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







वार्षिक जलवायु सारांश - 2021

ANNUAL CLIMATE SUMMARY - 2021

द्वारा जारी / ISSUED BY

जलवायु अनुसंधान एवं सेवाएँ
CLIMATE RESEARCH & SERVICES,

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Climate Monitoring & Prediction Group

भारत मौसम विज्ञान विभाग
INDIA METEOROLOGICAL DEPARTMENT

पुणे - 411005
PUNE - 411005

COVER PHOTOS

① Damaged Dhauliganga hydropower project after a glacier broke off in Joshimath causing a massive flood in the Dhauli Ganga river, in Chamoli district of Uttarakhand, Sunday, Feb. 7, 2021. (https://cdn.thewire.in)

② Chiplun and Khed in Ratnagiri district were the worst-affected, as flood water from Vasisthi river and the discharge of water from Koyana dam submerged several areas.

③ Rapid Action Force (RAF) and Kerala Fire and Rescue personnel during rescue operations at the site of landslide at Kavali in Kottayam district, on Sunday,17 October 2021.
(https://akm-img-a-in.tosshub.com)

④ Cyclone “Yaas” pounded coastal areas in north Odisha and neighbouring West Bengal as it made landfall with a wind speed of 130-140 kmph. In Pic: Sea water enters through boundaries of a house during cyclone Yaas landfall in Chandipur area of Balasore. (https:// indianexpress.com)

⑤ House Collapsed into the Sea in Kasargod (Kerala) due to the effect of Cyclone ”Tauktae”. (https://akm-img-a-in.tosshub.com)

⑥ Rough Sea waves crash against the Bhagavathi Prem Sinken Dredger, at Surathkal Beach near Mangaluru,(Karnataka) (https://firstpost.com)

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वर्ष 2021 में देश का औसत तापमान, सन 1981-2010 के औसत से 0.44 डिग्री सेलशियस (डि.से.) से अधिक रहा। यह साल 1901 से अब तक का पाचवाँ सबसे ऊष्ण साल रहा । शीत ऋतु के औसत तापमान में वृध्दि (+0.78 डि.से.) और उत्तर-पूर्व मानसून ऋतु के औसत तापमान में वृध्दि (+0.42 डि.से.) वार्षिक तापमान में वृध्दि का मुख्य कारण है। अब तक के 5 सबसे ऊष्ण साल इस क्रम से है :2016 (विसंगति +0.71 डि.से.), 2009 (+0.55 डि.से.), 2017 (+0.541 डि.से.), 2010 (+0.539 डि.से.), और 2021 (+0.44 डि.से.)।

दक्षिणी पश्चिमी मानसून ऋतु (जून-सितंबर, जो देश की वर्षा ऋतु का प्रमुख काल माना जाता है) में देशभर में व्यापक रुप से वर्षा सामान्य रही (दीर्घ काालावधि औसत के 99%)। हालांकि सामयिक रुप से वर्षा अस्थाई थी लेकिन फिर भी देश भर में वर्षा का वितरण काफी अच्छा रहा।

दक्षिण प्रायद्वीप (जिसमे 5 प्रभाग आते हैं, और जो उत्तर-पूर्व मानसून वर्षा का मुख्य क्षेत्र है, नामतः तटीय आन्ध्रप्रदेश, रायलसीमा, तमिलनाडु और पुडुचेरी, दक्षिणी आंतरिक कर्नाटक और केरल) में अक्तूबर से दिसंबर तक पडने वाली उत्तर-पूर्व मानसून वर्षा, सामान्य से अधिक (दीर्घ कालावधि औसत के 144%) रही। जो 1901 से सबसे अधिक रही।

वर्षा

2021 में देश भर में वार्षिक वर्षा सामान्य थी । वर्षा का परिमाण दीर्घ कालावधि औसत के 105% रहा ।देश के 36 प्रभागों में से 18 प्रभागों में अधिक, 13 प्रभागों में वर्षा सामान्य रही और 5 प्रभागों में वर्षा कम रही ।

तापमान

देश के अधिकतर भागों में अधिकतम, न्यूनतम और औसत तापमान की विसंगति -0.1 डि. सें. से + 1.0 डि. सें. की श्रेणी में रही ।मगर देश के उत्तर-पूर्व भाग,जम्मु काश्मीर लदाख, हिमाचल प्रदेश, उत्तराखंड, गुजरात, पश्चिमी राजस्थान, और अंदमान और निकोबार द्वीपसमुह के कुछ भागो में औसत तापमान 1 डि. सें. से अधिक रहा ।

चक्रवाती तूफान

2021 मे बंगाल की खाडी मे तीन चक्रवाती तूफान हुए । यह चक्रवाती तूफान मई (यास), सितंबर (गुलाब) और दिसंबर (जावद) में प्रतिमाह एक हुए ।इनके अलावा अरबी समुद्र में मई माह में एक (तौते) और अक्तूबर में एक (शाहीन) चक्रवाती तूफान हुए । मानसून ऋतु में 15 कम दबाव के क्षेत्र बने (1 चक्रवात, 1 तीव्र अवदाब,4 सुस्पष्ट निम्न दाब क्षेत्र और 7 निम्न दाब क्षेत्र, और 2 भुमीय निम्न दाब) ।इन सभी कम दबाव की प्रणालियों की वजह से संबन्धित स्थानों मे अच्छी वर्षा हुई ।

महत्वपूर्ण मौसम संबंधी घटनाएं

भारी वर्षा और बाढ संबंधी घटनाओं से करीब 755 से ज्यादा लोगों की मृत्यु की सूचना प्राप्त हुई । आकाशीय बिजली से करीब 780 लोगों की मृत्यु की सूचना (मानसून पूर्व, मानसून और मानसूनोत्तर ऋतुओं में), देश के विभिन्न भागों से प्राप्त हुई ।चक्रवाती तूफान की वजह से 172 लोगों की मृत्यु की सूचना प्राप्त हुई । शीत लहर कि चपेट में 10 लोगों की मृत्यु की सूचना प्राप्त हुई । हिमपात की वजह से जम्मु, कश्मीर,हिमाचल प्रदेश और उत्तराखंड से 12 लोगों की मृत्यु की सूचना मिली ।आंधी की वजह से उत्तर प्रदेश से 5 लोगों की मृत्यु की सूचना मिली, झंझे की वजह से मध्य प्रदेश , ओडिसा से 4 लोगों की मृत्यु की सूचना मिली ।

HIGHLIGHTS

The annual mean land surface air temperature averaged over India during 2021 was +0.44^{0}C above the long-term average (1981-2010 period). The year 2021 was the fifth warmest year on record since nationwide records commenced in 1901. However, this is lower than the highest warming observed over India during 2016 (anomaly of +0.71^{0}C).The winter (January to February) and post-monsoon (October to December) seasons with all India mean temperature anomalies of +0.78^{0}C and +0.42^{0}C respectively mainly contributed to this warming. The all India mean temperatures during the other two seasons; pre-monsoon (March to May) and monsoon (June to September) seasons, were also above normal with anomalies of +0.35^{0}C and +0.34^{0}C respectively.

The 2021 annual rainfall over the country as a whole was 105% of its Long Period Average (LPA) value for the period 1961-2010. The monsoon season rainfall over the country as a whole was 99% of its LPA.The seasonal rainfall during the Northeast monsoon season (October – December) over the NE Monsoon core region of the south peninsula was 171% of its LPA.The NE Monsoon rainfall (579.1 mm) received over core region was highest since 1901.

During 2021, five cyclonic storms formed over the North Indian Ocean; Extremely Severe cyclonic storm TAUKTAE, Very Severe cyclonic storm YAAS, and Cyclonic storms GULAB, SHAHEEN and JAWAD. Of these, TAUKTAE and SHAHEEN formed over Arabian Sea, while remaining three cyclones viz. YAAS, GULAB and JAWAD formed over Bay of Bengal.

A) TEMPERATURE

Annual:

Spatial pattern of annual mean, maximum and minimum temperature anomalies for 2021 are shown in Fig.1. During 2021, minimum, maximum and mean temperature anomaly over many parts of the country was generally in the range of ± 1.0°C. Mean temperature over parts of Jammu & Kashmir and Ladakh, Himachal Pradesh, Uttarakhand, northeastern parts of Indian region, Gujarat region and adjoining parts of west Rajasthan and Andaman & Nicobar Islands was above normal by about 1°C. Mean temperature over parts of Haryana, Chandigarh & Delhi was below normal by about 1°C.

Maximum temperature over parts of Himachal Pradesh was above normal by about 2°C. However, Maximum temperature over parts of Andaman & Nicobar Islands was below normal by about 2°C.

Minimum temperature was generally above normal over most parts of the country except parts ofHaryana, Chandigarh & Delhi, Uttar Pradesh state, east Rajasthan, Madhya Pradesh state, Vidarbha, Chhattisgarh, Andhra Pradesh state, Telangana, South Interior Karnataka and extreme southern parts of Tamil Nadu, Puducherry and Karaikal.

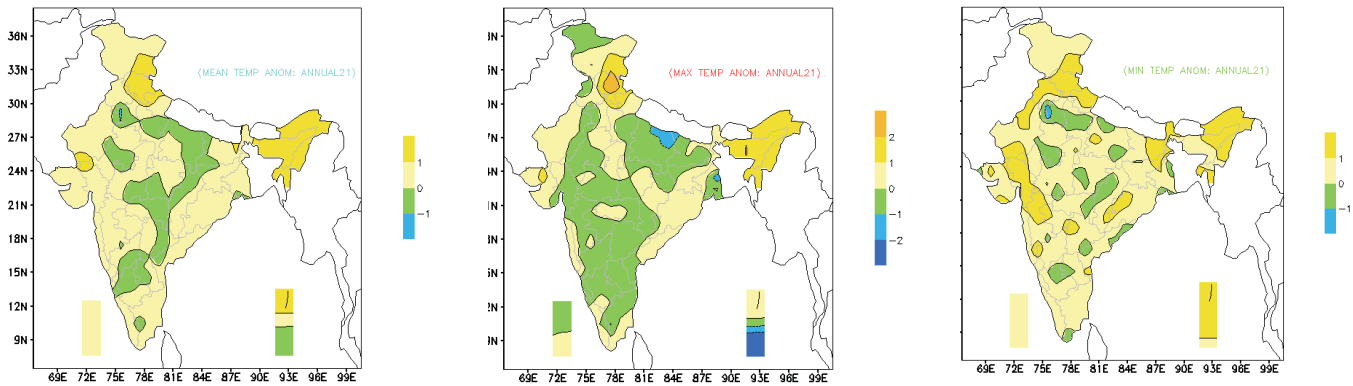


Fig. 1. Annual temperature anomalies (°C) for 2021, (a) Mean, (b) Maximum, and (c) Minimum temperature. (Based on 1981-2010 Average)

The 2021 annual mean land surface air temperature for the country was +0.44^{0}C above the 1981-2010 period average, thus making the year 2021 the fifth warmest year on record since 1901 (Fig. 2A). The five warmest years on record, in descending order, were 2016 (+0.71^{0}C), 2009 (+0.55^{0}C), 2017 (+0.541^{0}C), 2010 (+0.539^{0}C), and2021 (+0.44^{0}C).It may be mentioned that 11 out of 15 warmest years were during the recent fifteen years (2007-2021).The past decade (2011-2020/ 2012-2021) was also the warmest decade on record with the decadal averaged annual mean temperature anomaly of 0.34^{0}C /0.37^{0}C.The country averaged annual mean temperature during 1901-2021 showed an increasing trend of 0.63^{0}C/100 years (Fig. 2A) with a significant increasing trend in maximum temperature (0.99^{0}C/100 years) and a relatively lower increasing trend (0.26^{0}C/100 years) in minimum temperature.

Time series and trend in mean temperature anomalies for different seasons viz. Winter (Jan to Feb), Pre-Monsoon (Mar to May), Monsoon (June to Sept) and Post-Monsoon (Oct to Dec) seasons for the period 1901-2021 are shown in Figs 2B, 2C, 2D and 2E respectively. The mean temperature for the winter season was above normal (with anomaly +0.78°C) and the third warmest after the years 2016 (+1.15°C), 2009 (+0.94°C)since 1901.The mean temperature was above normal during January (+0.67°C) and February (+0.90°C).

The mean temperature during pre-monsoon season (with anomaly +0.35°C) was above normal. The mean temperature was above normal during March (+1.24°C), April (+0.38°C) and the mean temperature was below normal during May (-0.57°C).

The mean temperature during monsoon season (with anomaly +0.34°C) was above normal. The mean temperature was below normal during June (-0.17°C) and above normal during July (+0.55°C), August (+0.52°C) and September (+0.48°C).The mean temperature during this year, August was third warmest after the years 2009(+0.64°C), 2020 (+0.58°C) since 1901.

The Post-monsoon season mean temperature this year (with anomaly +0.42°C) was above normal. The mean temperature was above normal during October (0.77°C), November (0.25°C) and December (0.24°C).The mean temperature during this year, October was the fifth warmest since 1901.

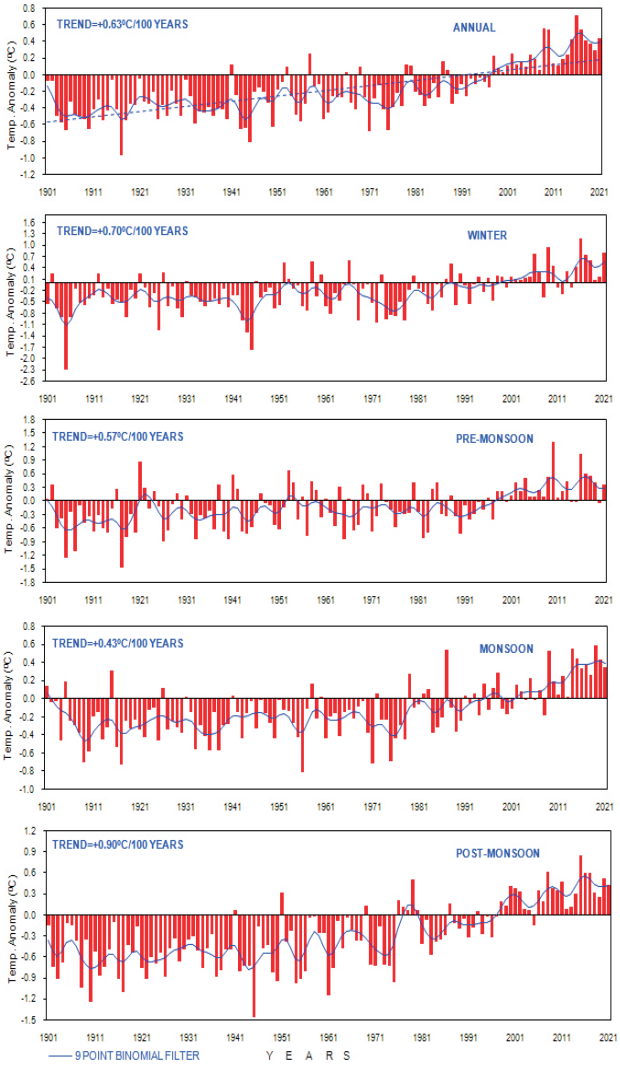


Fig. 2. All India mean temperature anomalies (a) Annual (b) Winter(c) Pre-monsoon (d) SW-monsoon (e) Post-monsoon for the period 1901 - 2021 shown as vertical bars. The solid blue curve had sub-decadal time scale variations smoothed with a Binomial Filter

(Departures from the 1981 - 2010 average)

Spatial pattern of trend in mean annual temperature anomalies based on the data for the period 1901-2021(Fig.3)suggests significant positive (increasing) trend over most parts of the country except for some parts of Bihar, East Uttar Pradesh, Gujarat region and adjoining southern parts of Rajasthan, where significant negative (decreasing) trend was observed.

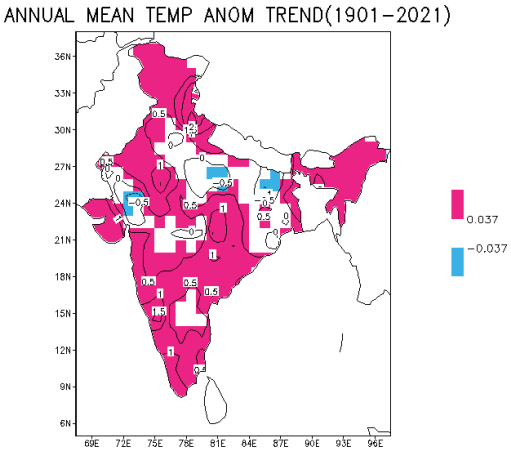
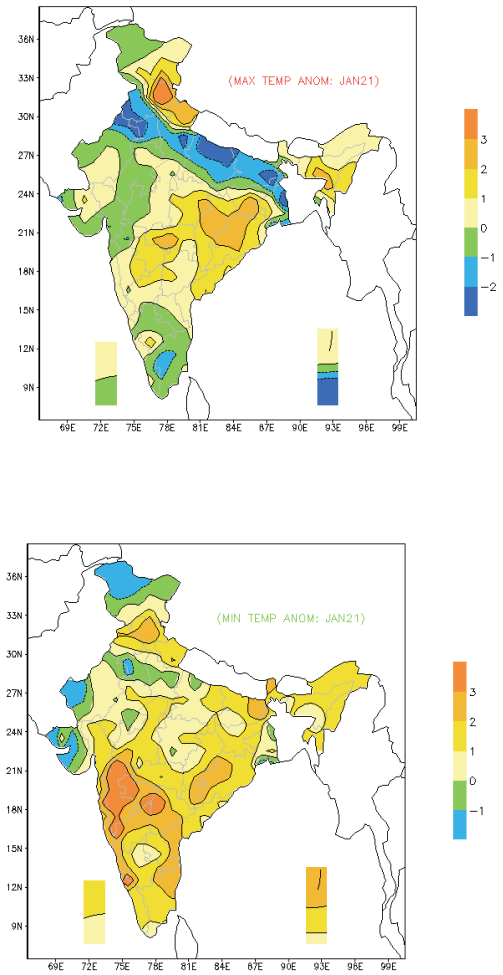


Fig. 3. Annual mean temperature anomaly trends (°c / 100 years) are shown as contour lines. The trends significant at 95% level are shaded with colours. Positive trends are shown in red while the negative trends are shown in blue. Period of analysis: 1901 -2021

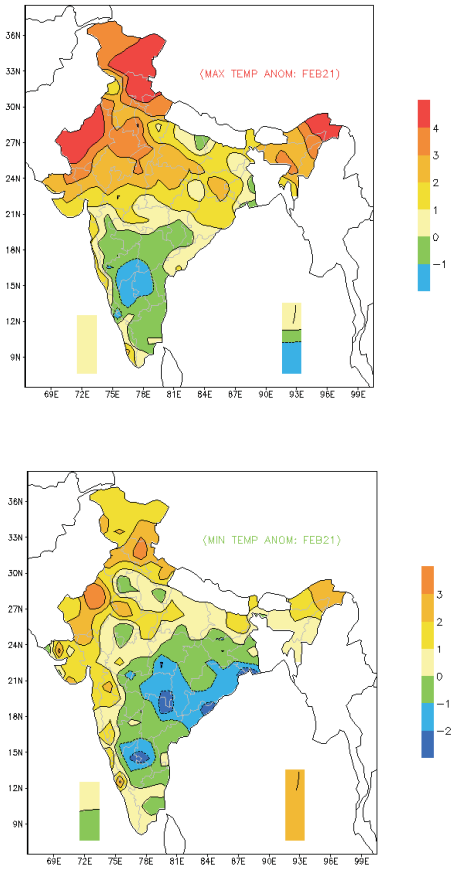
The spatial pattern of monthly maximum and minimum temperature anomalies. Regions with significant temperature anomaly (> +2°C or < -2°C) during each month of the season are discussed below (Figure 4).

January-February (winter season):

During January, maximum temperature anomaly was more than 3^{0}C over parts of Himachal Pradesh. Maximum temperature anomaly was less than -2^{0}C over parts of Punjab, West Rajasthan, Haryana, Chandigarh & Delhi, Uttar Pradesh state, Bihar, Gangetic West Bengal and Andaman & Nicobar Islands. Minimum temperature anomaly was more than 3^{0}C over parts of Madhya Maharashtra, Marathwada, North Interior Karnataka, South Interior Karnataka, Kerala and Mahe and Telangana. (fig4a)

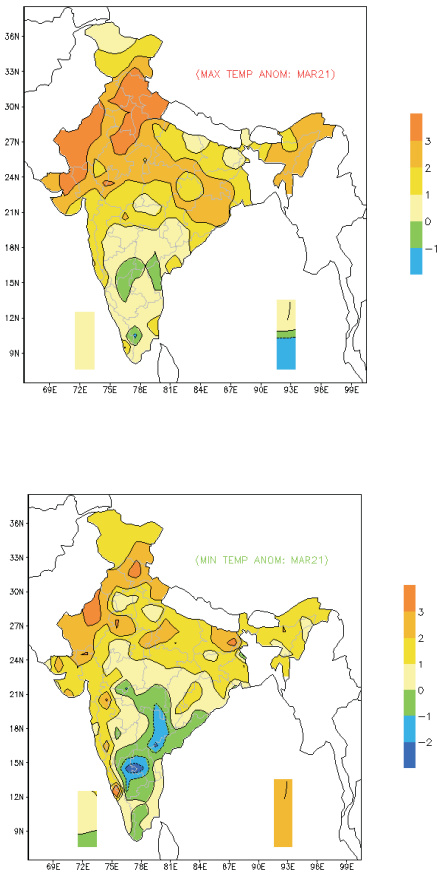


(Fig. 4a). Maximum and Minimum temp anomalies spatial plots for January 2021



(Fig. 4b). Maximum and Minimum temp anomalies spatial plots for February 2021

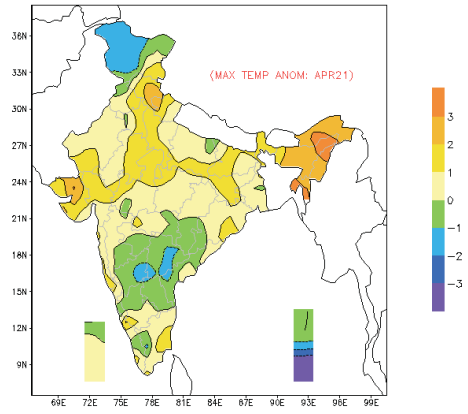
During February,maximum temperature anomaly was more than 4°C over parts of Jammu, Kashmir & Ladakh, Himachal Pradesh, Uttarakhand, Arunachal Pradesh and West Rajasthan.Minimum temperature anomaly was more than 3°C over parts of Himachal Pradesh and West Rajasthan. Minimum temperature anomaly was less than -2°C over parts of Vidarbha, Gangetic West Bengal, East Madhya Pradesh, South Interior Karnataka, Telangana and Andhra Pradesh state (fig 4b).

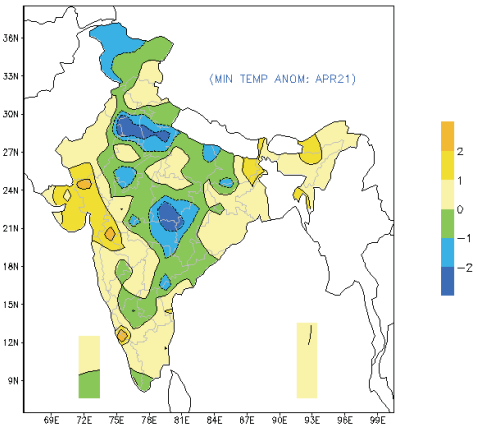


(Fig. 4c). Maximum and Minimum temp anomalies spatial plots for March 2021

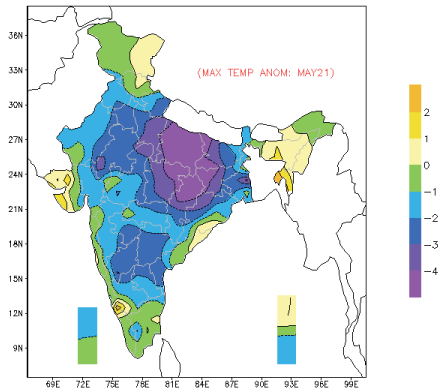
March - May (Pre Monsoon Season) :

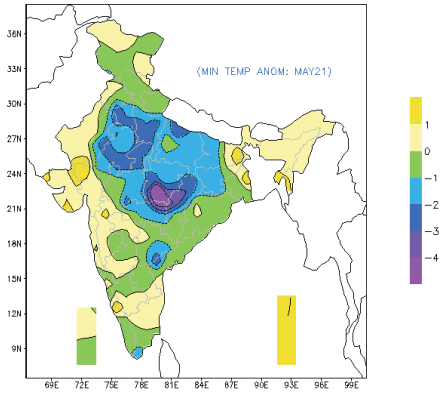
During March, maximum temperature anomaly was more than 3°C over parts of Himachal Pradesh, Uttarakhand, Punjab, Haryana, Chandigarh & Delhi, West Uttar Pradesh, Rajasthan state, Gujarat state and West Madhya Pradesh. Minimum temperature anomaly was more than 3°C over parts of Himachal Pradesh, West Rajasthan, Bihar and Kerala & Mahe. Minimum temperature anomaly was less than -2°C over parts of Coastal Andhra Pradesh & Yanam, Rayalaseema and South Interior Karnataka (fig 4c).





(Fig. 4d). Maximum and Minimum temp anomalies spatial plots for April 2021

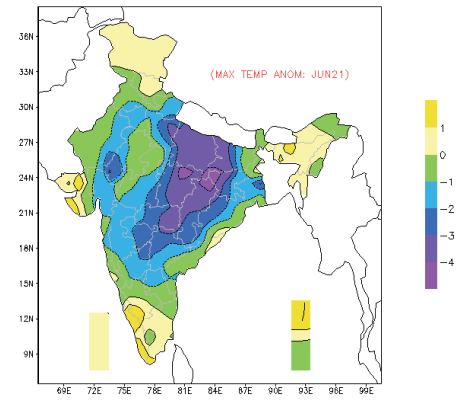


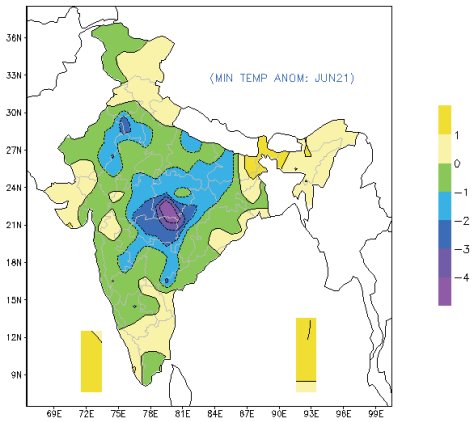


(Fig. 4e). Maximum and Minimum temp anomalies spatial plots for May 2021

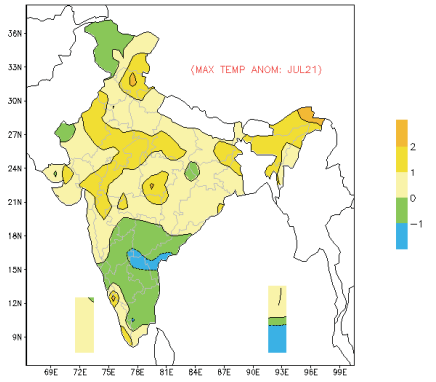
During April, Maximum temperature anomaly was more than 3°C over parts of Arunachal Pradesh, Assam & Meghalaya, Manipur and Tripura. Maximum temperature anomaly was less than -3°C over parts of Andaman & Nicobar Islands. Minimum temperature anomaly was more than 2°C over parts of Gujarat region, Madhya Maharashtra and southern Coastal Karnataka. Minimum temperature anomaly was less than -2°C over parts of Haryana, Chandigarh & Delhi, West Uttar Pradesh, East Madhya Pradesh, Vidarbha and Chhattisgarh (fig 4d).

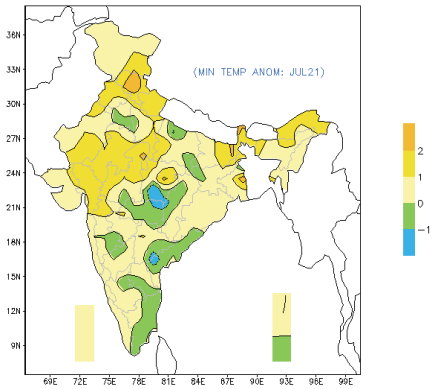
During May, Maximum temperature anomaly was more than 2°C over parts of Tripura and northern Kerala & Mahe. Maximum temperature anomaly was less than -4°C over parts of East Uttar Pradesh, Bihar, Jharkhand, Chhattisgarh and East Madhya Pradesh. Minimum temperature anomaly was less than -4°C over parts of East Madhya Pradesh, Chhattisgarh and Vidarbha (fig 4e).





(Fig. 4f). Maximum and Minimum temp anomalies spatial plots for June 2021



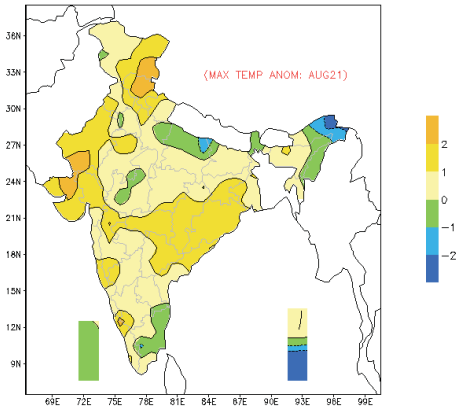


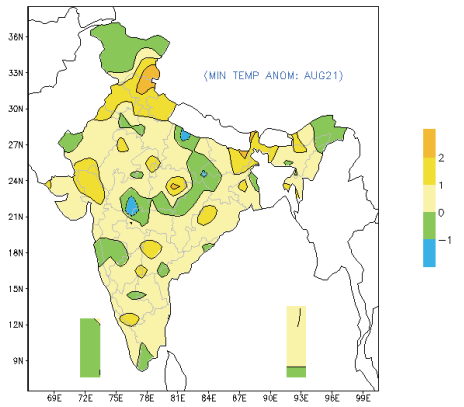
(Fig. 4g). Maximum and Minimum temp anomalies spatial plots for July 2021

June - September (Monsoon Season) :

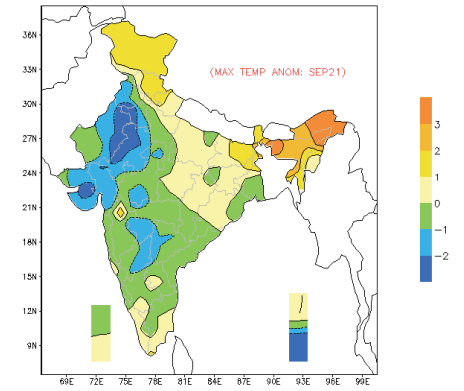
During June, maximum temperature anomaly was less than -4°C over parts of East Uttar Pradesh, Jharkhand, Chhattisgarh and East Madhya Pradesh. Minimum temperature anomaly was less than -4°C over parts of East Madhya Pradesh and Vidarbha (fig 4 f).

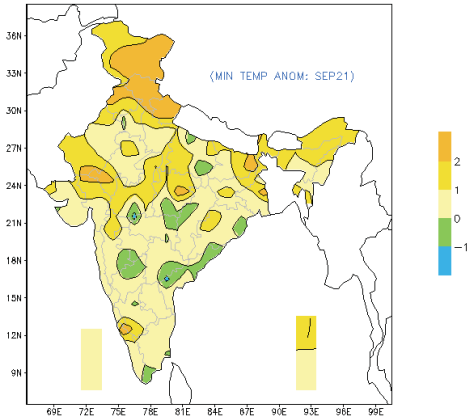
During July, maximum temperature anomaly was more than 2°C over parts of Himachal Pradesh, Arunachal Pradesh, East Madhya Pradesh and Kerala & Mahe. Minimum temperature anomaly was more than 2°C over parts of Himachal Pradesh, Bihar, Sikkim state, Gangetic West Bengal and Madhya Pradesh state (fig 4g).





(Fig. 4h). Maximum and Minimum temp anomalies spatial plots for August 2021

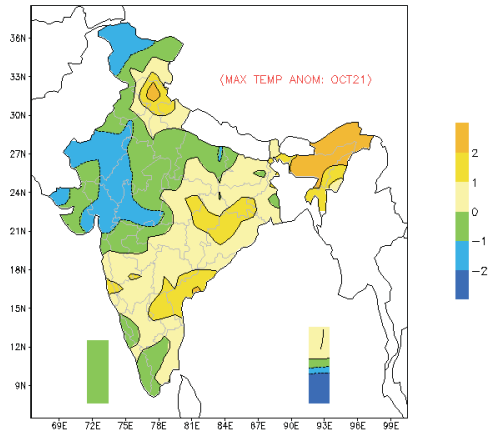


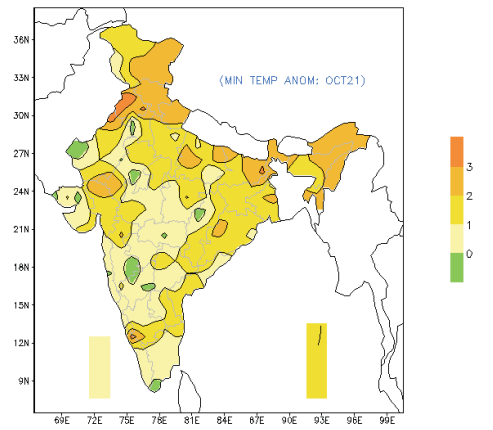


(Fig. 4i). Maximum and Minimum temp anomalies spatial plots for September 2021

During August, Maximum temperature anomaly was more than2°C over parts ofHimachal Pradesh, Ladakh, West Rajasthan, Saurashtra & Kutch and northern region of Kerala & Mahe. Maximum temperature anomaly was less than -2°C over parts of Arunachal Pradesh and Andaman & Nicobar Islands. Minimum temperature anomaly was more than 2°C over parts of Himachal Pradesh, Ladakh, Sikkim, Bihar and East Madhya Pradesh (fig 4h).

During September, maximum temperature anomaly was less than -2°C over parts of Punjab, Haryana, Chandigarh & Delhi, Rajasthan state, Saurashtra & Kutch and Andaman & Nicobar Islands. Minimum temperature anomaly was more than 2°C over parts of Jammu, Kashmir & Ladakh, Himachal Pradesh, Uttarakhand, Punjab, Rajasthan state, Gujarat region, East Madhya Pradesh, Bihar, Gangetic West Bengal, South Interior Karnataka and Kerala & Mahe (fig 4i).

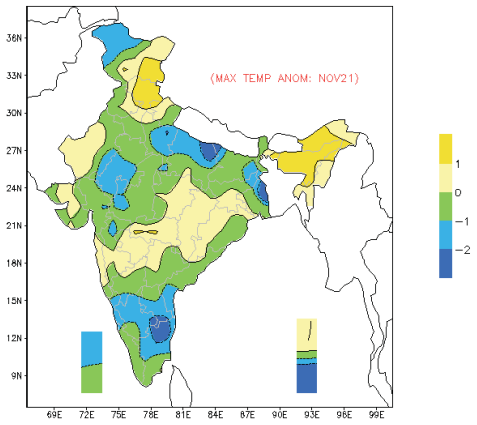


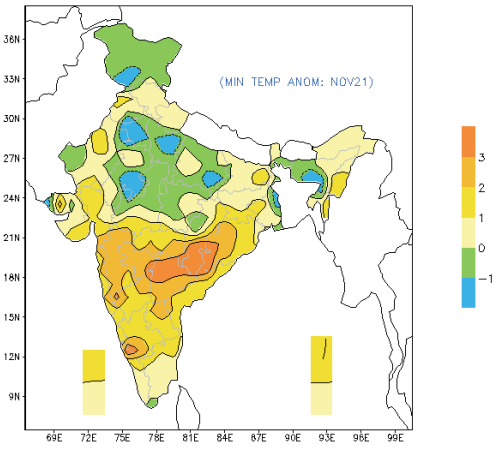


(Fig. 4j). Maximum and Minimum temp anomalies spatial plots for October 2021

October-December (Post-monsoon season):

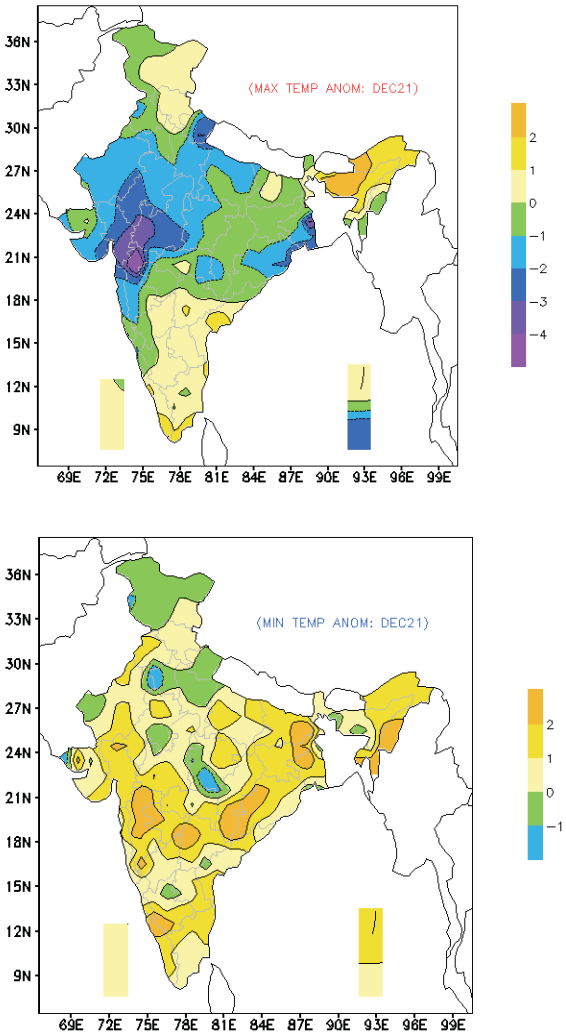
During October, maximum temperature anomaly was more than 2°C over parts of Arunachal Pradesh, Assam & Meghalaya, Nagaland, Himachal Pradesh and Coastal Andhra Pradesh & Yanam. Maximum temperature anomaly was less than -2°C over parts of Andaman & Nicobar Islands(fig 4j).





(Fig. 4k). Maximum and Minimum temp anomalies spatial plots for November 2021

During November, maximum temperature anomaly was less than -2°C over parts of Gangetic West Bengal, Bihar, East Uttar Pradesh, Rayalaseema, South Interior Karnataka, Tamil Nadu, Puducherry & Karaikal and Andaman & Nicobar Islands.Minimum temperature anomaly was more than 3°C over parts of Odisha, Chhattisgarh, Vidarbha, Marathwada, Telangana, Kerala & Mahe and South Interior Karnataka (fig 4k).



(Fig. 4l). Maximum and Minimum temp anomalies spatial plots for December 2021

During December,maximum temperature anomaly was more than 2°C over parts of Arunachal Pradesh and Assam & Meghalaya. Maximum temperature anomaly was less than -3°C over parts of Gangetic West Bengal, Gujarat region, East Rajasthan, West Madhya Pradesh and Madhya Maharashtra.Maximum temperature anomaly was less than -4°C over parts of Madhya Maharashtra. Minimum temperature anomaly was more than 2°C over parts of Nagaland, Manipur, Mizoram, Tripura, Bihar, Chhattisgarh, Gangetic West Bengal, Jharkhand, Odisha, Gujarat region, Madhya Maharashtra, Vidarbha, Telangana, South Interior Karnataka and Kerala & Mahe (fig 4l).

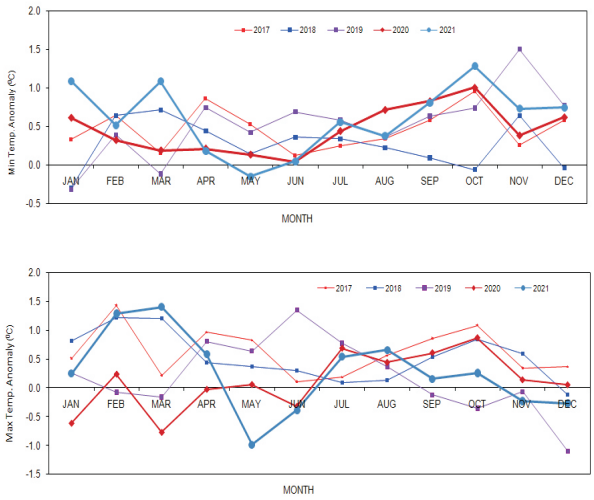


Fig. 5. Mean monthly (a) minimum (b) maximum temp anomalies(2017-2021)

Fig.5 (a) and (b) respectively shows the monthly minimum and maximum temperature anomaly for the country as a whole during past five years (2017-2021).In respect of maximum temperature, month of March and August were warmest in last five years while January, March and October were warmest in respect of minimum temperature during the last five years.

Cold Wave conditions:

In the month of January,Cold wave conditions were subdued over central, western and parts of eastern India in January 2021 while over northern parts of India these events were mainly observed in the 2nd half of the month. Cold wave conditions at isolated places also occurred over north Madhya Pradesh during14-16, 20, 30-31 January; over Gangetic West Bengal and Odisha during 15-17 and 31 January; over Saurashtra & Kutch on 5, 26 and during 28-31 January.

In the month of February,Cold wave conditions prevailed during the first fortnight of the month over parts of Odisha, Gangetic West Bengal, Jharkhand, Vidarbha, Chhattisgarh, Rayalaseema and South Interior Karnataka on one or two days. Extensive dense to very dense fog was reported during the period of 10-22 February 2021 over many areas of Punjab and Haryana.

Cold day to Severe Cold day conditions at a few places had occurred over East & West Madhya Pradesh on one day each during the week 16- 23 December.Cold day conditions at isolated places had occurred over East Madhya Pradesh on four days; over West Madhya Pradesh on three days; over East & West Uttar Pradesh on two days each; over Punjab, Haryana, Chandigarh & Delhi, East & West Rajasthan, Jharkhand, Odisha and Gangetic West Bengal on one day each during the week 16-23 December.

Cold day to Severe Cold day conditions at isolated places had occurred over Punjab and Himachal Pradesh on one day each during last week of December. Cold day conditions at a few places with severe cold day conditions isolated places had occurred over East and West Madhya Pradesh on one day each during last week of December. Cold day conditions at isolated places had occurred over Chhattisgarh on one day during last week of December.

Fig 6 shows the minimum temperature anomaly diagram for the duration when cold wave condition was at its peak during 18-22 December 2021.

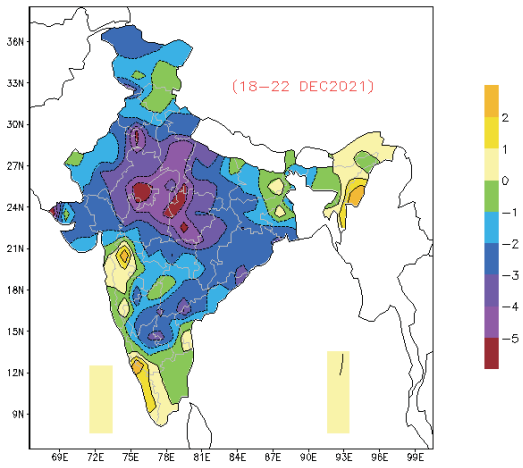


Fig. 6. Minimum temperature anomaly during cold wave period

Heat Wave Conditions:

In the month of March, heat wave conditions were observed at most places with Severe Heat wave conditions at isolated places occurred over West Rajasthan during 29-31 March. Heat wave conditions were also observed at a few places over east Rajasthan during 30-31 March, over Odisha and adjoining parts of Gangetic west Bengal, Coastal Andhra Pradesh, Tamil Nadu on 31 March.

In the month of April,Heat wave conditions in April 2021 were occasional and also for shorter periods over very smaller pockets. They were observed over Tamil Nadu, Puducherry & Karaikal, Coastal Andhra Pradesh & Yanam, Rajasthan, Haryana, Chandigarh & Delhi, Saurashtra & Kutch, Gangetic West Bengal and Odisha.

Fig 7shows the maximum temperature anomaly diagrams for the duration when heat wave condition was at its peak during 27-31 March 2021.

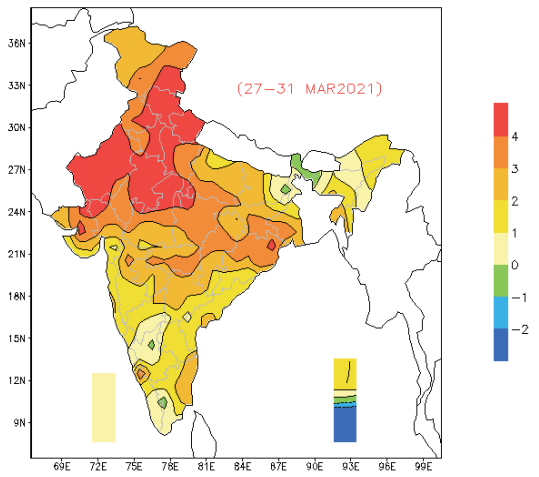


Fig. 7. Maximum temperature anomaly during heat wave period

B) RAINFALL

Time series of percentage departure of area weighted seasonal and annual rainfall over the country as a whole are shown in Fig. 8. In 2021, annual rainfall over the country as a whole was 105 % of its LPA value.

Season wise rainfall distribution over the country as a whole is listed below:

Winter (January to February): **68% of LPA**
Pre-monsoon (March to May): **118% of LPA**
Monsoon (June to September): **99% of LPA**
Post-monsoon (Oct to Dec): **144 % of LPA**

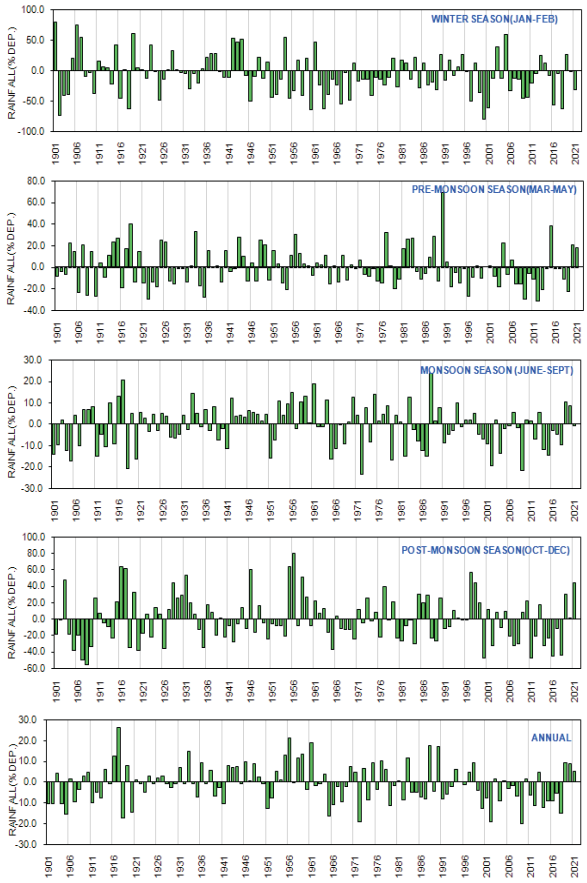


Fig. 8. Percentage departure of area weighted (Seasonal and Annual) rainfall over the country as a whole (1901-2021)

(With respect to 1961-2010 average)

Sub-division wise annual and seasonal rainfall statistics is given in Table 1 and its percentage departures is shown in Fig. 9a,b,c,d,e

Annual:

Rainfall activity over the country as a whole was normal (105 % of LPA) during the year.Out of 36 meteorological subdivisions, 18 received excess rainfall, 13 received normal rainfall and remaining 5 subdivisions received deficient rainfall.

At the end of year, of the four homogeneous regions, South Peninsular India received 129% of its LPA, central India received 110% of its LPA, and Northwest India received 97 % of its LPA while East & Northeast India received 89% of its LPA rainfall.

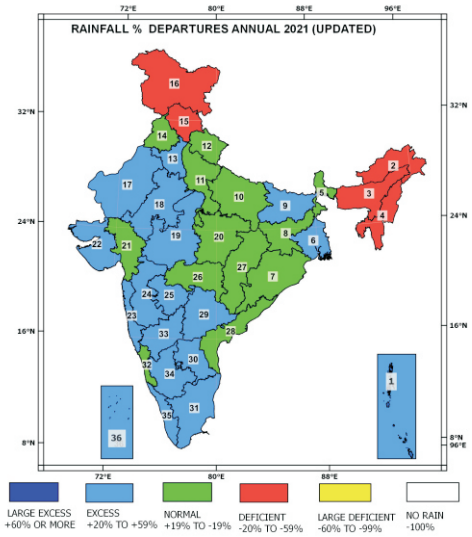


Fig. 9(a). Sub-divisionwise Annual rainfall percentage departure.

Winter season:

Rainfall realized during the season was 68% of LPA. It was 117% of LPA during January and was 32.5% of LPA during February.

During the season, out of 36 meteorological subdivisions, 10 received large excess rainfall, 3 received excess rainfall, one received normal rainfall, 8 received deficient rainfall, 13 received large deficient rainfall and one subdivision did not receive any rain.

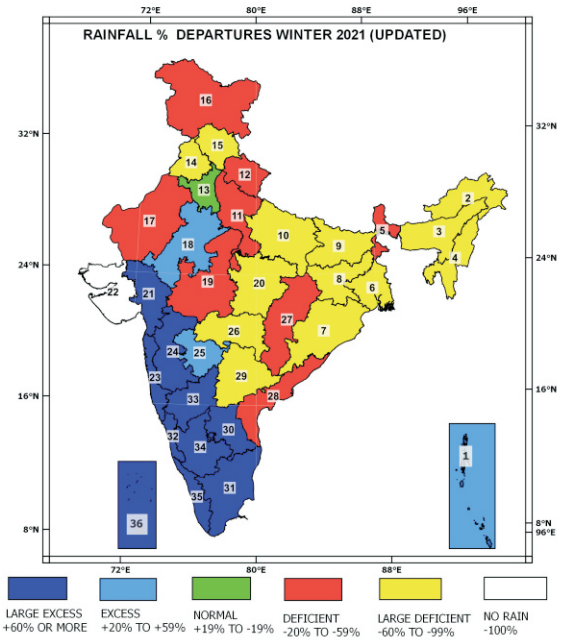


Fig. 9(b) : Sub-divisionwise rainfall percentage departure for Winter season.

Pre-monsoon season:

Rainfall realized during the season was 118% of its LPA.It was 55% of its LPA, 79% of its LPA and 174% of its LPA during March, April and May respectively.

Rainfall activity during the season was above normal.During the season, out of 36 meteorological subdivisions, 17 received large excess rainfall, 9 received excess rainfall, 6 received normal rainfall, 4 received deficient rainfall.

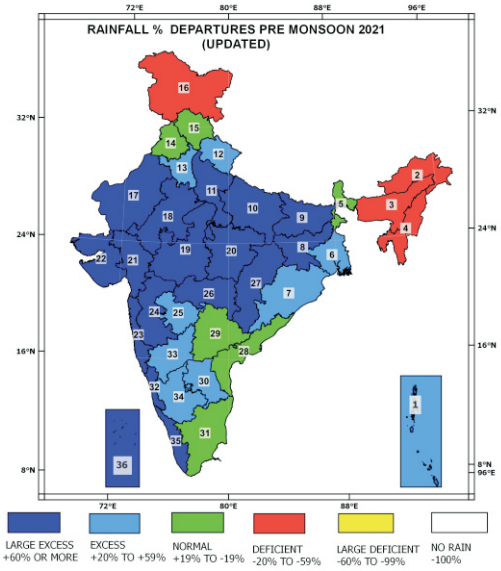


Fig. 9(c). Sub-divisionwise rainfall percentage departure for Pre monsoon season.

Monsoon season:

Rainfall realized during the season was 99% of its LPA. It was 110% of its LPA, 93% of its LPA, 76% of its LPA and 135% of its LPA during June, July, August and September respectively.

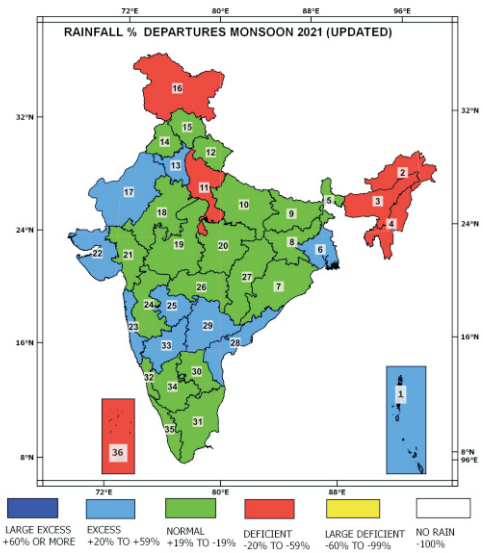


Fig. 9(d). Sub-divisionwise rainfall percentage departure for Monsoon season.

Most sub-divisions of the country received excess/normal rainfall except a few from extreme northeastern region, West Uttar Pradesh, Jammu & Kashmir and Ladakh and Lakshadweep.During the season, out of 36 meteorological subdivisions, 20 subdivisions received excess rainfall, 10 received normal rainfall and the remaining 6 subdivisions received deficient rainfall.

Daily area weighted rainfall (mm) over the country as a whole during the monsoon season 2021 (1st Jun. to 30th Sep.) and its long term average (1961-2010) values are shown in Fig. 11. .For the country as a whole, rainfall averaged was generally above or near normal on many days during Season. On about 20 occasions in the whole season, it was nearly more than one & half times its normal value. It was above normal at a stretch for few days viz. for the duration from 1 – 6 June, 9 – 20 June, 19 – 24 July, 28 – 31 August, 30 August – 2 September, 6 – 9 September, 11 – 17 September, 21 – 24 September and 26 – 30 September. However, it was below normal for rainfall spells during 21 June – 11 July, 15 – 18 July, 1 – 17 August, 21 – 29 August and 3 – 5 September.

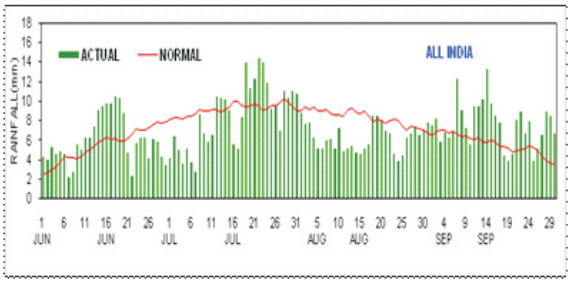


Fig. 10. Daily area weighted rainfall (mm) over the country as a whole (vertical bars in green) and its long term average (1961-2010)(continuous line in red) 1 JUNE- 30 SEPTEMBER 2021

Post-monsoon season:

Rainfall realized over the country as a whole during the season was 144% of its LPA. It was 133% of its LPA, 186% of its LPA and 117% of its LPA during October, November and December month respectively.All the subdivisions received large excess/excess/normal rainfall except Arunachal Pradesh, Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, East Madhya Pradesh and Telangana.

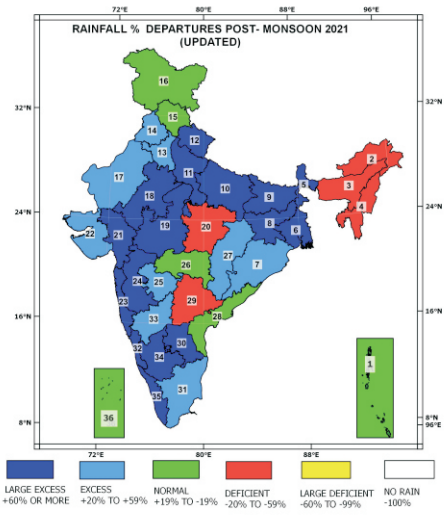


Fig. 9(e). Sub-divisionwise rainfall percentage departure for Post - Monsoon season.

Rainfall activity over core region of the South Peninsular India (comprising of 5 subdivisions viz. Coastal Andhra Pradesh, Rayalaseema, Tamil Nadu & Puducherry, South Interior Karnataka and Kerala) during the season as a whole was above normal [171% of Long Period Average (LPA)]. It was above normal during October and November (129 %of its LPA, 269%of its LPA respectively) and below normal during December (78% of is LPA). Rainfall over this core region (579.1 mm) was highest since 1901.

During the season, out of 36 meteorological subdivisions, 16 received large excess rainfall, 9 received excess rainfall, 6 received normal rainfall, 5 received deficient rainfall. Time series of northeast monsoon seasonal rainfall over the core region of south peninsula is shown in Fig 11.

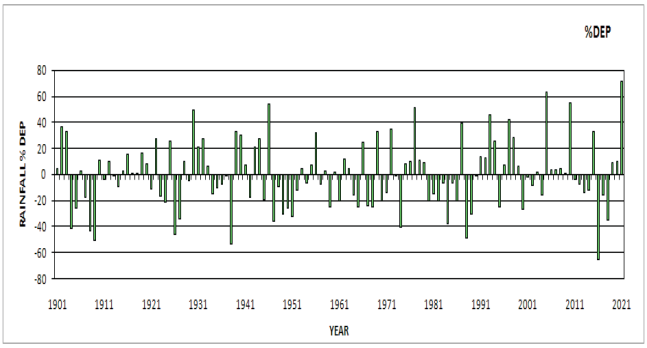


Fig. 11. Percentage departure of rainfall during the Post-monsoon season (October to December) over the core zone of South Peninsula (1901-2021)

The highest maximum & lowest minimum temperature and highest rainfall (in 24 hours) recorded over a station during the year 2021 with the dates of occurrences are given in Table 2.

C) Standardized Precipitation Index

The Standardized Precipitation Index (SPI) is an index used for monitoring drought conditions and is based on precipitation. This index is negative for dry, and positive for wet conditions. As the dry or wet conditions become more severe, the index becomes more negative or positive. Fig.12 gives the district wise SPI values for the year 2021.

Cumulative SPI values of the past twelve months indicate extremely wet-severely wet conditions over parts of A & N Islands, Gangetic West Bengal, Odisha, Jharkhand, Bihar, East Uttar Pradesh, Uttarakhand, Haryana, Chandigarh & Delhi, Punjab, East Rajasthan, West Madhya Pradesh, Gujarat Region, Konkan & Goa, Madhya Maharashtra, Marathawada, Andhra Pradesh state, Telangana, Tamil Nadu, North Interior Karnataka, South Interior Karnataka and Kerala. Extremely dry-severely dry conditions were observed over parts of Arunachal Pradesh, Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, Sub Himalayan West Bengal & Sikkim, East Uttar Pradesh, Himachal Pradesh and Jammu & Kashmir.

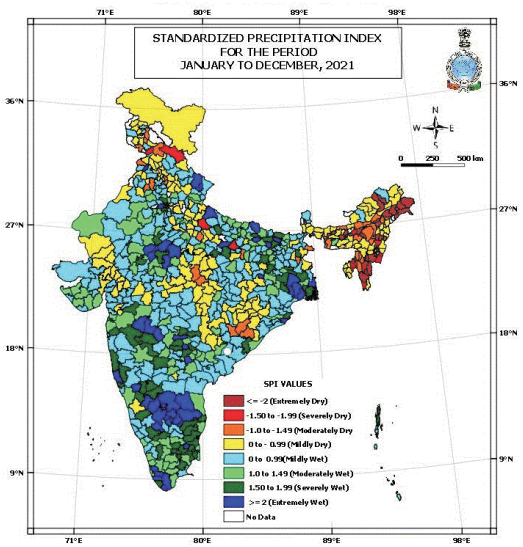


Fig. 12. Standardized Precipitation Index for the period January- December 2021

D) TROPICAL STORMS / DEPRESSIONS IN THE INDIAN SEAS

In 2021, five cyclonic storms formed over the north Indian Ocean. These are: (1) Extremely Severe Cyclonic Storm TAUKTAE, (2) Very Severe Cyclonic Storm YAAS, (3) Severe Cyclonic Storm SHAHEEN (remnant of GULAB), (4) Cyclonic Storm GULAB & (5) Cyclonic Storm JAWAD. Of these, three cyclones (YAAS, GULAB, JAWAD) formed over the Bay of Bengal. & the remaining two cyclones (viz. TAUKTAE &SHAHEEN) formed over the Arabian Sea.

Among these 5 cyclones, the most devastating was Extremely Severe Cyclonic Storm TAUKTAE (14 May to 19 May) which formed in the pre-monsoon season over the Arabian Sea, crossed Saurashtra coast on 17th May, claiming 144 lives from across the states in western India stretching from Kerala in the far southern part of the country to Gujarat in the northwest.

The Very Severe Cyclonic Storm YAAS, (23 May to 28 May) formed during the pre-monsoon season over the Bay of Bengal, crossed the north Odisha coast on 26th May 2021 and claimed 9 lives from Odisha, Jharkhand, West Bengal & Bihar.

The Cyclonic Storm GULAB (24 September to 28 September), formed during the southwest monsoon season & crossed north Andhra Pradesh – south Odisha coasts on 26thSeptember, claiming 19 lives from Andhra Pradesh, Telangana, Odisha, Maharashtra.

The Severe Cyclonic Storm SHAHEEN (29 September to 4 October) formed over Arabian Sea and moved away from Indian region towards Oman coast.

The Cyclonic Storm JAWAD (2-6 December) formed over Bay of Bengal and weakened close to Odisha coast. However, these two systems do not have extreme impacts in India.

During winter season, no intense low pressure system formed.

During pre-monsoon season, apart from the above mentioned intense system, one depression (over BOB) formed in April and one low pressure area (over AS) formed in month of May.

During the monsoon season, fifteen low pressure systems (1 cyclonic storm, 1 Deep Depression,4 well marked low pressure areas, 7 sea low pressure areas and 2 land low pressure areas) were formed. The only deep depression formed over Northwest Bay Of Bengal & adjoining Odisha Coast on 12th September travelled in West North Westward direction and dissipated over northeast Madhya Pradesh & neighborhood on 15th September. The frequency and place of origin of these low pressure systems formed over the Indian region during the monsoon season is shown in the table A below.

During the post monsoon season, ten low pressure systems (2 cyclonic storm, 3 Depression,2 well marked low pressure areas, 2 sea low pressure areas and 1 land low pressure area) were formed. The frequency and place of origin of these low pressure systems formed over the Indian region during the post monsoon season is shown in the table B below.

Month /Systems	CS and above	DD	D	WML	LPA(Sea)	LPA(Land)
June	0	0	0	0	1(BOB)	1
July	0	0	0	2 (BOB)	1(BOB),1(AS)	1
August	0	0	0	0	2(BOB)	0
September	1(BOB)	1(BOB)	0	2(BOB)	1(BOB),1(AS)	0
	(AS : Arabian Sea)		(BOB : Bay of Bengal)			

TABLE A :CS: Cyclonic Storm, **DD**: Deep Depression, **D**: Depression, **WML**: Well Marked low, **LPA**: Low Pressure Area.

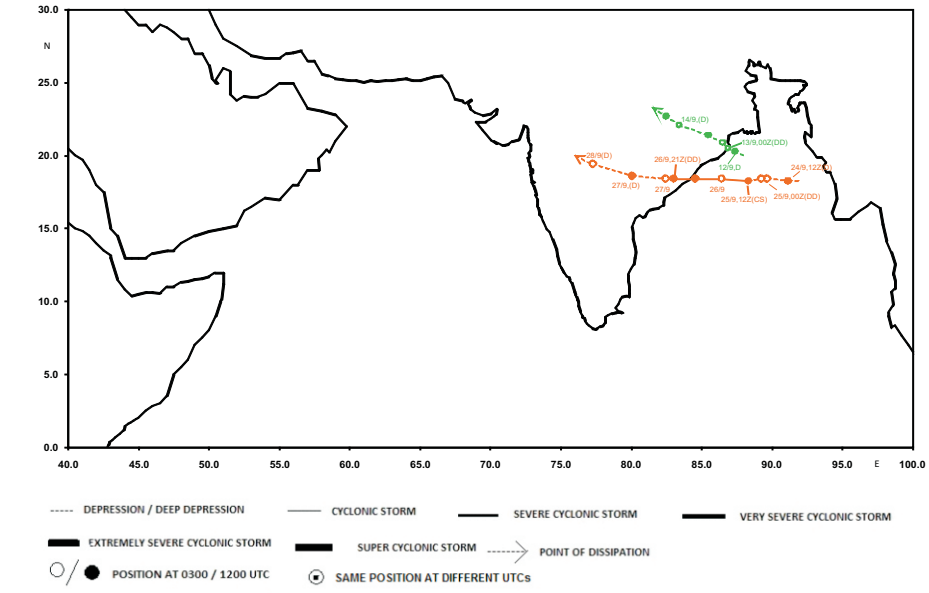
Month /Systems	CS and above	DD	D	WML	LPA(Sea)	LPA(Land)
October	1 (AS)	0	0	0	1(BOB), 1 (AS)	1
November	0	0	2(BOB), 1 (AS)	1(AS)	0	0
December	1 (BOB)	0	0	1(BOB)	0	0
	(AS : Arabian Sea)		(BOB : Bay of Bengal)			

TABLE B : CS: Cyclonic Storm, **DD**: Deep Depression, **D**: Depression, **WML**: Well Marked low, **LPA**: Low Pressure Area.

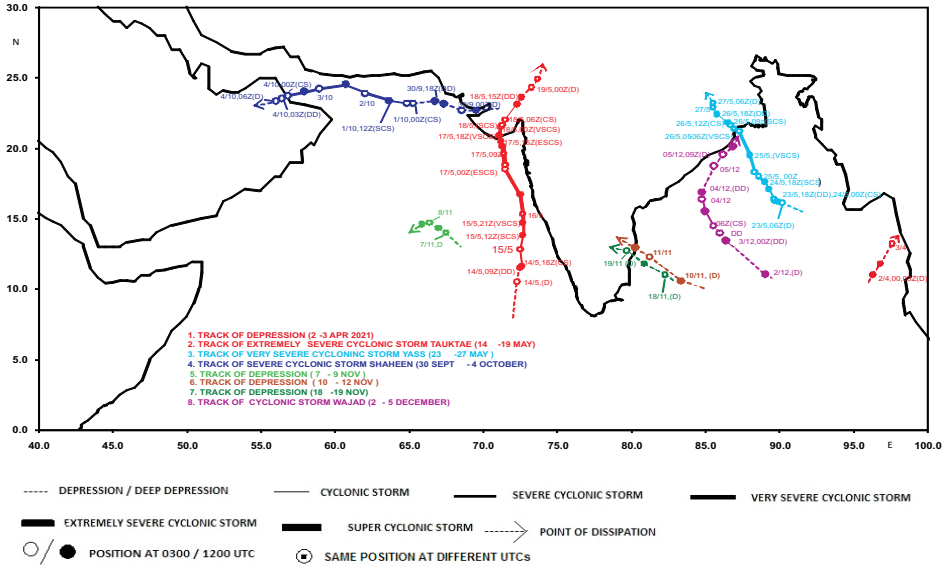
Three depressions formed during November 2021 two over Bay of Bengal (7 - 9 Nov, 18 - 19 Nov) and one over Arabian sea (10 - 12 Nov).

The first depression of the post monsoon season formed over eastcentral Arabian sea on 7th November travelled in northwestward direction and weakened on 9th November over central parts of Arabian sea. The second depression of the season formed over southwest Bay of Bengal on 10th November travelled in west northwestward direction and weakened over north interior Tamilnadu and neighbourhood on 12th November. The third depression formed over Bay of Bengal on 18th November travelled west northwestwards and weakened over north interior Tamilnadu and adjoining Karnataka and Rayalseema on 19th November.

Fig. 13 (a) and 13 (b) respectively show track of these systems formed duringthe monsoon season and other seasons in the year 2021. Frequency of depressions and cyclonic storms formed over the north Indian Ocean and Land (1951-2021) during the monsoon and post monsoon is shown in Fig.14 (a) and 14(b) respectively.



(a)



(b)

Fig. 13. Tracks of depressions and cyclonic storms formed during 2021
(a) Monsoon season (b) Other seasons

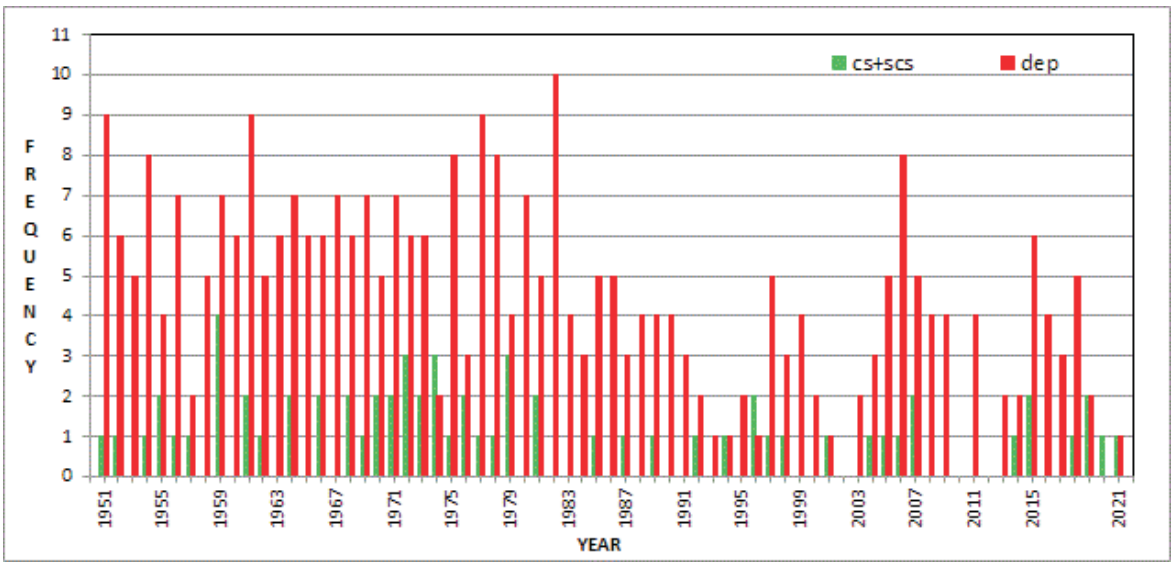


Fig. 14(a). MONSOON SEASON (JUNE-SEPTEMBER)

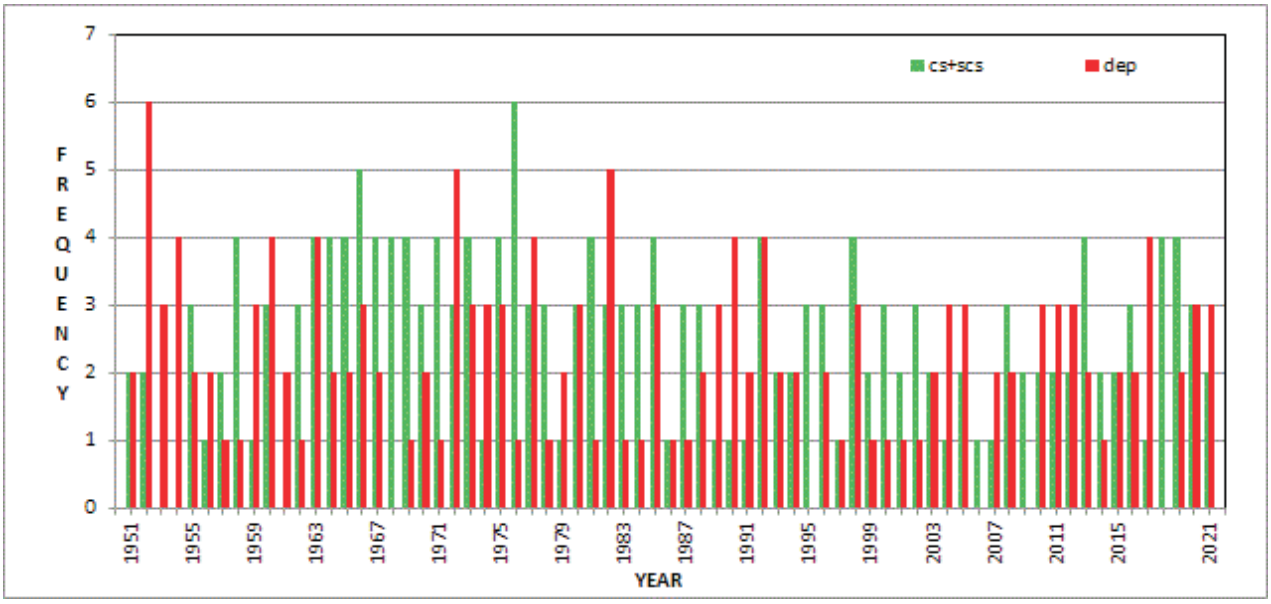


Fig. 14(b). POST MONSOON SEASON (OCTOBER-DECEMBER)

Fig. 14. Frequency of depressions and cyclonic storms formed over the North Indian Ocean & land (1951-2021)
(Source : Cyclone e-atlas, RSMC New Delhi)

E) SIGNIFICANT WEATHER EVENTS

In addition to casualties and damage due to cyclonic storms, there were impacts of other Extreme Weather Events like, extremely heavy rainfall, floods, landslide, lightning, thunderstorm, etc. Few of them listed and given in the table No.3. The causalities caused by these extreme events mentioned here are based on the media and the government reports from disaster Management Authorities.

Major Extreme Weather Events & associated loss of life, distribution of the number of deaths & its percentage, State-wise Distribution of the number of deaths & State-wise Number of Districts during 2021 are shown in Fig.15, 16, 17, 18 respectively.

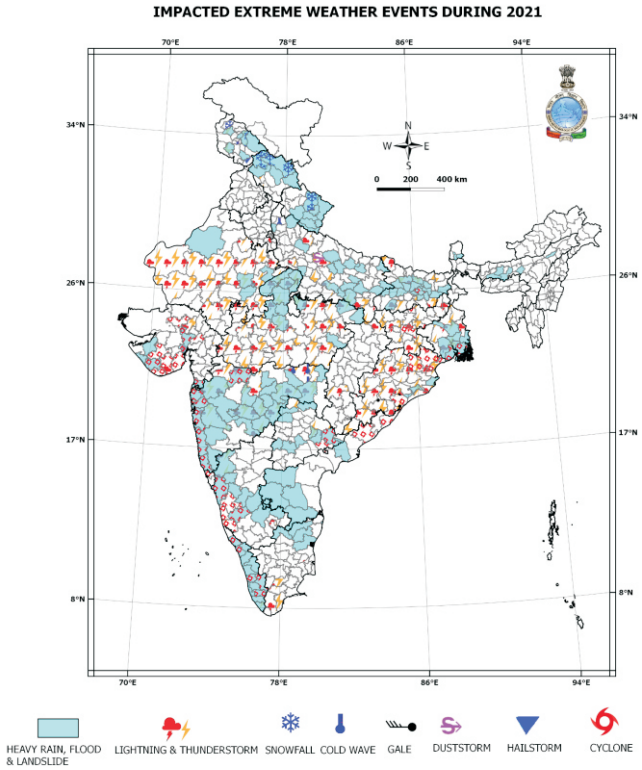


Fig.15. Major extreme weather events occurred during 2021

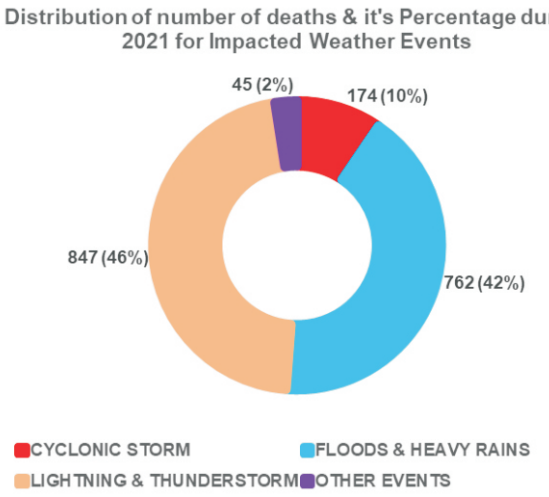


Fig. 16. Distribution of the number of deaths & its percentage during 2021 for impacted weather events

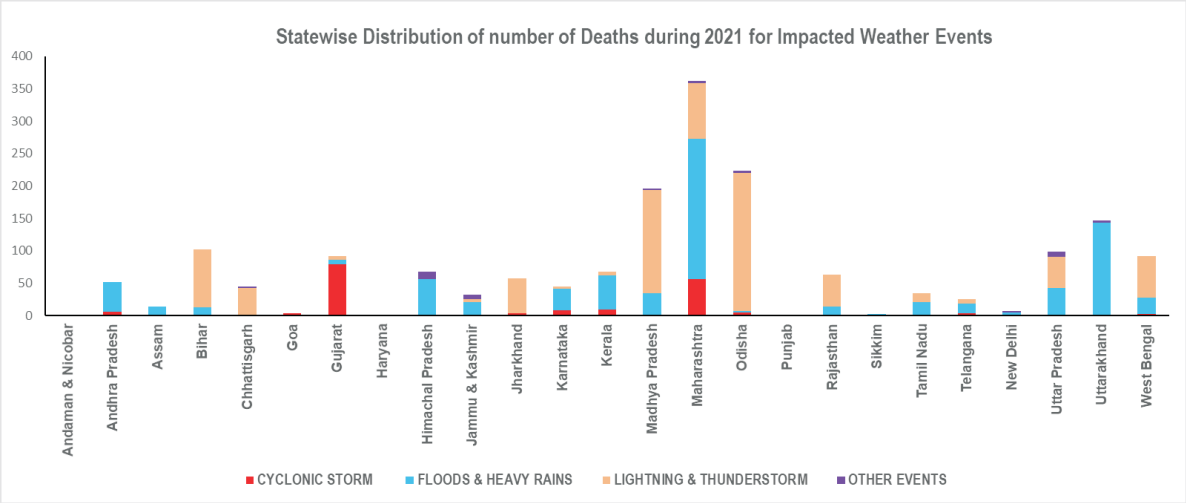


Fig. 17. State-wise distribution of the number of deaths during 2021 for high impacted weather events

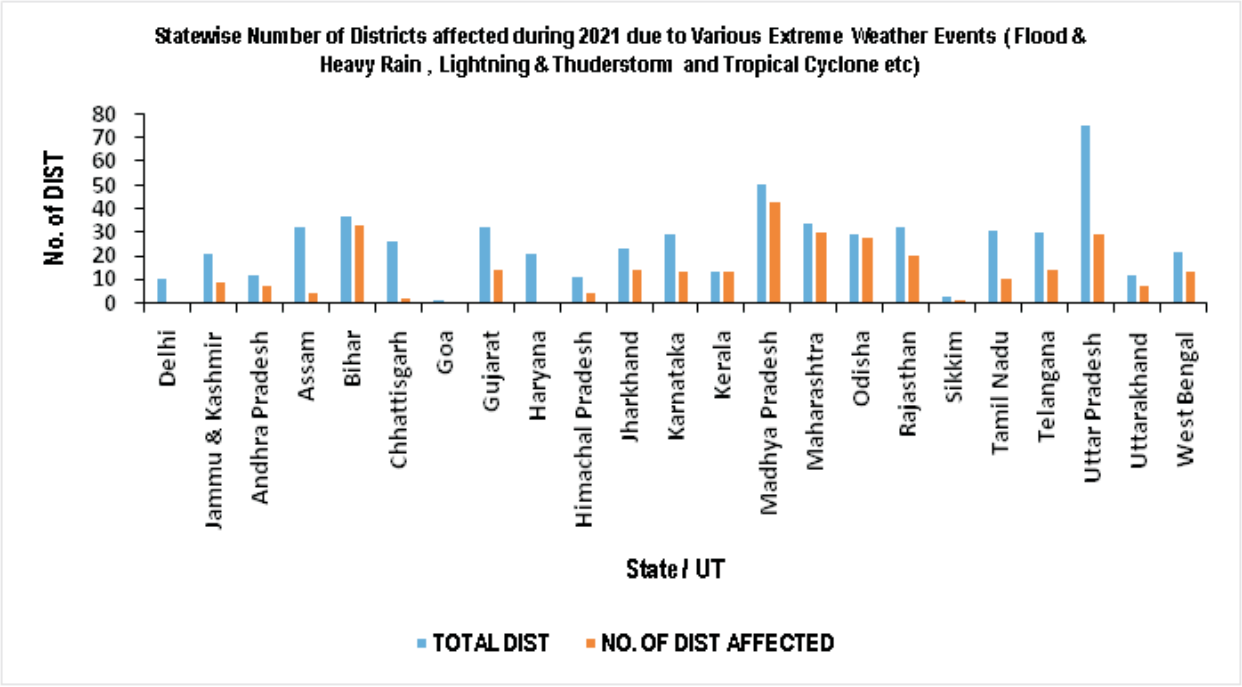


Fig. 18. State-wise number of districts affectedduring 2021 due to various extreme weather events

TABLE -1
METEOROLOGICAL SUB-DIVISIONWISE SEASONAL AND ANNUAL RAINFALL STATISTICS FOR THE YEAR 2021

		Winter (Updated)			Pre monsoon (Updated)			Monsoon (Updated)			Post monsoon (Updated)			Annual(Updated)		
S.NO	SUB-DIVISION	ACT	NORMAL	%DEP	ACT	NORMAL	%DEP	ACT	NORMAL	%DEP	ACT	NORMAL	%DEP	ACT	NORMAL	%DEP
1	A & N ISLANDS	91.5	75.4	21	602.6	466.8	29	2025.0	1653.8	22	774.4	675.8	15	3493.4	2871.8	22
2	ARUNACHAL PRADESH	41.8	146.7	-72	581.5	772.9	-25	1294.0	1726.6	-25	157.2	267.4	-41	2083.8	2913.6	-28
3	ASSAM &MEGHALAYA	11.2	46.7	-76	414.0	587.8	-30	1385.8	1773.7	-22	151.7	196.5	-23	1974.5	2604.7	-24
4	NAG.,MANI.,MIZO.,TRIP	6.7	37.8	-82	216.7	483.0	-55	964.0	1426.7	-32	152.9	221.0	-31	1340.2	2168.5	-38
5	S.H.W.B.&SIKKIM	21.3	45.9	-54	467.3	442.9	6	1817.5	1970.8	-8	310.6	179.4	73	2616.7	2639.0	-1
6	GANGETIC W.B.	0.8	32.8	-98	284.9	185.8	53	1543.9	1181.5	31	283.1	156.4	81	2112.7	1556.5	36
7	ORISSA	4.2	29.2	-86	188.6	128.4	47	1045.1	1155.3	-10	182.9	131.3	39	1420.8	1444.2	-2
8	JHARKHAND	3.6	28.2	-87	240.5	83.3	189	1041.5	1054.7	-1	159.3	90.3	76	1444.8	1256.5	15
9	BIHAR	0.7	20.1	-97	266.0	81.7	226	1044.3	1017.2	3	201.7	73.0	176	1512.7	1192.0	27
10	EAST U.P.	1.7	25.5	-93	115.0	32.4	255	867.8	839.4	3	93.6	47.7	96	1078.1	945.0	14
11	WEST U.P.	16.2	29.3	-45	67.0	29.9	124	573.7	721.3	-20	93.9	32.7	187	750.7	813.2	-8
12	UTTARANCHAL	44.5	101.4	-56	244.2	155.3	57	1156.1	1176.9	-2	219.6	60.5	263	1664.5	1494.1	11
13	HAR., CHANDI., DELHI	26.2	30.9	-15	55.2	39.3	40	576.7	444.0	30	28.9	20.2	43	686.7	534.4	28
14	PUNJAB	13.0	48.7	-73	49.7	55.1	-10	436.8	467.3	-7	34.8	26.3	32	534.4	597.4	-11
15	HIMACHAL PRADESH	57.7	192.7	-70	213.7	243.4	-12	690.9	763.5	-10	75.4	91.6	-18	1037.6	1291.2	-20
16	JAMMU & KASHMIR	122.6	224.0	-45	248.0	335.2	-26	401.6	566.0	-29	122.6	133.5	-8	894.7	1258.7	-29
17	WEST RAJASTHAN	3.6	8.8	-59	39.3	22.5	75	317.5	265.3	20	14.8	11.6	28	375.2	308.2	22
18	EAST RAJASTHAN	15.7	10.0	57	73.5	19.0	287	696.6	602.9	16	67.8	25.8	163	853.6	657.7	30
19	WEST M.P.	6.5	12.5	-48	46.9	12.9	264	981.8	857.7	14	93.2	50.9	83	1128.5	934.0	21
20	EAST M.P.	12.6	32.9	-62	96.9	23.6	311	891.8	1048.4	-15	44.7	57.4	-22	1046.0	1162.3	-10
21	GUJARAT REGION	2.6	1.5	73	56.83	6.3	802.1	788.8	922.9	-15	61.2	29.8	106	909.5	960.5	-5
22	SAURASHTRA & KUTCH	0.0	1.0	-100	44.5	4.0	1013	626.6	507.2	24	37.0	27.5	35	708.2	539.7	31
23	KONKAN & GOA	15.4	0.7	2107	192.5	36.0	435	3558.7	2875.3	24	265.8	139.6	90	4032.5	3051.6	32
24	MADHYA M'RASHTRA	20.5	2.9	607	62.4	32.5	92	872.7	751.2	16	181.0	103.1	76	1136.5	889.7	28
25	MARATHAWADA	10.8	6.9	57	36.9	27.4	35	989.5	668.8	48	120.0	100.0	20	1157.1	803.1	44
26	VIDARBHA	5.0	17.8	-72	44.4	27.4	62	968.3	943.1	3	78.1	81.5	-4	1095.9	1069.8	2
27	CHATTISGARH	12.8	21.3	-40	97.3	41.0	137	1107.7	1142.1	-3	91.9	76.7	20	1309.6	1281.1	2
28	COASTAL A.P.	16.8	22.4	-25	97.9	98.7	-1	704.3	586.9	20	360.6	338.1	7	1179.6	1046.1	13
29	TELANGANA	3.5	14.5	-76	66.7	59.8	12	1044.2	751.9	39	94.2	123.3	-24	1208.5	949.5	27
30	RAYALASEEMA	34.8	8.1	330	113.7	82.1	39	488.2	411.6	19	469.7	223.3	110	1106.5	725.1	53
31	TAMIL NADU	151.5	28.1	439	120.7	125.4	-4	393.3	336.1	17	714.3	449.7	59	1379.9	939.3	47
32	COASTAL KARNATAKA	76.8	2.5	2973	457.1	155.7	194	2800.9	3095.1	-10	557.4	256.8	117	3892.2	3510.1	11
33	N.I.KARNATAKA	12.5	5.2	141	114.3	80.0	43	603.1	497.1	21	173.0	138.1	25	902.9	720.4	25
34	S.I.KARNATAKA	48.6	5.8	738	179.1	140.4	28	701.6	681.8	3	500.8	204.1	145	1430.1	1032.1	39
35	KERALA	114.1	22.4	409	746.8	361.5	107	1719.1	2049.3	-16	1026.3	491.6	109	3606.3	2924.8	23
36	LAKSHADWEEP	216.9	25.2	761	514.6	203.3	153	790.9	1013.1	-22	376.3	321.8	17	1898.7	1563.4	21

TABLE -2

STATION WISE ANNUAL TEMPERATURE AND RAINFALL EXTREMES# FOR THE YEAR 2021

S.NO.	STATION NAME	MIN (^{0}C)	DATE (MONTH_DATE)	MAX (^{0}C)	DATE (MONTH_DATE)	HIGHEST 24 Hr. RAINFALL(mm)	DATE (MONTH_DATE)
1	Agartala AP	8.0	2_2	39.5	4_26	113.7	7_1
2	Cherrapunji*	3.8	1_15	32.1	10_12	559.6	6_29
3	Dibrugarh AP	7.4	1_1	37.3	9_14	74.2	6_20
4	Guwahati AP	8.5	12_31	38.1	4_26	121.5	9_7
5	Imphal AP	2.6	1_14	34.7	5_23	54.0	8_2
6	Passighat	10.1	1_22	37.6	6_13	172.9	8_13
7	Shillong*	4.1	1_16	28.7	5_24	63.3	7_20
8	Tezpur	10.6	1_4	37.3	4_30	66.4	9_2
9	Baghdogra AP	7.2	1_29	36.8	10_9, 10_11	195.6	10_20
10	Berhampore	8.2	1_16	40.6	4_28	86.0	6_29
11	Kolkata	11.2	12_20	39.7	4_25	150.0	7_30
12	Cooch Behar AP	5.1	1_31	37.8	9_27	201.7	7_17
13	Contai	7.0	1_31, 2_4	37.2	3_25	181.8	9_15
14	Darjeeling*	1.8	12_29	25.4	10_12	233.8	10_20
15	Gangtok*	2.8	12_30	26.6	5_24	129.7	10_20
16	Jalpaiguri	6.9	2_1	37.2	5_24	183.6	9_2
17	Kalimgpong*	6.0	12_30	31.0	5_21	199.0	10_20
18	Krishnanagar	6.8	1_3	39.6	4_20	78.2	7_30
19	Midnapore	9.5	12_20	43.1	3_30	276.2	9_15
20	Panagarh	6.2	1_31	42.6	3_30	141.4	6_26
21	Balasore	9.8	12_21	43.0	3_31	135.4	9_14
22	Bhubaneshwar AP	10.0	12_21, 12_23	44.2	3_31	199.9	9_13
23	Chandbali	9.2	12_21	42.6	3_31	288.3	5_26
24	Gopalpur	11.8	12_21, 12_22	37.4	3_20	143.3	11_2
25	Jharsugda AP	5.6	12_20	42.8	4_28	76.8	9_15
26	Puri	13.6	12_21	37.0	5_23	342.5	9_13
27	Sambalpur	8.5	12_21	42.3	4_28	80.2	7_19
28	Daltonganj	4.9	12_20	43.2	4_29	116.6	8_1
29	Gaya AP	3.0	1_30	42.0	4_14 , 4_24	120.0	5_28
30	Jamshedpur AP	6.8	12_21	42.4	4_25	147.4	5_31
31	Patna AP	3.4	1_31	42.0	4_28	146.0	6_26
32	Purnea	7.1	1_14, 1_31	38.8	4_25	212.6	5_28
33	Ranchi AP	5.8	12_22	39.5	4_28	182.4	7_31
34	Allahabad AP	4.9	1_28	44.3	4_28	127.0	9_16
35	Bahraich	4.6	1_31	41.0	4_27	109.8	7_21
36	Bareilly	3.4	1_1	41.5	4_28	178.0	10_19
37	Dehar Dun	3.8	12_18	38.8	4_28	125.2	7_22
38	Gorakhpur	5.4	1_1	41.0	4_28, 5_16	192.9	10_2
39	Jhansi	4.0	1_27	44.9	4_29	169.4	8_2
40	Lucknow AP	0.5	1_1	41.9	4_28	128.0	9_17
41	Mukteshwar**	-1.2	1_30	27.8	4_28	340.8	10_19
42	Varansai	5.0	1_28	43.4	4_28	96.6	9_16
43	Ambala	3.1	1_14	42.9	6_9	70.0	7_20
44	Chandigarh	5.7	1_13	25.8	1_4	55.4	8_5
45	Hissar	-1.2	1_1	45.0	6_9	117.0	7_30
46	Karnal	2.6	1_28	42.0	6_9	245.0	7_14
47	New Delhi AP	1.1	1_1	43.5	6_30	138.8	8_21
48	Amritsar AP	0.7	12_18	43.4	6_9	151.2	9_11
49	Patiala	3.3	12_30	43.8	6_9	123.2	9_24
50	Shimla*	-1.0	2_5	28.6	7_1	69.6	7_28
51	Banihal*	-3.6	12_17	33.8	6_30	80.4	1_6
52	Gulmarg*	-13.4	1_28	25.5	6_10, 6_29	51.0	1_6
53	Jammu AP	2.3	12_18	42.9	6_30	150.6	7_12
54	Srinagar*	-8.8	1_31	35.0	7_18	56.9	1_6
55	Ajmer	3.1	12_19	42.4	4_28	137.2	8_1
56	Barmer	7.1	1_19	43.8	4_26, 4_27	40.8	6_19
57	Bikaner	4.4	12_18	46.4	5_28	30.8	9_12
58	Ganganagar	0.2	1_13	47.3	5_28	58.8	6_27
59	Jaipur AP	4.5	12_19	42.6	4_29, 5_28	80.4	8_3
60	Jaisalmer	4.5	1_8	44.6	5_28	66.3	7_13
61	Jodhpur AP	6.0	12_19	43.0	4_28	17.8	7_26
62	Kota AP	5.0	12_19	43.4	4_28, 4_29, 4_30	157.7	8_4
63	Udaipur	2.6	1_27, 12_19	40.6	5_9	100.2	11_20
64	Ambikapur	4.9	12_20	39.5	4_25	76.3	8_1
65	Betul	4.8	12_20	41.4	4_29	58.5	7_25
66	Bhopal(AP)	3.4	12_20	42.8	4_29, 5_6	48.2	6_12
67	Guna	2.6	12_19	43.4	4_29	164.1	8_7
68	Gwalior	1.8	12_19, 12_20	44.3	4_28	79.7	7_27
69	Indore(AP)	6.5	12_20	40.6	4_29, 4_30	107.8	9_2
70	Jabalpur	4.8	1_30, 12_20	42.4	4_29	71.7	7_24
71	Jagdalpur	6.5	12_21	39.4	5_29	44.9	6_1
72	Khandwa	6.0	12_21	43.1	4_29, 5_8	122.0	7_24
73	Nowgong	1.2	12_20	45.0	4_30	96.2	7_22
74	Pendra	5.7	12_20	40.8	4_28	183.2	9_15
75	Ratlam	5.4	1_21	43.8	4_30	161.0	9_20
76	Sagar	4.4	12_19	42.8	4_29	66.4	9_6
77	Satna	3.7	1_28	42.8	4_29	82.7	7_28
78	Seoni	6.6	1_30	40.4	5_28	112.8	10_1

TABLE -2 (contd.)

S.NO.	STATION NAME	MIN (^{0}C)	DATE (MONTH_DATE)	MAX (^{0}C)	DATE (MONTH_DATE)	HIGHEST 24 Hr. RAINFALL(mm)	DATE (MONTH_DATE)
79	Umaria	1.2	12_20	43.9	4_30	170.5	7_24
80	Ahmedabad AP	9.2	12_22	43.5	5_16	113.6	5_19
81	Baroda	10.4	2_8, 12_21, 12_22	42.4	4_26	85.4	5_19
82	Bhavnagar AP	10.8	1_30	40.6	4_25, 4_26	110.4	5_19
83	Bhuj AP	8.6	1_1	42.9	4_24	54.9	6_19
84	Deesa	7.8	12_19	43.1	4_27	130.4	9_26
85	Dwarka	12.7	1_9	37.9	5_17	167.6	9_9
86	Naliya	2.5	12_18	42.0	5_16	42.1	9_2
87	New Kandala	9.6	1_29	41.7	6_6	94.2	9_2
88	Porbandar AP	8.6	1_3, 1_26	43.8	5_16	144.4	9_14
89	Rajkot AP	9.0	1_3	43.4	5_16	203.2	9_14
90	Surat	12.6	1_28	40.8	4_25	103.0	6_18
91	Veraval	12.1	1_3	39.4	3_26	155.0	7_13
92	Akola	10.5	2_9	43.4	4_28, 5_6	116.4	7_22
93	Ahmadnagar	9.8	12_21	34.0	10_8	122.0	10_10
94	Aurangabad AP	10.4	12_21	40.6	4_28	127.5	9_8
95	Buldhana	10.5	12_20	41.4	4_27	89.7	9_28
96	Chandrapur	9.6	12_21	46.2	5_29	112.8	7_23
97	Dahanu	14.2	1_29	37.8	3_25	282.6	5_18
98	Harnai	19.3	1_29	38.2	5_15	368.4	9_7
99	Jalgaon	7.0	2_9, 12_21	42.9	4_25	99.9	9_5
100	Kolhapur	15.7	12_19, 12_20, 12_21	39.5	3_29, 3_31	181.0	7_24
101	Mahabaleshwar*	11.3	2_20	33.0	3_31, 4_6	594.4	7_23
102	Malegaon	9.6	2_8	42.8	4_26	59.0	9_1
103	Mumbai	17.5	1_29	38.0	3_27	207.6	5_18
104	Nagpur AP	7.6	12_21	43.9	5_29	100.3	7_9
105	Panjim	18.4	12_19	36.0	5_12, 5_13	227.7	5_17
106	Parbhani	9.9	2_9	41.6	5_14	160.5	7_12
107	Pune	8.6	2_9	39.6	4_5	80.3	7_24
108	Ratnagiri	16.9	1_28	40.0	3_26	363.7	5_17
109	Sholapur	10.8	12_21	41.7	4_5	96.1	6_27
110	Yeotmal	9.0	12_21	43.2	4_29	67.3	8_18
111	Anantpur	13.4	12_22	41.6	3_31	119.4	6_4
112	Hyderabad AP	10.8	12_21	40.1	4_3	90.7	10_10
113	Kakinada	17.1	12_18	41.0	5_28	167.2	9_7
114	Kalingapatnam	11.8	12_22	39.5	5_26	125.9	9_27
115	Kurnool	15.2	12_23	41.7	3_31	57.2	10_9
116	Machilipatnam	16.9	12_22	41.2	5_26	92.5	6_28
117	Nellore	20.6	2_14	42.4	4_1	91.3	11_28
118	Nizamabad	12.1	12_22	42.4	4_29	144.4	9_28
119	Ongole	19.3	12_22	43.3	4_2	62.0	2_20
120	Ramgundam	9.2	12_21	43.2	5_29	81.6	9_7
121	Rentachintala	10.6	12_23	42.0	4_2, 5_31	NOT AVAILABLE	
122	Visakhapatnam AP	15.2	2_4, 2_6	43.0	5_27	267.0	9_27
123	Chennai AP	19.0	12_24	41.8	4_2	148.9	12_31
124	Coimbatore	17.0	2_8, 2_10	38.2	3_31	112.8	1_7
125	Cuddalore	19.5	12_24	40.2	5_30	185.6	2_21
126	Kanyakumari	20.4	7_10	35.6	4_4	129.6	5_26
127	Kodaikanal*	5.7	12_10	22.6	3_31	66.0	10_4
128	Madurai AP	17.8	2_12	42.3	4_2	103.6	9_25
129	Nagapattinam	19.9	12_24	39.1	6_10	310.4	11_10
130	Palayamkottai	21.4	1_30	38.4	4_7	107.0	11_26
131	Pamban	22.0	12_24, 12_25	37.0	9_22	115.2	11_28
132	Salem	17.0	12_25	42.8	3_31	98.2	7_5
133	Tiruchirapalli AP	17.6	2_10, 2_12	42.5	4_3	117.6	8_10
134	Vellore	16.1	2_8, 2_10	43.4	4_2	81.2	11_19
135	Bangalore*	14.2	12_22	37.2	3_31	73.4	11_19
136	Chitradurga	12.5	12_21	37.9	3_31	128.1	10_7
137	Gadag	12.1	12_19	39.1	3_31	92.4	5_24
138	Gulbarga	14.7	12_22	43.3	5_10	106.0	7_10
139	Honavar	18.4	12_7	35.5	2_1	124.1	6_18
140	Karwar	17.2	12_20	37.2	2_9, 4_30	130.7	7_15
141	Mangalore AP	20.3	12_21	36.7	3_4	192.3	10_13
142	Medikeri*	11.8	12_24	40.5	4_14	154.8	7_15
143	Mysore	11.8	2_11	37.9	3_31	82.0	10_21
144	Raichur	12.0	12_18, 12_22, 12_24	41.0	3_31	62.4	10_9
145	Alapuzha	21.6	2_11	37.2	3_6	157.2	5_15
146	Cochi AP	21.4	1_26	33.8	4_30, 5_6	209.0	5_15
147	Kozhikode	21.8	5_27	35.8	3_27	216.0	10_12
148	Thiruvananthapuram	20.4	2_11, 2_12	36.3	3_30	155.8	5_12
149	Car Nicobar	21.2	1_24	35.0	5_14	123.2	8_19
150	Port Blair	21.3	2_10	35.2	5_14	106.9	9_16
151	Amini Divi	20.8	2_22	35.4	4_29	101.2	8_9
152	Minicoy	21.6	2_13	34.6	4_18	71.4	6_8

(* : Hill Stations) (# : Based on Reai-time data)

TABLE -3

HIGH IMPACTED WEATHER EVENTS OCCURRED DURING 2021 ALONG WITH ASSOCIATED LOSS OF LIFE AND DATES

Event		Number of Casualties	Season	Date	State / Union Territory Affected
Floods & Heavy Rain		762	Whole year	7 Feb. to 21 Nov.	Andhra Pradesh, Assam, Bihar, Gujarat, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Sikkim, Tamil Nadu, Telangana, Union Territory (New Delhi), Uttar Pradesh, Uttarakhand, West Bengal
Lightning & Thunderstorm		847	Whole year	2 Jan to 28 Dec.	Bihar, Chhattisgarh, Gujarat, Haryana, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu, Telangana, Uttar Pradesh, West Bengal
Snowfall		20	Winter, Post Monsoon	6, 12 Jan.; 1, 21, 23, 24 Oct.	Jammu & Kashmir, Himachal Pradesh, Uttarakhand
Cold Wave		11	Winter, Post Monsoon	3, 18 Jan.; 29 Nov.; 18, 21 Dec.	Jammu & Kashmir, New Delhi, Uttar Pradesh, Madhya Pradesh, Maharashtra
Dust Storm		5	Pre Monsoon	12 May	Uttar Pradesh
Gale		5	Pre Monsoon	5, 23, 27, 29 May	Madhya Pradesh, Odisha, Andaman & Nicobar
Hailstorm		4	Pre Monsoon, Post Monsoon	18 Apr., 28 Dec.	Chhattisgarh, Jammu & Kashmir
Extremely Severe Cyclonic Storm “TAUKTAE”		144	Pre Monsoon	14 to 19 May	Gujarat, Maharashtra, Kerala, Karnataka, Goa
Cyclonic Storm “GULAB”		19	Monsoon	24 to 28 Sep.	Andhra Pradesh, Maharashtra, Odisha, Telangana
Very Severe Cyclonic Storm “YAAS”		9	Pre Monsoon	23 to 28 May	Odisha, Jharkhand, West Bengal, Bihar
Cyclonic Storm “JAWAD”		2	Post Monsoon	2 to 5 Dec.	Andhra Pradesh







वार्षिक जलवायु सारांश - 2021

ANNUAL CLIMATE SUMMARY - 2021

जलवायु अनुसंधान एवं सेवाएँ
CLIMATE RESEARCH & SERVICES

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