



# ANNUAL LIGHTNING REPORT 2023-24



## LIGHTNING RESILIENT INDIA CAMPAIGN

A joint initiative by Climate Resilient Observing Systems Promotion Council (CROPC), India Meteorological Department (IMD) and Ministry of Earth Sciences Government of India.

# **ANNUAL LIGHTNING REPORT 2023-24**

**is  
Dedicated  
to**



**SHRI. P. P. SHRIVASTAV  
(18.02.1934 – 06.04.2024)**

Shri. P. P. Shrivastava was the Member, Advisory Committee of the National Disaster Management Authority, Member, Governing Body, Tibet House, New Delhi; AND of The Asian Confluence, Shillong, Member, Board of Trustees, Sri Aurobindo Institute of Indian Culture, Shillong (Meghalaya), Member, North Eastern Council (Rank - Union Minister of State): 2005-13, Adviser to Governor: Assam (90-91), H.P. (93) Manipur (94) under President's Rule, Ministry of Home Affairs (3 tenures during 1975-93 and Retired as Special Secretary in 1993.



## DISCLAIMER

**“Annual Lightning Report 2023-24”** has been prepared by Col. Prof. Sanjay Kumar Srivastava, Chairman of Climate Resilient Observing Systems Promotion Council (CROPC) and his team under the guidance of patrons of Climate Resilient Observing Systems Promotion Council (CROPC).

The Lightning Strikes’ data used in this report has been obtained from Indian Institute of Tropical Meteorology (IITM), Pune, National Remote Sensing Centre (NRSC), World Wide Lightning Detection Network. (WWLDN) and Vaishala. The data for mortality has been obtained from National Crime Record Bureau (NCRB) and SDMAAs, wherever the data about mortality was not available secondary sources were referred.

Every care has been taken to ensure that the data is correct, consistent and complete as far as possible. However, the constraints of time and resource available, do not preclude the possibility of errors, omissions etc. in the data and consequently in the report preparation.

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D.O No. 22/CH/NCSC/2024

Dated: 28<sup>th</sup> June, 2024

### Message

It gives me immense pleasure to extend greetings on release of Annual Lightning Report 2023-2024. The report is acknowledge of the hard work and sincere efforts of "Lightning Resilient India Campaign" to save life of people from extreme natural hazard lightning. As I have come to know that the volunteers of the campaign have been physically visiting and training children from weaker sections of society and making them weather wise and lightning safe. Lightning, due to innovative solutions by India Meteorological Department (IMD) and Climate Resilient Observing Systems Promotion Council (CROPC), now is an 100% avoidable death. I congratulate our scientists for their dedication and making successful forecasts of lightning as well as creating lightning safe shelters. I came to know that thousands of precious life of human and animals could be saved due to efforts of CROPC and Lighting Resilient India Campaign. I bow my head in respect to all the involved with Lightning Resilient India Campaign.

6<sup>th</sup> Annual Lightning Conference 20204, now in its fifth consecutive year, marks a significant milestone in our efforts to combat the devastating effects of lightning, particularly among the vulnerable Scheduled Castes communities. The remarkable efforts of the "Lightning Resilient India Campaign" at the grassroots level has been instrumental in this achievement, leveraging the scientific knowledge products and expertise to support disaster management agencies at gram panchayat, district, state, and national levels.

The Annual Lightning Report is a testament to a successful campaign that has not only saved lives but also promoted essential research on lightning. The Lightning Resilient India Campaign, in collaboration with the Climate Resilient Observing Systems Promotion Council (CROPC), IMD, Ministry of Earth Sciences (MoES), Indian Meteorological Society (IMS), National Disaster Management Authority (NDMA), State Disaster Management Authorities (SDMAs), and academia, has made significant strides in reducing lightning-related fatalities. This comprehensive approach has ensured that the most vulnerable, including many from the Scheduled Castes, are better protected.

One of the campaign's biggest achievements is the formulation of a dedicated Lightning Risk Mitigation program at both national and state levels. This program includes raising awareness about lightning, implementing early warning systems, establishing safety protocols, and developing mitigation strategies. The partnership between CROPC and various agencies has paved the way for comprehensive lightning risk management across the country.







The customized analysis of lightning hazards for each state required tremendous efforts in coordination, data collection, and analysis. The positive effects of this campaign are evident in the significant reduction of deaths among people and animals, which is a direct benefit to our communities. However, there is still room for improvement, particularly in early warning, forecasting, and dissemination mechanisms through SDMAs and DDMAAs to reach the last mile. Ensuring compliance with safety advisories in far-flung tribal areas and hilly terrains remains a challenge.

With the support of state governments, academia, NGOs, and community-based organizations, the Lightning Resilient India Campaign aims to better disseminate scientific knowledge to communities. This initiative focuses on education, awareness, training, and capacity building, which are essential for empowering our Scheduled Castes communities to protect them from lightning hazards.

The Annual Lightning Report 2023-2024 provides detailed insights into five years of lightning mapping, covering technical, social, and economic aspects. It identifies lightning hotspots, seasonality, timing, and the vulnerability of populations and infrastructures. The report also highlights the socio-economic impacts of lightning and offers local solutions, which are invaluable for stakeholders, particularly those working to protect the Scheduled Castes.

The campaign has been instrumental in promoting lightning research and collaborating with academia and other scientific bodies. It has successfully translated scientific findings into community-friendly language, addressing localized hazards. CROPC's collaboration with state disaster management bodies and academia has fostered proactive risk understanding, which is crucial for our communities.

I extend my heartfelt congratulations to Col. Sanjay Srivastava, Chairman of CROPC, and the entire team for their commendable work and leadership. Their lifesaving efforts are praiseworthy, and I wholeheartedly support the continuation of this research-oriented program. Best wishes to the entire team of CROPC, MoES, IMD, and NDMA for their future endeavours towards a lightning-resilient society.

(Kishor Makwana)  
Chairman





सत्यमेव जयते

डॉ. एम. रविचंद्रन  
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### Message

It is a matter of immense professional satisfaction and honour that the Annual Lightning Report 2023-2024 is being released during the Annual Lightning Conference 2024. This marks the fifth consecutive year of this significant event, driven by the remarkable efforts of the "Lightning Resilient India Campaign" at the grassroots level. The campaign leverages the Ministry of Earth Sciences' knowledge products and expertise to support disaster management agencies at gram panchayat, district, state, and national levels.

The Annual Lightning Report is a testament to the successful campaign that has saved lives and promoted research on lightning. The Lightning Resilient India Campaign, in collaboration with the Climate Resilient Observing Systems Promotion Council (CROPC), IMD, IITM, Ministry of Earth Sciences (MoES), Indian Meteorological Society (IMS), National Disaster Management Authority (NDMA), State Disaster Management Authorities (SDMAs), and academia, has made significant strides in reducing lightning-related fatalities.

One of the campaign's biggest achievements is the formulation of a dedicated Lightning Risk Mitigation program at both national and state levels. This includes raising awareness about lightning, early warning systems, safety protocols, and mitigation strategies.

The partnership between MoES and CROPC has proven to be one of the most successful initiatives, paving the way for comprehensive lightning risk management in the country. The customized analysis of lightning hazards for each state required tremendous efforts in coordination, data collection, and analysis. The campaign's positive effects are evident in the reduction of deaths among people and animals.

However, there is still room for improvement in early warning, forecasting, and dissemination mechanisms through SDMAs and DDMAAs to reach the last mile. Reaching the most vulnerable individuals and ensuring compliance with safety advisories remains a challenge, particularly in far-flung tribal areas and hilly terrains. The 'DAMINI' Lightning Alert app, developed by IITM Pune, is being enhanced to support regional languages, addressing this issue.



With the support of state governments, academia, NGOs, and community-based organizations, the Lightning Resilient India Campaign aims to better disseminate scientific knowledge to communities, focusing on education, awareness, training, and capacity building.

The Annual Lightning Report 2023-2024 details five years of lightning mapping, covering technical, social, and economic aspects in detail. It identifies lightning hotspots, seasonality, timing, vulnerability of populations, and infrastructures. The report also highlights the socio-economic impacts of lightning and offers local solutions.

The campaign has been instrumental in promoting lightning research, collaborating with academia and other scientific bodies. It has successfully translated scientific findings into community-friendly language and addressed localized hazards. CROPC's collaboration with state disaster management bodies and academia has fostered proactive risk understanding.

The innovative solutions and recommendations provided in the report will be invaluable to stakeholders. I extend my congratulations to Col. Sanjay Srivastava, Chairman of CROPC, and the entire team for their commendable work and leadership. Their lifesaving efforts are praiseworthy, and I support the continuation of this research-oriented program. Best wishes to the entire team of CROPC, MoES, IITM, IMD, and NDMA for their future endeavours towards a lightning-resilient society.

  
(M. Ravichandran)





**RAJENDRA SINGH, (PTM, TM)**  
**Member & HoD**  
Former Director General, Indian Coast Guard



**National Disaster Management Authority**

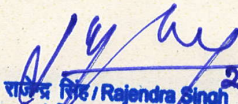
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It gives me immense pleasure to extend my greetings to India Meteorological Department (IMD) and the Climate Resilient Observing Systems Promotion Council (CROPC) on the release of Annual Lightning Report 2023-2024 during the 6<sup>th</sup> Annual Lightning Conference on 28 June 2024.

The Annual Lightning Report 2023-2024 is a testimony of India's collective effort to extreme climate events like lightning. The report showcases a synergised scientific, administrative and community based initiatives to address the lightning hazard and reduce mortality as well as economic losses.

The Report provides comprehensive insights into lightning mapping, covering technical, social, and economic dimensions, identifying hotspots, seasonality and vulnerability. A significant outcome of Lightning Resilient India Campaign has been the development of a Draft National Programme document on lightning risk mitigation for NDMA.

This initiative has been important in advancing lightning research, translating scientific findings into simple language and fostering proactive risk management. I congratulate IMD and the CROPC team for their outstanding work. Their dedication ensures continued progress towards building a lightning-resilient society.

  
राजेंद्र सिंह / Rajendra Singh  
सदस्य एवं प्रमुख / Member & HoD  
राष्ट्रीय आपदा प्रबंधन प्राधिकरण  
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गृह मंत्रालय / Ministry of Home Affairs  
भारत सरकार / Government of India  
नई दिल्ली / New Delhi  
26/06/24.





## डॉ. मृत्युंजय महापात्र

मौसम विज्ञान विभाग के महानिदेशक,  
विश्व मौसम विज्ञान संगठन में भारत के स्थाई प्रतिनिधि  
विश्व मौसम विज्ञान संगठन के तीसरे उपाध्यक्ष

*Dr. Mrutyunjay Mohapatra*

Director General of Meteorology,  
Permanent Representative of India to WMO  
Third Vice President of WMO

भारत सरकार  
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### Message

It is a matter of great pleasure that the Annual Lightning Report 2023-2024 is being released during 6<sup>th</sup> Annual Lightning Conference 2024. The report and the annual conference on lightning, for the fifth consecutive year since 2020, has been an incredible journey of making lightning resilience a key agenda among stakeholders and policymakers. Both activities are a key component of the "Lightning Resilient India Campaign" of CROPC through which it aims to enhance the outreach of India Meteorological Department (IMD)'s lightning forecasts and knowledge products at all time and space scales to disaster management agencies at national, state, district and gram panchayat level, thereby improving the knowledge of lightning as a disaster at the grass root level. The Annual Lightning Report of 2023-2024, brought out in collaboration with India Meteorological Department (IMD), Ministry of Earth Science contains information about the spatial distribution of lightning in all states of India, and their trends through the past few years. The report clearly brings out the lightning hotspots, seasonality and timings of lightning for each state thereby highlighting the vulnerable population. This knowledge of lightning distribution and intensity throughout India will go a long way in improving our understanding of the science of lightning and its mitigation. One of the biggest achievements of the Lightning Resilient India Campaign is sensitisation of NDMA and SDMA towards creation of a dedicated Lightning Risk Mitigation programme at national and state levels.

Through the Lightning Resilient India Campaign and the Annual Lightning Report 2023-2024, it is hoped that the message of lightning resilience can be carried forward for broader community with the support of state governments, academia, NGOs and Community based organisations, especially in creating education, awareness, training and capacity building.

I commend the excellent effort done by IMD, NDMA and CROPC under the leadership of Col Professor Sanjay Srivastava and his team. I convey my best wishes for all their future endeavours towards lightning resilience.

  
(Mrutyunjay Mohapatra)

**Dr. K. J. Ramesh**  
**Former Director General**  
**India Meteorological Department (IMD)**

**Lightning Resilient India Campaign**  
**8, Nelson Mandela Road**  
**New Delhi 110070**



It is a matter of immense pride and professional satisfaction to me on the occasion of release of Annual Lightning Report 2023-2024, consecutively for the fifth year at 6<sup>th</sup> Annual Lightning Conference on 28 June 2024 at the premises of Climate Resilient Observing Systems Promotion Council and Institute of Social Sciences. I would like to extend my greetings to entire team of Climate Resilient Observing Systems Promotion Council (CROPC) and India Meteorological Department (IMD) on the successful campaign of Lightning Resilient India Campaign. The report is testimony of hard work of “Lightning Resilient India Campaign” – a joint initiative of CROPC and IMD, duly supported by National Disaster Management Authority (NDMA) since its inception in 2019. In my opinion, this partnership between IMD and CROPC has been one of the most fruitful and outstanding partnership.

The Annual Lightning Report 2023-2024 is testimony of India’s collective effort to extreme climate events like lightning in exemplary manner. The report is a platform which showcases a synergised scientific, administrative and community based initiatives to address the lightning hazard and reduce mortality and economic losses. The community first approach based on citizen science has yielded marvellous results.

With changing dynamics of disasters and their extremities, it has become necessary to create specialisation in hazards like lightning. Today CROPC stands as an organisation of international repute, dedicated to knowledge management agency to serve the country and states as technical support in terms of planning their vulnerability atlas, identifying hotspots, enhancing season based preparedness, innovation and ideas in detection, lightning protection, development of programmes, policy and guidelines, research and development etc. This is an outstanding contribution to the nation through NDMA, SDMA, and community.

Annual Lightning Report 2023-2024 and the 6<sup>th</sup> Annual Lightning Conference 2024, mark the fifth consecutive year of this event, signifying sustainability and significant milestone in addressing lightning hazard. In addition, the climate healing long term programmes contribute to climate action, to reduce the occurrence of extreme events. The commendable efforts of the grassroots "Lightning Resilient India Campaign" have been pivotal in this



success, utilizing the Ministry of scientific expertise to aid disaster management agencies from local to national levels.

The Annual Lightning Report 2023-2024 provides comprehensive insights from five years of lightning mapping, covering technical, social, and economic dimensions, identifying hotspots, seasonality, and vulnerability. The most significant outcome of Lightning Resilient India Campaign has been development of a National Programme on lightning for NDMA with the technical support of CROPC , authored by Col Prof. Sanjay Srivastava. This is unique feather for India. At local level specific community focussed programmes on tribal and weaker section of society in Sunderban, Odisha, Shantiniketan , Jharkhand have richly built resilience of vulnerable communities.

CROPC's contribution in the field of lightning is gone international. The Lightning Resilient India Campaign also serves its neighbouring SAARC countries. It is matter of pride that Annual Lightning Reports are praised and hosted by World Meteorological Organisation (WMO) on their website. These efforts of India has been well acknowledged by United Nations Office of Disaster Risk Reduction (UNDRR). CROPC, through its research and analysis, is also contributing for a lightning resilient infrastructures through Coalition of Disaster Resilient Infrastructure(CDRI). CROPC has also been instrumental in designing scientific and suitable lighting protection solutions for large solar energy parks, chemical industrial hub and petroleum industries.

This initiative has been pivotal in advancing lightning research, translating scientific findings into accessible language, and fostering proactive risk management.

I would like to put on record that it is committed efforts and persona of Col Prof Sanjay Srivastava Chairman CROPC that he has been bring entire scientific community, NDMA, SDMA, academia, NGOs/CSOs, Lightning Protection Industries and others on one platform and achieve consensus to accept lightning as a hazard and work to mitigate it. He has led by example and initiated policy, plans, research and development, advocacy, awareness and sensitisation. Based on scientific inputs from IMD and MoES institutions from MoU for outreach to authoring National Programme on Lightning Risk Management for NDMA has been historical achievement. I extend my heartiest greetings to Col Prof Sanjay Srivastava and his team of CROPC for their outstanding leadership. Their dedication ensures continued progress towards a lightning-resilient society by avoiding lightning induced mortalities altogether.



(Dr. K.J. Ramesh)

**Col Prof Sanjay Srivastava**  
Chairman, CROPC  
Convenor, Lightning Resilient  
India Campaign

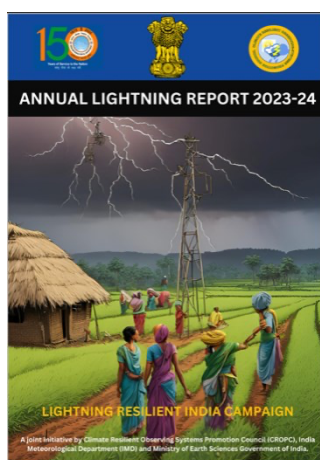


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It is a matter of great humility and dedication to present Annual Lightning Report 2023-2024 of Lightning Resilient India Campaign- a joint initiative of Climate Resilient Observation Systems Promotion Council (CROPC) and India Meteorological Department (IMD) . This is the fifth successive annual reports in a row since 2019. The report is also success story of India that how in a vast country like India, a collective and coordinated efforts by scientific agencies, disaster management agencies of governments at national and state level, backed by an organisation from society, serve the community for lightning resilience.

The report documents untiring efforts of scientific community and disaster Management agencies that is IMD, NDMA, IITM, NRSC, NESAC to come up with precise Lightning detection and forecast. The report represents the efforts of National Disaster Management Authority (NDMA) and their proactive intervention by policy, advisory, protocols, plans and provision of fund to address Lightning – an extreme climate hazard. **A National Programme by NDMA, Government of India is an historical intervention.**

The state of art early warning being forecast by IMD is one the best in the world today. The improvement in observational network has led to high accuracy in forecasts. ***Thus, there has been significant improvement in Lightning forecast. IMD now does one the best lightning forecast in the world with a lead outlook of 5-3 days to 24 hours and nowcast of 3 hours to 30 minutes with very high accuracy.***



Annual Lightning Report 2022-2024 is also incredible example how scientific observations, data and knowledge products have been converted in high value products that is hotspot atlas at micro level and used to prevent loss of life and damages to infrastructure. CROPC along with academia , district and Gram Panchayats, NGOs created a Lightning Resilience Framework and the same was practised at the level of vulnerable communities. The outcome has been Zero/minimum death. **It proves that Lightning deaths are 100% avoidable.**

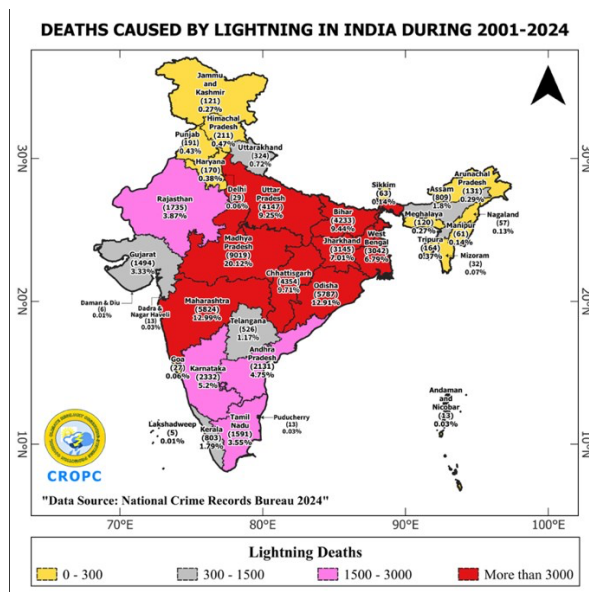
Lightning Atlas and hotspot mapping has been found revealing. It has added new dimensions. The observational data of last five year from 2019 to 2023 establishes new patterns of lightning strikes over various parts of India. Major breakthrough is myth of highest lightning strike in north east as observed by WWLDN. The observations by IITM Lightning Detection Network (LDSN) as well as NRSC's LDSN corroborate that highest Cloud-to-ground(CG) lightning strike are in eastern and central India And hence maximum damage In eastern and central India. Second revelation is emergence of Rajasthan, Gujarat, Haryana, Punjab, Delhi – the desert and semi-arid zone as new lightning hotspots. Third is identification of hotspots along Kaimur and Satpura Range in between river Ganges and Sone in Madhya Pradesh, Bihar, Uttar Pradesh, as prominent hotspots. Report also represents district wise micro-zonation of lightning strikes and dividing the country into high, moderate and low vulnerable based on four criteria that is lightning occurrences, deaths, climate change and socio-economic aspects.

## Major Highlights

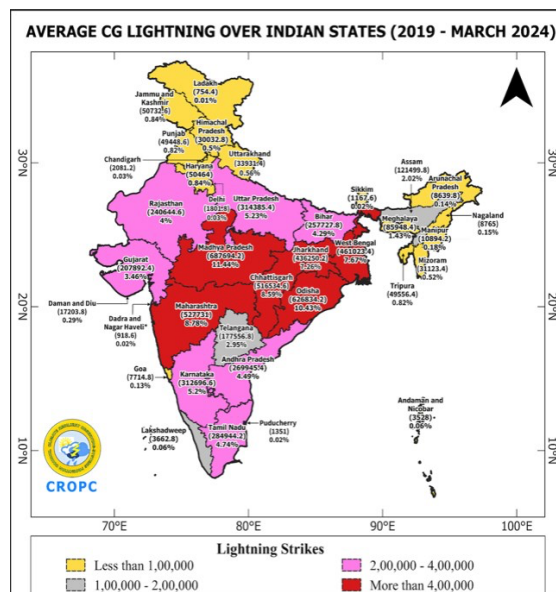
**As per the data from IITM , Pune , there was a decrease of CG Lightning from 72 Lakh in 2022-23 to 57 Lakh in 2023-24, a significant decrease by 21%. There is apparent reduction in lightning observed in central India and southern peninsula during the months of peak season like July to September 2023. *The 2023 was last monsoon of El Nino phase and hence the absence of moisture could be the main reason for the decrease. However, there are states who have registered increase like Gujarat , Rajasthan, Punjab which is new trend. Similarly, The recent analysis of Lightning occurrences as observed by TRMM data that North East India was hub of lightning has been broken. As per both the Indian Lightning Detection Network by IITM and NRSC shows more lightning in Eastern and Central India.***

***There has also been reduction in the casualties, especially in Central and eastern India .This could be attributed to the efforts by NDMA and IMD and other institutions.***

***The comparative analysis shows interesting facts. Almost 88% mortality is confined mostly to eastern and central India among seven states. The reason is intense frequency of lightning and more than 75-80% rural population. This needs deep analysis.***



**Deaths due to Lightning**



**Lightning strikes**

### ***Dissemination of lightning Early warning and Last mile connectivity***

NDMA in India has commissioned Common Alerting Protocol (CAP) and SACHET mobile application has been launched. IMD issues forecasts direct to NDMA, SDMAs, other departments, state and people through social media and official letters. There has been innovative EW Dissemination system "Indravani developed by CROPC and its start-ups . The same is a two way automated audio and video system broadcasting alerts promptly. This is a very useful technology and it can be used for other disasters too.

### **Lightning Protection new dimension due to change in rise in surge of atmospheric electricity**

There has been phenomenal rise in frequency, intensity and dimension of lightning strikes , specially cloud to ground strikes. It has recorded three to four times rise in its parameters, specially frequency, intensity and pattern of lightning. Each strikes over India has been mapped and the organisations interested may write to Chairman, CROPC at email id [cropcn@gmail.com](mailto:cropcn@gmail.com) to obtain it for their specific location.

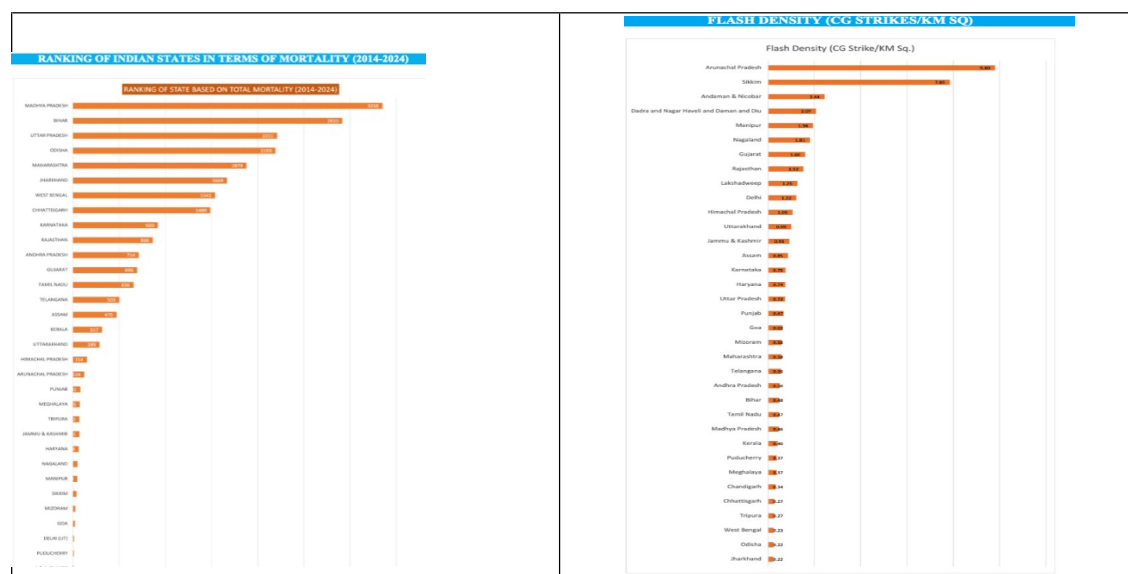
Lightning flashes frequency, density, intensity, dimensions and relevant parameters are mandatory to be incorporated in the risk assessment as prescribed by IEC-62305 and subsequent design engineering and finalising technical specifications . Therefore, the parameters published in this report are real time evidence based lightning flash frequency and intensity as observed by observation-systems of IMD, IITM, NRSC. They cannot be compared to any external source of data.

***The members of Indian Lightning Protection Industries brought out that at present, lightning protection in India is based on foreign standards that is IEC or NFC Standards. These standards have their own merits . There is a need that the lightning protection in India should be standardised as per the local conditions and need. The lightning protection industries demanded an Indian Lighning Protection Standard. A separate committee should be formed under NDMA involving BIS and experts, consultants and manufacturers.***



## Ranking of states in terms of Lightning flash density and deaths

The ranking of states in terms of lightning flash density and deaths reflect that Arunachal Pradesh, Sikkim, Himalayan foothills, Delhi etc. are emerging hotspots. Death wise, the states of Madhya Pradesh, Uttar Pradesh, Bihar, Jharkhand, Odisha and West Bengal need to put in more efforts. The details are given below :-



## **Recommendations for Future Action:**

1. Given the ubiquity and fatality of lightning incidents, it's recommended to classify it as a national disaster and notify it. In absence of lightning not being notified, its addressed holistically. At present only relief is being addressed. We need to address in entirety that is prevention, mitigation and capacity building too.  
**NDMA should take it on priority.**
2. Strengthening lightning detection and Early Warning systems is paramount.
3. Implementation of standardized, safe, and cost-effective lightning protection devices is essential. There is a need to develop indigenous Indian Lightning Protection standards.  
In this regard, it is requested that under National Disaster Management Authority (NDMA) ,a committee of experts and lightning protection industries be formed to develop indigenised Lightning protection standards.
4. Striving for self-reliance in lightning instrumentation, public alert systems, and protection mechanisms should be pursued.
5. Developing a cadre of lightning experts is advisable.
6. Encouraging the involvement of private industries is pivotal.
7. A review and enhancement of building bylaws and lightning protection standards are warranted.
8. Further popularizing the Damini app is crucial.
9. States must formulate Lightning Action Plans, with a focus on season-based resilience strategies. Proactive involvement of Panchayats is essential to disseminate scientific knowledge effectively, particularly given that 96% of lightning casualties occur in rural areas.

## **Acknowledgements**

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**Sanjay Kumar Srivastava**



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