Down To Earth

CLIMATE

INDIA 2024

AN ASSESSMENT OF EXTREME WEATHER EVENTS

JANUARY - SEPTEMBER

India experienced extreme weather events on 93% of the days in the first nine months of the year

These weather events killed 3,238 people and affected 3.2 million hectares of crop area

35 out of 36 Indian states and Union Territories experienced extreme weather events

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AN ASSESSMENT OF EXTREME WEATHER EVENTS

JANUARY - SEPTEMBER

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CSE, founded in 1980, is a public interest research and advocacy organisation based in New Delhi. CSE researches into, lobbies for and communicates the urgency of development that is both sustainable and equitable.
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Down To Earth is a fortnightly on the politics of environment and development. In its 33th year of publication, it continues to adhere to its founder Anil Agarwal's objective of bringing out news, perspectives and knowledge to prepare citizens to change the world.

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Scan to access India's Atlas on Weather Disasters

EXECUTIVE SUMMARY

The UN Intergovernmental Panel on Climate Change defines extreme weather events as occurrences that are "rare at a particular place and time of year". While India does not have an official definition, the India Meteorological Department (IMD), in its annual "Statement of Climate of India" reports, classifies lightning and thunderstorms, heavy to very heavy, and extremely heavy rainfall, landslides and floods, coldwaves, heatwaves, cyclones, snowfall, dust and sandstorms, squalls, hailstorms and gales as extreme weather events. The agency defines each of these weather events on its website "Climate Hazards and Vulnerability Atlas of India", launched in January 2022, and in other documents (see 'How IMD defines extreme weather events').

The "Climate India 2024: An assessment of extreme weather events", prepared by the Centre for Science and Environment and *Down To Earth* (CSE/DTE), attempts to build an evidence base on the frequency and expanding geography of extreme weather events in India. It has sourced data on extreme events from two key government sources: IMD and the Disaster Management Division (DMD) of the Union Ministry of Home Affairs. In addition, it has scanned media reports to track the events—particularly the pre-monsoon period when official data is inadequate. The media reports have also provided further information on the extent of loss and damage.

SOURCE USED: INDIA METEOROLOGICAL DEPARTMENT

Information on extreme weather events in a 24-hour period and forecasts and warnings are published in IMD's All India Weather Summary and Forecast bulletins and daily press releases. CSE/DTE tracks each day's report from the IMD website and maps out the events by state and Union Territory (UT) and event type.

On loss and damage due to extreme weather events, IMD uses media reports and publishes the number of human deaths and livestock losses in its "Climate Summary for the Month".

SOURCE USED: HOME MINISTRY'S DISASTER MANAGEMENT DIVISION

The department under the Union Ministry of Home Affairs issues a "Situation report regarding flood/Heavy rainfall in the country" as and

How IMD defines extreme weather events

LIGHTNING AND STORMS

Lightning is an electrical discharge caused by imbalances between storm clouds and the ground or within the clouds themselves. Storms include duststorms (caused by thunderstorms or strong pressure gradients associated with cyclones which increase wind speed over a wide area), hailstorms (an outgrowth of a severe thunderstorm in which balls or irregularly shaped lumps of ice fall with the rain), thunderstorms and gales (a very strong wind).

HEAVY RAINS, FLOODS AND LANDSLIDES

Heavy rainfall happens when a region receives 64.5-115.5 mm rain in 24 hours. In the case of very heavy rainfall, the threshold increases to 115.6-204.4 mm and in extremely heavy rainfall it is 204.5 mm or more. The report has considered all very heavy and extremely heavy rainfall events, and heavy rainfall events only when they have caused damage.

HEATWAVES

Heatwave conditions signify a certain amount of rise in temperature at a given place with respect to normal climatological value. The report has considered heatwaves (4.5°C to 6.4°C departure of the maximum temperature from normal), and severe heatwaves (departure of more than 6.4°C).

COLD DAY/COLDWAVE

Cold day conditions occur when the maximum temperature drops by 4.5°C to 6.4°C than average. If the deviation is more than 6.4°C, then it is considered a severe cold day. Coldwave conditions occur when the minimum temperature drops by 4.5°C to 6.4°C than normal. Similarly, severe coldwave occurs when the minimum temperature drops by more than 6.4°C than normal. The report has considered all the four categories.

SNOWFALL

Snowfall is a hydrological hazard where a large amount of snow can affect transport, crops and people. IMD's "Annual Disaster Weather Report" reports the snowfall cases over India that caused human deaths. The report has also considered only those snowfall events that caused deaths.

CLOUDBURSTS

A cloudburst is very heavy rainfall (100 mm per hour) over a localised area. It is accompanied with strong winds and lightning.

CYCLONES

Cyclones are intense vortex or whirls in the atmosphere with very strong winds circulating around them in anti-clockwise direction in the Northern Hemisphere and in clockwise direction in the Southern Hemisphere.

when the event happens. It includes the forecast from IMD and the Central Water Commission (on floods). It also has a section on damages reported by the states/Union Territories in the previous 24-hour period.

From June 10, 2022, the situation reports have provided the "Cumulative loss and damage data for the monsoon season". This datasheet provides information on human deaths during the monsoon period because of drowning, lightning, landslides and other reasons. It also provides information about the damage to houses, crops and

livestock in the affected states. But starting 2024, the cumulative data is not published online. As a result, CSE/DTE database this year had to source its loss and damage numbers from the "Damage reported by States/UTs during the last 24 hrs" table published under the "Situation report regarding Flood/ Heavy rainfall in the Country". An analysis of the previous years shows that the cumulative numbers are usually higher than the total of the daily numbers. DMD must resume releasing the cumulative numbers since they are more comprehensive.

The situation reports are primarily for floods and heavy rainfall, and cyclones; India needs similar daily assessment for all weather-related disasters and the loss and damage they cause, given the frequency of these events.

One of the key indicators to establish the extent of damage is "people affected". It is also a target under the Sendai Framework for Disaster Risk Reduction (target B-1), by the UN Office for Disaster Risk Reduction. While DMD's daily situation report provides information on this globally accepted parameter of population affected, it is not included in the cumulative loss and damage datasheet. DMD must require states to provide this data at the end of each weather disaster so that it can be included in the cumulative data that is issued for the monsoon period.

In addition, each state has a disaster management authority (SDMA), which report on the events on their websites. However, the data is at best sketchy and not released regularly. There are signs of change. Assam's SDMA releases daily situation reports with details on the extent of loss and damage. But, in this CSE/DTE report, SDMA data has not been considered as it is not uniformly available for the country.

In the case of any discrepancy in the three sources—IMD, DMD and media reports— the source with the highest reported number has been considered. Also, since DMD does not provide data on crop area affected for the pre-monsoon period, CSE/DTE has sourced it from media reports (which is also used by IMD for compiling its loss and damage data).

GAPS IN DATA

While a realistic estimate can be made about the number of days the country recorded extreme weather events from IMD releases, major gaps remain when it comes to loss and damage assessment. DMD provides data as received by the states, which are mainly for the monsoon season. It does not include all extreme events as defined by IMD. Moreover, the data is not comprehensive. For instance, media reports suggest widespread crop loss in Haryana, Madhya Pradesh, Rajasthan and Gujarat during the monsoon season (June-September),

but the Centre's loss and damage report for the season does not quantify the same. The absence of a robust public database on extreme weather events in the country poses difficulties in the evaluation of disaster situations and their impacts.

It is also clear that now, given the intensity and frequency of these events, the country no longer needs to count just the disasters; it needs credible numbers on the loss and damage.

WHY THIS REPORT?

India recorded extreme weather events on 255 of the 274 days from January 1 to September 30, 2024. This means that for more than 90 per cent of the first nine months of this year, India had an extreme weather event breaking in one or more parts of the country. It also experienced record-breaking temperatures for several months even as regions across the country were deluged because of very and extremely heavy rainfall. This led to floods and the loss of life and livestock. This speaks of the increased frequency and intensity of the extreme events that we are seeing in our rapidly warming world.

What the country has witnessed so far in 2024 is the new abnormal in a warming world. A 2020 report by the UN Office for Disaster Risk Reduction says globally, there has been "a sharp increase [in disasters] over the previous twenty years".

The CSE/DTE report is an attempt to build an evidence base on the frequency and expanding geography of extreme weather events in India. This is extremely important as currently fragmented data on extreme weather events are publicly available and they fail to provide the overall picture. It provides season-wise, month-wise and region-wise analysis of extreme weather events and their associated loss and damage. Along with this report, DTE also has "India's Atlas on Weather Disasters", an open-access online public interactive database on extreme weather events that is updated every month.

HIGHLIGHTS AND KEY FINDINGS

India faced extreme weather events on 93 per cent of days in the first nine months of this year, marked by heat and coldwaves, cyclones, lightning, heavy rain, floods, and landslides. These events claimed 3,238 lives, affected 3.2 million hectares of crops, destroyed 235,862 houses, and killed approximately 9,457 livestock. This reported damage is likely an underestimate due to incomplete data collection on event-specific losses, particularly public property and crop damage.

Madhya Pradesh experienced extreme weather every other day, the most in the country. However, Kerala recorded the highest fatalities

at 550, followed by Madhya Pradesh (353 deaths) and Assam (256 deaths). Andhra Pradesh had the most houses damaged (85,806), while Maharashtra, which saw extreme events on 142 days, accounted for over 60 per cent of the affected crop area nationwide, followed by Madhya Pradesh (25,170 ha).

Regionally, the Central area faced the highest frequency of extreme events, with 218 days, followed closely by the Northwest at 213 days. In terms of lives lost, the Central region had the most deaths (1,001), followed by the South Peninsula (762 deaths), East and Northeast (741 deaths), and the Northwest (734 deaths) .

The year 2024 also set several climate records. January was India's ninth driest since 1901. In February, the country recorded its second-highest minimum temperature in 123 years. May saw the fourth-highest mean temperature on record, and July, August, and September all registered their highest minimum temperatures since 1901. In the Northwest, January was the second driest, and July recorded the region's second-highest minimum temperature. The South Peninsula saw its hottest February ever, followed by exceptionally hot and dry March and April, but with a 36.5 per cent surplus in July rainfall and the second-highest minimum temperature in August.

These record-breaking statistics reflect climate change's impact, where events that used to occur once every century are now happening every five years or less. This frequency overwhelms the most vulnerable populations, who lack the resources to adapt to this relentless cycle of loss and damage.

In terms of event types, the past nine months have seen everything from lightning and storms—spanning 32 states and resulting in 1,021 deaths—to relentless monsoon rains, which led to flooding across various regions. In Assam alone, heavy rains, floods and landslides were recorded on 122 days, leaving large parts of the state submerged and communities devastated. Nationwide, 1,376 lives were lost due to floods.

While heatwaves claimed 210 lives, the data does not reflect the extended health impacts of prolonged high temperatures on the well-being of people in north India, including farmers and labourers, who endured intense heat with little means of relief. Similarly, the toll of severe cold snaps and frost on crop losses is not captured, highlighting the need for robust compensation systems for weather-induced losses. For instance, there are many media reports on crop damage across the agrarian states of Madhya Pradesh, Uttar Pradesh,

Rajasthan and Haryana, though no credible and comparable national data is available for the same.

The extreme weather report card is essential reading, as it reveals not only the frequency of such events but also the cumulative and far-reaching damage they cause. This underscores the urgent need for systems that accurately capture losses, giving a human face to the impacts of climate change.

The report highlights a critical shift needed in our approach to extreme events—from disaster response to risk reduction and resilience-building. Flood management, for example, requires more than plans on paper; it calls for the strategic development of drainage and water recharge systems, along with expanded green spaces and forests to act as natural water reservoirs in preparation for future storms.

Additionally, the report emphasises the need for climate reparations from high-emission countries responsible for much of the damage. Climate models are clear: extreme weather events are set to become more frequent and severe. This trend is no longer hypothetical—it is visible in the escalating crises we face today. In the first nine months of 2024, India experienced extreme weather events on 255 out of 274 days, surpassing the 235 days in 2023 and the 241 days in 2022 for the same period. This increase in frequency has led to devastating human and economic losses, with 3,238 lives lost in 2024 compared to 2,755 in 2022—a rise of 18 per cent in just three years.

This report is not good news, but it is a necessary warning, a call to recognise nature's backlash and the urgent action required to mitigate it. Without combating climate change at a meaningful scale, today's challenges will only worsen tomorrow.

DISASTER A DAY

India experienced extreme weather events on 255 of the 274 days, or a little over 93 per cent of the days from January 1 to September 30. They claimed 3,238 lives, affected 3.2 million hectares (ha) of crop area, damaged 235,862 houses and killed over 9,457 animals

Region-wise extreme weather events (January 1- September 30, 2024)

Number of days | Deaths | Crop area affected (ha) | Total animal deaths (big and small) | Houses damaged (fully and partially)

Central region

It recorded extreme weather events on **218** of the **274** days, which claimed **1,001** lives, damaged **2.08 million** ha crop area

Madhya Pradesh	176	353	25,170	61	7,278
Maharashtra	142	208	1,951,801	166	93
Gujarat	102	210	100,000	2,618	19,571
Odisha	99	112	0	0	1,761
Chhattisgarh	92	110	0	54	1,533
Goa	54	8	740	0	298
DNH&DD*	0	0	0	0	0

*Dadra & Nagar Haveli and Daman & Diu

South Peninsula region

It recorded extreme weather events on **168** of the **274** days, which claimed **762** lives, damaged **425.62K** ha of crop area

Kerala	113	550	4,717	0	4,881
Karnataka	96	60	83,605	50	2,493
Tamil Nadu	67	25	1,039	14	189
Andhra Pradesh	60	60	262,840	501	85,806
Telangana	50	66	73,418	4,350	0
Puducherry	19	1	0	0	0
Andaman & Nicobar	9	0	0	0	0
Lakshadweep	3	0	0	0	0

Northwest region

It recorded extreme weather events on **213** of the **274** days, which claimed **734** lives, damaged **44.91K** ha of crop area

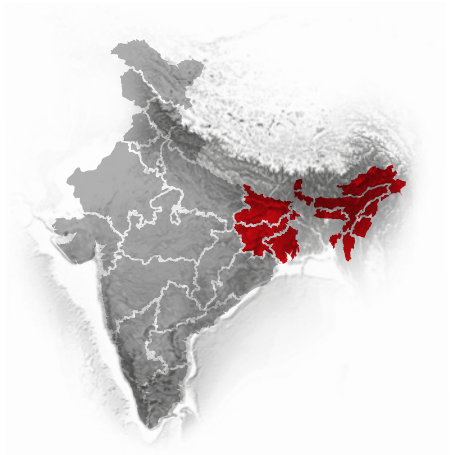
Uttar Pradesh	156	256	0	23	1,797
Himachal Pradesh	136	214	0	110	734
Rajasthan	124	105	0	0	1,227
Uttarakhand	102	85	3,783	0	3,216
Punjab	96	24	15,000	0	73
Haryana	82	4	26,131	0	0
Delhi	46	16	0	0	0
Chandigarh	38	0	0	0	0
Jammu and Kashmir	38	30	0	0	2,133
Ladakh	4	0	0	0	0

Number of days | Deaths | Crop area affected (ha) | Total animal deaths (big and small) | Houses damaged (fully and partially)

East and Northeast region

It recorded extreme weather events on **191** of the **274** days, which claimed **741** lives, damaged **652.83K** ha of crop area

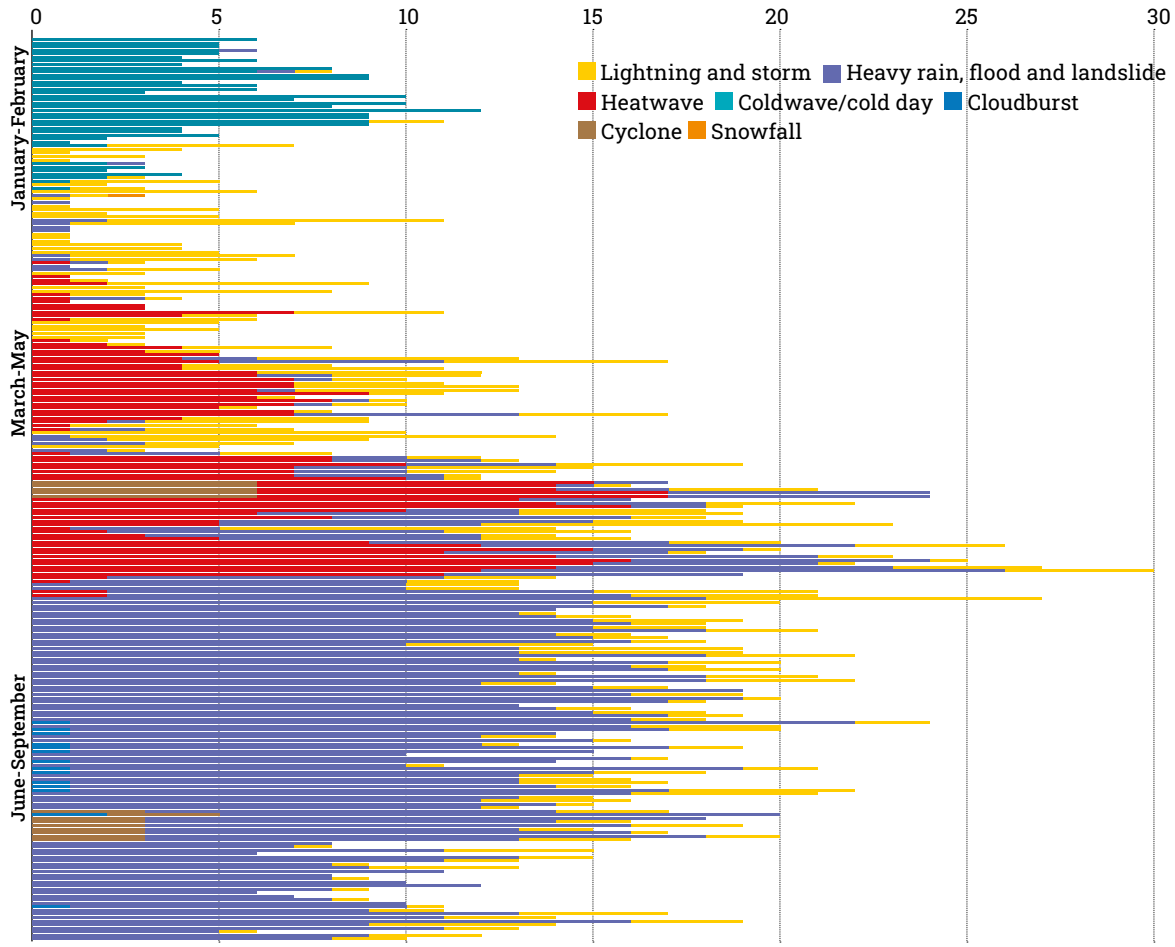
Assam	131	201	48,281	1,408	77,559
Sikkim	98	21	0	0	1,988
Meghalaya	93	18	0	0	218
Bihar	88	205	300,000	0	1,096
West Bengal	83	64	200,900	0	0
Jharkhand	59	63	0	100	0
Tripura	50	86	103,000	0	14,971
Nagaland	46	25	0	0	1,556
Arunachal Pradesh	42	5	0	0	252
Mizoram	24	45	130	0	29
Manipur	18	8	522	0	5,110



Day-wise extreme weather events in India

(January 1 - September 30, 2024)

Number of affected states and Union Territories



Sources: India Meteorological Department, Pune, Disaster Management Division under the Union Ministry of Home Affairs, and media reports

EXTREME WEATHER EVENTS

SEASON-WISE

WINTER

January - February 2024
(60 days)

India experienced extreme weather events on 50 out of the 60 days in the winter months of 2024. The events were spread across 19 states/UTs

Coldwaves/cold days were reported on 38 days, lightning and storms on 17 days, followed by heavy rains, floods and landslides on 5 days and snowfall on 1 day

The events claimed 15 human lives and affected crop area across 41,910 hectares

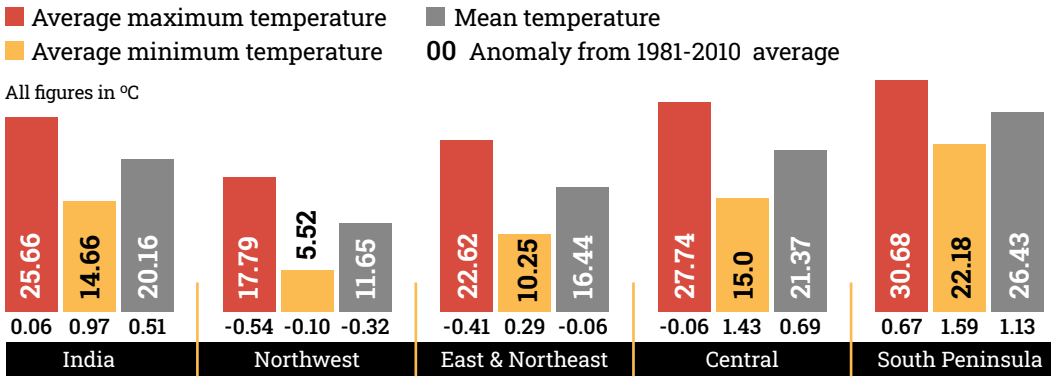
Punjab and Haryana were the worst hit as they experienced extreme weather events on 34 days. They were followed by Uttar Pradesh and Rajasthan that experienced extreme weather events on 27 and 26 days, respectively

INDIA 2024
JANUARY

TEMPERATURE

January recorded the 4th highest minimum temperature since 1901, with the average minimum temperature standing 0.97°C above the long-term average (1981-2010). Central India and the South Peninsula experienced warmer-than-usual temperatures.

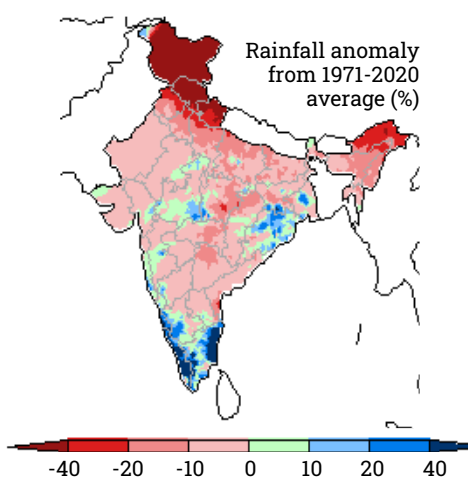
South Peninsula recorded its 4th warmest January since 1901

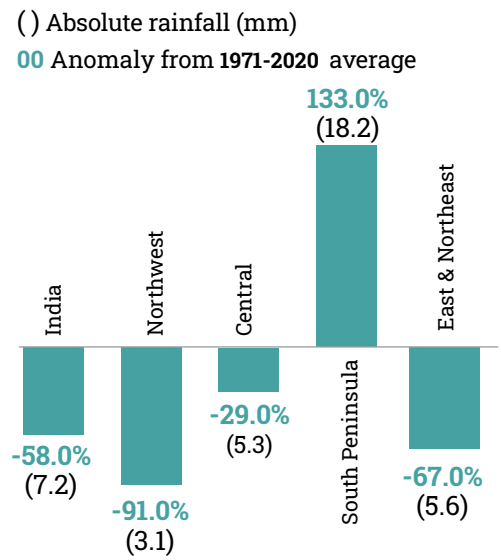


RAINFALL

India experienced its 9th driest January (7.2 mm) this year, with rainfall levels 58 per cent lower than the long period average (1971-2020). Rainfall over northwest India (3.1 mm) was the 2nd lowest since 1901. South Peninsula alone ditched the dry spell and recorded a rainfall surplus of 133 per cent over normal.

19 sub-divisions received large deficient rainfall and seven received large excess. Only six sub-divisions received normal rainfall



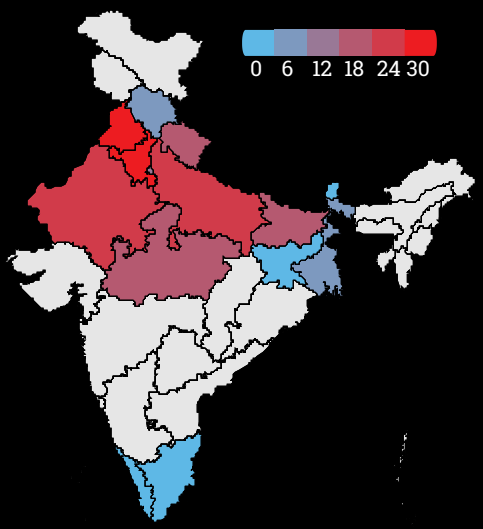


Source: India Meteorological Department, Pune

INDIA 2024
JANUARY

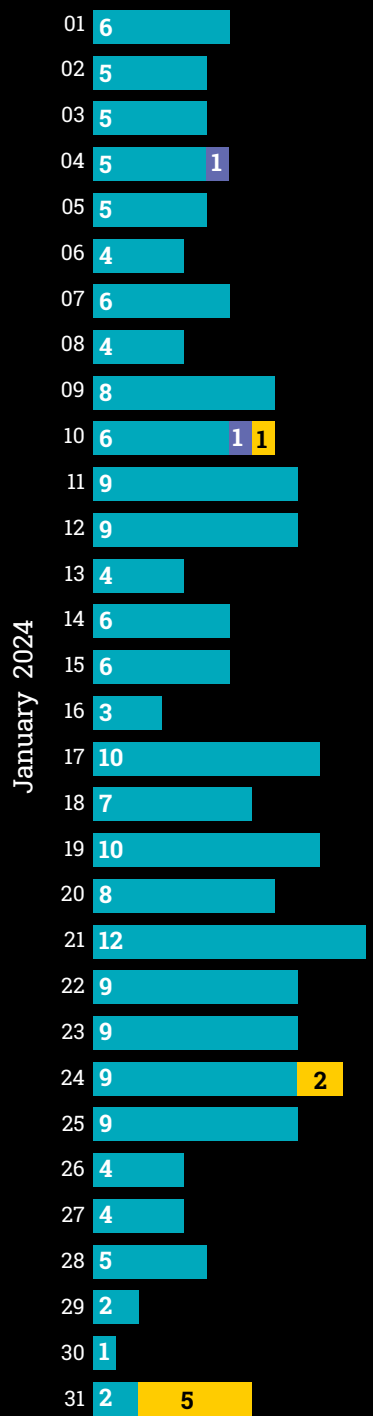
EXTREME WEATHER EVENTS

India experienced extreme weather events on all 31 days in January. This was spread across 15 states/UTs. Haryana and Punjab were the worst hit with extreme weather events on 30 and 28 days of the month, respectively.



Statewise number of days with extreme weather events

Bars indicate the number of states/UTs that experienced extreme weather events each day



Coldwave/ cold day **(31 days)**

Heavy rain, flood and landslide **(2 days)**

Lightning and storm **(3 days)**

LOSS AND DAMAGE

6
people died due to extreme events in Bihar in January

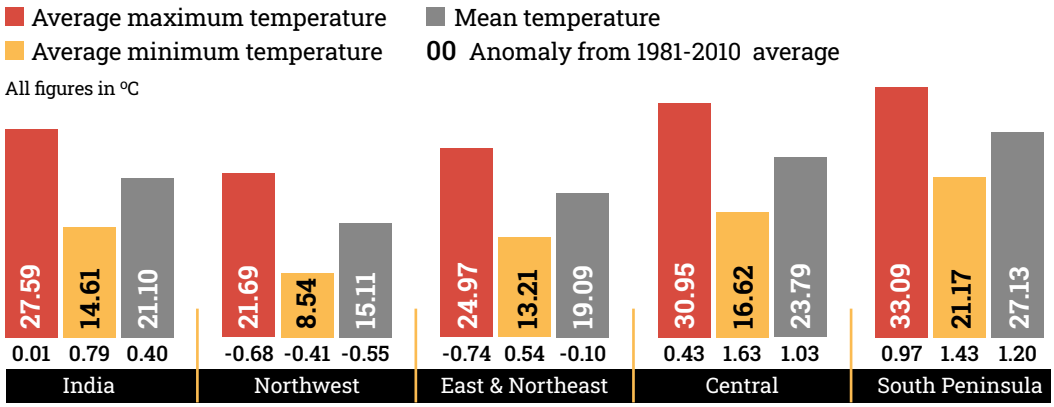
0
No crop area loss was recorded across India

Sources: India Meteorological Department, Pune, Disaster Management Division under the Union Ministry of Home Affairs and media reports

TEMPERATURE

India recorded an average minimum temperature of 14.61°C in February, the 2nd highest since 1901. In the South Peninsula, temperatures soared, setting records for the highest February maximum, minimum, and mean temperatures.

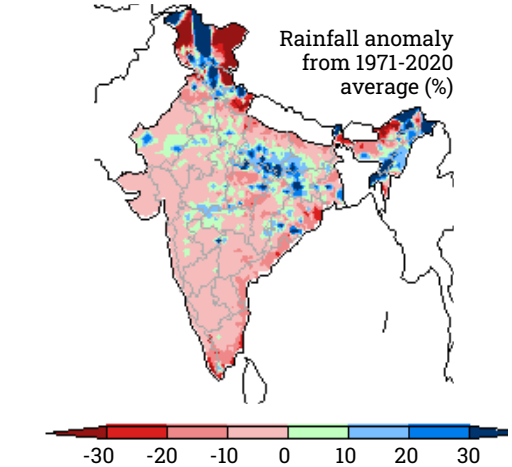
Central India and South Peninsula saw record-high minimum temperatures this February



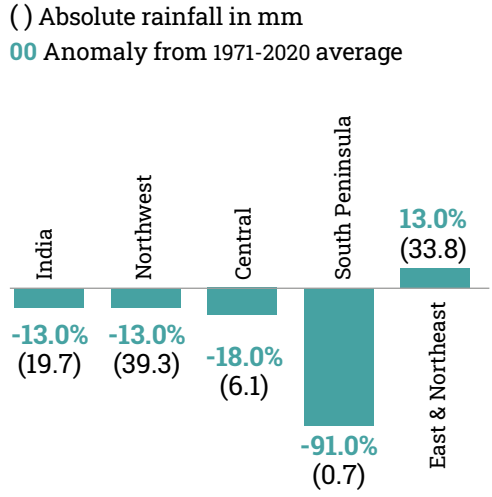
RAINFALL

Overall rainfall in February was 13 per cent below the Long Period Average of 22.7 mm. Only the Eastern and Northeastern region saw above-average rainfall, while other areas recorded deficits. In particular, South Peninsula India received just 0.7 mm of rainfall, marking the 15th lowest February rainfall since 1901.

South Peninsula recorded a rainfall deficit of 91 per cent in February



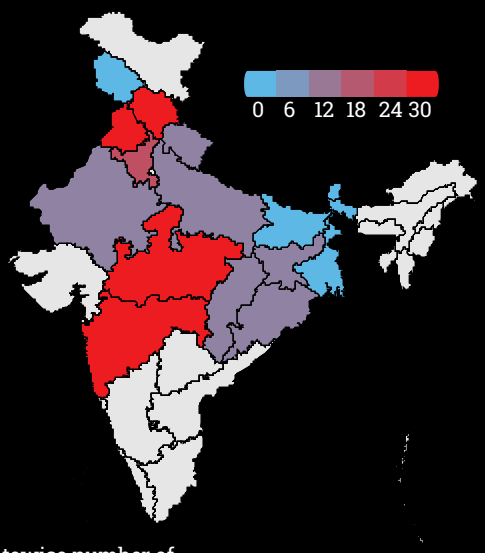
Source: India Meteorological Department, Pune



INDIA 2024
FEBRUARY

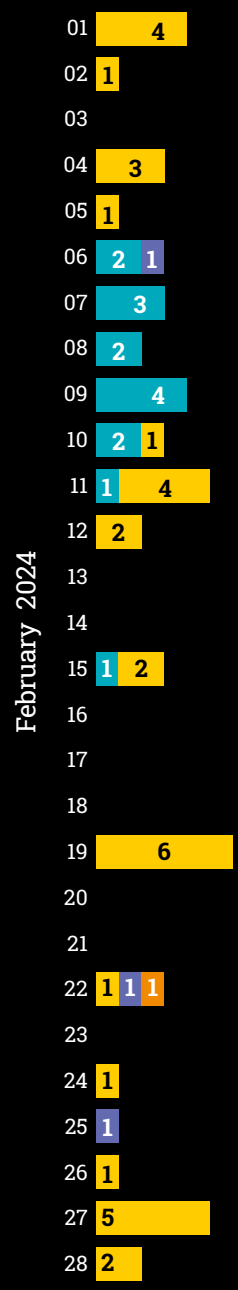
EXTREME WEATHER EVENTS

India experienced extreme weather events on 19 out of the 29 days in February. This was spread across 16 states/UTs. Himachal Pradesh and Madhya Pradesh were the worst hit with extreme weather events on 8 and 7 days in the month, respectively



Statewise number of days with extreme weather events

Bars indicate the number of states/UTs that experienced extreme weather events each day



LOSS AND DAMAGE

9
people died due to extreme events. Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Maharashtra (2 deaths each) and Jharkhand (1)

41,910 hectares
of cropped area affected across Maharashtra (30,691 ha) and Haryana (11,219 ha)

Lightning and storm **(14 days)** | Coldwave/ cold day **(7 days)** | Heavy rain, flood and landslide **(3 days)** | Snowfall **(1 day)**

Sources: India Meteorological Department, Pune, Disaster Management Division under the Union Ministry of Home Affairs and media reports

PRE MONSOON

March-May 2024
(92 days)

India experienced extreme weather events on 83 out of the 92 days in the pre-monsoon months of 2024. The events were spread across 34 states/UTs

Lightning and storms were reported on 71 days, heatwaves on 54 days, followed by heavy rains, floods and landslides on 40 days

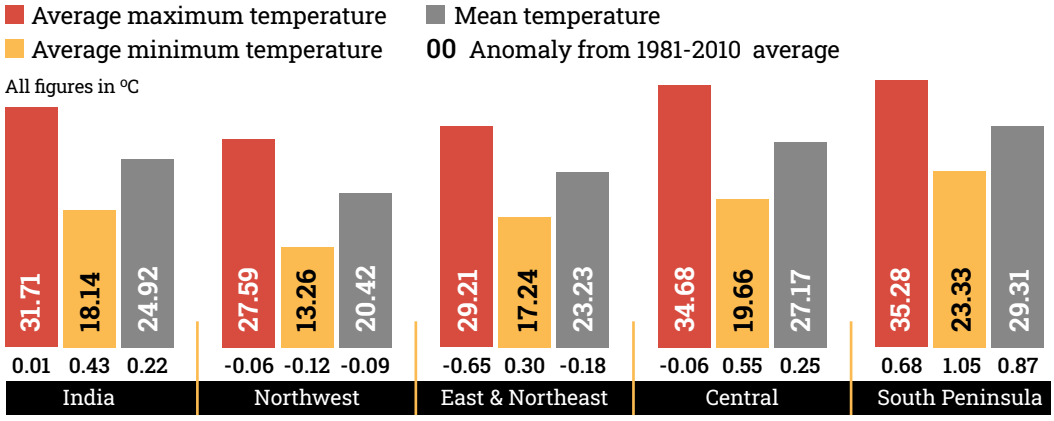
The events claimed 507 human lives and affected crop area across 0.12 million hectares

Madhya Pradesh was the worst hit with extreme weather events on 49 days, followed by Maharashtra (44 days) and West Bengal (33 days)

TEMPERATURE

While India's overall temperatures in March stayed close to normal, the South Peninsula experienced unusual heat, recording its 3rd highest maximum temperature at 35.28°C, 2nd highest minimum at 23.33°C, and 2nd mean temperature at 29.31°C.

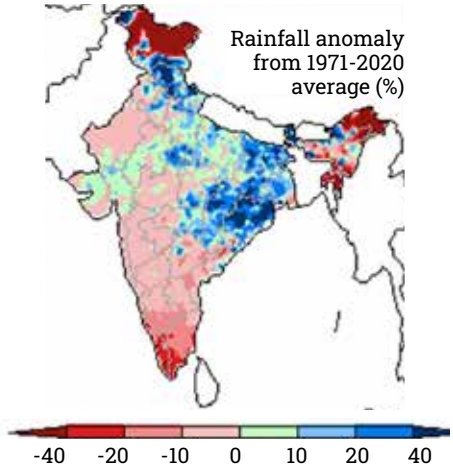
South Peninsula recorded a minimum temperature anomaly of 1.05°C



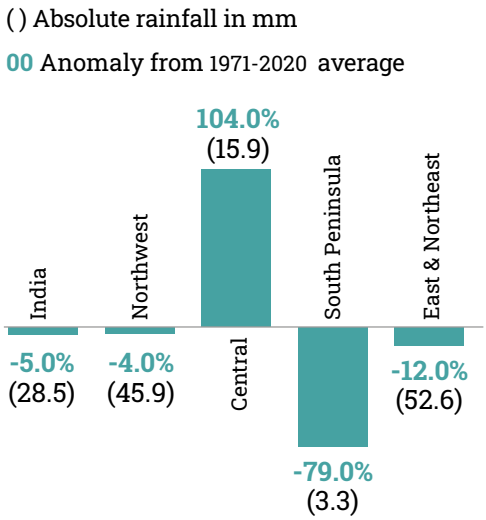
RAINFALL

While India's overall rainfall was slightly below average, the South Peninsula saw a 79 per cent deficit, and Central India recorded a 104 per cent surplus. East and Northeast India, along with the Northwest—regions that typically receive most March rainfall in the country—also recorded minor deficits.

12 sub-divisions received large deficient rainfall and 10 received large excess



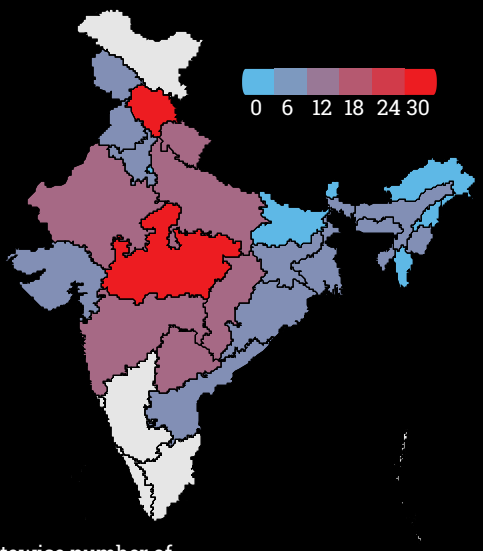
Source: India Meteorological Department, Pune



INDIA 2024
MARCH

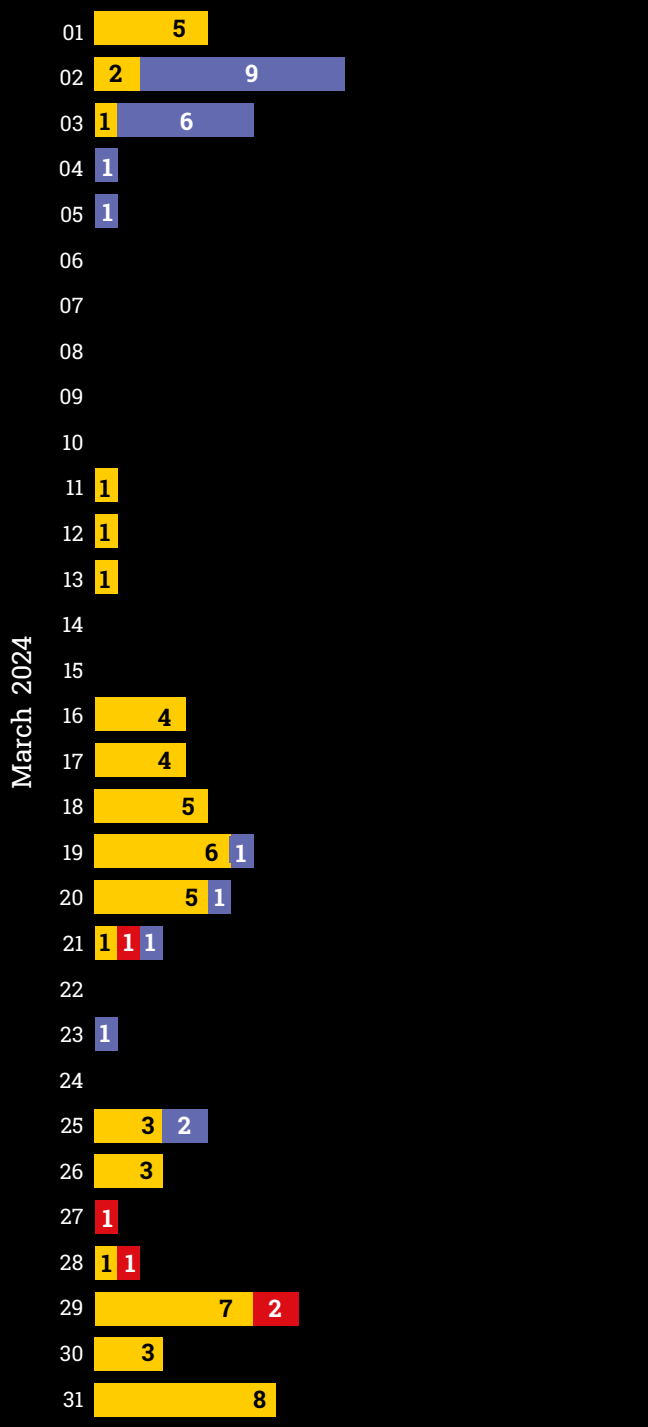
EXTREME WEATHER EVENTS

India experienced extreme weather events on 22 out of the 31 days in March. This was spread across 27 states/UTs. Himachal Pradesh and Uttar Pradesh were the worst hit with extreme weather events on 11 days in the month. Lightning and storms were recorded on 18 days in the month, followed by heavy rains, floods and landslides on 9 days.



Statewise number of days with extreme weather events

Bars indicate the number of states/UTs that experienced extreme weather events each day



LOSS AND DAMAGE

56
people died due to extreme events. Jammu and Kashmir (11), Tripura (10) and Rajasthan (6)

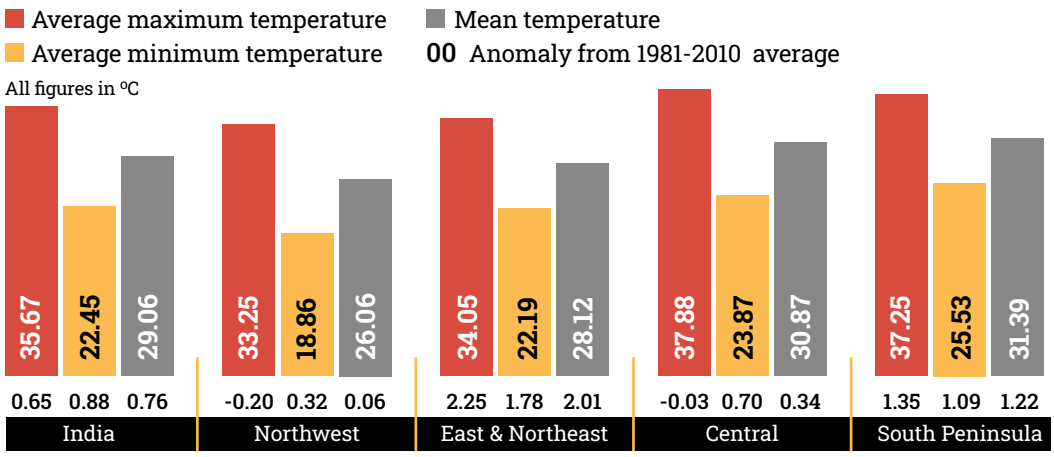
62,969 hectares
of crop area affected. Madhya Pradesh (24,925 ha), Punjab (15,000 ha), Haryana (14,912 ha)

Sources: India Meteorological Department, Pune, Disaster Management Division under the Union Ministry of Home Affairs and media reports

TEMPERATURE

South Peninsula recorded its 2nd highest maximum, minimum and mean temperatures since 1901, while East and Northeast India experienced its highest-ever minimum and mean temperatures.

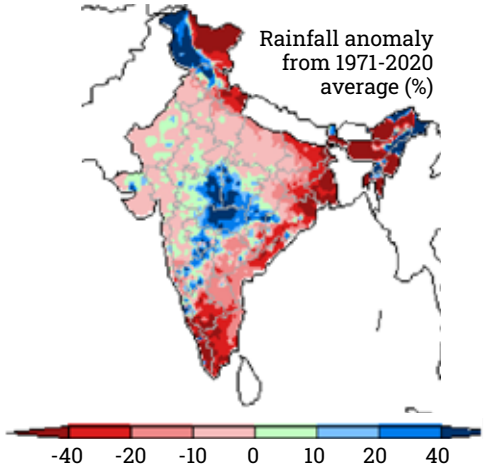
Maximum temperature of East and Northeast India was 2.25°C above the normal

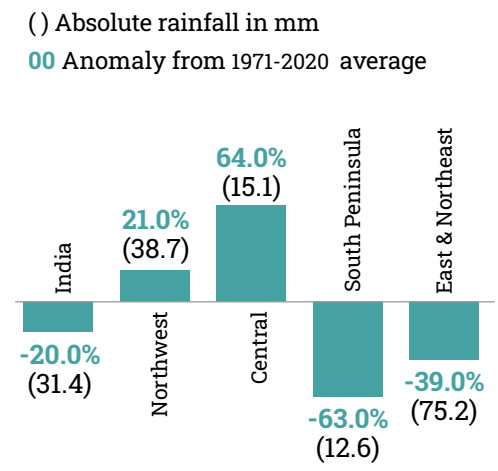


RAINFALL

India received 31.4 mm of rainfall, 20 per cent below the Long Period Average of 39.3 mm. Central and Northwest India recorded surplus rainfall at 64 per cent and 21 per cent, respectively, while the South Peninsula and East and Northeast India faced deficits of 63 per cent and 39 per cent, respectively.

12 sub-divisions received large deficient rainfall and 6 received large excess



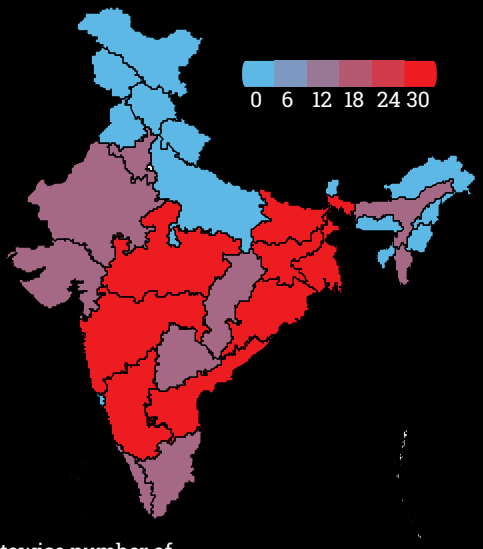


Source: India Meteorological Department, Pune

INDIA 2024
APRIL

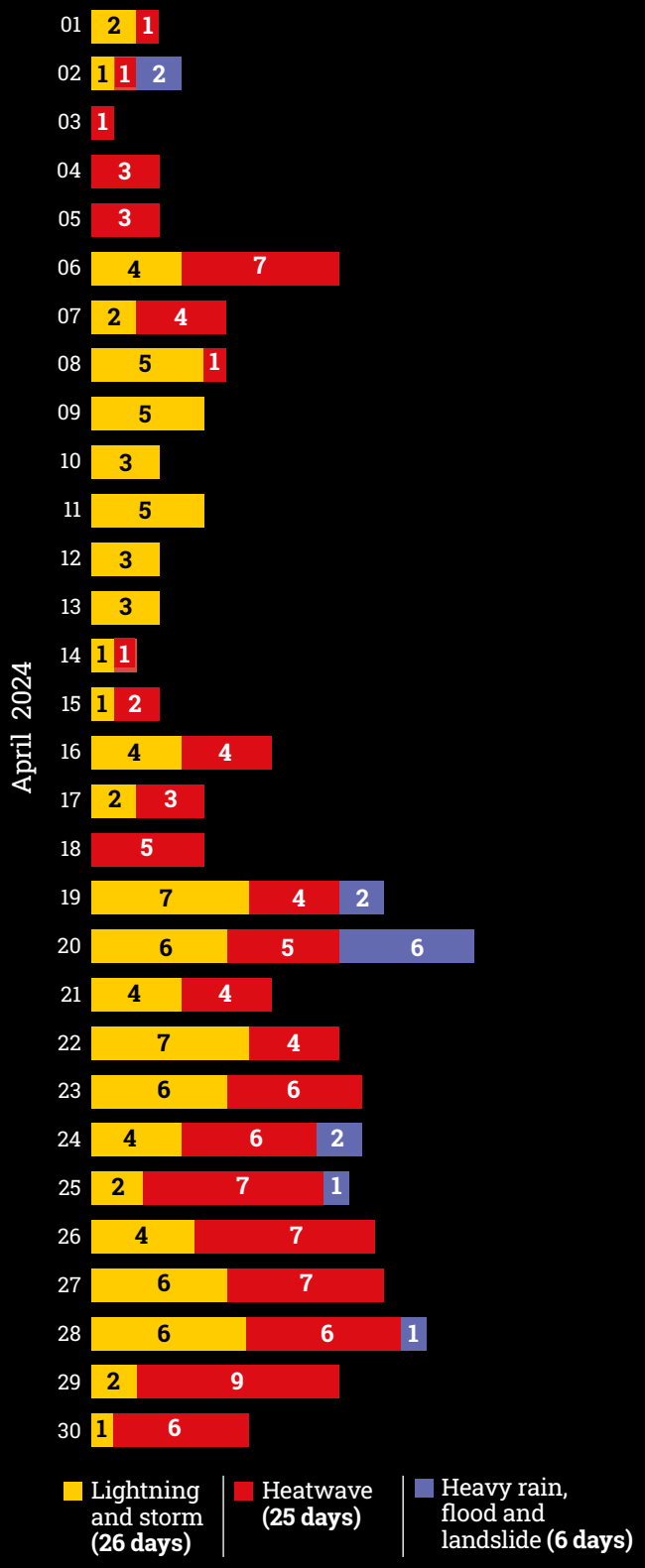
EXTREME WEATHER EVENTS

India experienced extreme weather events on all the 30 days in April. This was spread across 31 states/ UTs. Odisha was the worst hit with extreme weather events on 19 days, followed by West Bengal (18 days), and Karnataka (17 days).



Statewise number of days with extreme weather events

Bars indicate the number of states/UTs that experienced extreme weather events each day



LOSS AND DAMAGE

60
people died due to extreme events. Assam and Odisha (11 deaths each) and Karnataka (6)

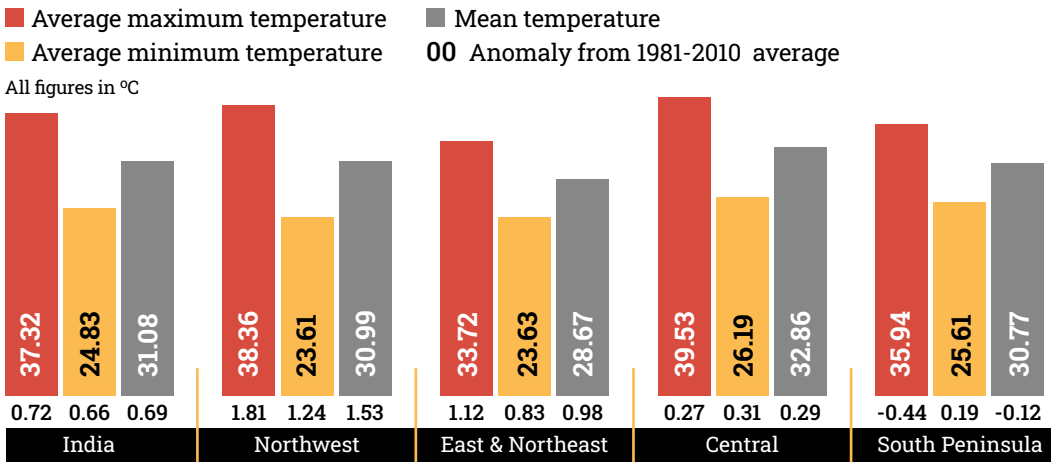
58,336 hectares
of crop area affected. Maharashtra (50,000 ha), Assam (6,546 ha) and West Bengal (900 ha)

Sources: India Meteorological Department, Pune, Disaster Management Division under the Union Ministry of Home Affairs and media reports

TEMPERATURE

In May 2024, India's average maximum, minimum, and mean temperatures were 37.32°C, 24.83°C, and 31.08°C, respectively, exceeding the normal by 0.72°C, 0.66°C, and 0.69°C. Northwest recorded its 3rd maximum since 1901 with an anomaly of 1.81°C.

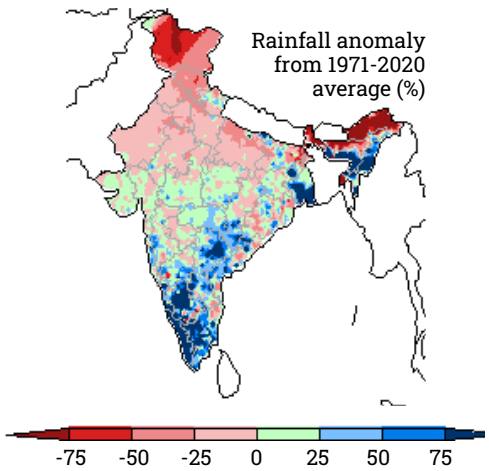
India recorded its fourth-highest mean temperature for May in 2024

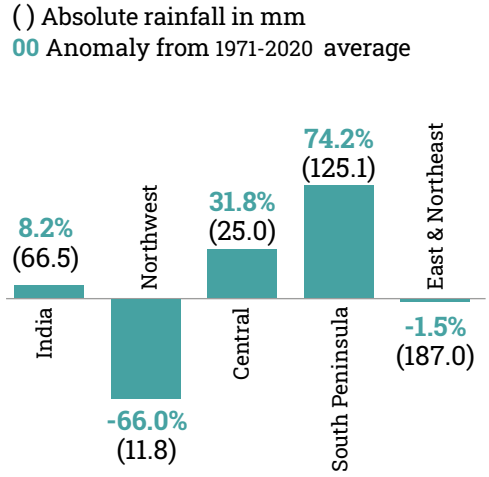


RAINFALL

South Peninsula experienced 74 per cent excess rainfall, and Central India saw a surplus of nearly 32 per cent. In stark contrast, Northwest India remained unusually dry, recording a significant rainfall deficit of 66 per cent.

8 sub-divisions received large deficient rainfall and 11 received large excess



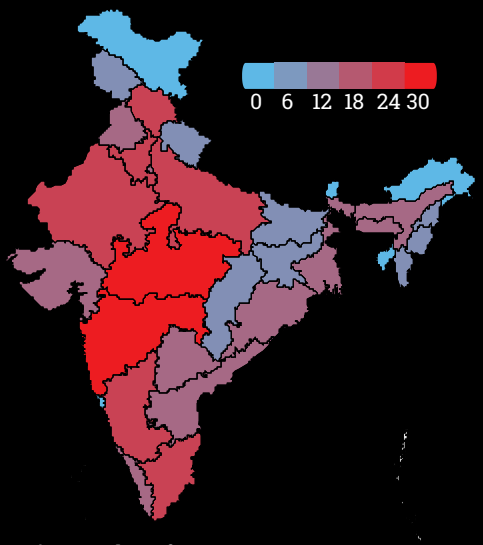


Source: India Meteorological Department, Pune

INDIA 2024
MAY

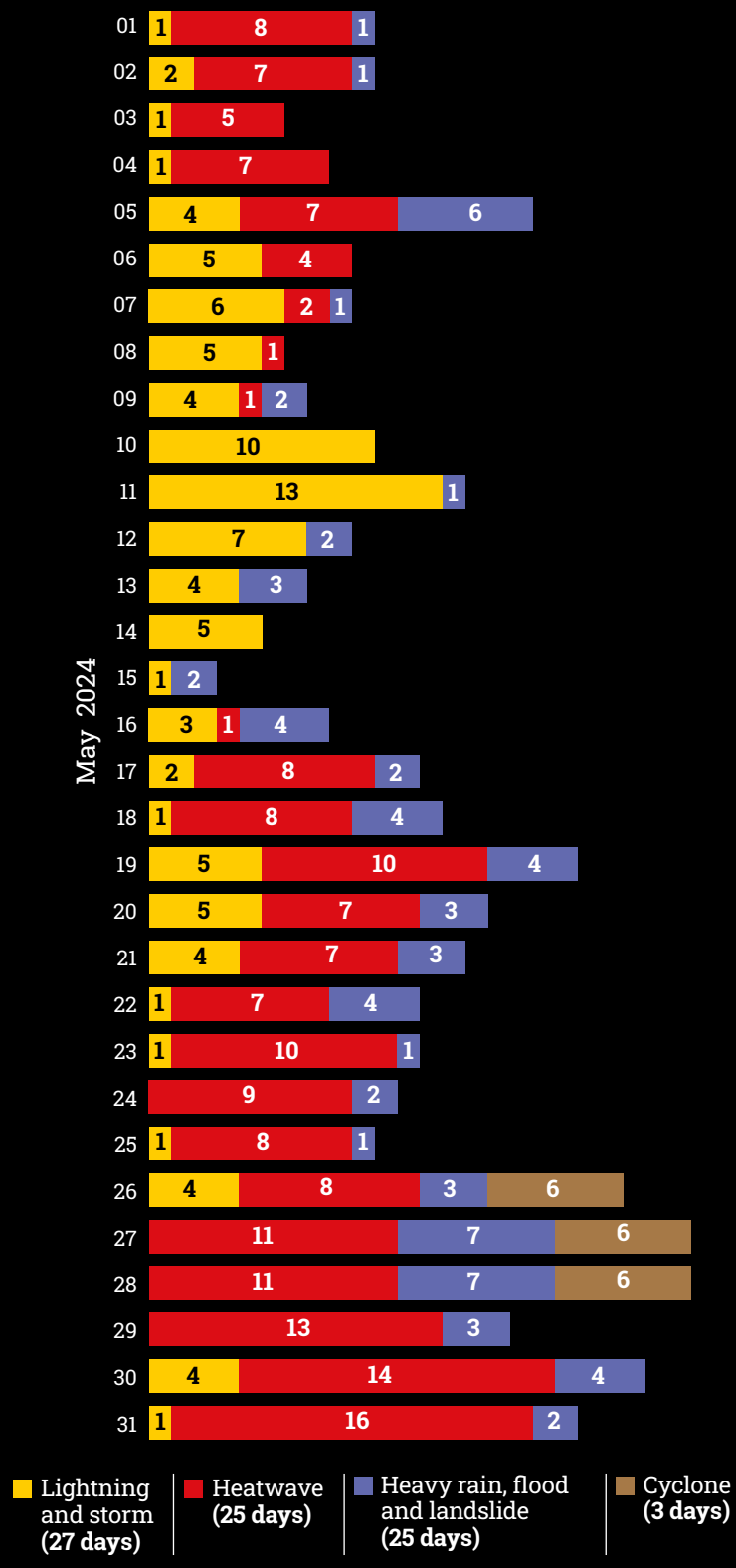
EXTREME WEATHER EVENTS

India experienced extreme weather events on all the 31 days in May. This was spread across 34 states/UTs. Maharashtra was the worst hit with extreme weather events on 25 days, followed by Madhya Pradesh (24 days), and Rajasthan and Tamil Nadu (19 days each).



Statewise number of days with extreme weather events

Bars indicate the number of states/UTs that experienced extreme weather events each day



LOSS AND DAMAGE

391
people died due to extreme events. Bihar and Uttar Pradesh (57 deaths each), Maharashtra (52) and West Bengal (42)

1,708 hectares
of crop area was affected. Tamil Nadu (1,039 ha), Manipur (522 ha), Mizoram (130 ha)

Sources: India Meteorological Department, Pune, Disaster Management Division under the Union Ministry of Home Affairs and media reports

MONSOON

June-September 2024
(122 days)

India experienced extreme weather events on all 122 days in the monsoon months of 2024. The events were spread across 35 states/UTs

Heavy rains, floods and landslides were reported on 122 days, followed by lightning and storms (103 days), heatwaves (23 days), cloudbursts (14 days) and cyclones (4 days)

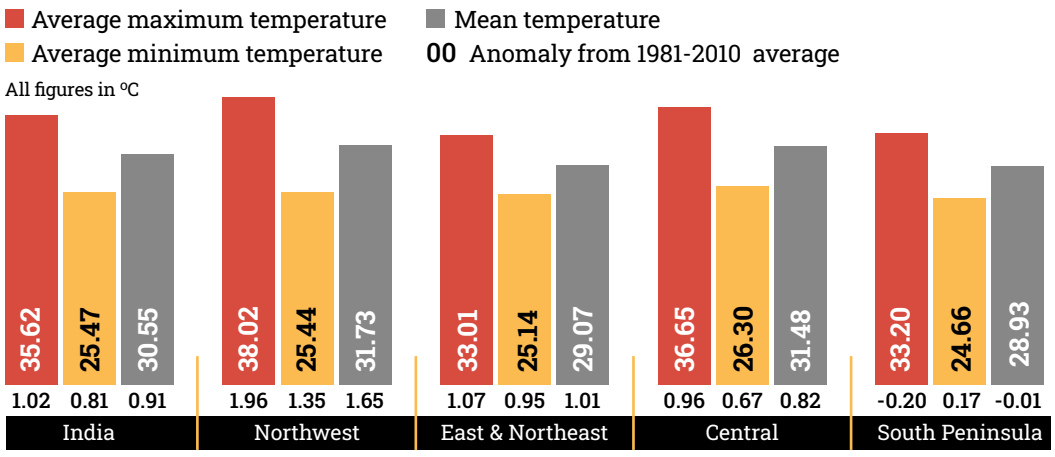
The events claimed 2,716 human lives and affected crop area across 3.04 million hectares

Assam was the worst hit with extreme weather events on 111 days. It was followed by Madhya Pradesh and Uttar Pradesh (105 days each)

TEMPERATURE

In June 2024, India's average maximum, minimum and mean temperatures were 35.62°C, 25.47°C, and 30.55°C, respectively—exceeding the normal by 1.02°C, 0.81°C, and 0.91°C. Northwest India recorded its highest maximum (1.96°C above normal) and mean (1.65°C above normal) temperatures.

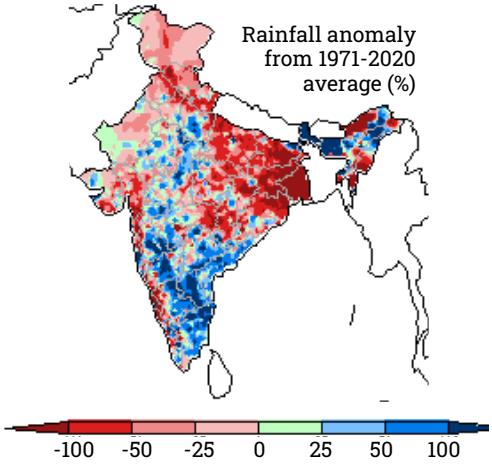
East and Northeast India recorded highest minimum temperature for June

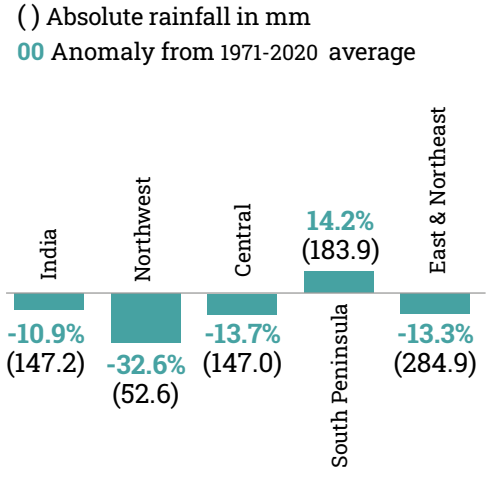


RAINFALL

India's rainfall for June 2024 was 147.2 mm, 11 per cent below the Long Period Average (165.3 mm). The South Peninsula saw a 14.2 per cent surplus, while Central (-13.7 per cent), Northwest (-32.6 per cent), and East and Northeast India (-13.3 per cent) recorded deficits.

This year, India recorded its seventh-lowest May rainfall since 2001





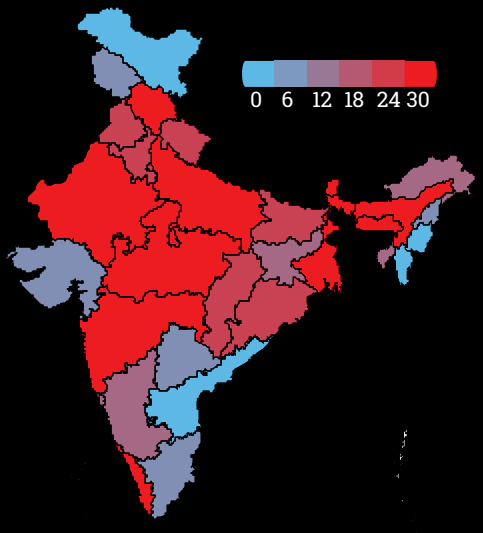
Source: India Meteorological Department, Pune

INDIA 2024

JUNE

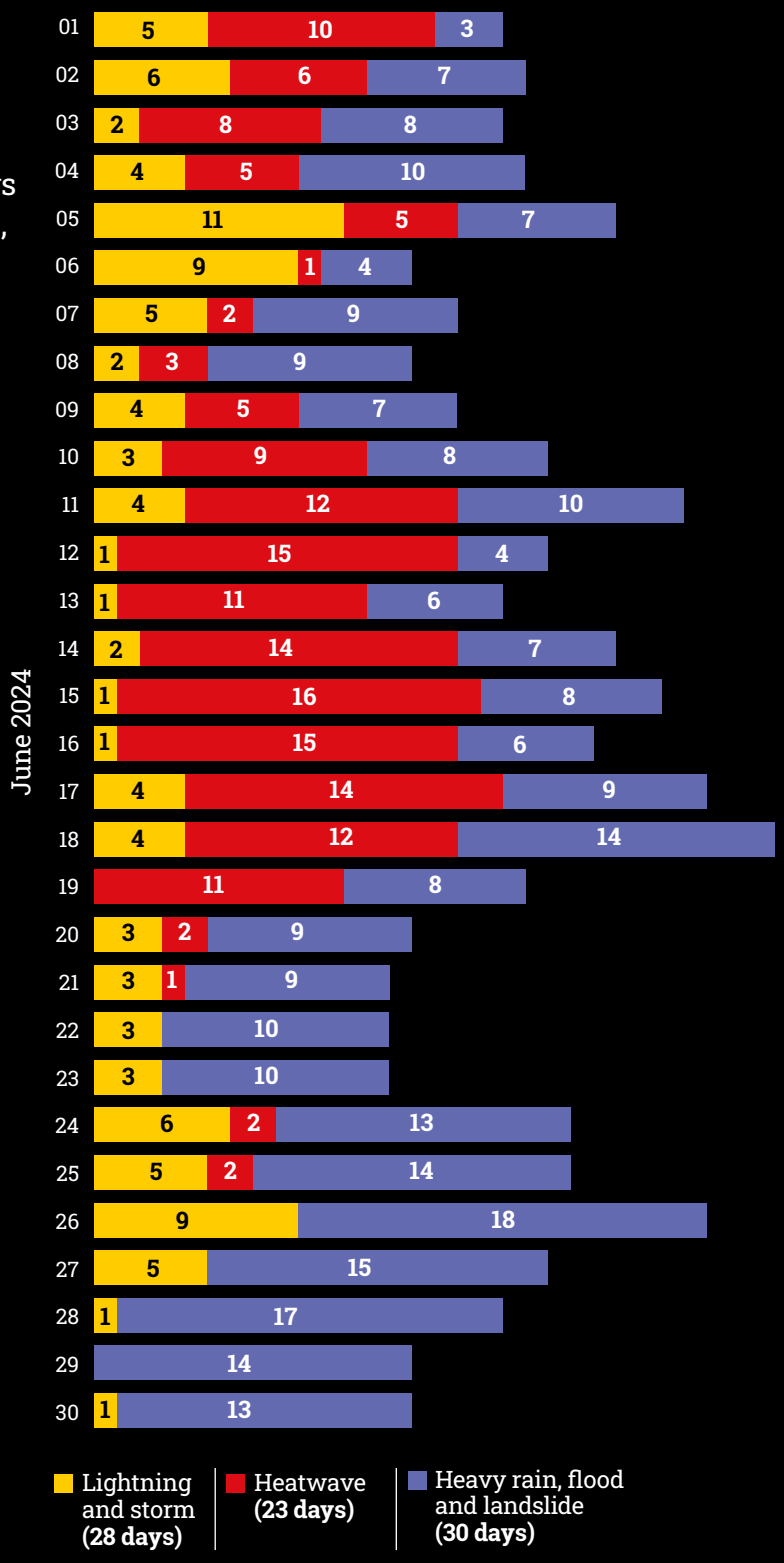
EXTREME WEATHER EVENTS

India experienced extreme weather events on all the 30 days in June. This was spread across 35 states/UTs. Kerala and Uttar Pradesh were the worst hit with extreme weather events on 27 days each, followed by Assam (26 days), and Madhya Pradesh and Sikkim (25 days each).



Statewise number of days with extreme weather events

Bars indicate the number of states/UTs that experienced extreme weather events each day



LOSS AND DAMAGE

424
people died due to extreme events. Madhya Pradesh (67 deaths), Odisha (62) and Uttar Pradesh (38)

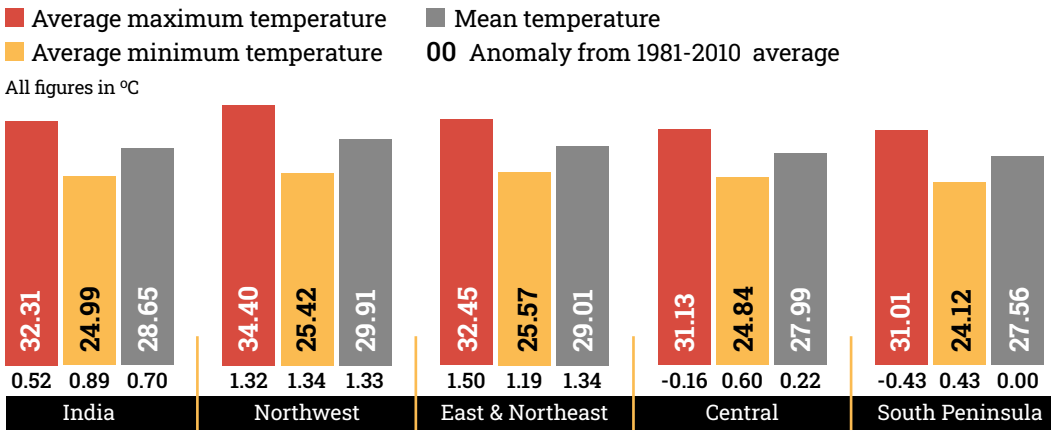
2,273 hectares
of crop area was affected in Assam

Sources: India Meteorological Department, Pune, Disaster Management Division under the Union Ministry of Home Affairs and media reports

TEMPERATURE

In 2024, India recorded its highest minimum temperature and the 2nd highest mean temperature for July, with anomalies of 0.89°C and 0.7°C, respectively. Unusually high minimum temperatures were observed across all four regions of the country.

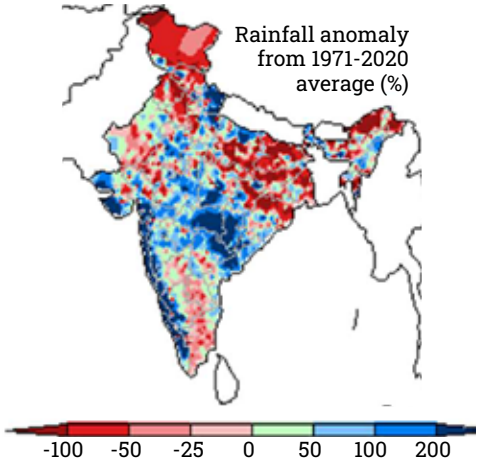
East and Northeast recorded its highest minimum, mean temperatures for July in 123 years

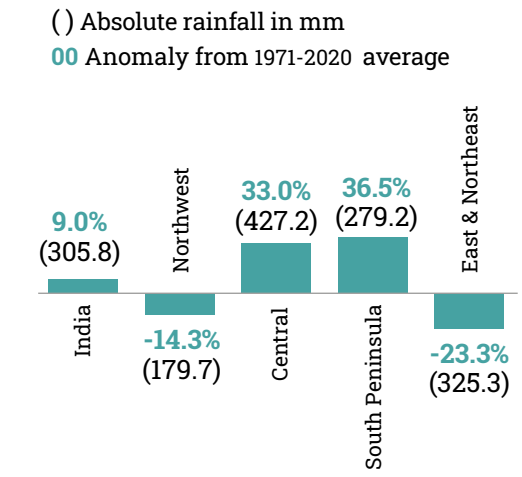


RAINFALL

In July 2024, India recorded total rainfall of 305.8 mm, exceeding the Long Period Average by 9 per cent. Central India and South Peninsula experienced excess rainfall of 33 per cent and 36.5 per cent, respectively. In contrast, Northwest and the East and Northeast regions faced deficits of 14.3 per cent and 23.3 per cent, respectively.

East & Northeast India also recorded its 12th driest July in 123 years





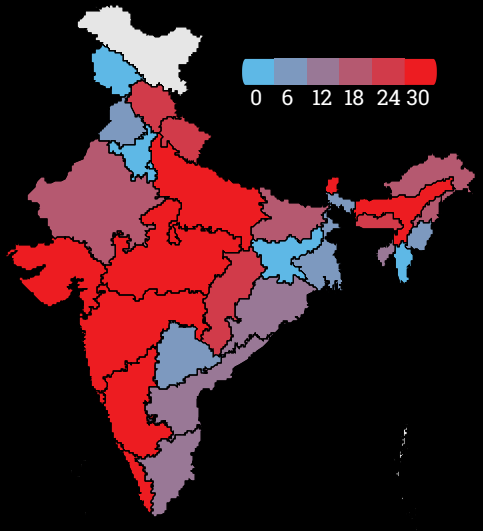
Source: India Meteorological Department, Pune

INDIA 2024

JULY

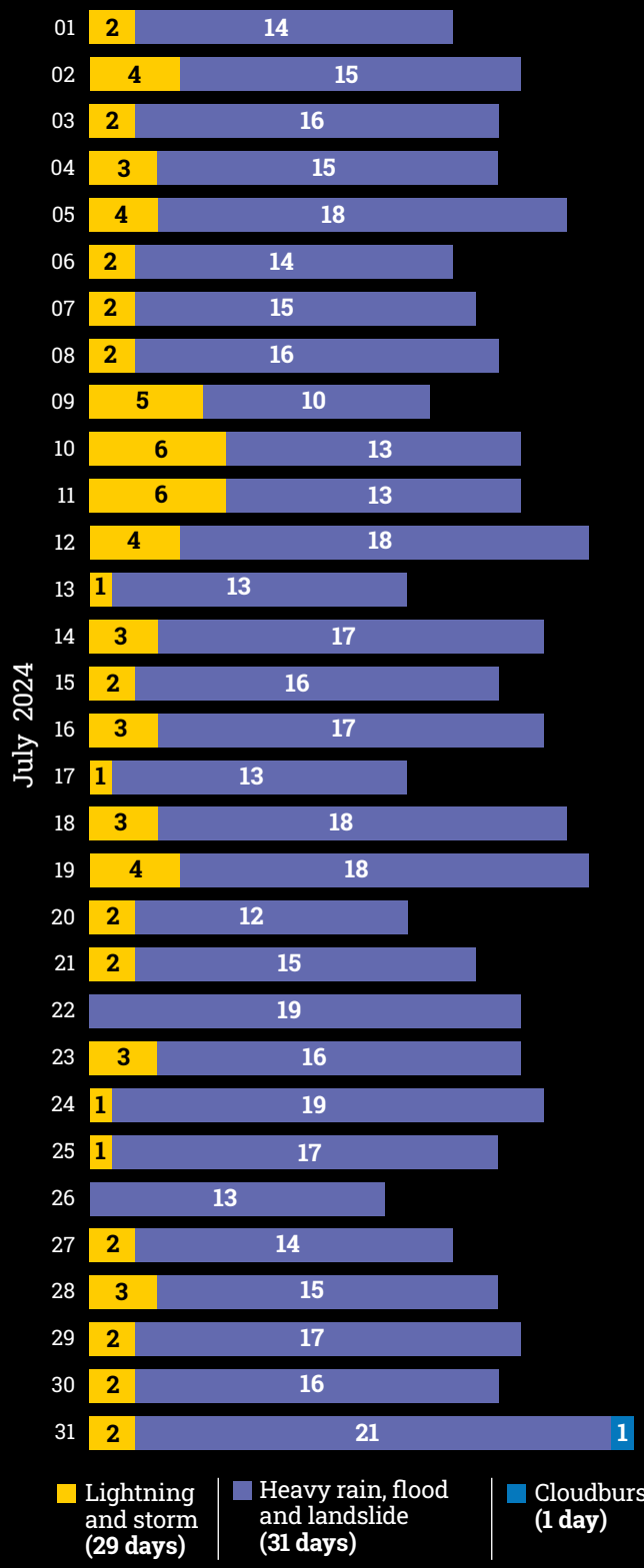
EXTREME WEATHER EVENTS

India experienced extreme weather events on all the 31 days in July. This was spread across 32 states/ UTs. Assam and Uttar Pradesh were the worst hit with extreme weather events on 31 days each, followed by Gujarat (30 days), and Karnataka and Kerala (29 days each).



Statewise number of days with extreme weather events

Bars indicate the number of states/UTs that experienced extreme weather events each day



LOSS AND DAMAGE

1,196
people died due to extreme events. Kerala (447 deaths), Assam (133) and Uttar Pradesh (122)

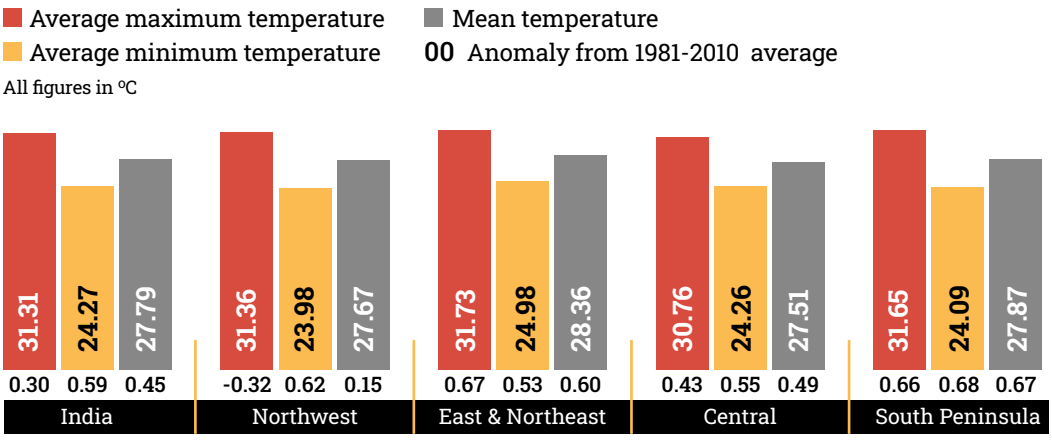
255,821 hectares
of crop area was affected. Gujarat (100,000 ha), Maharashtra (68,000 ha), Assam (39,452 ha)

Sources: The India Meteorological Department, Pune, Disaster Management Division under the Union Ministry of Home Affairs and media reports

TEMPERATURE

India recorded its highest minimum temperature for August. Central India noted its peak minimum temperature, while South Peninsula registered its 2nd highest. East and Northeast, along with Northwest India, saw their 4th highest minimum temperatures.

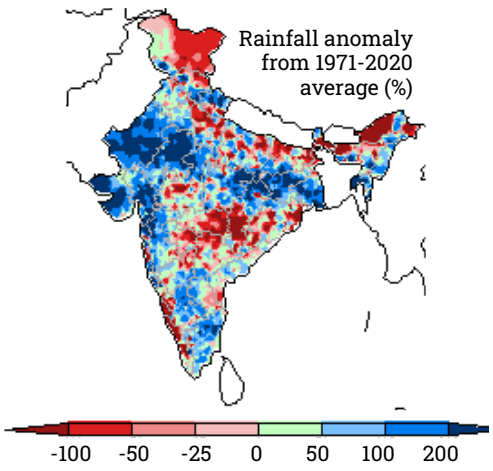
India recorded its fourth-highest mean temperature for August in 2024

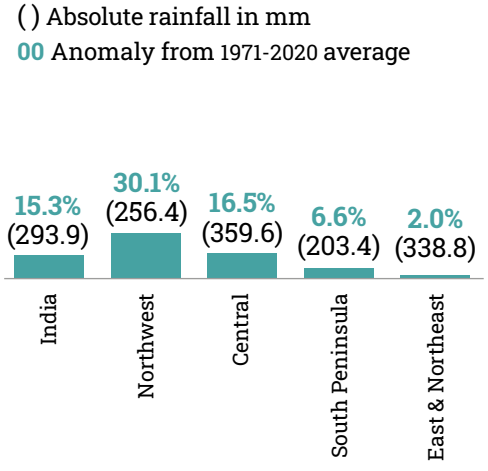


RAINFALL

India experienced a marginally above-normal rainfall in August, with all regions recording some degree of surpluses. Northwest region saw the highest surplus at 30.1 per cent, followed by Central India with a 16.5 per cent increase.

5 sub-divisions received large excess rainfall and 8 received excess



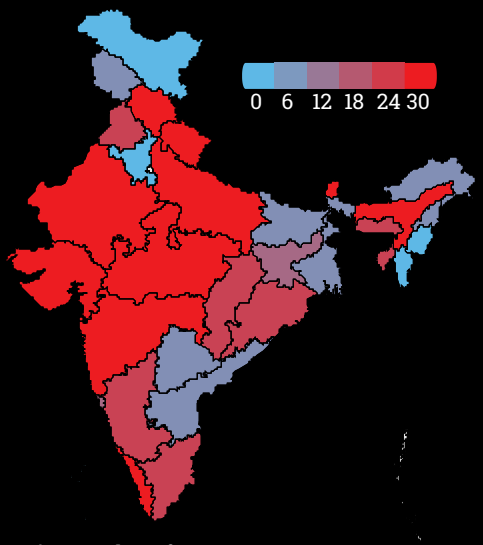


Source: India Meteorological Department, Pune

INDIA 2024
AUGUST

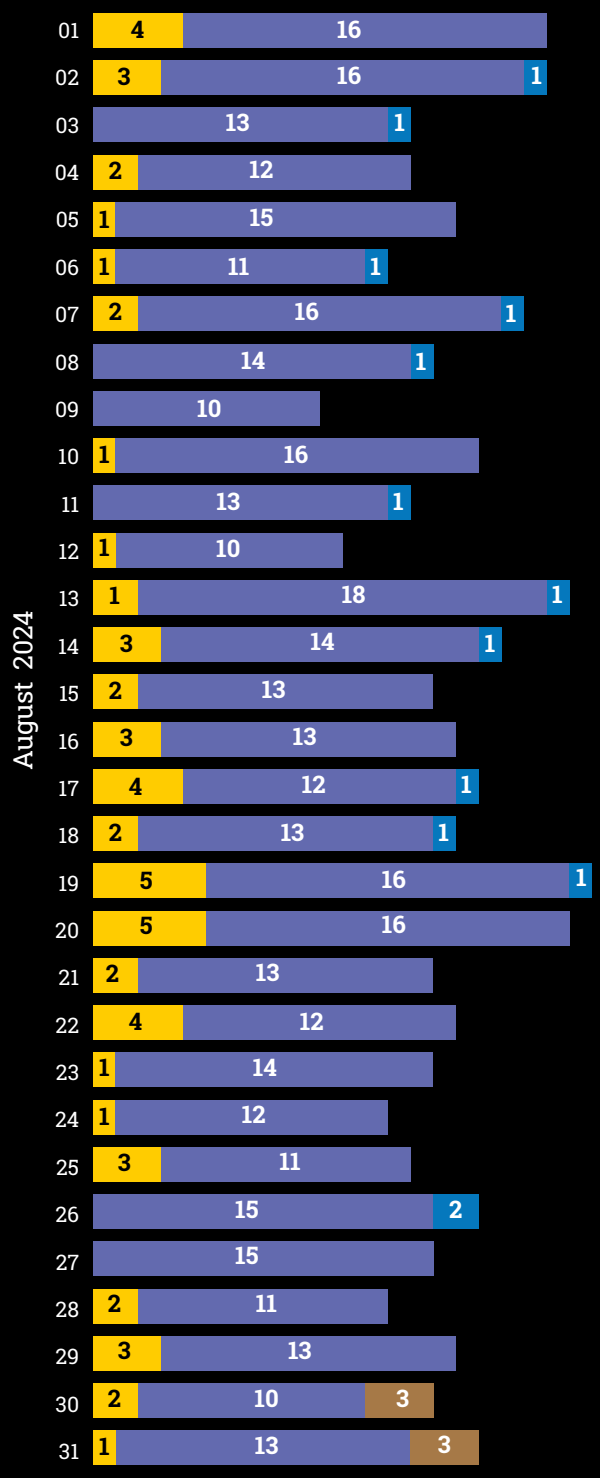
EXTREME WEATHER EVENTS

India experienced extreme weather events on all the 31 days in August. This was spread across 33 states/UTs. Assam was the worst hit with extreme weather events on 29 days, followed by Madhya Pradesh and Kerala (27 days each).



Statewise number of days with extreme weather events

Bars indicate the number of states/UTs that experienced extreme weather events each day



LOSS AND DAMAGE

624
people died due to extreme events. Himachal Pradesh (78 deaths), Gujarat (71) and Madhya Pradesh (65)

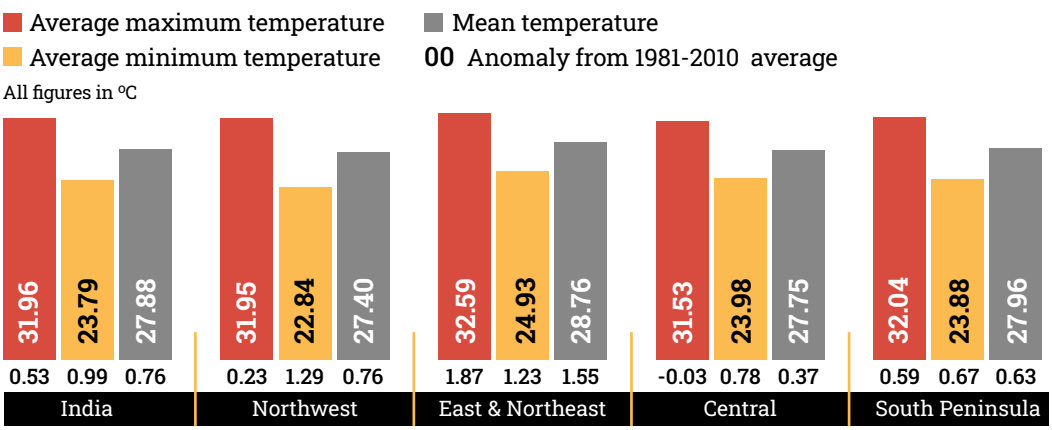
219,971 hectares
of crop area was affected. Tripura (103,000 ha), Karnataka (80,973 ha), Telangana (32,203 ha)

Sources: India Meteorological Department, Pune, Disaster Management Division under the Union Ministry of Home Affairs and media reports

TEMPERATURE

September was warmer than usual, with India recording its highest-ever average minimum temperature for the month. The mean temperature was also the 2nd highest on record.

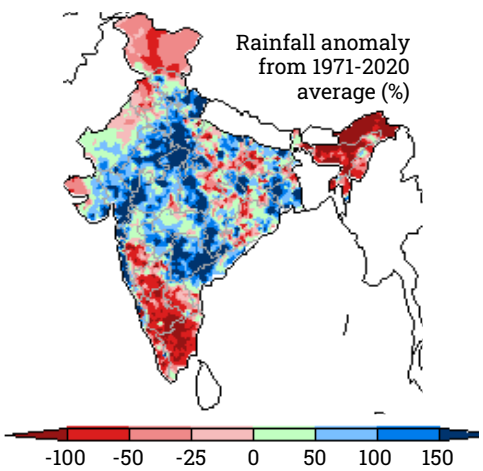
East & Northeast India recorded its hottest-ever September

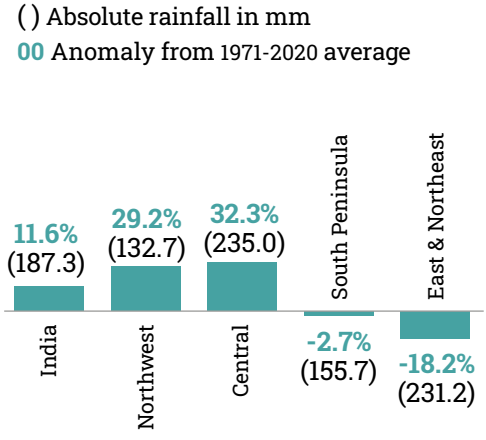


RAINFALL

India experienced a near-normal rain this September (187.3 mm). Central and Northwest India experienced 32.3 and 29.2 per cent surplus rainfall respectively. In contrast, East & Northeast India recorded a 18.2 per cent deficit rainfall.

India received a 11.6 per cent surplus rainfall this September



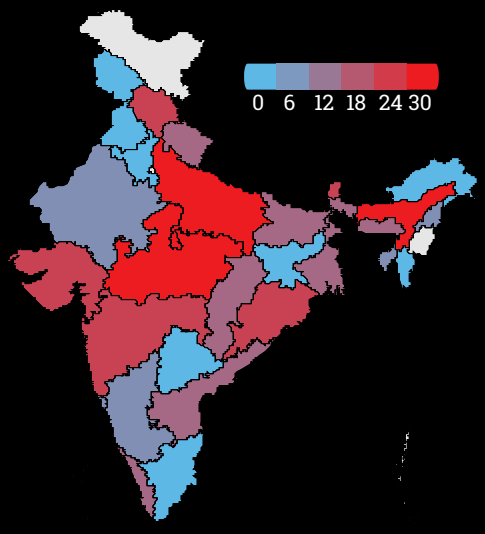


Source: India Meteorological Department, Pune

INDIA 2024
SEPTEMBER

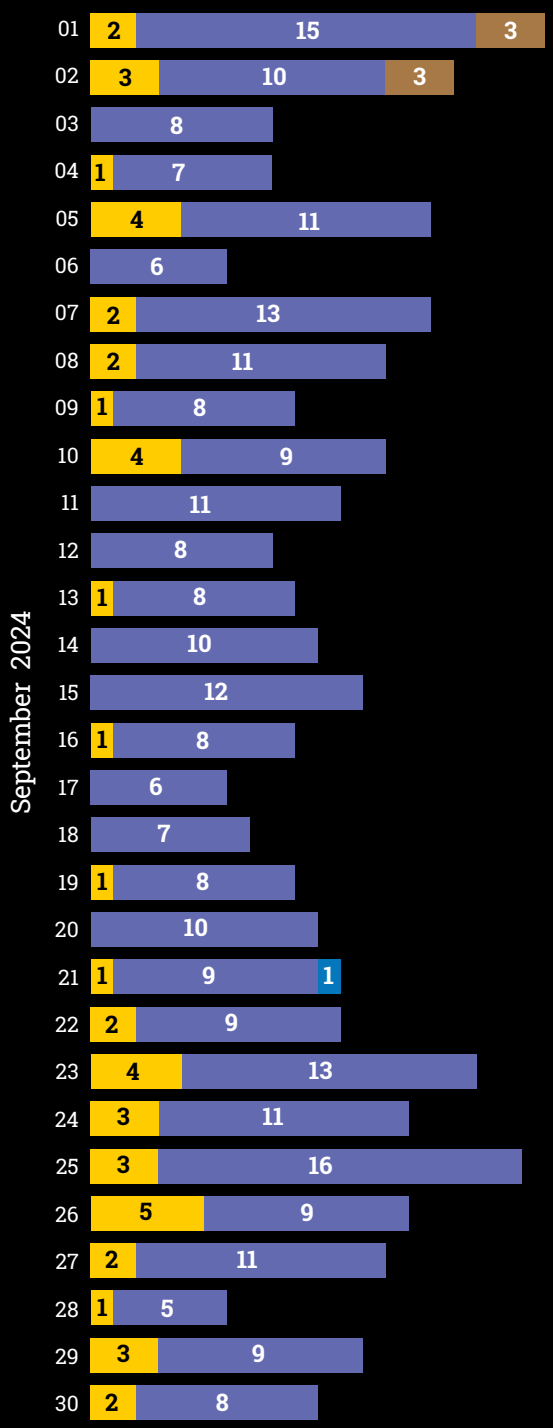
EXTREME WEATHER EVENTS

India experienced extreme weather events on all 30 days in September. This was spread across 30 states/ UTs. Madhya Pradesh was the worst hit with extreme weather events on 26 days, followed by Assam (25 days) and Uttar Pradesh (24 days).



Statewise number of days with extreme weather events

Bars indicate the number of states/UTs that experienced extreme weather events each day



LOSS AND DAMAGE

472
people died due to extreme events. Madhya Pradesh (104 deaths), Bihar and Gujarat (50 each) and Himachal Pradesh (35)

2,558,088
hectares
of crop area was affected. Maharashtra (1,800,000 ha), Bihar (300,000 ha) and Andhra Pradesh (225,686 ha)

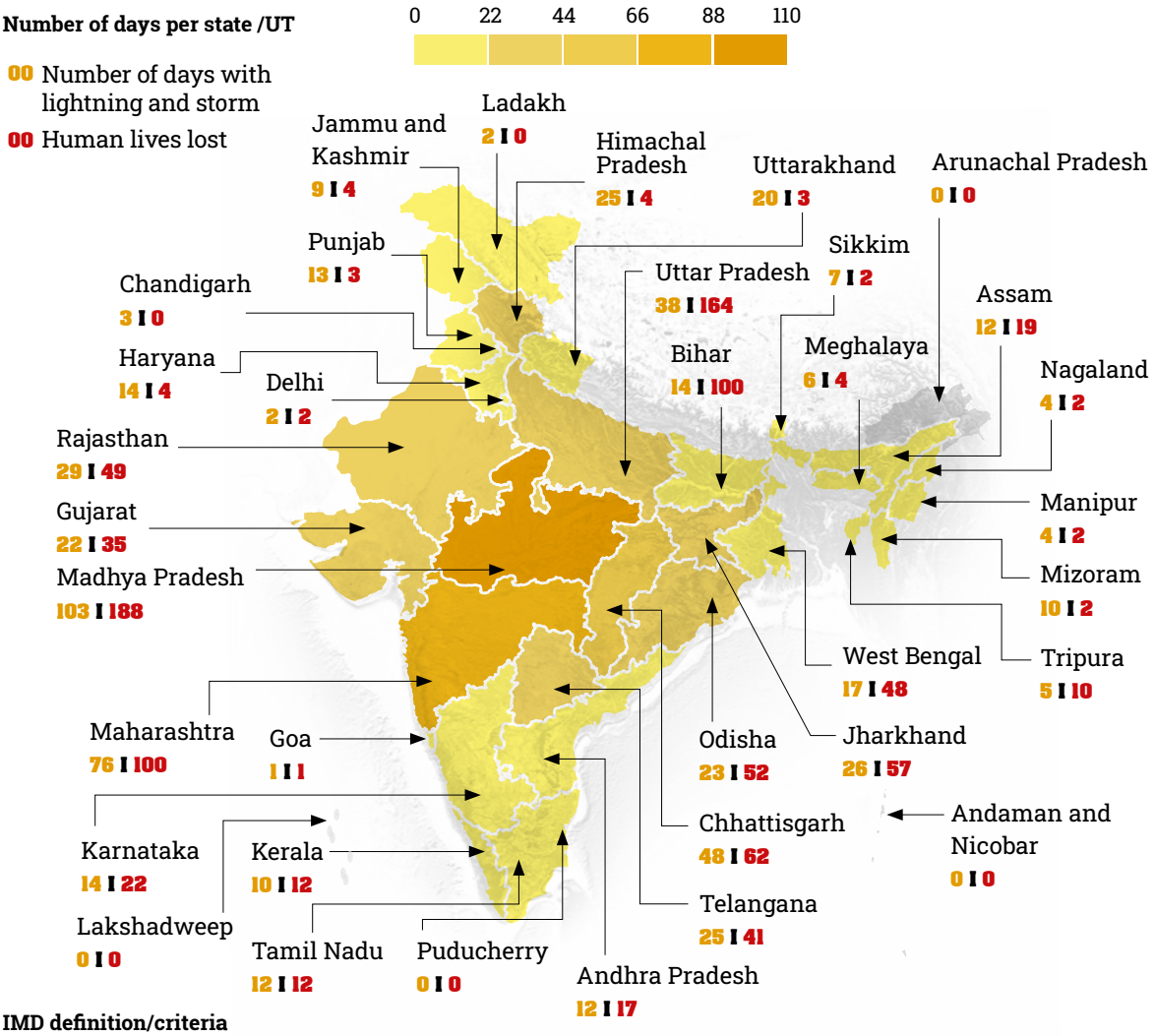
Sources: India Meteorological Department, Pune, Disaster Management Division under the Union Ministry of Home Affairs and media reports

EXTREME WEATHER EVENTS

DISASTER-WISE

LIGHTNING AND STORM

On 191 of 274 days, India experienced lightning and storms. They claimed 1,021 lives



IMD definition/criteria

Lightning is an electrical discharge caused by imbalances between storm clouds and the ground or within the clouds themselves. Storm includes duststorms (caused by thunderstorms or strong pressure gradients associated with cyclones which increase wind speed over a wide area), hailstorms (an outgrowth of a severe thunderstorm in which balls or irregularly shaped lumps of ice fall with the rain), thunderstorms and gales (a very strong wind).

FREQUENCY TRACKER

Number of days lightning and storm were recorded in India

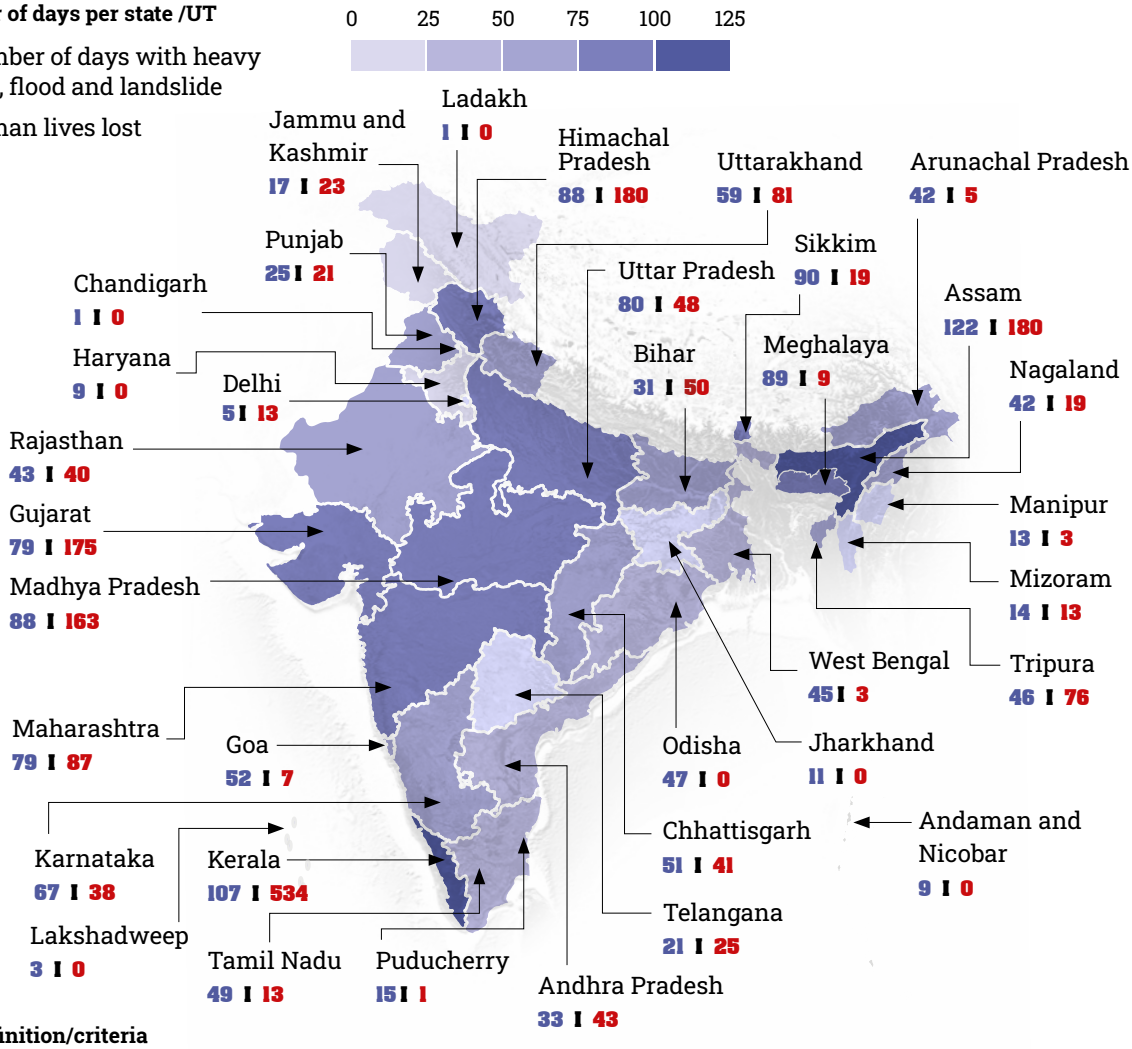
HEAVY RAIN, FLOOD AND LANDSLIDE

On 167 of 274 days, India experienced the extreme weather event. They claimed 1,910 lives

Number of days per state /UT

00 Number of days with heavy rain, flood and landslide

00 Human lives lost

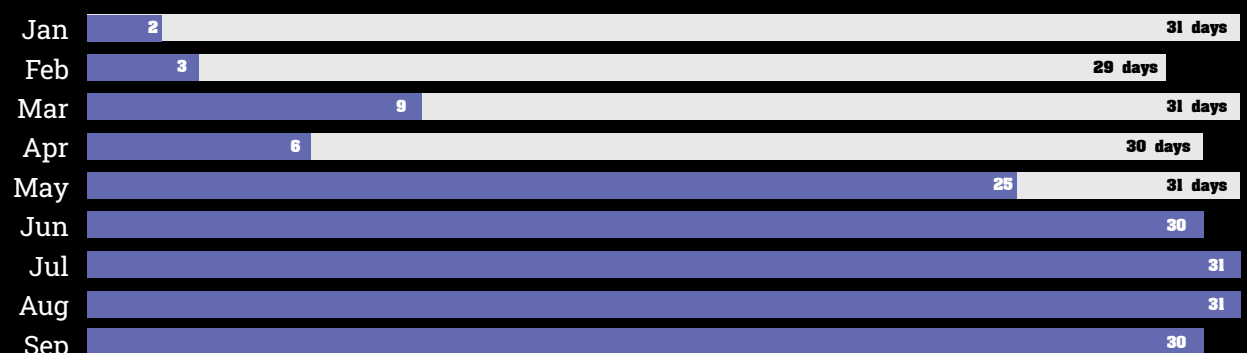


IMD definition/criteria

Heavy rainfall happens when a region receives 64.5-115.5 mm rain in 24 hours. In the case of very heavy rainfall, the threshold increases to 115.6-204.4 mm and in extremely heavy rainfall it is 204.5 mm or more. The report has considered all very heavy and extremely heavy rainfall events, and heavy rainfall events only when they have caused damages.

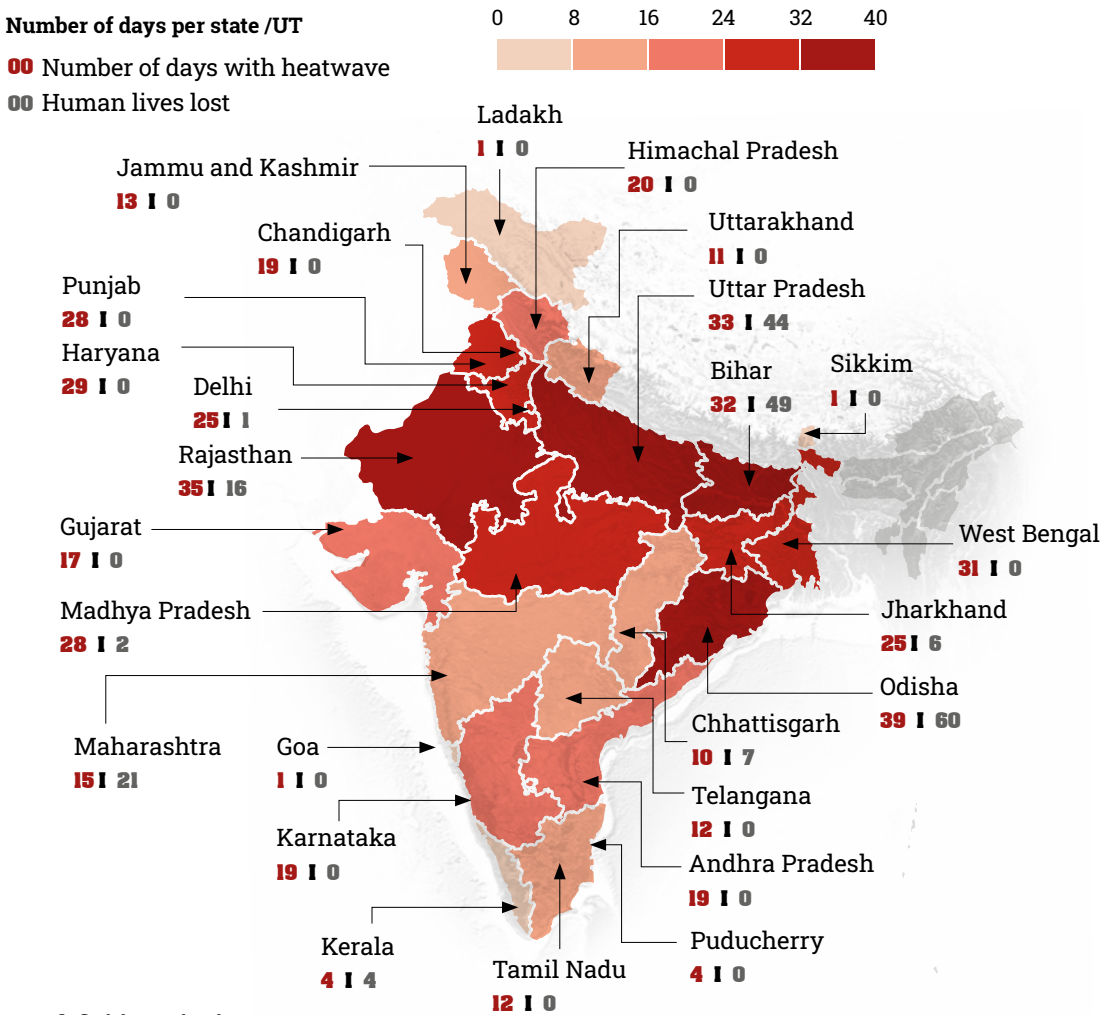
FREQUENCY TRACKER

Number of days heavy rain, flood and landslide were recorded in India



HEATWAVE

On 77 of 274 days, India experienced heatwaves. They claimed 210 lives

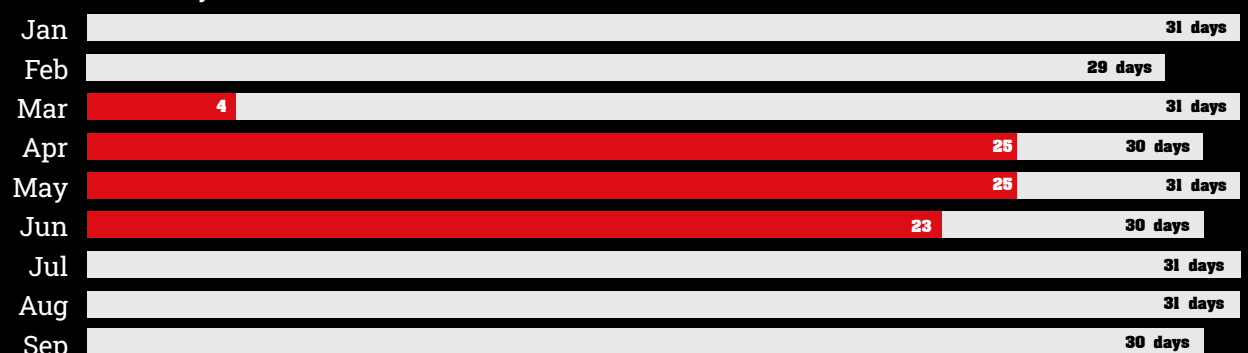


IMD definition/criteria

Heatwave conditions signify a certain amount of rise in temperature at a given place with respect to normal climatological value. The report has considered heatwaves (4.5°C to 6.4°C departure of the maximum temperature from normal), and severe heatwaves (departure of more than 6.4°C).

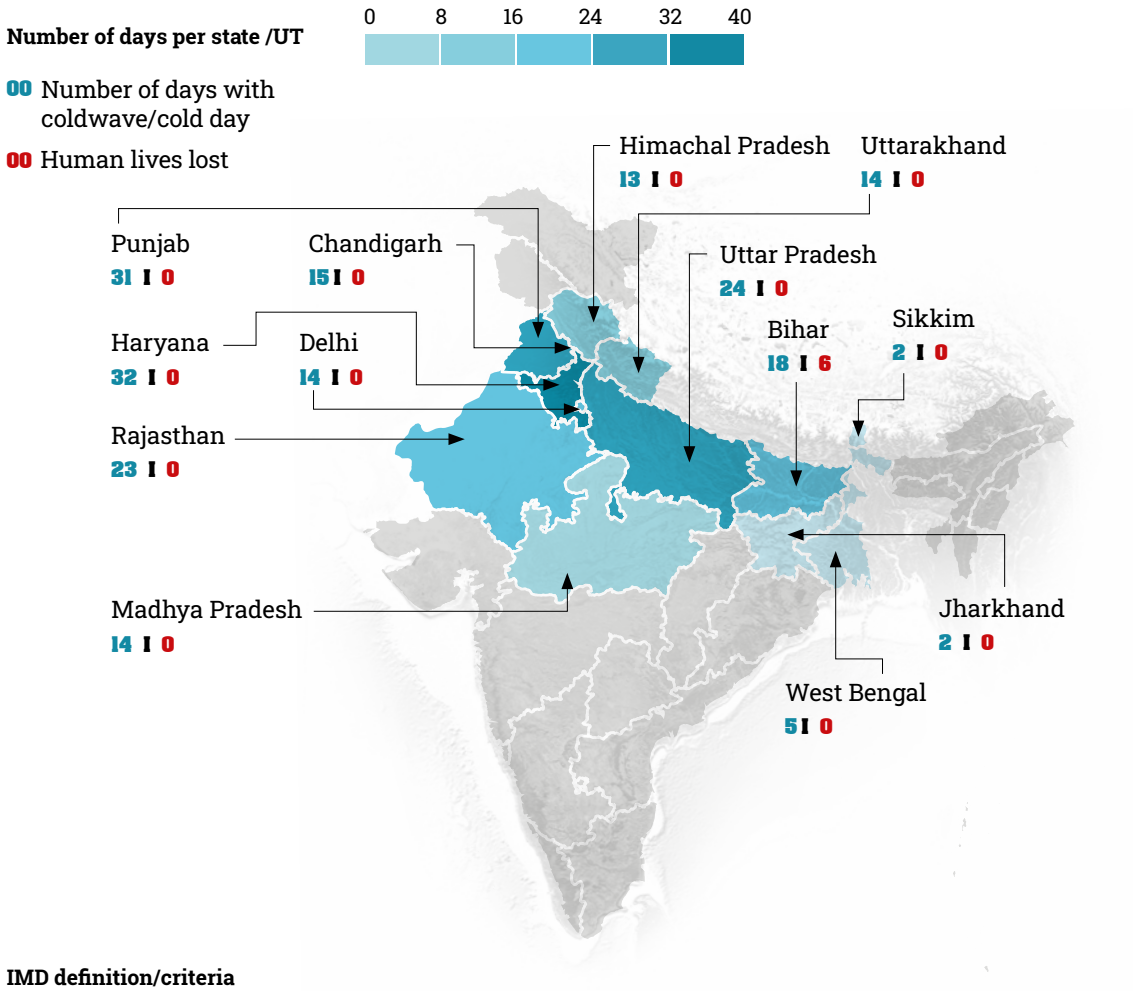
FREQUENCY TRACKER

Number of days heatwave were recorded in India



COLDWAVE/COLD DAY

On 38 of 274 days, India experienced coldwave/cold days. They claimed 6 lives



IMD definition/criteria

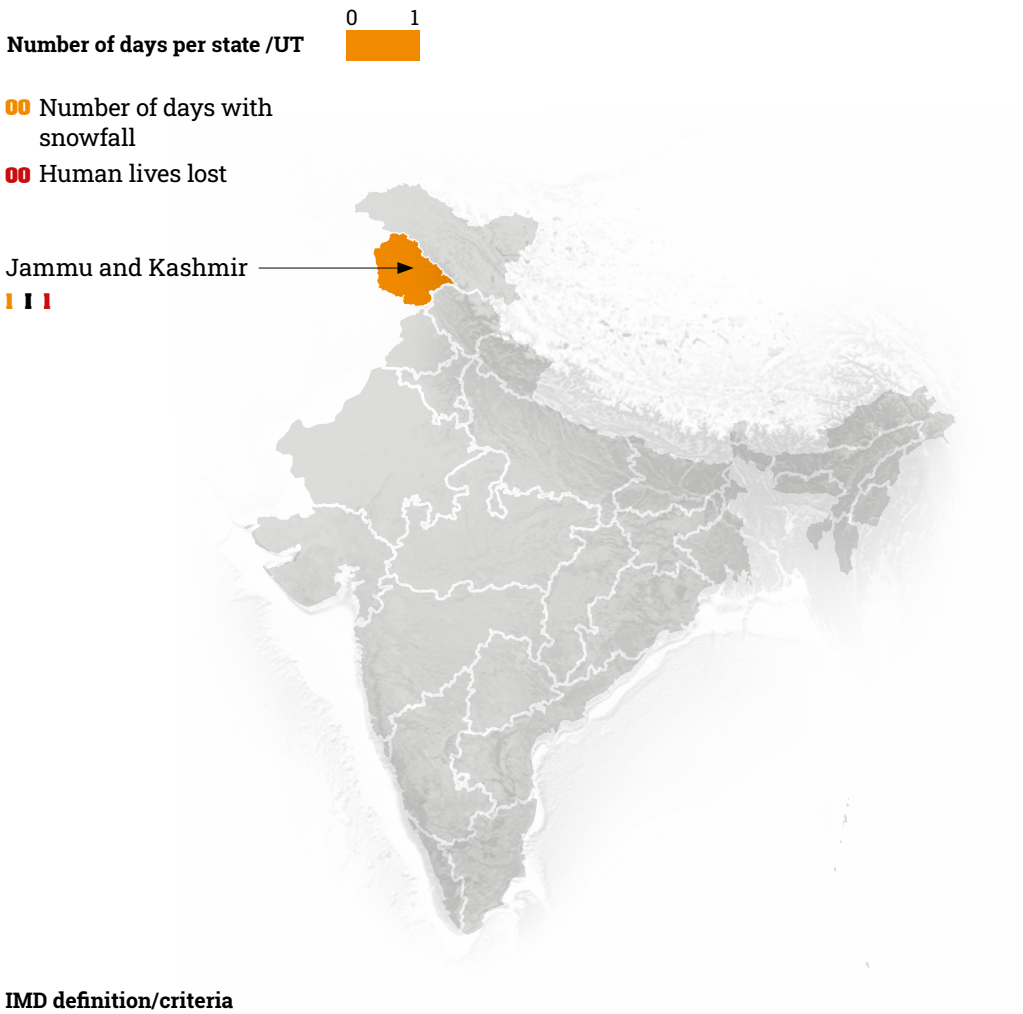
Cold day conditions occur when the maximum temperature drops by 4.5°C to 6.4°C than average. If the deviation is more than 6.4°C, then it is considered severe cold day. Coldwave conditions occur when the minimum temperature drops by 4.5°C to 6.4°C than normal. Similarly, severe coldwave occurs when the minimum temperature drops by more than 6.4°C than normal. The report has considered all the four categories.

FREQUENCY TRACKER

Number of days with coldwave/cold day

SNOWFALL

On 1 of 274 days, India experienced snowfall. It caused 1 human death

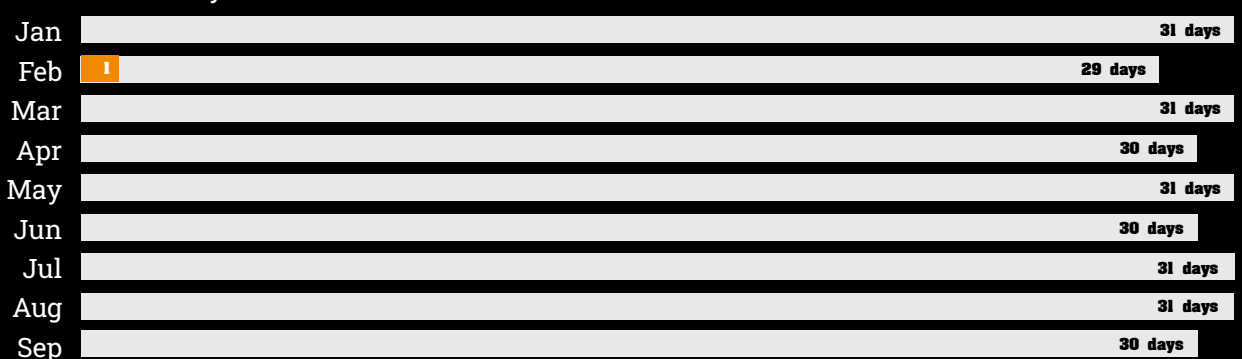


IMD definition/criteria

Snowfall is a hydrological hazard where a large amount of snow can affect transport, crops and people. Annual Disaster Weather Report by IMD reports the snowfall cases over India that caused human deaths. The report has also considered only those snowfall events that caused human deaths.

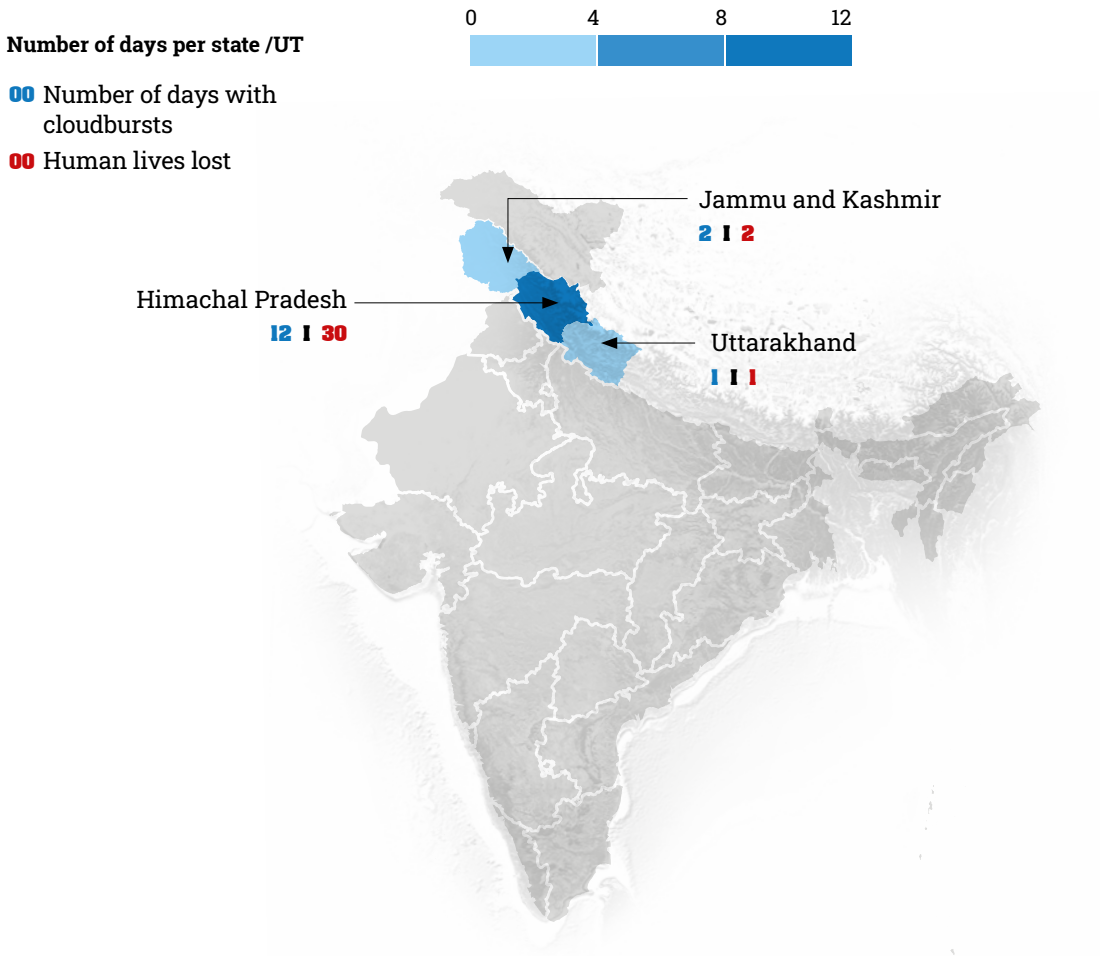
FREQUENCY TRACKER

Number of days with snowfall



CLOUDBURST

On 14 of 274 days, India experienced cloudbursts. They claimed 33 lives



IMD definition/criteria

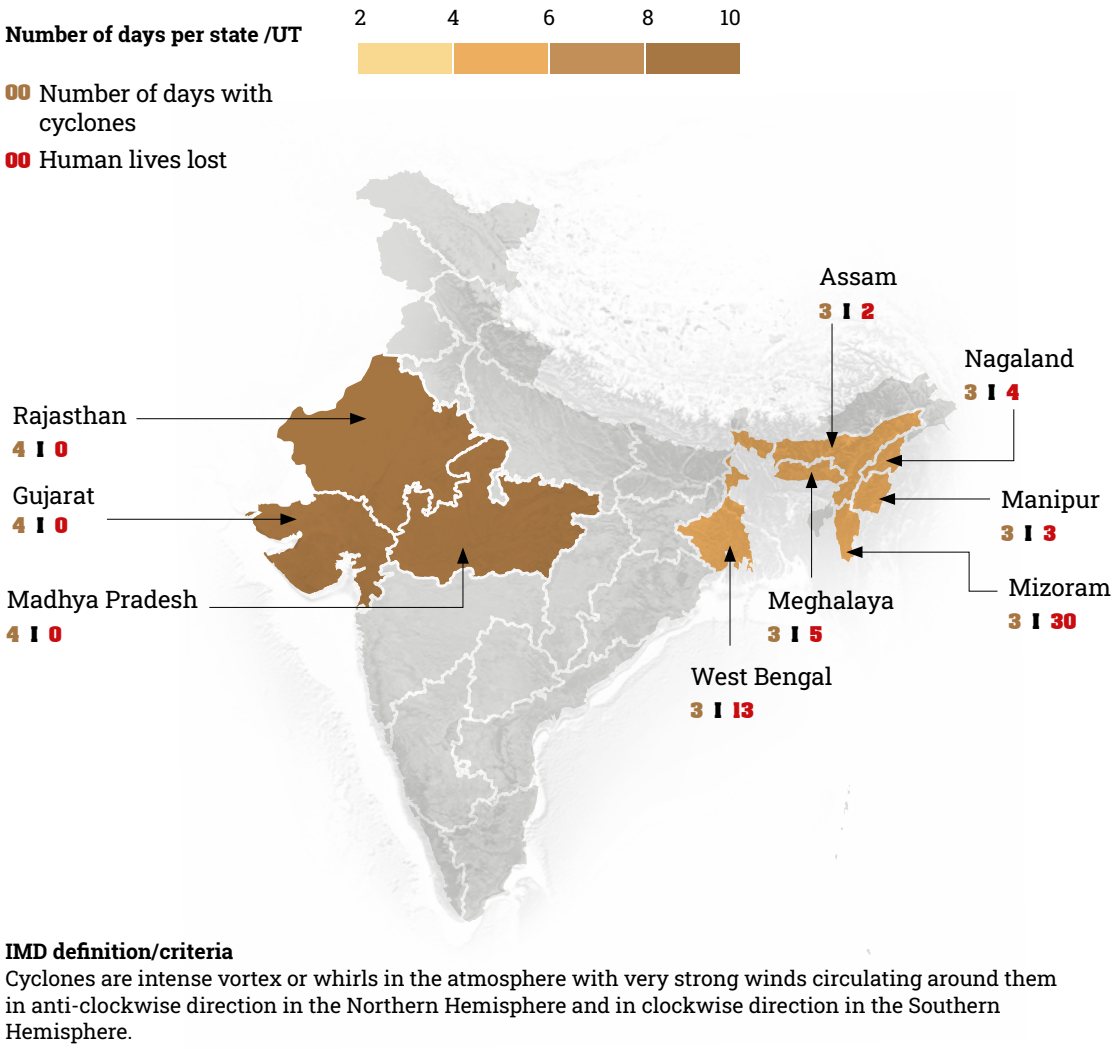
Cloudburst is very heavy rainfall (100 mm per hour) over a localised area. It is accompanied with strong winds and lightning.

FREQUENCY TRACKER

Number of days with cloudburst

CYCLONE

On 7 of 274 days, India experienced cyclones. They claimed 57 lives

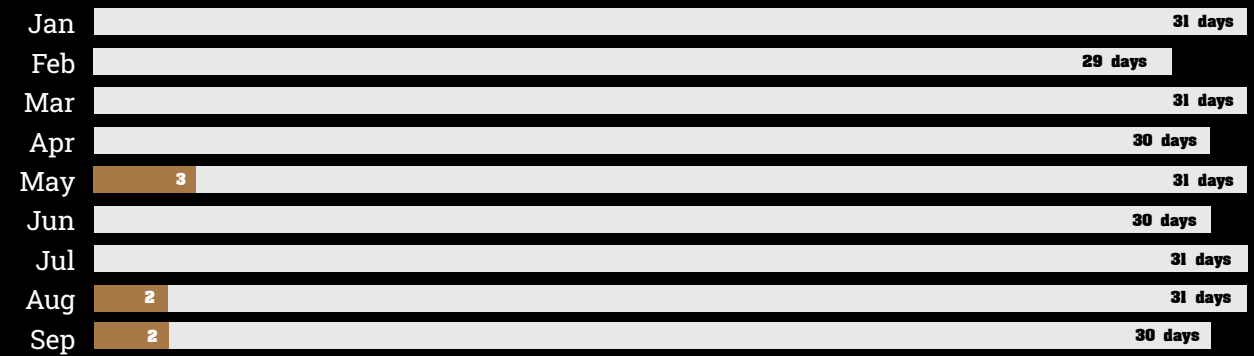


IMD definition/criteria

Cyclones are intense vortex or whirls in the atmosphere with very strong winds circulating around them in anti-clockwise direction in the Northern Hemisphere and in clockwise direction in the Southern Hemisphere.

FREQUENCY TRACKER

Number of days with cyclone



EXTREME WEATHER EVENTS

COMPARATIVE ANALYSIS (2022-24)

In the first nine months of 2024, India experienced extreme weather events on 255 out of 274 days, surpassing the 235 days in 2023 and the 241 days in 2022 for the same period. This marks 2024 as the most extreme year in terms of weather events in the past three years, with a trend of daily events persisting across 2022, 2023, and 2024.

Extreme weather events in India have not only become more frequent but also more severe in impact. In 2024, these events reached new peaks, with extreme weather occurring on 93 per cent of days from January to September—up from 86 per cent in 2022 and 88 per cent in 2023. This increase in frequency has led to devastating human and economic losses, with 3,238 lives lost in 2024 compared to 2,755 in 2022—a rise of 18 per cent in just three years.

According to data from CSE/DTE's atlas, the impact on agriculture has been severe, with extreme weather affecting at least 3.2 million hectares of cropped land in 2024, a 74 per cent increase from the 1.84 million hectares damaged in 2022. However, this number likely underestimates the true damage, as data from major agricultural states such as Uttar Pradesh and Haryana was unavailable.

The intensification of extreme weather events aligns with the projections from the UN Intergovernmental Panel on Climate Change and other scientific studies warning of the increased frequency and severity of these events due to climate change.

Over the past three years, all regions in India have reported more extreme weather days, with Central India bearing the brunt. This region saw the highest number of extreme weather days in 2024—218 days—and significant increases in crop loss, underscoring the high cost of climate change borne by farmers.

SEASONAL BREAKDOWN OF EXTREME WEATHER IN 2024

Winter (January–February): Extreme weather events spanned 50 days, a sharp rise from 38 days in 2022 and 28 in 2023. Cold days and coldwaves dominated, occurring on 38 days—a 17-day increase from the previous year. Additionally, lightning and storms were recorded on 17 days, up from 5 days last year.

Pre-Monsoon (March–May): Extreme weather events were recorded on 83 days, slightly lower than 2022 (85 days) and the same as 2023. Heatwaves occurred on 54 days in 2024, nearly double the 28 days in 2023. This increase contributed to a surge in fatalities, with 507 lives lost, compared to 321 the previous year.

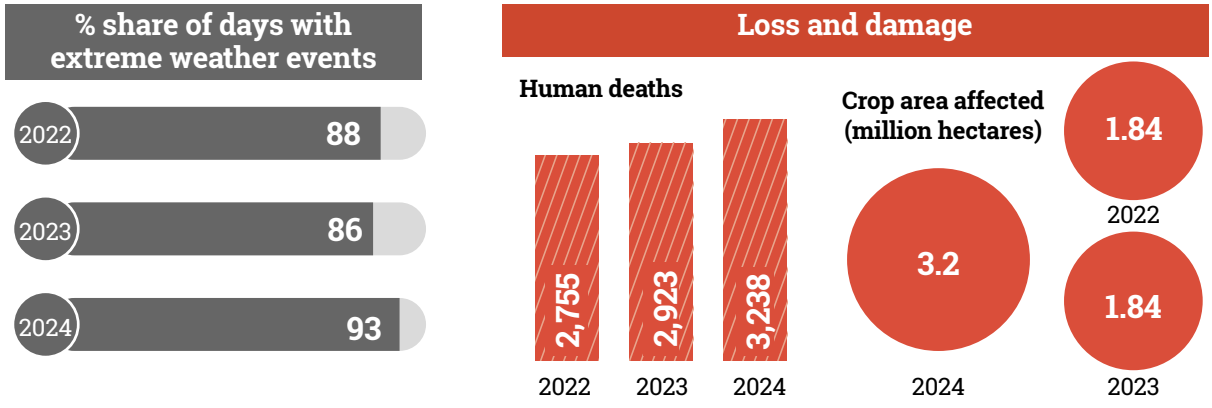
Monsoon (June–September): Extreme weather persisted across all 122 monsoon days, as in 2023. However, deaths increased to 2,716, up from 2,594 in 2023 and 2,431 in 2022.

VISIBLE CHANGE

The first nine months of 2024 saw a notable increase in the frequency and severity of extreme weather events across India compared to the same period in 2023. Extreme weather events were recorded on 255 days in 2024, claiming 3,238 lives, affecting 3.2 million hectares of crop area. In contrast, the first nine months of 2023 recorded extreme weather on 235 of 273 days, with 2,923 deaths, 1.84 million hectares of crops affected

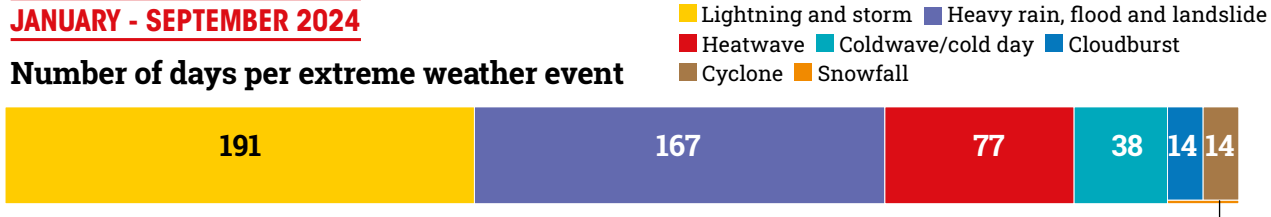
ON THE RISE

2024 saw the highest number of days with extreme weather and resultant loss and damage in the past three years

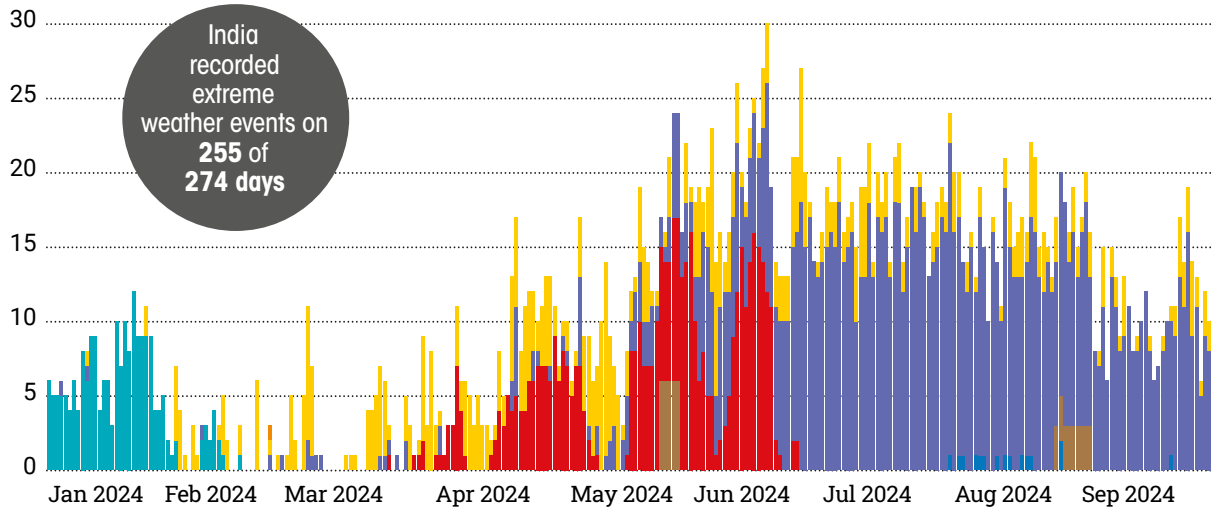


JANUARY - SEPTEMBER 2024

Number of days per extreme weather event

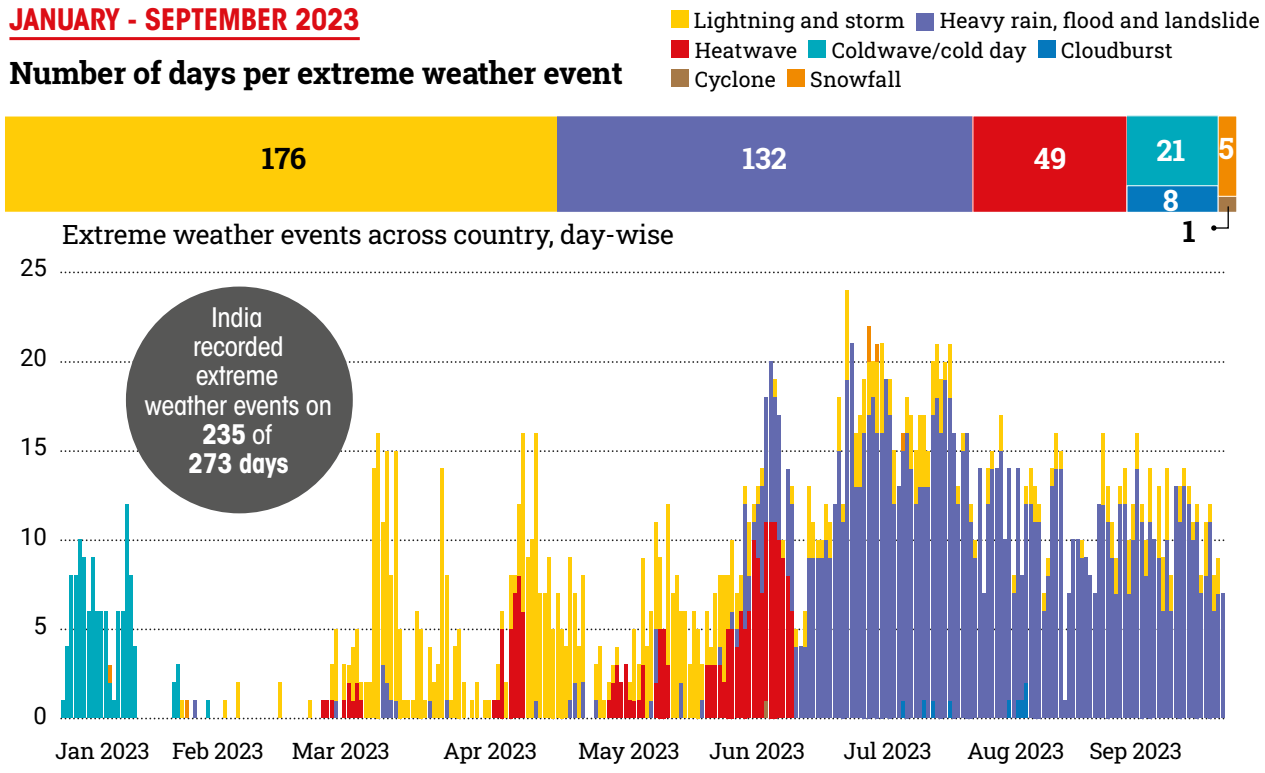


Extreme weather events across country, day-wise



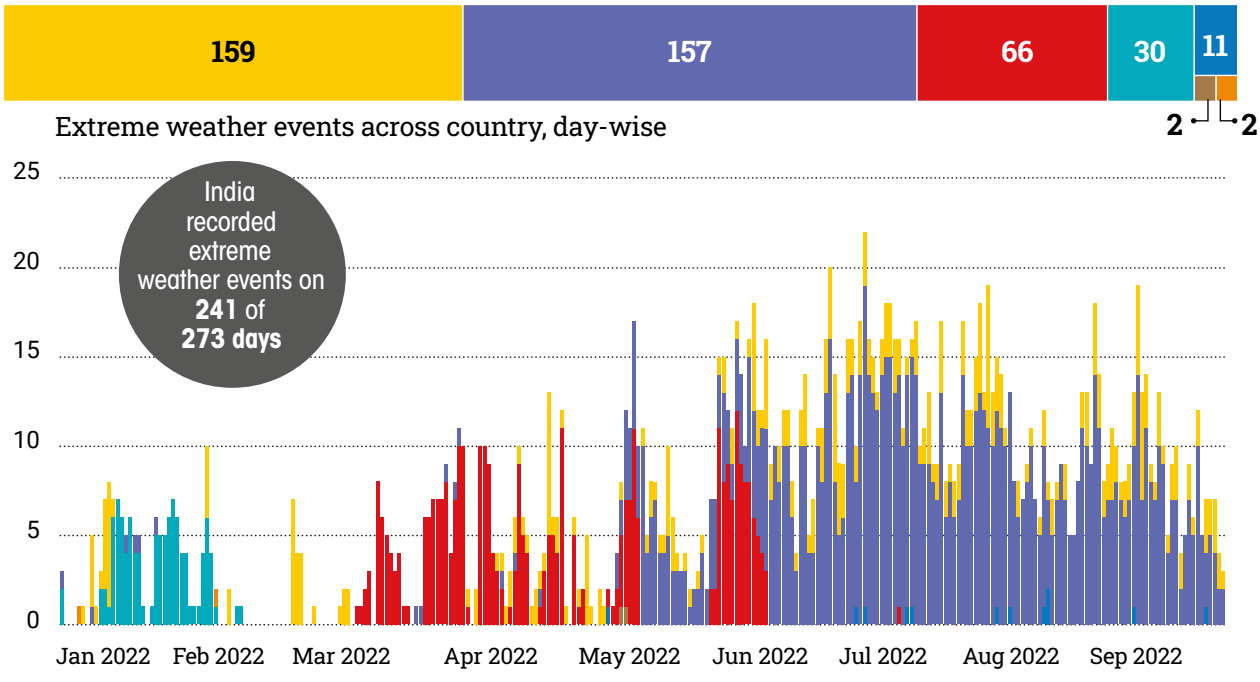
JANUARY - SEPTEMBER 2023

Number of days per extreme weather event



JANUARY - SEPTEMBER 2022

Number of days per extreme weather event

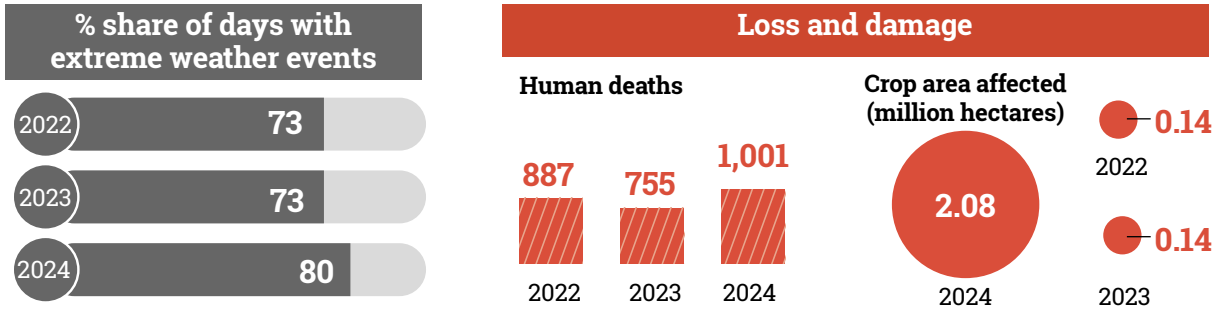


Source: Based on India's database of weather disasters dashboard by CSE-DTE Data Centre. Data sourced from the Disaster Management Division Union Ministry of Home Affairs, India Meteorological Department and media reports

INDIA 2024

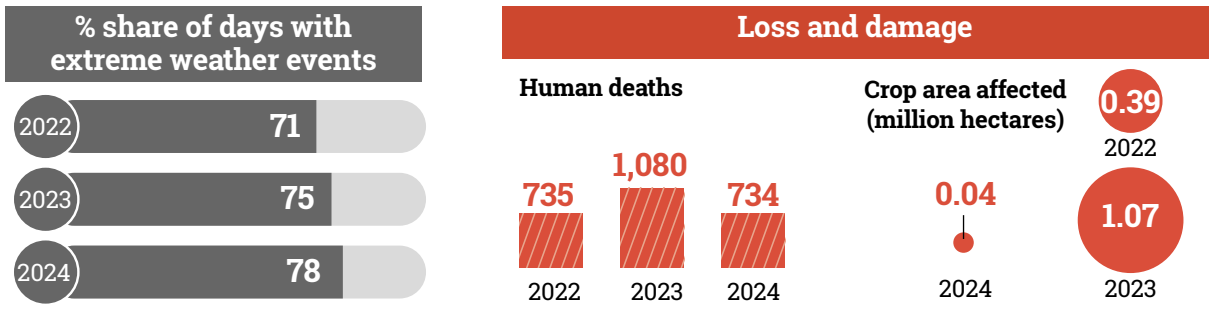
CENTRAL INDIA

The region saw a rise in extreme weather events and related losses



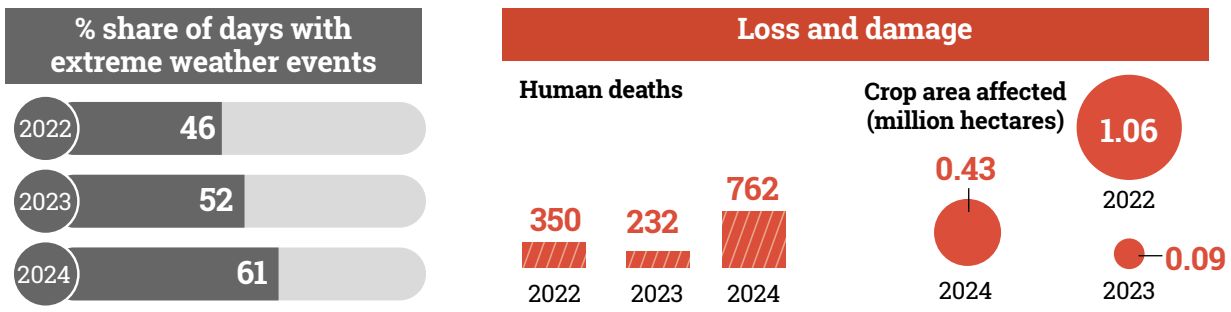
NORTHWEST INDIA

Although extreme weather days have increased, loss and damages have declined



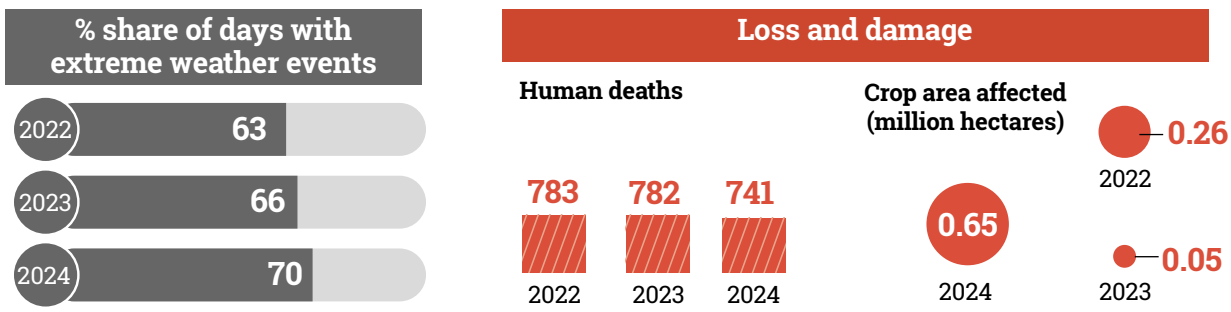
SOUTH PENINSULA

Human deaths in 2024 exceed the combined total of the past two years



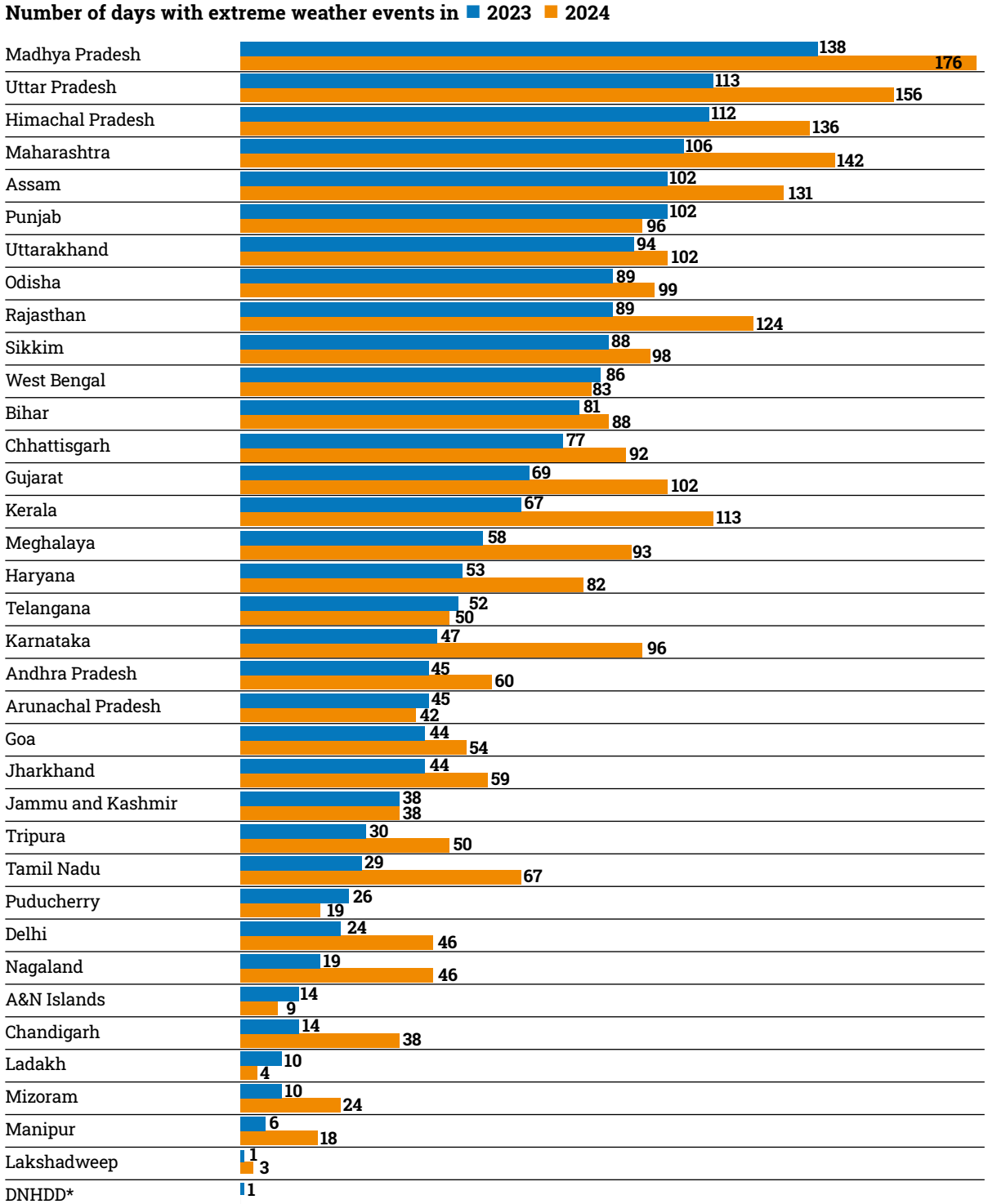
EAST AND NORTHEAST INDIA

2024 saw an increase in extreme weather days and resultant crop area affected



DEEP IMPACT

27 states and Union Territories saw a rise in extreme weather days in 2024, with Karnataka, Kerala, and Uttar Pradesh each experiencing 40 or more additional days of such events



*DNHDD: Dadra Nagar and Daman Diu, A&N Island: Andaman and Nicobar Islands; Source: Based on India's database of weather disasters dashboard by CSE-DTE Data Centre. Data sourced from the Disaster Management Division of Union Ministry of Home Affairs, India Meteorological Department and media reports

MEASURE OF NIGHT TEMPERATURES

WARM NIGHTS

In 2024, the India Meteorological Department (IMD) began publishing data on warm nights. This reflects an emerging trend where, instead of cooler nights that bring relief after a day's heat, the temperature remains uncomfortably high. IMD classifies a warm night as one where the maximum temperature has reached 40°C and the minimum temperature is 4.5°C to 6.4°C above normal. If this departure exceeds 6.4°C, it qualifies as a "severe warm night," posing additional discomfort and health risks.

Nights give the human body a chance to cool down. But when nights get warmer, people endure heat stress without any ebb. This combined effect of a warm day and warm night is detrimental to human health.

Between March and June 2024, some 17 states and Union Territories recorded significant warm-night events, underscoring the widespread reach of this phenomenon. Severe warm nights were concentrated in northern India, where five regions—Chandigarh, Delhi, Haryana, Punjab, and Uttar Pradesh—experienced unseasonably high night temperatures mid-June. Notably, Chandigarh, Delhi, and Haryana each recorded four consecutive "severe warm nights" from June 15 to June 18, marking a new extreme as nighttime temperatures failed to drop to typical levels.

The onset of warm nights was first noted in March 2024, with Maharashtra and Gujarat reporting uncharacteristically high minimum temperatures on March 27. This month saw uncomfortable night temperatures in central India, affecting states like Chhattisgarh and Madhya Pradesh. As April approached, the warmth spread, with 11 states across IMD's four climate regions registering 10 uncomfortable nights. Odisha became the first state to witness severe warm-night conditions in late April, with minimum temperatures soaring over 6.4°C above normal. This marked the beginning of what would become a prolonged warm period across regions as nighttime temperatures reached unprecedented highs.

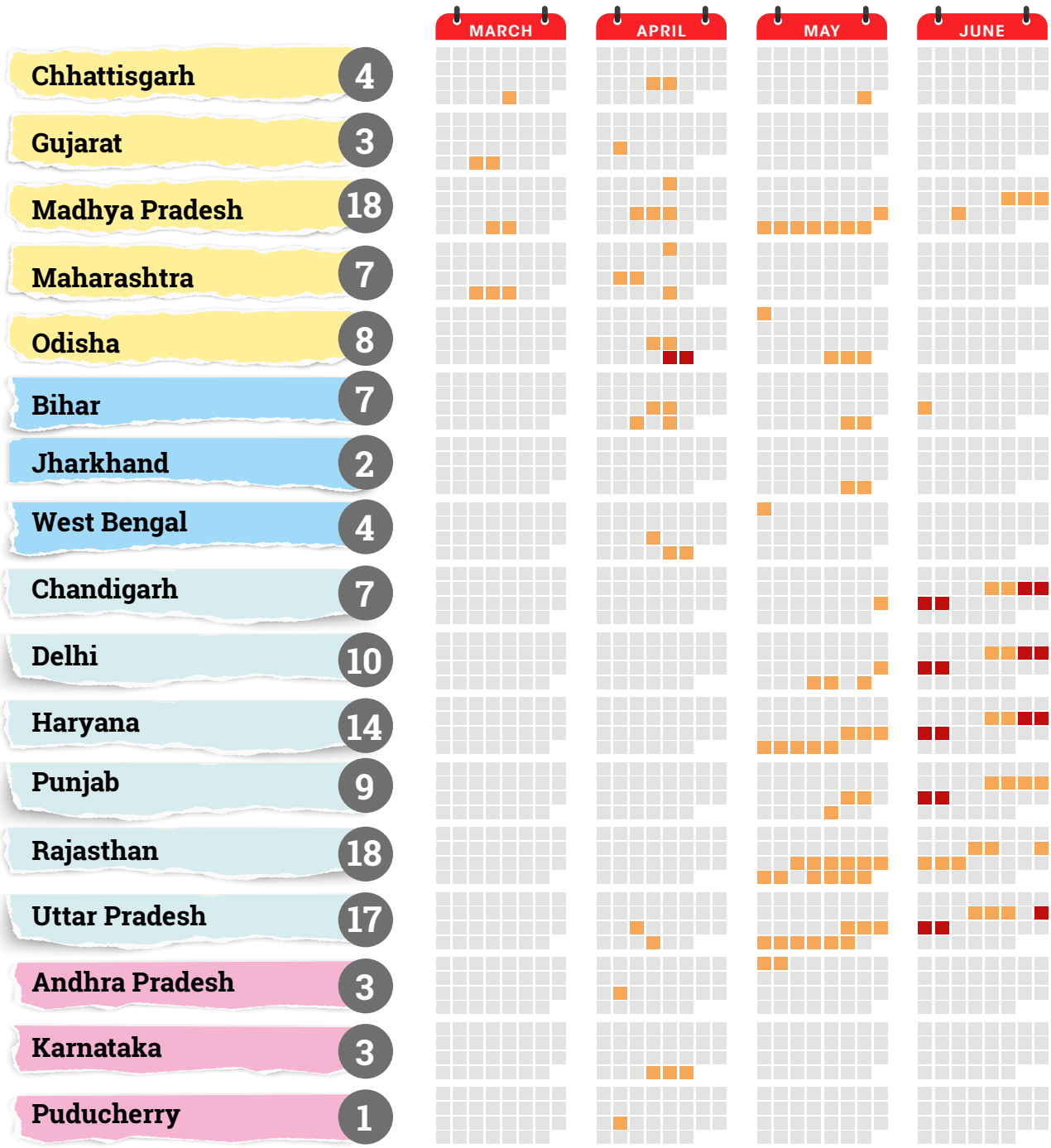
May 2024 was particularly severe, with 13 states enduring at least 15 warm nights, six of them in the northern region. Rajasthan experienced the brunt of it, recording 12 warm nights in May, including an eight-day streak of continuous warm conditions from May 19 to 26. Meanwhile, Uttar Pradesh endured the longest warm-night stretch, with nine nights from May 22 to May 30. The persistence of warm nights through May extended into June, where eight states, especially those in northern India, continued to grapple with elevated night temperatures. By June 20, rain showers finally brought some relief to Delhi-NCR, breaking a warm-night spell that had persisted since June 19.

UNCOMFORTABLE NIGHTS

Across the country, 17 states and UTs experienced warm nights from March to June 2024. Of these, Odisha, Chandigarh, Delhi, Haryana, Punjab and Uttar Pradesh recorded "severe warm" nights with minimum temperatures more than 6.4°C above normal

Regions
Central East and North East
Northwest South Peninsula

Warm night Severe warm night*
Total days with warm and severe warm nights between March and June 2024



Note: *Warm nights record a minimum temperature 4-6.4°C above normal, when the maximum daytime temperature is 40°C; severe warm nights record a minimum temperature 4-6.4°C above normal, when the maximum daytime temperature is 40°C Source: India Meteorological Department

Between June 11 and 19, as Delhi was experiencing sweltering nights, 192 bodies were recovered from public spaces such as pavements, in front of residential buildings and parks; 80 per cent of them were believed to be homeless. The figure is the highest for the same period in the past five years, says the Centre for Holistic Development (CHD), a Delhi-based non-profit that has analysed data from the Zonal Integrated Police Network under the Union Ministry of Home Affairs. Sunil Kumar Adelia, executive director of CHD, attributes these deaths to the combined effects of high day- and night-time temperatures. "Almost everyone living on the streets reported experiencing sleeplessness," CHD wrote in a letter to the secretary general of the National Human Rights Commission. These people, the letter states, suffer numerous heat-related effects, including heatstroke, weakness, increased vector-borne diseases, eye ailments, diarrhoea, rashes, nausea, dizziness, vomiting and infections.

Harshal Salve, additional professor, Centre for Community Medicine at the All India Institute of Medical Sciences, Delhi, says in case of a warm night, our exposure to heat gets prolonged. The immediate impacts can be dehydration, confusion, delirium, eye irritation and heat stroke. The impacts of chronic exposure is seen three to seven days later, through increase in all-cause mortality, cardiovascular ailments and stroke. In 2017, researchers from the UK published a study in *Environmental Epidemiology* that analyses impacts of day and night warming on mortality in Greater London. It links exposure to daytime heat with heart failure, infectious respiratory diseases and nervous system ailments, and nighttime heat with stroke and chronic ischemic diseases. The combined effects of hot days and hot nights pose a greater mortality risk than hot days followed by cool nights.

NEED FOR AN EASIER METRICS

Though IMD has started issuing warm-night alerts, its definition is difficult to follow as it does not provide an absolute temperature threshold. Most other countries have their own temperature threshold for warm nights, set as per their historical weather pattern and heat acclimatisation level of the population. European nations define warm nights as those when the temperature does not fall below 20°C. In the UK, the threshold varies regionally with London reporting warm nights if the minimum temperature exceeds 18°C. Threshold level also varies across the US, where the east coast states consider a minimum temperature of 27°C as a warm night.

EXTREME WEATHER EVENTS

CLIMATE CHANGE COSTS

2024 has been a defining year for climate science in India. At least seven major attribution studies released this year reveal that climate change has not only intensified extreme weather events but also increased their frequency. From January's severe coldwave to scorching heat waves in the pre-monsoon season, followed by extreme rains and landslides in Kerala's Wayanad district, the evidence points to a clear climate fingerprint. These findings come as climate experts and policymakers urge India to strengthen resilience and adaptive capacities.

CLIMATE CHANGE AT THE CORE OF EXTREME EVENTS

The Sixth Assessment report by the UN Intergovernmental Panel on Climate Change (IPCC) emphasised that extreme event attribution provides tangible proof of climate change's impacts. The frequency and intensity of extreme weather events observed across India in 2024 highlight this reality. According to the World Economic Forum's "Global Risks Report 2024", extreme weather has now risen to the top of global risks for 2024–2026. The report stresses that these risks will remain the most pressing global challenges over the next decade, making the need for climate adaptation more urgent.

BLOW HOT AND COLD

The severe coldwave that swept across northern India in January this year left Delhi and other regions grappling with prolonged, bone-chilling temperatures. Attribution studies, including one led by Raju Attada from the Indian Institute of Science Education and Research (IISER), Mohali, attribute this unusual cold to a powerful atmospheric blocking pattern and an influx of cold, dry air from the Siberian high-pressure system. The blocking phenomenon trapped the cold air over India, creating a prolonged period of extreme cold exacerbated by climate-induced shifts in atmospheric patterns.

India recorded heatwaves on at least 50 days from April to May, making it the third consecutive year of life-threatening high temperatures during the pre-monsoon season. Six different attribution studies this year link human-caused climate change to this intense heat. A global study released in May confirmed that climate change played a significant role in the record-breaking temperatures across Asia, including India. The study, involving experts from Imperial College London and the Red Cross Red Crescent Climate Centre, stated

CLEAR LINK

In 2024, at least seven attribution studies on India concluded that climate change intensified extreme events and significantly increased their likelihood

January 2024
Coldwave in Delhi and northern states

"Winter atmospheric blocking this year intensified cold waves and prolonged their persistence from the end of December to January."

Synoptic dynamics of cold waves over north India: Underlying mechanisms of distinct cold wave conditions | Attada, R. et al | Weather and Climate Extremes| March 2024

April 2024
Extreme temperature in South Asia, including India

"These extreme temperatures are now about 45 times more likely and 0.85°C hotter."

Climate change made the deadly heatwaves that hit millions of highly vulnerable people across Asia more frequent and extreme | | World Weather Attribution | May 14, 2024

May 18-20, 2024
Heatwave in Western India

"Human-caused climate change made this excessive heat at least five times more likely, signifying an exceptional climate change event."

Climate change is boosting severe heat in western India | Climate Shift Index, Climate Central | May 17, 2024

June 16-24, 2024
Heatwave in India

"Between June 16-24, 2024, 4.97 billion people experienced extreme heat reaching CSI levels (Climate Shift Index level) of at least 3, indicating that climate change made these temperatures at least three times more likely to occur. This includes 619 million people in India"

Global extreme heat in June 2024 strongly linked to climate change | Climate Shift Index, Climate Central | June 27, 2024

June-August 2024
Extreme temperature in India

"From June to August this year, India recorded its second-hottest period since 1970, with over 112 million people enduring at least one month of potentially health-threatening heat. More than 20.5 million people faced climate change-amplified temperatures for at least 60 days during this quarter."

People Exposed to Climate Change: June-August 2024 | Climate Central | September 18, 2024

August 2024
Extreme rainfall and landslide in Wayanad, Kerala

"The sudden rainfall that triggered landslides in Wayanad on 30 July was made 10 percent more intense due to human-induced climate change"

Landslide triggering rainfall made more intense by human-induced climate change, devastating highly vulnerable communities in northern Kerala | World Weather Attribution | August 14, 2024

June-September 2024
Climate change drives extreme rains and temperatures

"The longevity of the monsoon systems has increased. Simultaneously weather systems are now tracking more from Central India, south to their normal position. Despite excess Monsoon rains, rise in global warming has led to a consistent rise in minimum temperatures."

Monsoon 2024: Climate change drives extreme rains and temperatures | Climate Central | October 20, 2024

that climate change has made such extreme temperatures about 45 times more likely and nearly 0.85ºC hotter than previous averages.

The persistence of high temperatures affected numerous states, including Odisha, Andhra Pradesh, and Kerala, with increased humidity exacerbating discomfort. In Northwest and Central India, the absence of Western Disturbances, coupled with prolonged dry spells and anticyclones, created an especially intense heat wave from May 16 to 31. These conditions led to nighttime temperatures soaring, particularly alarming given the increase in "warm nights" across Indian cities. According to a June report by Climate Central, the occurrence of warm nights has increased by 32 per cent in the last decade due to climate change.

By mid-June, nearly 5 billion people globally were exposed to extreme heat levels influenced by climate change, with 619 million in India alone. This study underscores the outsized vulnerability of India's population to climate-driven heat events.

SWEPT AWAY

The 2024 monsoon brought with it relentless rains and devastating floods. Climate Central's October report concluded that global warming has altered monsoon behaviour, leading to an increase in heavy rainfall events and an unprecedented rise in minimum nighttime temperatures during the monsoon months. Despite the heavy rains, the anomalous 0.61°C rise in night temperatures is attributed to ongoing warming trends that have restructured typical weather patterns, leading monsoon systems to track more centrally and extend southward from their usual positions.

The devastating landslides in Wayanad on July 30, 2024, serve as a tragic example of climate-induced changes. According to scientists from World Weather Attribution (WWA), the rains that triggered these landslides were 10 per cent more intense due to human-caused climate change. This added intensity to an already vulnerable region, underscoring the compounded effects of climate change on both natural disasters and human safety.

The findings from these attribution studies underscore the immediate need for climate-resilient policies, infrastructure, and community preparedness. As extreme weather events become more frequent and intense, India's path to mitigating the impacts of climate change must prioritise climate adaptation measures, robust infrastructure, and early-warning systems for extreme weather events.

ABOUT THE REPORT

All Indian states are significantly climate vulnerable and the gap between the least vulnerable state (Maharashtra) and the most vulnerable state (Jharkhand) is small, as per the Centre's "Climate Vulnerability Assessment for Adaptation Planning in India Using a Common Framework 2019-20".
Yet robust data on extreme weather events, which are increasing in frequency and intensity due to climate change, is not available publicly. This happens because government agencies use different definitions and data collection sources, which obscures the bigger picture.

This report is an attempt to build an evidence base on the frequency and expanding geography of extreme weather events in India. It provides season-by-season, month-by-month, and region-by-region analyses of extreme weather events and the loss and damage they caused in the first nine months of 2024.

Scan to access India's Atlas on Weather Disasters

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