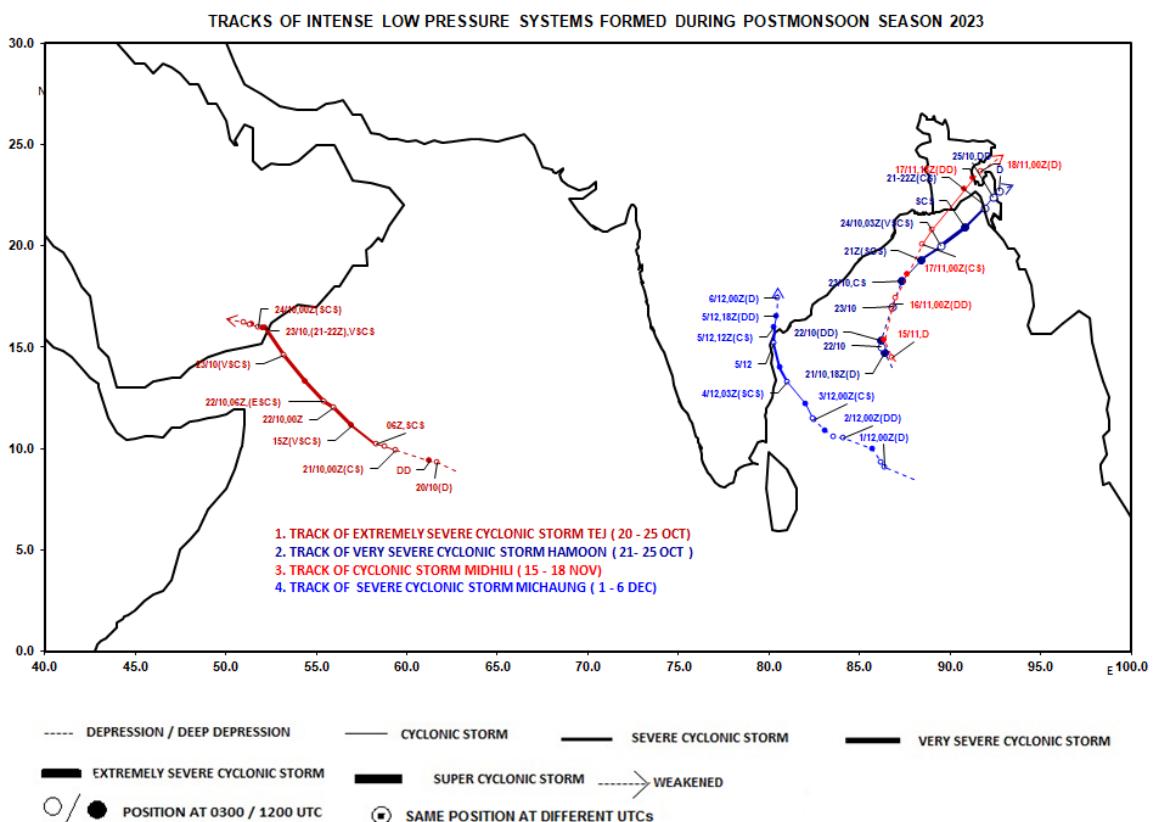


**(b) MINIMUM**



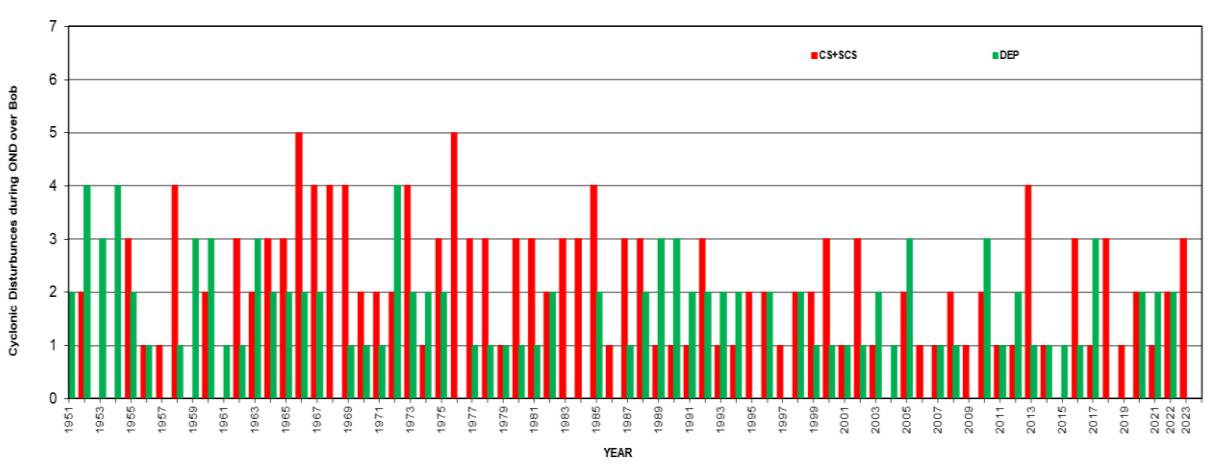
आकृति १६: १९७१-२०२३ की अवधि के दौरान उत्तर-पूर्व मानसून के लिए पूरे देश और चार सजातीय क्षेत्रों के लिए तापमान की समय श्रृंखला (ए) अधिकतम (बी) न्यूनतम

**FIG. 16: TIME SERIES OF TEMPERATURE FOR THE COUNTRY AS A WHOLE AND THE FOUR HOMOGENEOUS REGIONS FOR POST-MONSOON SEASON OF THE PERIOD 1971-2023**  
**(a) MAXIMUM (b) MINIMUM**



आकृति १७: उत्तर-पूर्व मानसून २०२३ के दौरान गठित तीव्र निम्न दबाव प्रणाली का ट्रैक

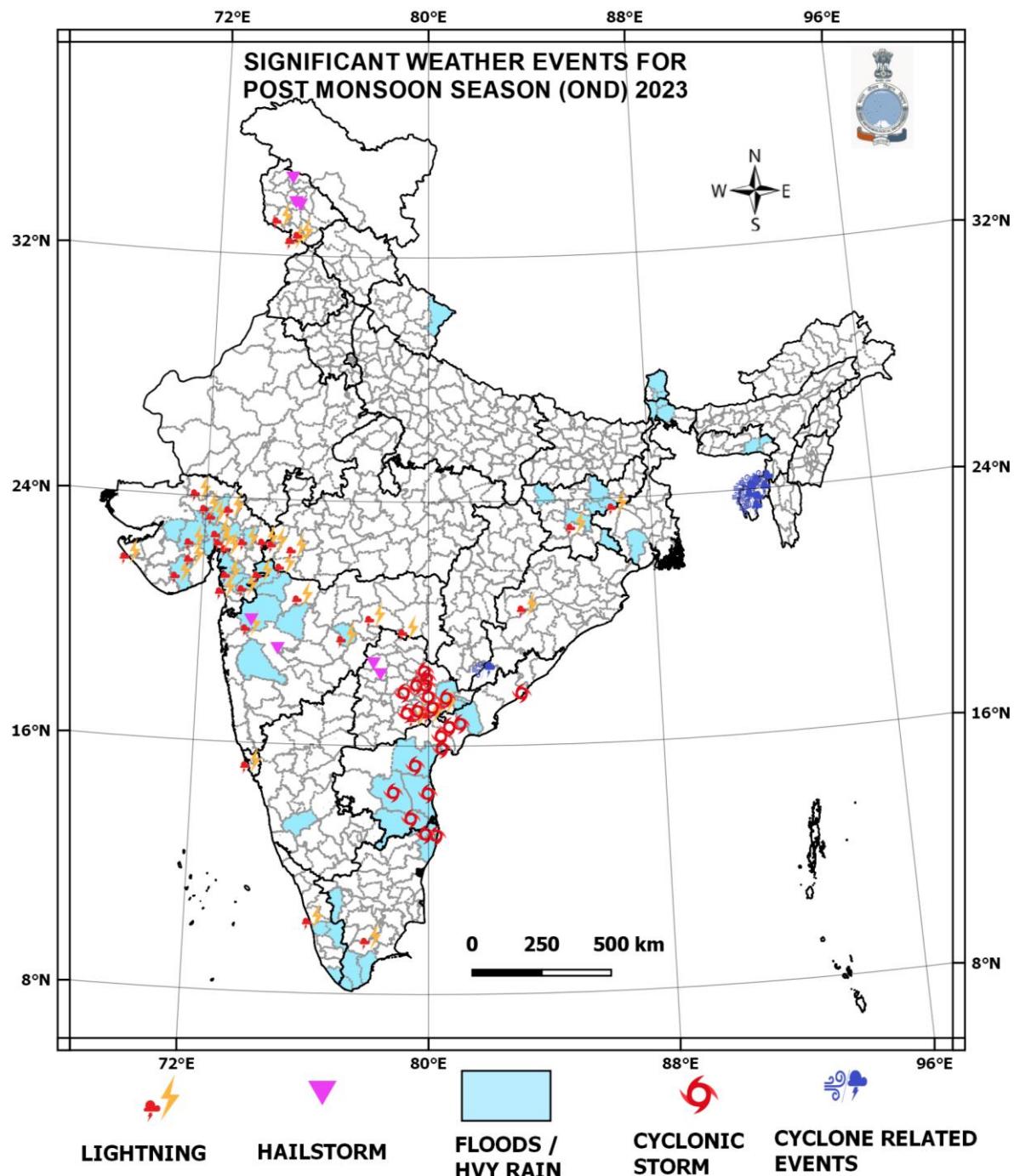
FIG. 17: TRACKS OF INTENSE LOW PRESSURE SYSTEMS FORMED DURING POST-MONSOON SEASON OF 2023



आकृति १८: मानसून के बाद के मौसम के दौरान बंगाल की खाड़ी में बने अवसाद/चक्रवाती तूफानों

की आवृत्ति की समय श्रृंखला अक्टूबर-दिसंबर (१९५१-२०२३)

FIG. 18: TIME SERIES OF FREQUENCY OF DEPRESSIONS/CYCLONIC STORMS FORMED OVER BAY OF BENGAL DURING THE POST MONSOON SEASON OCT- DEC (1951- 2023)  
(SOURCE: CYCLONE EATLAS RSMC NEW DELHI) BASED ON REAL TIME DATA



आकृति १९: उत्तर-पूर्व मानसून २०२३ के दौरान महत्वपूर्ण मौसम की घटनाएं  
(वास्तविक समय मीडिया रिपोर्ट के आधार पर)

**Fig. 19: SIGNIFICANT WEATHER EVENTS DURING POST-MONSOON SEASON 2023  
(BASED ON REAL TIME MEDIA REPORT)**

तालिका - १ / TABLE - 1

**उत्तर-पूर्व मानसून २०२३ के लिए उपमंडल वार वर्षा के आकड़े**  
**METEOROLOGICAL SUBDIVISION WISE RAINFALL STATISTICS**  
**FOR THE POST-MONSOON SEASON 2023 BASED ON OPERATIONAL DATA**

MET. SUBDIVISION	ACTUAL	NORMAL	%
	(mm)	(mm)	DEP
1 A & N ISLAND	769.6	670.5	14.8
2 ARUNACHAL PRADESH	200.6	241.5	-16.9
3 ASSAM & MEGHALAYA	178.6	190.1	-6.0
4 N M M T	177.5	199.1	-10.8
5 SHWB & SIKKIM	200.8	168.3	19.3
6 GANGETIC WEST BENGAL	225.2	175.0	28.7
7 ODISHA	119.9	140.8	-14.8
8 JHARKHAND	177.6	89.1	99.3
9 BIHAR	102.7	67.1	53.1
10 EAST U.P.	47.7	42.3	12.8
11 WEST U.P.	18.6	30.1	-38.2
12 UTTARAKHAND	26.6	55.0	-51.6
13 HAR. CHD & DELHI	17.5	19.4	-9.8
14 PUNJAB	39.9	24.1	65.6
15 HIMACHAL PRADESH	45.2	82.9	-45.5
16 JAMMU & KASHMIR & LADAKH	131.0	127.7	2.6
17 WEST RAJASTHAN	22.4	12.1	85.1
18 EAST RAJASTHAN	24.2	25.9	-6.6
19 WEST MADHYA PRADESH	42.3	46.5	-9.0
20 EAST MADHYA PRADESH	51.4	55.7	-7.7
21 GUJARAT REGION	37.8	32.8	15.2
22 SAURASHTRA & KUTCH	15.8	28.6	-44.8
23 KONKAN & GOA	117.8	140.7	-16.3
24 MADHYA MAHARASHTRA	55.8	103.5	-46.1
25 MARATHWADA	57.8	96.7	-40.2
26 VIDARBHA	50.5	76.2	-33.7
27 CHHATTISGARH	62.5	75.5	-17.2
28 COASTAL A. P.& YANAM	260.6	322.9	-19.3
29 TELANGANA	52.8	124.1	-57.5
30 RAYALASEEMA	164.7	236.4	-30.3
31 TAMILNADU, PUDU. & KARAikal	459.1	443.3	3.6
32 COASTAL KARNATAKA	232.3	264.0	-12.0
33 N. I. KARNATAKA	45.8	131.5	-65.2
34 S. I. KARNATAKA	147.3	199.0	-26.0
35 KERALA & MAHE	625.5	491.9	27.2
36 LAKSHADWEEP	226.9	335.6	-32

**तालिका - 2 / TABLE - 2**  
**उत्तर-पूर्व मानसून २०२३ के दौरान की तापमान विसंगति**  
**TEMPERATURE ANOMALIES OVER INDIA AND FOUR HOMOGENEOUS REGIONS  
DURING POST-MONSOON 2023**

POST-MONSOON 2023		Max Temp ( $^{\circ}\text{C}$ )	Min Temp ( $^{\circ}\text{C}$ )	Mean Temp ( $^{\circ}\text{C}$ )
ALL INDIA	ACTUAL	29.59	18.89	24.24
	NORMAL	28.91	17.58	23.24
	ANOMALY	0.68	1.31	1.00
NORTHWEST INDIA	ACTUAL	25.60	12.45	19.03
	NORMAL	25.60	11.21	18.40
	ANOMALY	0.01	1.25	0.63
EAST & NORTHEAST INDIA	ACTUAL	28.87	17.08	22.98
	NORMAL	27.59	15.88	21.74
	ANOMALY	1.28	1.20	1.24
CENTRAL INDIA	ACTUAL	31.23	19.20	25.21
	NORMAL	30.86	17.73	24.30
	ANOMALY	0.37	1.46	0.92
SOUTH PENINSULAR INDIA	ACTUAL	31.41	23.58	27.49
	NORMAL	30.39	22.30	26.35
	ANOMALY	1.01	1.28	1.15

Note: Values are rounded off to nearest two decimal

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Climate Monitoring & Prediction Group

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