

भारत सरकार Government of India पृथ्वी विज्ञान मंत्रालय (एम. ओ. ई. एस.) Ministry of Earth Sciences (MoES)



भारत मौसम विज्ञान विभाग INDIA METEOROLOGICAL DEPARTMENT Climate Research and Services (CRS)

Climate Summary for the month of October 2024

1. Monthly Rainfall Scenario (01st to 31th October 2024)

Rainfall over the country as a whole for the month of October 2024 was 75.7 mm which is very closed to its Long Period Average (LPA) of 75.4 mm. Daily variation of the rainfall over the country as a whole during the month of October 2024 with normal based on data of 1971-2020 is presented in Fig. 1(a). The all India rainfall percentage departure from normal for October during 1901-2024 is presented in Fig. 1(b).

Rainfall over All India (75.7 mm) was 53rd highest since 1901 and 11th highest since 2001 presented in Fig. 1(c). Rainfall over homogeneous region of East & northeast India (140.8 mm) was 49th highest since 1901 and 9th highest since 2001 presented in Fig. 1(d). Rainfall over homogeneous region of South Peninsular India (170.3 mm) was 38th highest since 1901 and 6th highest since 2001 presented in Fig. 1(e). Rainfall over homogeneous region of Northwest India (5.2 mm) was 17th lowest since 1901 and 6th lowest since 2001 presented in Fig. 1(f).



Fig. 1(a): Daily variation of rainfall over the country as a whole during October 2024



Fig. 1(b): All India monthly rainfall percentage departure from normal (1971-2020) for October from 1901-2024



Fig. 1(c): Time series of area weighted rainfall over All India for October (1901 - 2024)



Fig. 1(d): Time series of area weighted rainfall over East & Northeast India for October (1901 – 2024)



(1901 – 2024)



Fig. 1(f): Time series of area weighted rainfall over Northwest India for October (1901 – 2024)

2. Withdrawal of southwest monsoon from the country:

The Southwest Monsoon withdrew from entire country on 15th October, 2024 delayed by 4 days from its normal. Simultaneously, the Northeast Monsoon rainfall activity has commenced over the southeast peninsular India today on the same date i.e. 15th October. The date of withdrawal of the southwest Monsoon rainfall and commencement of NE Monsoon since 2010 is given in the table below;

Years	Withdrawal of Southwest monsoon from entire country	Commencement of NEM over Tamil Nadu and adjoining South Peninsular India
2010	29 th Oct	29 th Oct
2011	24 th Oct	24 th Oct
2012	18 th Oct	19 th Octr
2013	21 st Oct	21 st Oct
2014	18 th Oct	18 th Oct
2015	19 th Oct	28 th Oct
2016	28 th Oct	30 th Oct
2017	25 th Oct	27 th Oct
2018	21 st Oct	01 th Nov
2019	16 th Oct	16 th Oct
2020	28 th Oct	28 th Oct
2021	25 th Oct	25 th Oct
2022	23 th Oct	29 th Oct
2023	16 th Oct	16 th Oct
2024	15 th Oct	15 th Oct

The withdrawal dates of the Southwest monsoon season 2024 with its normal dates

are shown in Fig. 2.



Fig. 2: Isochrones of withdrawal of Southwest Monsoon 2024.

	The monthly	rainfall for	October	2024 is	given	in the	table belo)W:
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Regions	Actual Rainfall (mm)	Normal Rainfall (mm)	% Departure from LPA
Country as a whole	75.7	75.4	0.4
Northwest India	5.2	21.6	-75.8
Central India	54.0	57.0	-5.3
South Peninsula	170.3	152.3	11.8
East & northeast India	140.8	123.2	14.3

During this month, 4 sub-divisions received large excess, 7 received excess, 8

received normal, 9 received deficient rainfall and 8 sub-divisions received large deficient rainfall (Fig. 3).



Fig. 3: Subdivision-wise rainfall distribution for October 2024

The observed spatial distribution of rainfall during October 2024, normal rainfall based

on data of 1971 to 2020 and rainfall departures from normal during October 2024 are shown in Fig. 4.

RAINFALL OVER THE COUNTRY FOR OCTOBER 2024



Fig. 4: Observed spatial Rainfall pattern for the month October 2024 over India and their departure from normal (1971 to 2020 period). Departure from normal is anomaly = actual rainfall - normal rainfall.

3. Frequency of Heavy Rainfall events

During October heavy rainfall events were confined mainly over East & northeast India and some parts of peninsular Indian region. October 2024 witnessed Extremely very heavy rainfall events (>= 204.4 mm) mainly over Assam & Meghalaya, Odisha, Tamilnadu, Puducherry & Karaikal and Kerala & Mahe, very heavy rainfall events (115.6 – 204.4 mm) and heavy rainfall events (64.5 – 115.5 mm) were observed mainly over East & northeast India, east central parts, peninsular India and west central parts.

The Heavy rainfall information for the last five years during October month is given below;

The Number of very Heavy/Ext. Heavy Rainfall events occurred in the month of October during last 5 years.						
YEAR	Rainfall Category	Number of stations reported Events				
2020	V. Heavy (115.6 to 204.5)	151				
2020	Ext Heavy (more than 204.5)	10				
2021	V. Heavy (115.6 to 204.5)	160				
	Ext Heavy (more than 204.5)	36				
2022	V. Heavy (115.6 to 204.5)	133				
2022	Ext Heavy (more than 204.5)	13				
2022	V. Heavy (115.6 to 204.5)	77				
2023	Ext Heavy (more than 204.5)	5				
2024	V. Heavy (115.6 to 204.5)	96				
	Ext Heavy (more than 204.5)	5				

Extremely Heavy Rainfall over occurred over Assam & Meghalaya on 4th and 5th

October and Kerala & Sub-Himalayan West Bengal on 8th October. Extremely heavy rainfall occurred over Tamil Nadu, Puducherry & Karaikal and Rayalaseema on 16th October and North Odisha on 26th October.

The location of occurrences of heavy, very heavy and extremely heavy rainfall events is shown in the Figure 5. Out of total 517 occasions, 5 were extremely heavy rainfall (>= 204.4 mm), 85 were very heavy rainfall (115.6 to 204.4 mm) and 427 were heavy rainfall (64.5 to 115.5 mm) categories during this month.



(Only highest category of rainfall event considered for a station) Fig. 5: The location of occurrences of heavy, very heavy and extremely heavy rainfall events in the month of October 2024

4. Chief Synoptic weather features observed during October 2024.

A total of four Low Pressure Systems formed during the month. Out of which, two became depression, one Severe Cyclonic Storm and one Low pressure Area. A total of 19 LPS days was observed during the month. During the month, it was back to back depressions over Arabian Sea (13-15 Oct) and Bay of Bengal (15-17 Oct) and formed and moved during the withdrawal phase of southwest monsoon. Tracks of these systems are presented in Fig. 6.



Fig. 6: Tracks of intense low pressure systems formed during October 2024

4.1 Depression over Central Arabian Sea (13th – 15th October)

A cyclonic circulation lay over South Kerala & neighbourhood in the morning (0830 hours IST) of the 7th October, 2024. Under its influence, a Low Pressure Area formed over Lakshadweep and adjoining southeast & eastcentral Arabian Sea in the morning (0830 hours IST) of the 9th October, 2024. It lay as a Well Marked Low Pressure Area over eastcentral Arabian Sea off Karnataka-Goa coasts in the morning (0830 hours IST) of the 10th October 2024. It intensified into a Depression in the evening (1730 hours IST) of the 13th October, 2024 over central Arabian Sea. It moved northwestwards and crossed Oman coast near latitude 19.35°N and longitude 57.7°E, close to Duqm (Oman) between 2230 hours IST and 2330 hours IST. It then weakened and lay as a Well Marked Low Pressure Area over coastal Oman in the same midnight (2330 hours IST), the 15th October, 2024. India Meteorological Department monitored the system since 10th October. The formation of the system was first indicated in the extended range outlook issued on 10th October (3 days prior to formation of depression). With High probability (67-100%), it was indicated that the Well Marked Low Pressure over eastcentral Arabian Sea would intensity into a Depression over central Arabian Sea and would move nearly west-northwestawrds. Actually, depression formed on central Arabian Sea on 13th October. No adverse weather was observed in association with this system. Observed track of the depression is presented in Fig.7.



Fig. 7: Observed Track of Depression over Central Arabian Sea during 13th to 15th October, 2024

4.2 Depression over southwest Bay of Bengal (15th – 17th October)

A cyclonic circulation lay over southeast Bay of Bengal and adjoining North Equatorial Indian Ocean in the morning (0830 hours IST) of the 12th October, 2024. It moved westnorthwestwards. Under its influence, a Low Pressure Area formed over southeast Bay of Bengal in the early morning (0530 hours IST) of the 14 th October 2024. It lay as a Well Marked Low Pressure Area over the central parts of south Bay of Bengal in the early morning (0530 hours IST) of 15th October 2024. It intensified into a Depression over southwest Bay of Bengal in the same evening (1730 hours IST). It moved west-northwestwards and crossed north Tamil Nadu - South Andhra Pradesh coasts between Puducherry and Nellore, close to north of Chennai, near latitude 13.5N and longitude 80.2E around 0430 hrs IST of today, the 17th October. Subsequently, it weakened into a Well Marked Low Pressure Area and lay over South coastal Andhra Pradesh and adjoining North coastal Tamil Nadu in the early morning (0530 hrs IST) of today, the 17th October, 2024. India Meteorological Department monitored the system The extended range outlook issued on 10th October (5 days prior to formation of the depression indicated likely formation of an upper-air cyclonic circulation over central parts of south Bay of Bengal around 12th October. The system caused intense rainfall activity over TamilNadu, Puducherry & Karaikal, Rayalseema, Coastal Andhra Pradesh & Yanam, South Interior Karnataka and parts of Kerala on 15th and 16th October. The observed track of the depression is presented in Fig.8.



Track of Depression over Southwest Bay of Bengal during 15th to 17th October, 2024

Fig. 8: Observed

4.3 Severe Cyclonic Storm "DANA" over Eastcentral Bay of Bengal during 22-26 October, 2024

The severe cyclonic storm "DANA" developed over eastcentral Bay of Bengal (BoB) and adjoining North Andaman Sea as a Low-Pressure Area. It moved nearly northnorthwestwards, intensified into a **depression** over eastcentral BoB on 22nd October, cyclonic storm "DANA" on 23rd October and into a severe cyclonic storm over central & adjoining northwest BoB in the mid-night (2330 hours IST/1800 UTC) of 23rd October, 2024. It reached its peak intensity on 24th October and crossed north Odisha coast close to Habalikhati Nature Camp (Bhitarkanika) and Dhamara during 0130 hrs IST to 0330 hrs IST of 25th October (2000 to 2200 UTC of 24th October) as a severe cyclonic storm with a wind speed of 100-110 kmph gusting to 120 kmph. It moved slowly during and after landfall. The landfall process continued for 9 hours during midnight of 24th till morning of 25th October. After landfall, it weakened rapidly into a cyclonic storm over north coastal Odisha in the forenoon of 25th and into a well marked low pressure over interior Odisha in the early morning of 26th October. India Meteorological Department (IMD) provided 1st information about the likely development of depression around 23rd October and its intensification into a cyclonic storm over eastcentral BoB in the extended range outlook issued on 17th October (about 7.5 days ahead of landfall). There was almost zero error in cyclone landfall point, landfall time and landfall intensity prediction for all lead periods of forecast upto 3.5 days. The operational track and intensity forecast errors were markedly less than the long period average (LPA) errors based on last five years (2019-2023) for all lead periods of forecast. The track forecast errors were 20-30 km and the intensity forecast

errors were 2-5 kt (3-10 kmph) upto 72 hours lead periods.

The observed track of the system is given in Fig. 9.



Fig. 9: Observed track of severe cyclonic storm "DANA)" over east central Bay of Bengal during 22-26 October, 2024

5. Characteristics of Temperatures for the month of October 2024

The average maximum, average minimum and mean temperature for the country as a whole during October 2024 were 32.05°C, 21.79°C and 26.92°C respectively, against the normal of 31.37°C, 20.01°C and 25.69°C based on data of 1991-2020. Thus, the average maximum, average minimum and mean temperatures were above normal with departure from normal of 0.68°C, 1.78°C and 1.23°C respectively for the country as a whole. The daily variation of maximum and minimum temperature departure from normal over the country as a whole for October 2024 is shown in the figure 10(a) and (b) respectively.



Fig 10(a): Daily variation of maximum temperature anomaly (departure from normal) over the country as a whole for October 2024



Fig. 10(b): Daily variation of minimum temperature anomaly (departure from normal) over the country as a whole for October 2024

Figure 11 shows the time series of monthly average maximum, average minimum and mean temperatures over the country as a whole for the month of October 1901-2024. Over the country during October, the average maximum temperature was 32.05°C with departure from normal of 0.68°C (7th highest since 1901). The average minimum temperature was highest at 21.79°C since 1901 against the earlier record of 21.28°C in 1951. The mean temperature was highest at 26.92°C since 1901 against the earlier record of 26.71°C in 1951.



Fig. 11: Time series of monthly average maximum, average minimum and mean temperature over the country as a whole for the month of October 1901-2024

Figure 12 shows the time series of average maximum, average minimum and mean temperature over the Northwest India for the month of October 1901-2024. Over Northwest India during October, the average maximum temperature was 4th highest (32.276°C with departure from normal of 1.55°C) after the years 2017(32.75°C), 1951(32.50°C) and 1941(32.278°C) since 1901. The average minimum temperature was highest at 18.98°C since 1901 against the earlier record of 18.92°C in 1951. The mean temperature was 2nd highest (25.63°C with departure from normal of 1.90°C) after the year 1951(25.71°C) since 1901.



Fig. 12: Time series of monthly average maximum, average minimum and mean temperature over Northwest India for the month of October 1901-2024

Figure 13 shows the time series of average minimum and mean temperature over the Central India for the month of October 1901-2024. Over Central India during October, the average minimum temperature was highest at 22.98°C since 1901 against the earlier record of 22.11°C in 1951. The mean temperature was highest at 28.18°C since 1901 against the earlier record of 28.09°C in 2015.



Fig 13: Time series of monthly average minimum and mean temperature over Central India for the month of October 1901-2024

Figure 14 shows the time series of average minimum and mean temperature over the South Peninsular India for the month of October 1901-2024. Over South Peninsular India during October, the average minimum temperature was highest at 23.46°C since 1901 against the earlier record of 23.11°C in 2021. The mean temperature was 2nd highest (27.585°C with departure from normal of 0.73°C) after the year 2023(27.85°C) since 1901.



Fig. 14: Time series of monthly average minimum and mean temperature over South Peninsular India for the month of October 1901-2024

Figure 15 shows the time series of average minimum and mean temperature over

the East & Northeast India for the month of October 1901-2024. Over East & Northeast India during October, the average minimum temperature was 3rd highest (22.34°C with departure from normal of 1.54°C) after the years 2020(22.69°C) and 2021(22.45°C) since1901. The mean temperature was 5th highest (26.14°C with departure from normal of 0.69°C) after the years 2020(27.17°C), 2021(26.91°C), 1915(26.37°C) and 1998(26.30°C) since 1901.



Fig. 15: Time series of monthly average minimum and mean temperature over East & Northeast India for the month of October 1901-2024

The Temperatures during October	2024 for all India a	and homogeneous r	egions with
its top ranks since 1901 are given below:			

OCT 202	Max Temp (⁰ C)	Min Temp (⁰ C)	Mean Temp (⁰ C)	
	ACTUAL	32.05	21.79	26.92
	NORMAL	31.37	20.01	25.69
	ANOMALY	0.68	1.78	1.23
	Rank since 1901	7	1	1
	ACTUAL	32.28	18.98	25.63
	NORMAL	30.72	16.73	23.73
NORTHWEST INDIA	ANOMALY	1.55	2.25	1.90
	Rank since 1901	4	1	2
	ACTUAL	29.94	22.34	26.14
	NORMAL	30.10	20.80	25.45
EAST & NORTHEAST INDIA	ANOMALY	-0.15	1.54	0.69
	Rank since 1901	45	3	5
	ACTUAL	33.37	22.98	28.18
	NORMAL	32.93	20.91	26.92
CENTRALINDIA	ANOMALY	0.45	2.07	1.26
	Rank since 1901	25	1	1
	ACTUAL	31.70	23.46	27.58
	NORMAL	31.18	22.53	26.85
SOUTH PENNINGULAR INDIA	ANOMALY	0.53	0.94	0.73
	Rank since 1901	11	1	2

Note: Values are rounded off to the nearest two decimals.

The five highest temperature records with corresponding top ranks since 1901 along

with year of occurrence for Northwest India (Tmax, Tmin, Tmean) and All India, Central India, South Peninsular India and East & Northeast India (TMin, TMean) are given in the tables below:

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Northwest India (October 2024)			All India (October 2024)						
Year	TMax	Normal	Anomaly	Rank	Year	TMin	Normal	Anomaly	Rank
2017	32.75	30.72	2.02	1	2024	21.79	20.01	1.78	1
1951	32.50		1.78	2	1951	21.28		1.28	2
1941	32.278		1.55	3	1915	21.063		1.06	3
2024	32.276	atter and	1.55	4	2021	21.061		1.05	4
2000	32.11		1.39	5	2013	20.82		0.81	5
				-					-
	Northwest	India (Oct	tober 2024)] [All Ind	ia (Octobe	r 2024)	
Year	TMin	Normal	Anomaly	Rank	Year	TMean	Normal	Anomaly	Rank
2024	18.98	16.73	2.25	1	2024	26.92	25.69	1.23	1
1951	18.92		2.19	2	1951	26.71		1.02	2
1941	18.43		1.70	3	2017	26.52		0.84	3
1915	18.42		1.69	4	2015	26.48		0.80	4
2013	18.35		1.62	5	2020	26.41		0.73	5
	Northwest	India (Oct	tober 2024)]				
Year	TMean	Normal	Anomaly	Rank					
1951	25.71	23.73	1.99	1					
2024	25.63	ontri anna	1.90	2					
1941	25.35		1.63	3					
2017	25.05		1.32	4					
2017	Z. I. M. I. I								
1905	24.71		0.98	5]				
1905	24.71		0.98	5					
1905	24.71 Central I	ndia (Octo	0.98	5 Bank	Sou	Ith Penins	ular India (October 20	2 4)
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Year 2024 1951 1998 2020 1915	23.03 24.71 TMin 22.98 22.11 22.00 21.92 21.84 Central I	ndia (Octo Normal 20.91 ndia (Octo Normal	0.98 ber 2024) Anomaly 2.07 1.21 1.09 1.02 0.93 ber 2024) Anomaly	5 Rank 1 2 3 4 5 8 8	Sou Year 2024 2021 2017 2019 2020	th Peninsu 7Min 23.46 23.11 23.05 23.03 23.02 th Peninsu TMean	ular India (Normal 22.53 ular India (October 20 Anomaly 0.94 0.59 0.52 0.51 0.49 October 20 Anomaly	24) Rank 1 2 3 4 5 24) Rank
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The observed spatial temperature pattern of monthly average maximum, average

minimum and mean temperature over India and their departures from normal (1991 to 2020 period) for the month of October 2024 is given in Figure 16.



Fig. 16: Observed spatial temperature pattern of monthly average maximum, average minimum, and mean temperature over India (top three from left to right) and their departure from normal (1991 to 2020 period) for October 2024 (lower three from left to right)

6. Significant Weather Events:

During October, a total of about 50 people reportedly died, more than 30 were injured, and more than 60 livestock perished, as per the media report. The details of event-wises casualties are given below. However, the actual data on casualties and damages may be available to concerned state governments.

Event	Number of human deaths
Lightning	24 (Mainly Gujarat, Telangana, Chhattisgarh, Odisha, Andhra Pradesh, Karnataka, Maharashtra, Tamil Nadu)
Heavy Rains, Floods &	22 (Mainly Karnataka and Meghalaya)
Landslide	
Severe Cyclonic Storm DANA	4 (Mainly West Bengal)

There was also damage reported from different states as mentioned above due to above hazards. Fig 17 shows loss and damages due to significant weather events during October 2024



Fig. 17: Deaths and damages due to significant weather events during October 2024 (Based on real time media reports)