CROPC

Regional Framework for Lightning Early Warning System for SAARC Countries

Presentation by

Climate Resilient Observing Systems Promotion Counci

Venue SAARC Disaster Management Center, Gandhinagar

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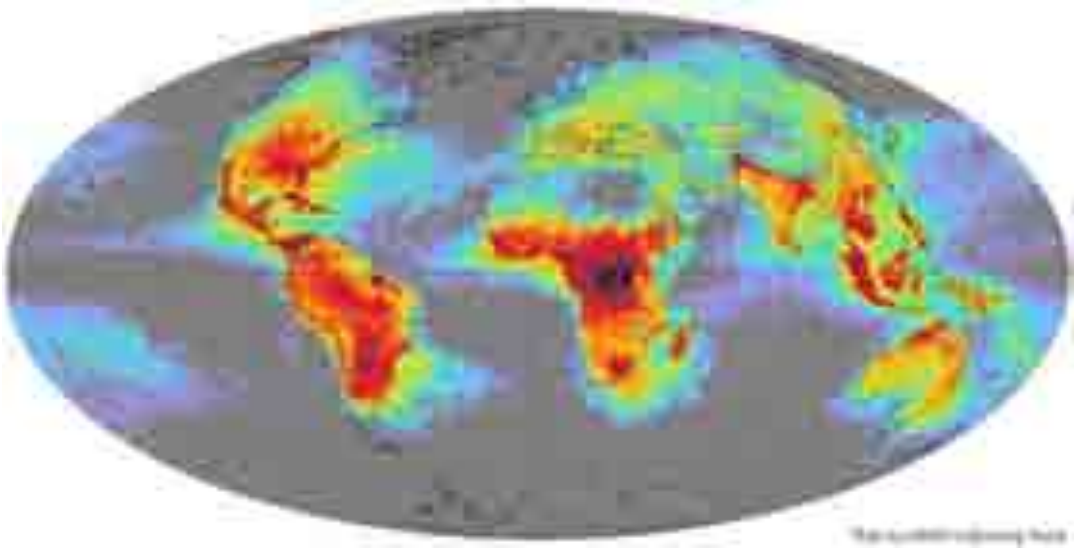
Lightning – direct promulgation of climate change extremities

- Global phenomenon, 2 million lightning anytime
- Heat – Moisture- Convection
- Global warming, Heat, deforestation, depletion of water bodies, pollution, environmental degradation
- Deaths now 24000 plus
- Climate Change extremities rising ---- lightning ---- Fatalities
- Deaths MUST stop
- Scientific community centric approach



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Lightning

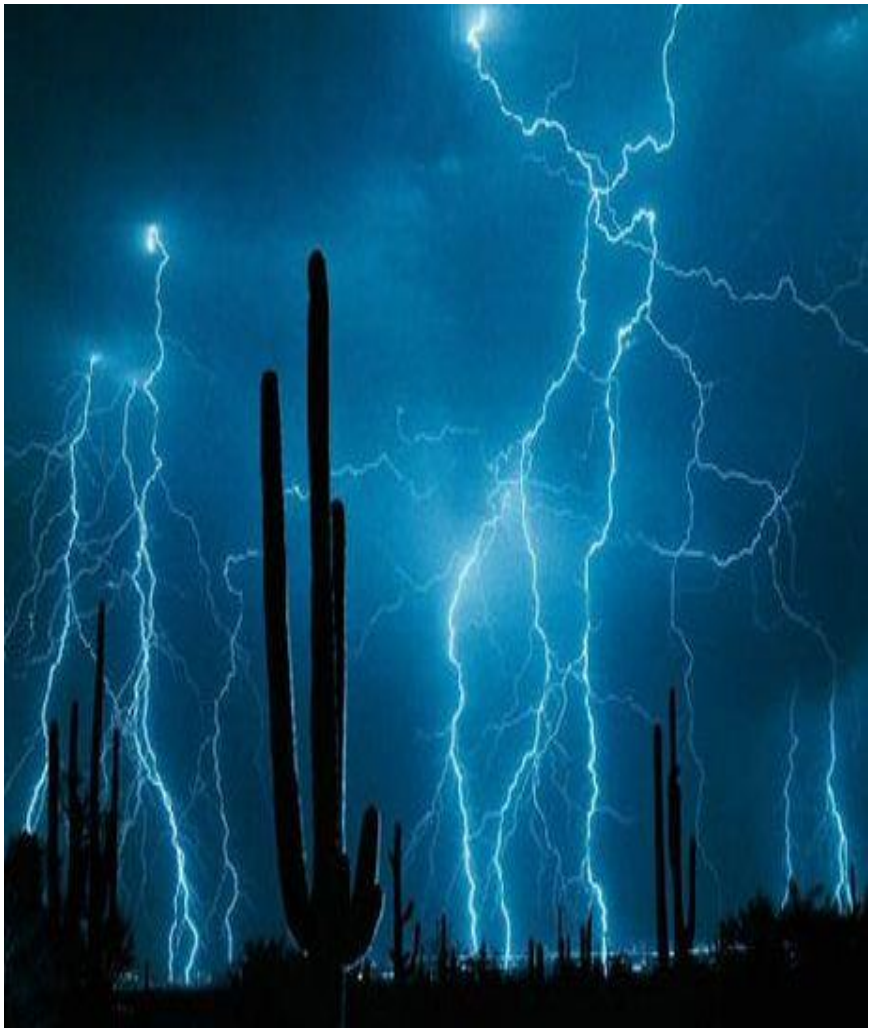
- Lightening strikes are common along with monsoon and hailstorms, caused by cloud to cloud or cloud to land (hill) collision discharging huge uncontrolled negative energy towards earth

- At least 5000 deaths in SAARC countries per year is attributable to Lightning (Source : NOAA , U.S.A,National Crime Records Bureau, India)

- Hilly, foothills, river basin, dry land, coastal states record substantial losses

- Lightening is still taken as mystery or act of God in many countries

- Lightning Early Warning System is not developed in many countries



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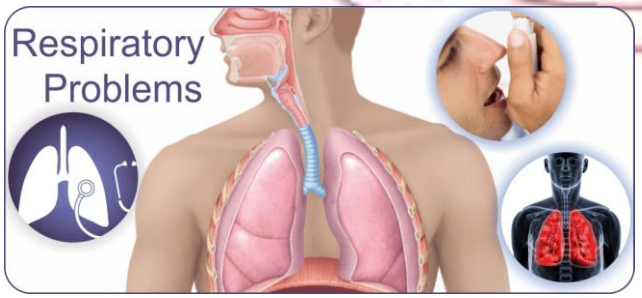
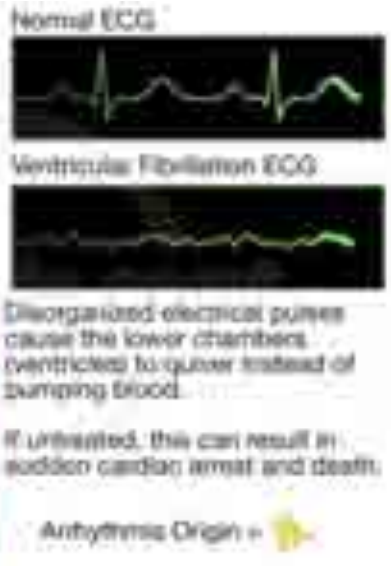
Effects of High Impulse Current on Human Being

- The current flow through a human body may cause respiratory problem, ventricular fibrillation, and cardiac fibrillation, muscular contraction and burn.
- In lightning injuries study, the accident can happen through direct or indirect strike such side flash and step voltage.
- Over 50% of lightning injuries in developed countries is caused by step voltage.

Lightning protection system should be mandatory in Government buildings, industries, schools, hosp itals public places to home .





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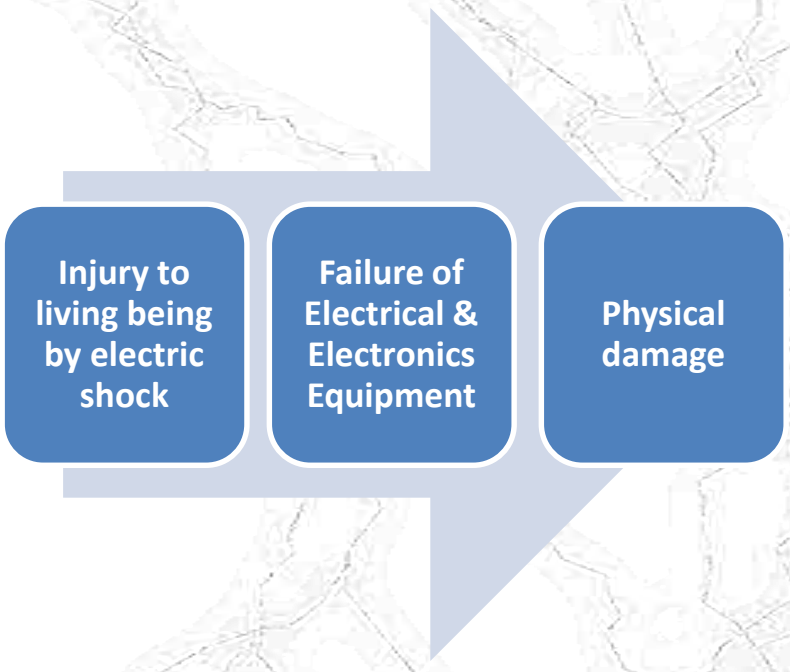
Major Impact of Lightning strikes



- Loss of Human and Animals Life
- Loss of Services to the Public
- Loss of Cultural Heritage
- Economic loss

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Early Warning Systems

- Know the disaster –Lightning
- Detection based on its parameters
- Forecast – Impact Based
- Dissemination – localisation
- Response mechanism – Self response
- Dos and Donts

Lightning Early Warning System

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Components

- Electric Charge
- Inter cloud (IC) Flashes
- Cloud to Ground (CG) Flashes
- Sound – Low VHF 1-30 MHz
- Energy 250 K Joules
- Current 30- 180 K Ampere

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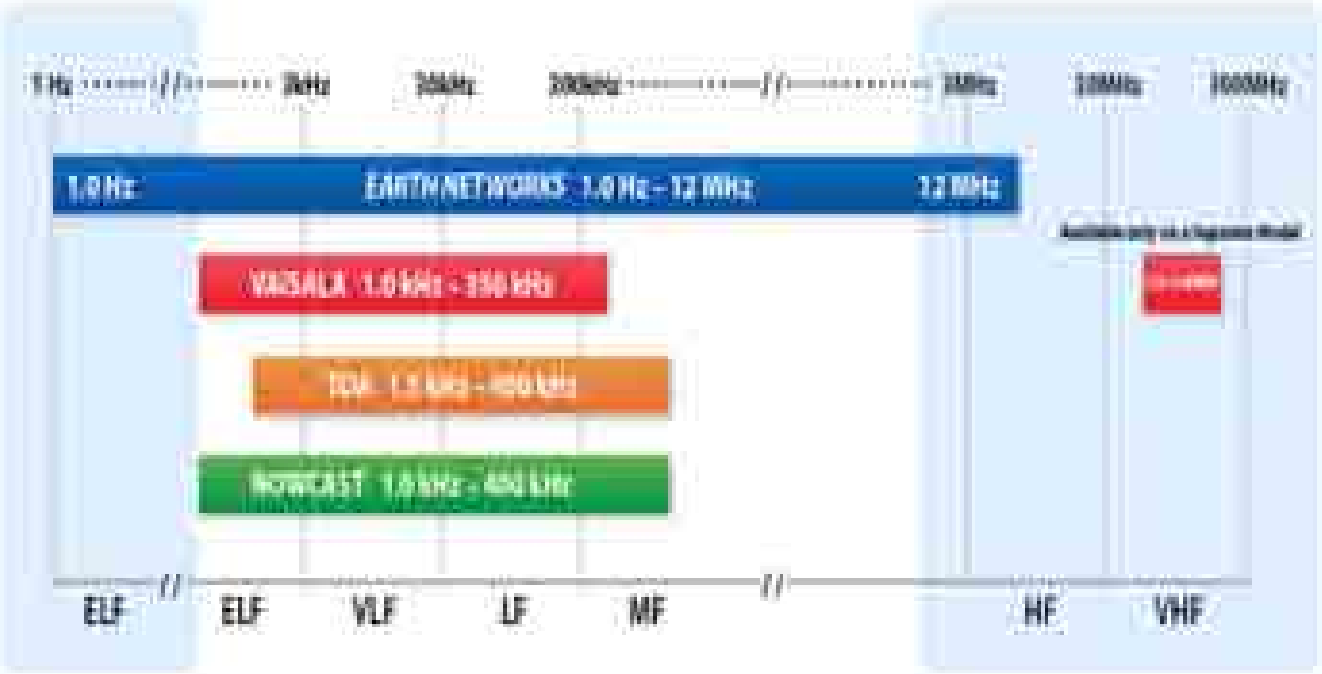
Phillipines P-POTEKA

TABLE II. OVERVIEW OF SENSORS MOUNTED ON DENSE OBSERVATION SYSTEM (P-POTEKA)

Name of sensors	***Observation components*** [Range of observation]	***Implementers*** (Model number)
Slow antenna	Electrostatic field change	Unique development
Electric field mill	Electrostatic field	Unique development
Infrasound (High frequency)	Infrasound by thunder [0.1-1000Hz]	SAYA Inc. (ADX II -INF03)
Automatic weather station	Wind speed Wind direction Temperature Humidity Pressure Solar radiation intensity Rain detection	Meisei Electric Co., Ltd.
Rain guage	Rainfall amount	Meisei Electric Co., Ltd.

LDS Wide-band Range of Detection

Produces high IC lightning detection efficiency on a continental scale enabling severe weather



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Lightning scenarios

- Cumulonimbus cloud , light wind
- Thunderstorm, hailstorm, squall
- Heavy rain
- Cloudburst, tornadoes, hurricane
- Cyclone
- Dry Lightning

Lightning in India

- Its mostly cloud to cloud or cloud to ground lightning
- Period – June to September during the monsoon , especially in initial and terminal phase of monsoon,
- Number of lightning days are less but deadly and intense
- Approximately 2500 plus deaths per year due to lightning , per strike casualties are in large number
- Rural areas and Forests with tall trees and water bodies are most vulnerable , 95 % deaths are in rural areas and people standing under tall trees
- Urban areas are less vulnerable due to having large number of lightning conductors , less number of tress and water bodies

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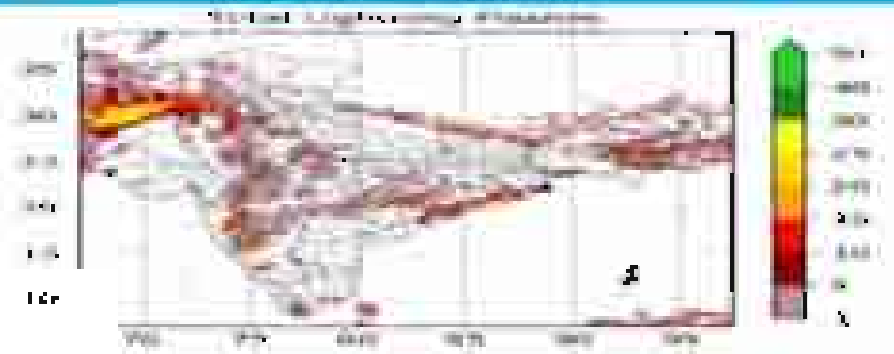
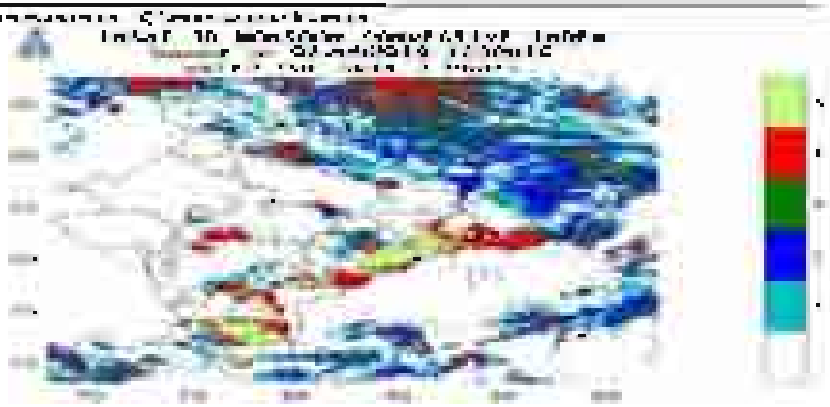
Reason-Climate Change extremities

- Global Warming
- Heat – high temperature
- Concretisation
- Depletion of water bodies
- Deforestation
- Pollution
- Carbon emmission
- Reduction in green cover

India Meteorological Department (IMD)'s Total Lightning forecasts and Nowcasts





IMD's now-cast gives you 3 hours to 30 minutes early warning against Lightning Web link to IMD's lightning forecast

http://srf.tropmet.res.in/srf/ts_prediction_system/index.php

State Governments and other stakeholder's should take this IMD's forecast on lightning to community on time and thereby can reduce the losses to life , livestock, livelihood and assets substantially.

Lightning Observing Systems and Early Warning Products

Observing Systems	Web Link
Satellites – Meteosat, RAPID and other satellites	www.mausam.gov.in
NCMRWF Regional 4 km model	Srf.tropmet.res.in/srf/ts-prediction_system/index.php
Lightning Detection Sensors (LDS)Network	http://imd.gov.in
Ensemble Model based	Srf.tropmet.res.in/srf/ts-prediction_system/index.php

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Doppler Radars and other Radars Network

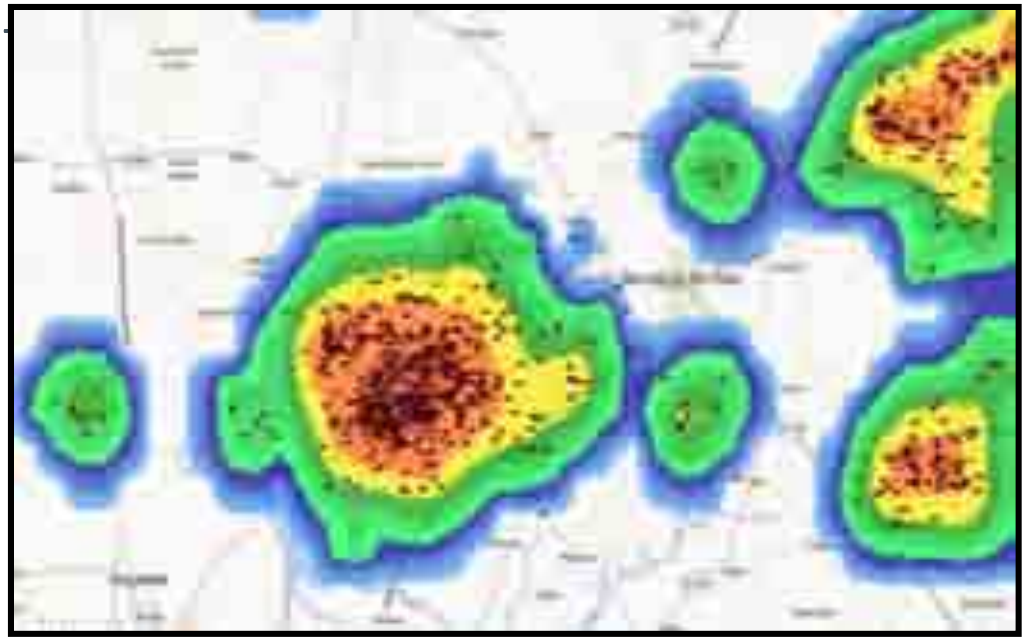
India Meteorological Department (IMD)'s Lightning Early Warning Products

Time in advance	Model	Detection
48 hours look out lead time	High resolution Global Model Thunderstorm 12.5 km spatial resolution	Lightning flash, Lightning probability, Heavy rain, gusty wind
24 hours lead time	High resolution Global Model	Lightning flash, Lightning probability, Heavy rain, gusty wind
2-3 Hours Nowcast	Multiple models	Lightning, thunderstorm, squall , cloudburst

PulseRad

Synthetic Radar using Total Lightning *only*

- Produces radar imagery by correlating radar dBZ and lightning flash rate
- Allows to identify heavy rainfall for severe weather monitoring
- Allows f itoring)



Sao Jose Rio Preto – Severe Storm Cell with PulseRad 11/13/12

Dissemination System

Mobile App based Dissemination

Mobile App based Dissemination

Products and Services

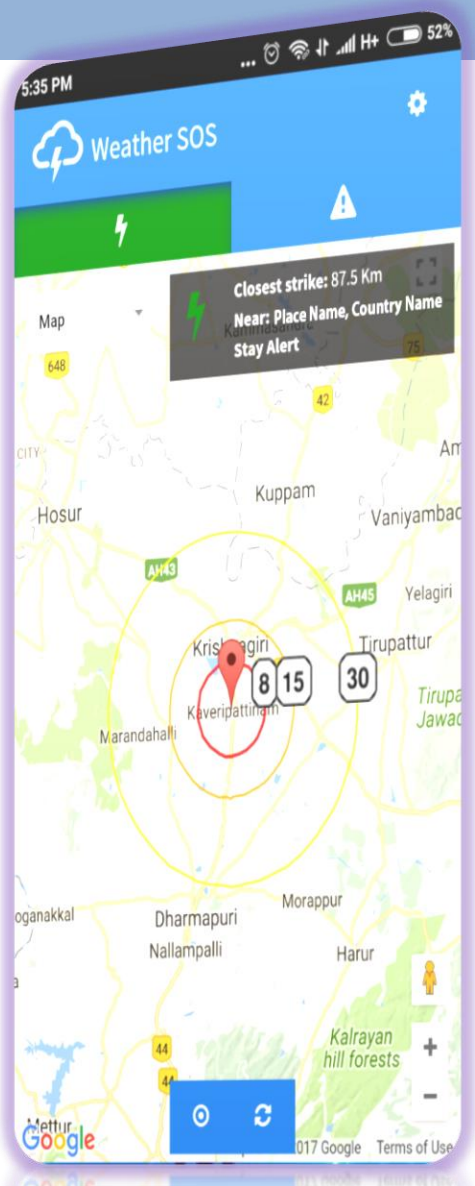
Product/Service	Description
Lightning Sensor Data Services	OEM equipment. Most modern in the world capable of detecting both CG and IC lightning ranging from 1Hz to 12MHz
Weather Station	27 observed and calculated measurements
Digital signal Processor and Network Appliance	Lightning sensor and weather station connected to a single network appliance for ease of installation
Flexible Mounting Options	Rooftop, telecom tower
Electricity and Internet	Minimal electricity consumption with 3 hour battery back up. Usually about 20 units per month. Maximum 10 GB of data required per sensor per month
Warranty	10 years

Mobile App
Severe Weather Dissemination Product

- Handy
- Can be downloaded in smart phone
- Local language
- GIS Plotted comprehensive data
- Alerts
- Advisory

Severe Weather Alert App – Key Features

- The home page of the app is a comprehensive map view of the real time occurrences of lightning(s) around the user's current geo location.
- The concentric circles at the center of the map view show the lightning occurrences that span from a radius within
  - 10 KM (RED – high danger) ;
  - within 20 KM (ORANGE – moderate danger) ;
  - within 30 KM (YELLOW – still within overall dangerous zone) from the user's current geo location..
- If there are lightning occurrences happening within any of these radiating circles, the pertinent color (RED, ORANGE, YELLOW) will be used as a warning indicator and the lightning alert box/header at the top left corner of the app screen will be displayed in the appropriate color. Green signifies normal weather and red emphasizes that the lightning has struck within a 8 km radius.
- The map view will also display the names of the locations of all lightning occurrences.
- The users can view lightning details either in Map or in Satellite view. They can also enlarge or diminish it. Users could use the 'locate' feature to zoom into the exact location they currently are in.
- The other Tab of the app is dedicated to DTA (Dangerous Thunderstorm Alerts).Real time alerts will be captured here.



SOS SMS Module

Description – This module preemptively notifies Vollage Revenue Officers (VROs) responsible for habitation centers regarding occurrences of inclement weather conditions such as lightning and thunderstorm alerts. Notification method will be in the form of SMSs

Events that trigger SOS SMSs to VROs	Text (in the regional language of choice)
Lightning (If VRO lat and long is at a proximity of <distance 0 to 8 KM> from lightning then SMS will be sent to VRO mobile number – Every 30mins until lightning strike stops)	Dear user, this is a high severity alert of a lightning strike that is occurring at <village name, Habitation>. Immediate action to safeguard yourself and all your near fellow citizens who are in the proximity of the lightning strike should be taken up by you.
Lightning (If VRO lat and long is at a proximity of <distance 8 to 15 KM> from lightning then SMS will be sent to VRO mobile number – Every 30mins until lightning strike stops)	Dear user, this is a high severity alert of a lightning strike that is occurring at <village name, Habitation>. Immediate action to safeguard yourself and all your near fellow citizens who are in the proximity of the lightning strike should be taken up by you.
Lightning (If VRO lat and long is at a proximity of <distance 15 to 30 KM> from lightning then SMS will be sent to VRO mobile number– Every 30mins until lightning strike stops)	Dear user, we are bringing to your notice a lightning strike that is occurring at <village name, Habitation>. Take all adequate measures to protect yourself and your fellow citizens, All warnings and guidance to avoid unfortunate loss of lives should be addressed promptly by you.

SOS IVR Module

Description – This module preemptively notifies VROs responsible for habitation centers regarding occurrences of inclement weather conditions such as lightning and thunderstorm alerts. Notification method will be in the form of IVR alerts

Events that trigger SOS IVR alerts to VROs	Voice Alert (in the regional language of choice)
Lightning (If VRO lat and long is at a proximity of <distance 0 to 8 KM> from lightning then SMS will be sent to VRO mobile number – Every 30mins until lightning strike stops)	Dear user, this is a high severity alert of a lightning strike that is occurring at <village name, Habitation>. Immediate action to safeguard yourself and all your near fellow citizens who are in the proximity of the lightning strike should be taken up by you.
Lightning (If VRO lat and long is at a proximity of <distance 8 to 15 KM> from lightning then SMS will be sent to VRO mobile number – Every 30mins until lightning strike stops)	Dear user, this is a high severity alert of a lightning strike that is occurring at <village name, Habitation>. Immediate action to safeguard yourself and all your near fellow citizens who are in the proximity of the lightning strike should be taken up by you.
Lightning (If VRO lat and long is at a proximity of <distance 15 to 30 KM> from lightning then SMS will be sent to VRO mobile number– Every 30mins until lightning strike stops)	Dear user, we are bringing to your notice a lightning strike that is occurring at <village name, Habitation>. Take all adequate measures to protect yourself and your fellow citizens, All warnings and guidance to avoid unfortunate loss of lives should be addressed promptly by you.

Integrated Communication Platform

- Earth Network, through it's wide spread sensors, collects weather information and streams the information into a cloud server.
- The **Visualization** component of the Integrated Communication Platform will :
  - Visually depict the weather information across all habitation centres
  - Highlight impacted habitation centres during inclement weather conditions (lightning, dangerous thunderstorms). Impacted habitation centres are those that are in the vicinity of the lightning/DTA occurrence
  - Display corresponding information (Village Revenue Officers (VRO) details, contact coordinates ..etc) within the visualization component
- The **Communication** component of the Integrated Communication Platform will :
  - Provide the integrated facility for users to communicate with habitation centre VROs , either via phone or SMS or IVR, on-demand and as needed.
  - Allow selection of the recipient of the communication(s) and mode of communication from within the Visualization component
  - Allow capture of **multi-lingual** content/message that needs to be communicated to the selected VROs within the Visualization component
- The **Audit/Log** component of the Integrated Communication Platform will :
  - Maintain audit of all outbound and inbound audio and text communications
  - Allow replay of audio communications (inbound or outbound), which will greatly aid regulatory compliances
  - Allow users to better identify their areas of operational inefficiencies (Example : inbound call drops peaking at certain times, outbound content not accurate or of poor quality ..etc) and help improve on these areas promptly and efficiently.

Impact of Early Warning Systems in World

Country	Type of LDS Network	Annual Lightning strikes in billion	Annual death rate Approx
USA	**1.Ground based systems** - 1.1. Bipolar Radars 1.2 Electric field detector 1.3. Low VHF LDS **2.Satellite based sensors** **3.Mid air sensors**	1.4	59
Europe	**1.Ground based systems** 1.1. Bipolar Radars 1.2 Electric field detector 1.3. Low VHF LDS **2.Satellite based sensors**	1.0	60
China	**Same as Europe**	1.45	450
India	**1.Ground based systems** 1.1. Doppler Radars 1.2 Low VHF LDS **2.Satellite based sensors**	1.2	2500
Sri Lanka	**Ground based** Low VHF LDS	0.9	300
Nepal	**Ground based** Low VHF LDS	0.6	600
Bangladesh	**Ground based** Low VHF LDS	0.7	1100
Singapore	**1.Ground based systems** 1.1.Electric field detector 1.2. Low VHF LDS	0.7	12

Jharkhand Project - Lightning Zone Mapping 2008-2012

- Second Research project undertaken with the help of Birla Institute of Technology, Mesra and NASA, U.S.A
- Period 2008-2012
- Lightning event count (LEC) was recorded
- Least LEC - < 50
  Highest LEC – 446
- Lightning Voltage
  Least – 50 KW
  Average – 100-200 KW
  Highest – 2000 KW
- Village named Bajarmara with yearly loss of 15-20 lives
- Level I – 15 Districts, Level II- 09 Districts

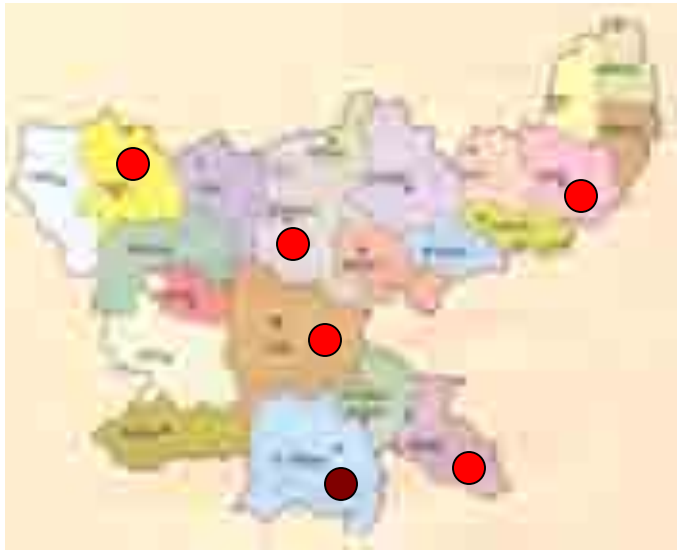
A Pilot Project
MONITORING LIGHTNING AND THUNDER ACTIVITIES IN JHARKHAND

Duration : 03 Years 2008-2010

Objective: To delineate the Jharkhand state in terms of frequency, intensity and severity of lightning incidences for prioritized adoption of safety measure

Lightning Detection Centres

1. RAC Campus……Central monitoring unit
2. ZRS Chianki……..Field unit
3. ZRS Darisai ……..Field Unit
4. KVK Jagannathpur …...Field unit
5. ZRS Dumka……...Field unit
6. Gauria Karma Farm…...Field Unit
7. Mobile lightning detection unit



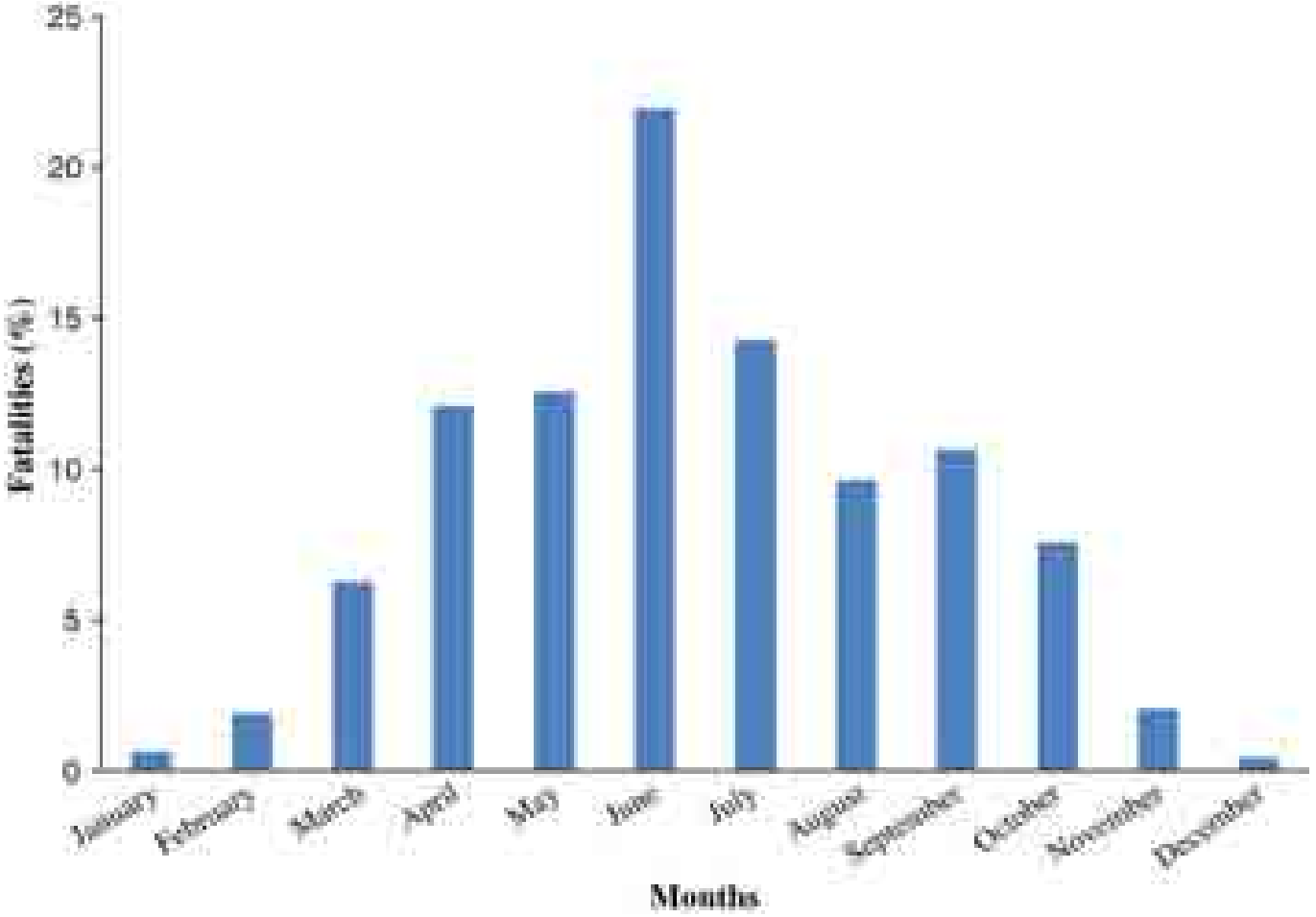
Sensor: Boltek LD-250 (imported from Canada)….500 km Resol.

Data was Collected

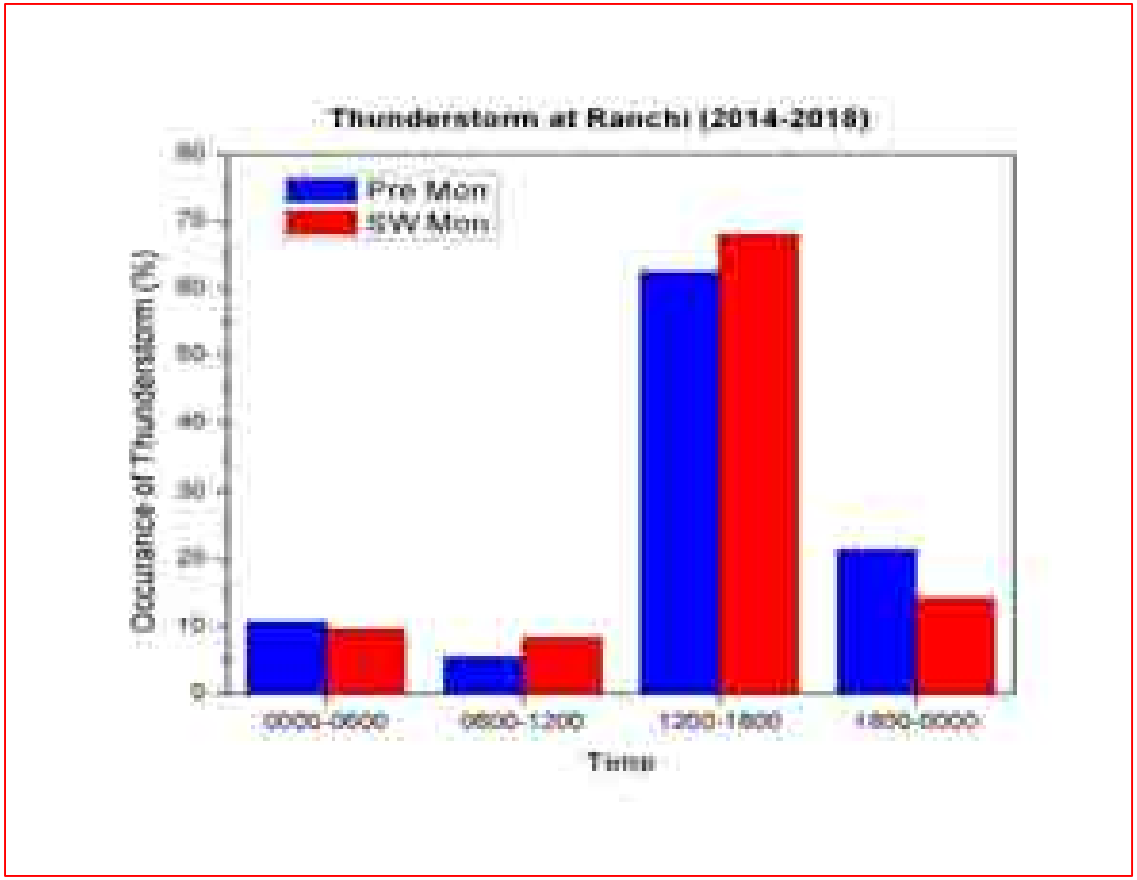
Time Lat Long Distance No. of strike/min Severity class Progress ……..

LIGHTNING DETECTION CENTRE

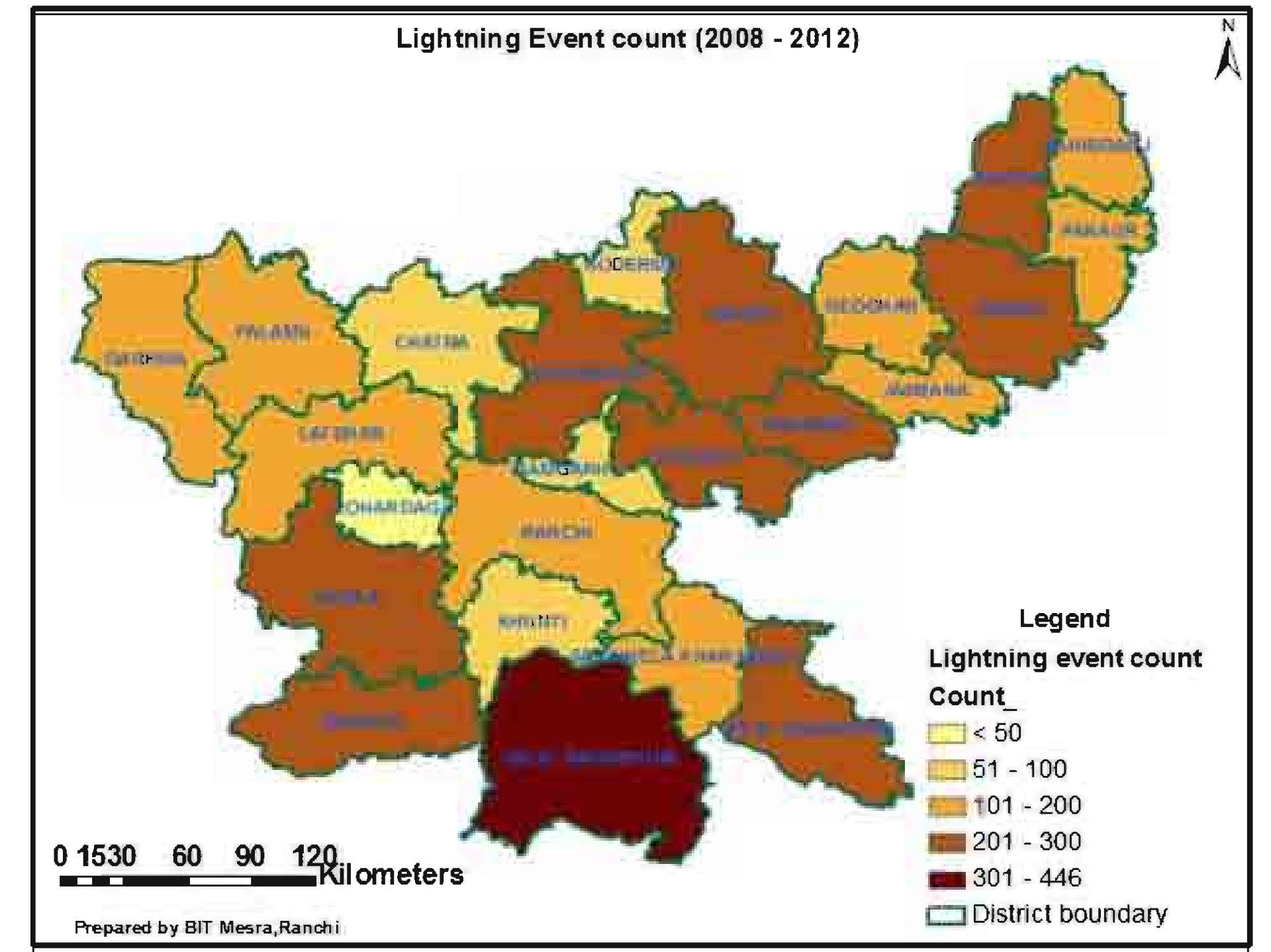
Lightning Fatalities Monthwise trend



Thunderstorm & lightning in Jharkhand



- **Probability of Initiation of TS is found 64% and 68% during 1200-1800 hrs IST in pre-Monsoon and Monsoon seasons respectively.**


Lightning Event count (2008 - 2012)
N
Legend
Lightning event count
Count_
< 50
51 - 100
101 - 200
201 - 300
301 - 446
District boundary
0 1530 60 90 120
Kilometers
Prepared by BIT Mesra,Ranchi

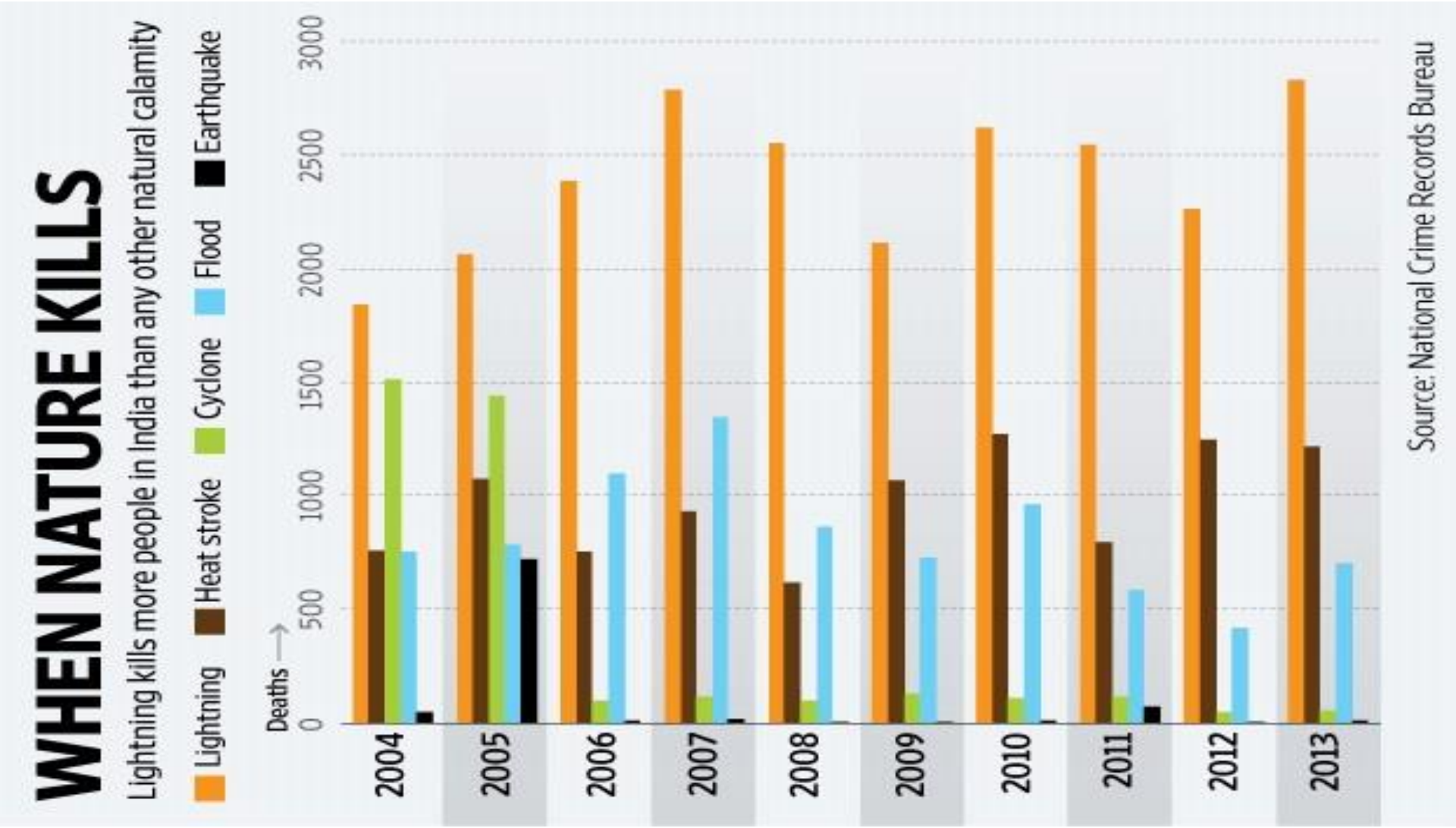
Lightning Profile : Jharkhand

Level	No of Districts	Name of Dsitricts
Level I	15	East Singhbhum , West Singhbhum, Saraikela Kharsawan, Ranchi, Ramgarh, Palamu, Chatra, Latehar, Koderma, Giridih, Hazaribagh, Lohardagga,Dumka, Deoghar, Khunti,
Level II	09	Simdega, Gumla, Garhwa, Bokaro,Dhanbad,Sahibganj, Godda, Pakur, Jamtara.

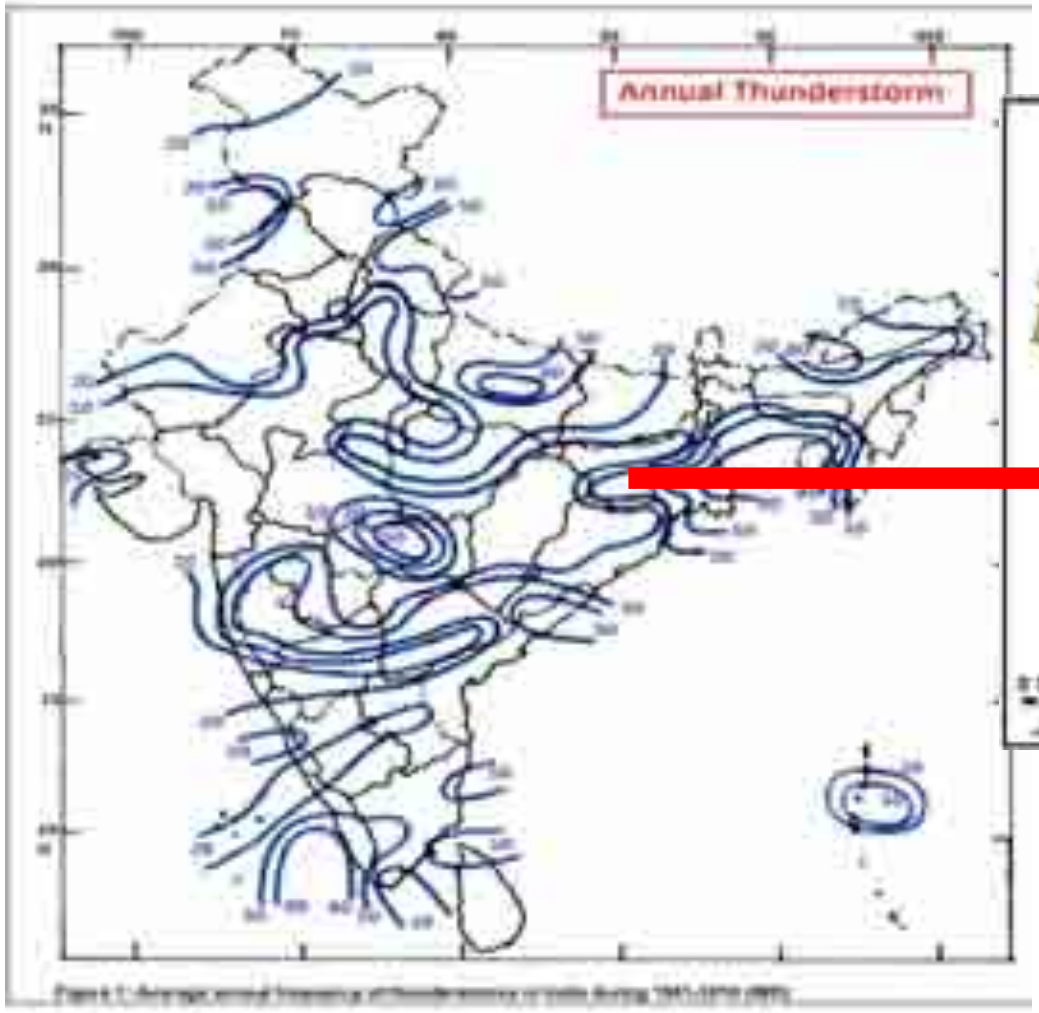
Lightning referred in CoP Paris 2015 by PM India as byproduct of extremities of Climate

India's problems shows how the poor are most exposed to changes in the environment. It also, however, demonstrates the desperate need for economic development. ***While reducing global warming may slow the increase in lightning deaths***, the fastest way to help these farmers is to get them off the fields

Lightning Kills more people in India than any other natural calamity



Annual Thunderstorm



Lightning Resilient India Campaign

- 1967-2017 More than 1 lakhs deaths (NCRB)
- 80 % districts are effected
- Lightning frequency increased 5-8 times
  - > Coastal – 12 times
  - > Hills – 10 times
  - > Plains – 8 times
- Lightning strike kill rates multiplied
- Lightning current strength increased 1.3 bn Volt
- Lightning counts 3 crores plus


Lightning Resilient India Campaign
वज्रपात सुरक्षित भारत अभियान
2019-2021
Launched on 26 March 2019
at IIT Delhi

Lightning Resilient India Campaign

Aim

To reduce the deaths and losses to humane , livestock, flora and critical infrastructures due to lightning up to 80% within 03 years by collective efforts

Lightning Resilient India Campaign

Vision

To create a Lightning Resilient Society through a comprehensive, multipronged innovative approach and collective action thereby taking Multi Hazard Early Warning to the community up to last mile , capacity building and creating lightning safe infrastructures with focus on local disaster hotspots in accordance with the Sendai Framework for Disaster Risk Reduction(SF DRR) and zero tolerance towards avoidable disasters.

Mission

To bring down the deaths due to lightning by 80% in a period of three years from 2019 to 2021 through increased standardised instrumentation ,prompt dissemination of early warning to last mile through committed volunteers in user friendly manner, create a culture of safety through active capacity building through education, awareness & training and guidance on installation of lightning safety devices in critical infrastructures like school, hospital. community centers etc.

Lightning Resilient India Campaign

वज्रपात सुरक्षित भारत अभियान

When lightning roars Never stand under tree or outdoor

जब बिजली करें गर्जना पेड़ के नीचे कभी ना रहना

Lightning Resilient India Campaign Focus

- **Disaster Hotspots** identification, enlisting, capacity building and operationalisation , priority being rural areas.

- **Instrumentation** .Increased , cost effective standardized instrumentation .

- **Lightning Early Warning** to reach to community to last mile in user friendly manner in local language with actionable inputs

- **Capacity Building** – Create a culture of safety through extensive drive on education, awareness and training drive with impact and assessments. Create Master trainers at State , district and local level at various tiers like school, rural (panchayat), health , industries .

Lightning Resilient India Campaign Focus

- **Automatic Weather Station (AWS) promotion** for point validation of weather information and awareness towards climate change
- **Lightning Protection Devices** Promotion of correct Lightning arresters /conductors amongst Individual to Institutional level. Schools & Hospitals must have lightning Arresters .
- Research and Development on climate change adaptation, creation of data base and analysis of local disaster hotspots

Lightning Resilient India Campaign Objective

- Competent Technical body at National level and state level to advise states on scientific approach to Lightning – spatio temporal vulnerability mapping, standardised instrumentation , Multi Hazard Early warning Systems , Emergency communication systems and Lightning Protection Device.

- Weather Data Processing and Dissemination Protocol

- Promotion of Weather Observing Systems especially Automatic Weather Stations down to Community level, through Government and Non Government Organizations in Agriculture, Industries, education etc.

Lightning Resilient India Campaign Objective

- Enhance Weather and Climate Resilience Activities- Enhance /mainstream Local level platform to be created amongst community with special focus on immediate, short and long term activities.
- Create Hazard safe hutments in sensitive zones on priority.
- Create a reliable data base
- Policy Advocacy.
- Research and Development.
- Knowledge sharing

Lightning Resilient India Campaign Strategy

- National level web platform – educative & interactive www.lightningcouncil.com
- Networking of stakeholders at National, state district and community level volunteers
- Local Disaster Hotspots enlisting
- Address highly vulnerable local disaster hotspots on priority
- Network of volunteers
- Technical support up to last mile

Lightning Resilient India Campaign Strategy

- Multi tier network
  - Academia – Universities , IMS, AAM
  - School
  - Farmer – Rural development ,
  - Hospitals
  - SHGs
- Feedback system – First Review report to NDMA and IMD by end of May 2019
- Evaluation and monitoring
- Documentation

Lightning Resilient India Campaign

Ser	Level	Government Agency	Academia	Others
1	National	IMD (Ministry of Earth Science) National Disaster Management Authority (NDMA)	IIT Delhi Institution of Engineers	IMS IEEE , Media PSU & SPONSORs
2	State	Regional IMD Office State Disaster Management Authority(SDMA)	Regional University	IMS State Chapter IEEE , Media PSU & SPONSORs
3	District	District Met Office District Disaster Management Authority (DDMA)	Local College	IMS Local chapter IEEE , Media PSU & SPONSOR
4	Block / community	Block Revenue/ Disaster Management Local community based organization	Local bodies	IMS Local chapter IEEE , Media PSU & SPONSOR

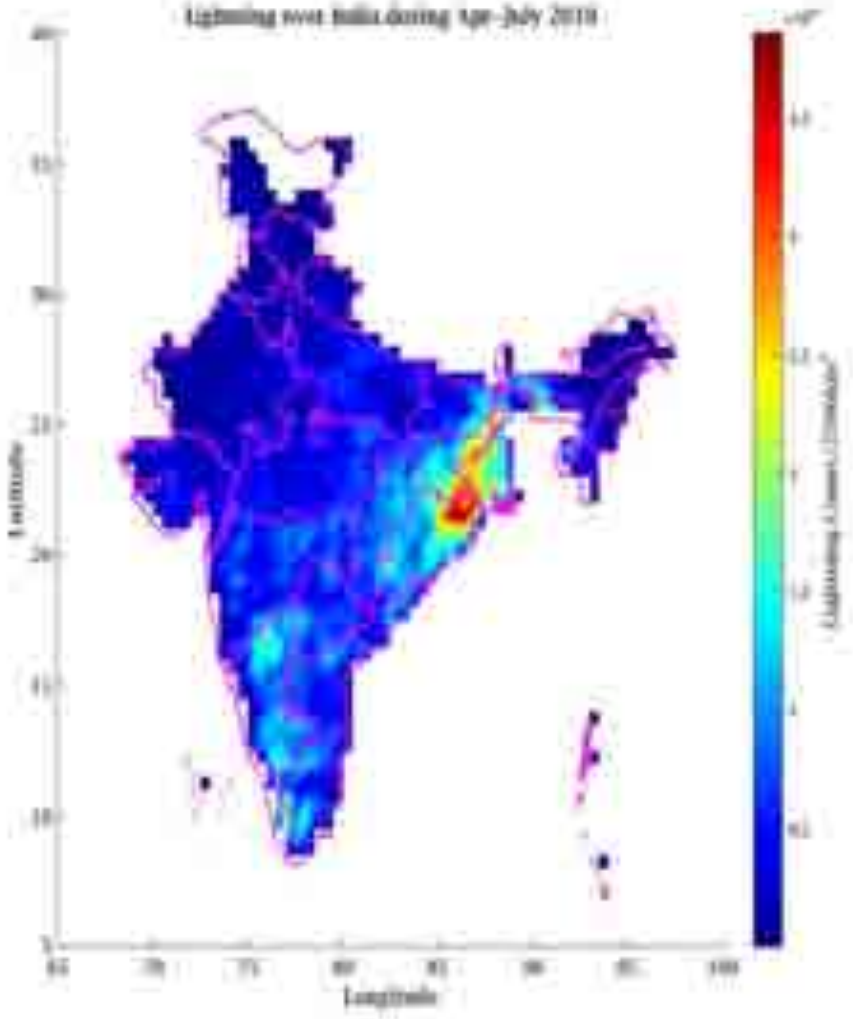
Mid-Monsoon 2019 Lightning Report

Lightning Resilient India Campaign

joint initiative by

India Meteorological Department and Climate Resilient Observing Systems Promotion Council

Mid Monsoon 2019
Lightning Report



Total Lightning Strikes 01 April-31 July 2019

64,55,540

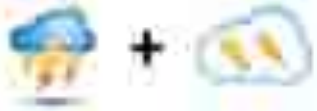
Total Lightning strikes

23,51,614

Cloud to ground Lightning

Total Lightning

is the combination of cloud to ground (CG) and in-Cloud (IC) lightning strikes



41,03,926

In-Cloud Lightning

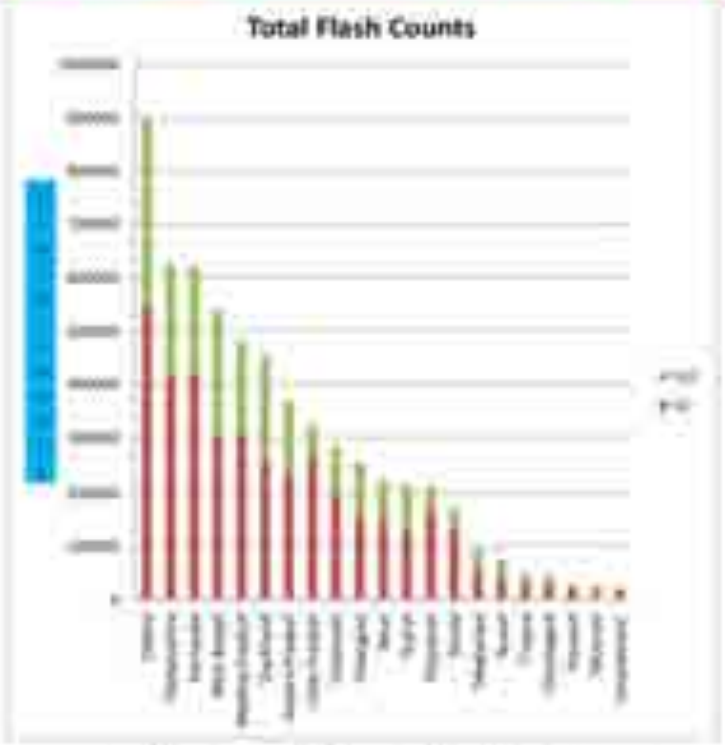
Mid Monsoon 2019 Lightning Report

Figure 1 : Lightning strikes counts rankings – first 22 states

Odisha tops with 9 lakh lightning strikes which is 15% of total strikes., Maharashtra, Karnataka, West Bengal, Madhya Pradesh, Jharkhand, Uttar Pradesh and Andhra Pradesh together account for more than 50% lightning strikes of India . Details about other states are at appendix . States can opt for micro-zonation of above strikes upto taluka /panchayat level from CROPC at [redacted]

Mid Monsoon 2019 Lightning Report

Lightning Flash Counts: IC vs CG



Total Lightning flash comprises of inter-cloud (IC) and Cloud to ground (CG) lightning flashes. It is important to note that it is CG lightning flashes which strike us. However, it is In-Cloud (IC) lightning which is instrumental in forecast of lightning .

Mid Monsoon 2019 Lightning Report

Lightning Day 01 April 2019 to 31 July 2019

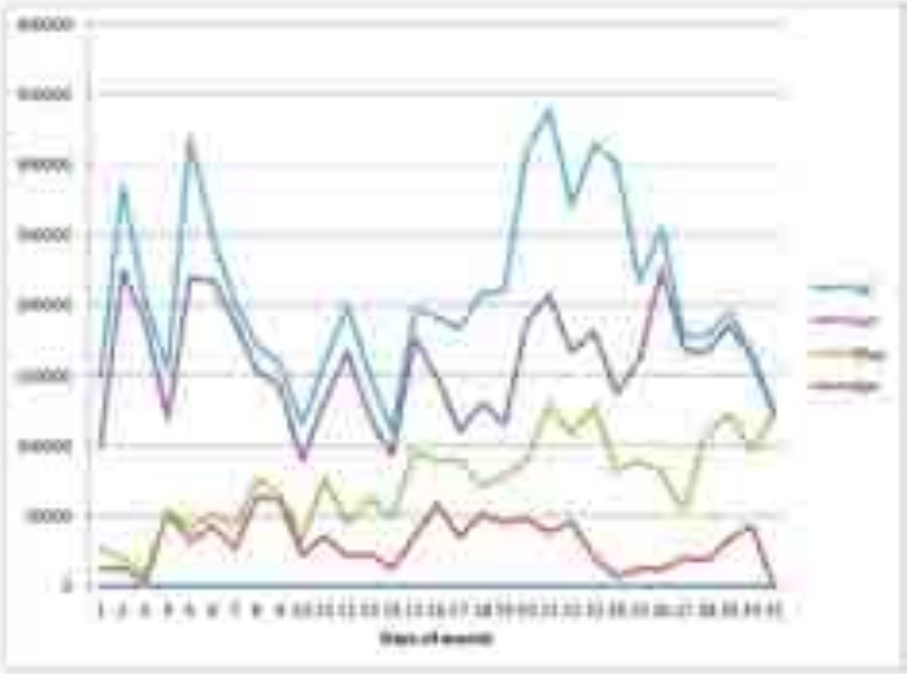


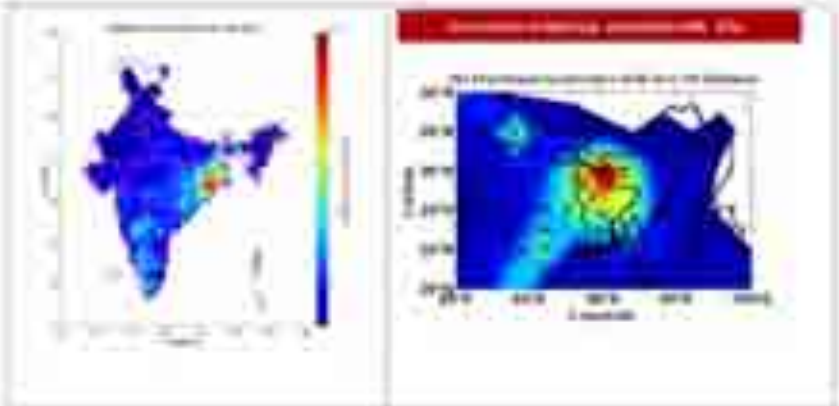
Figure 4 : lightning days during April, May, June and July (Source : IMD & ITM)

The number of lightning days across India has shown significant increase, every month progressively. July witnessed highest lightning days, especially in the later half due to turbulent onset of monsoon.There has been constant lightning almost every day in one or the other parts of country. Odisha and Andhra Pradesh have so far been most lightning active states. Ideally , location specific mapping of lightning days would figure out the trend for which states can approach CBOPC separately with their specific requirements .

Mid Monsoon 2019 Lightning Report

East to North East – the lightning road

Eight states of North East comprising of Assam, Arunachal Pradesh, Meghalaya, Manipur, Mizoram, Nagaland, Tripura and Sikkim –the 2.4% of geographical area of India with 3.86% of national population falls in the most hot lightning rod zone. Our research reveals that it orginates from Chotanagpur Plateau – the confluence of Odisha, West Bengal and Jharkhand ; extend through Bangladesh to Patkai plateau of Meghalaya affecting other North eastern states. This corroborates the study done by Prof. Sanjay Sharma and his team of Kohima Science College, Kohima presented at NESAC , Shillong on 22 June 2019 during Lightning Resilient India Campaign in North East.



Source : CRDPC report based on ITM sensors observations

Source: Dr. Sanjay Sharma & Team Kohima Science College report

Mid Monsoon 2019 Lightning Report

Lightning Deaths

This report on lightning deaths has been compiled based on reports as received from state Governments or media or reported by Volunteers. With few states, the data is still being reconciled .

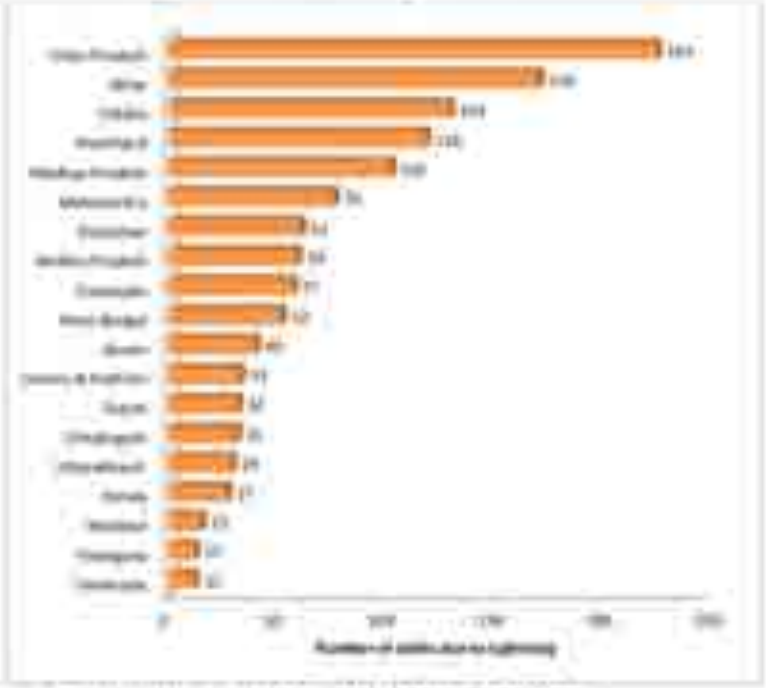
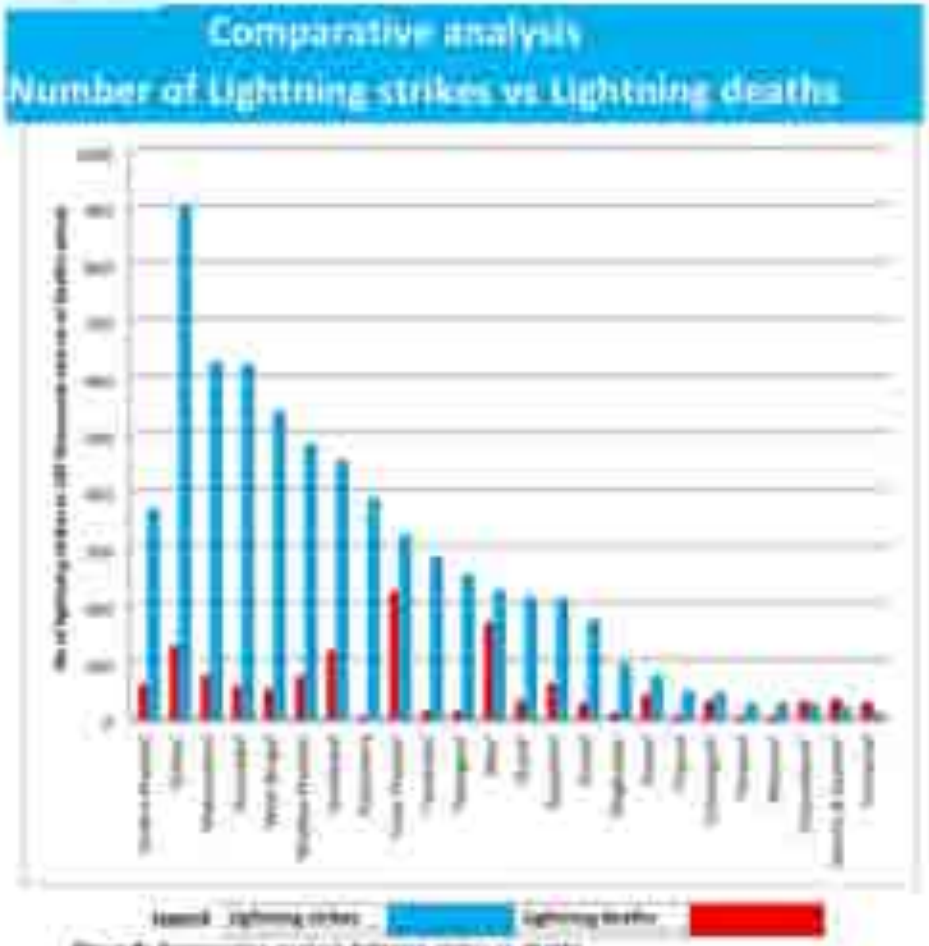


Figure 4 : Lightning deaths during 01 April 2019 to 11 July 2019

Uttar Pradesh tops the list followed by Bihar, Jharkhand, Madhya Pradesh , Odisha , Maharashtra are other high fatalities states . Each state of the country has incurred losses due to lightning. There are more than double the number of injured too.

Mid Monsoon 2019 Lightning Report



Mid Monsoon 2019 Lightning Report

Recap Lightning Case Studies 2019

What happened in Gujrat, Rajasthan, Madhya Pradesh, Maharashtra in Western and Central India on 16 April 2019, a new normal

03-04 may 2019 Cyclone Fani hit Odish with lakh of strikes had zero lightning casualty whereas UP lost 10 people

Central and East India

Pre monsoon wide spread lightning strikes create mayhem on 28 June 2019

Most fatal week

Delayed monsoon had a turbulent start with wide spread lightning from 25-31 July 2018 causing more than 200 deaths

Mid Monsoon 2019 Lightning Report

Mid Monsoon 2019 Lightning Report

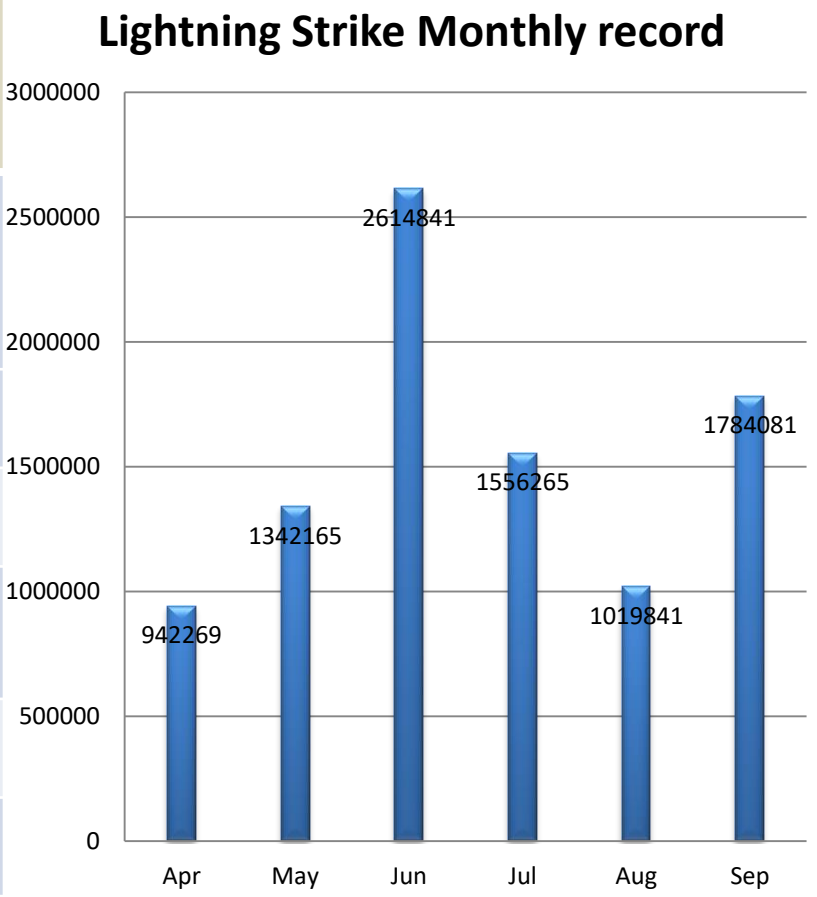
Lightning Deaths of Animals

There have been phenomenal losses of animals like large number of cows in Uttar Pradesh, 250 sheep in Kashmir, 200 goats in Uttarakhand. One elephant died due to Lightning strike and so many losses not even reported post 'Fani' Odisha , Bihar, Jharkhand and hills

Government of India (Ministry of Animal Husbandry) has an Animal Disaster Management Plan. But for its compliance at state level both MoAH and Ministry of Home Affairs and NDMA need to take cognizance and issue necessary guidelines to states.

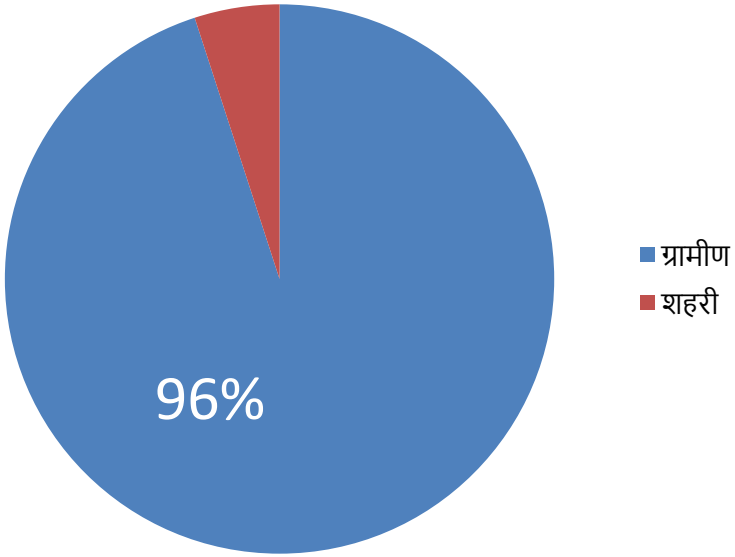
Mid Monsoon 2019
Lightning Report - Summary

Month	Total Lightning	IC Lightning	CG Lightning	Deaths
April	942269	619326	322943	299
May	1342165	891796	450369	
Jun	2614841	1608746	1006095	458
Jul	1556265	984058	572207	554
August	1019841	619255	400586	
Sept	1784081	1006247	777834	
	9259462	5729428	3530034	1311



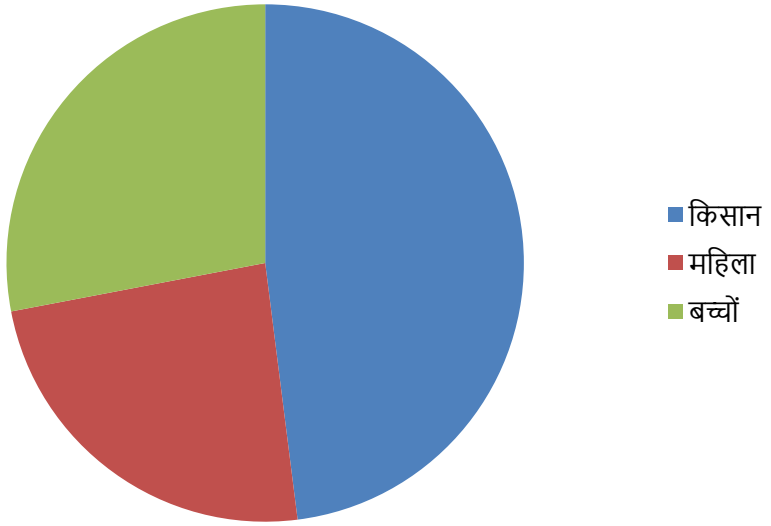
Mid Monsoon 201
Lightning Report

Lightning deaths Category wise



Urban 4 %

Rural 96%



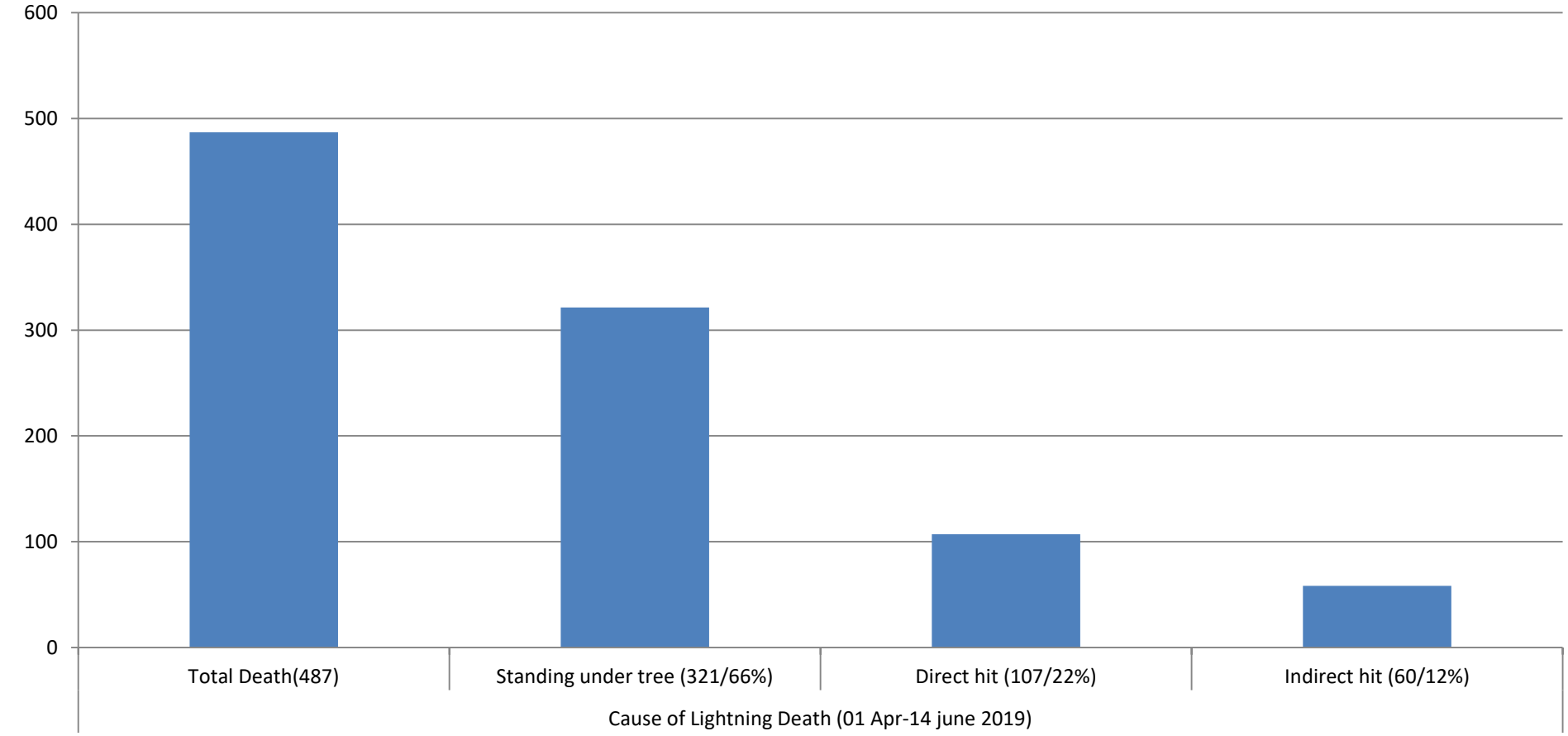
Farmer 65 %

Women 34%

Children 35%

Mid Monsoon 2019
Lightning Report

Lightning Deaths : Primary Cause



Mid Monsoon 2019
Lightning Report

LIGHTNING DEATHS ARE AVOIDABLE

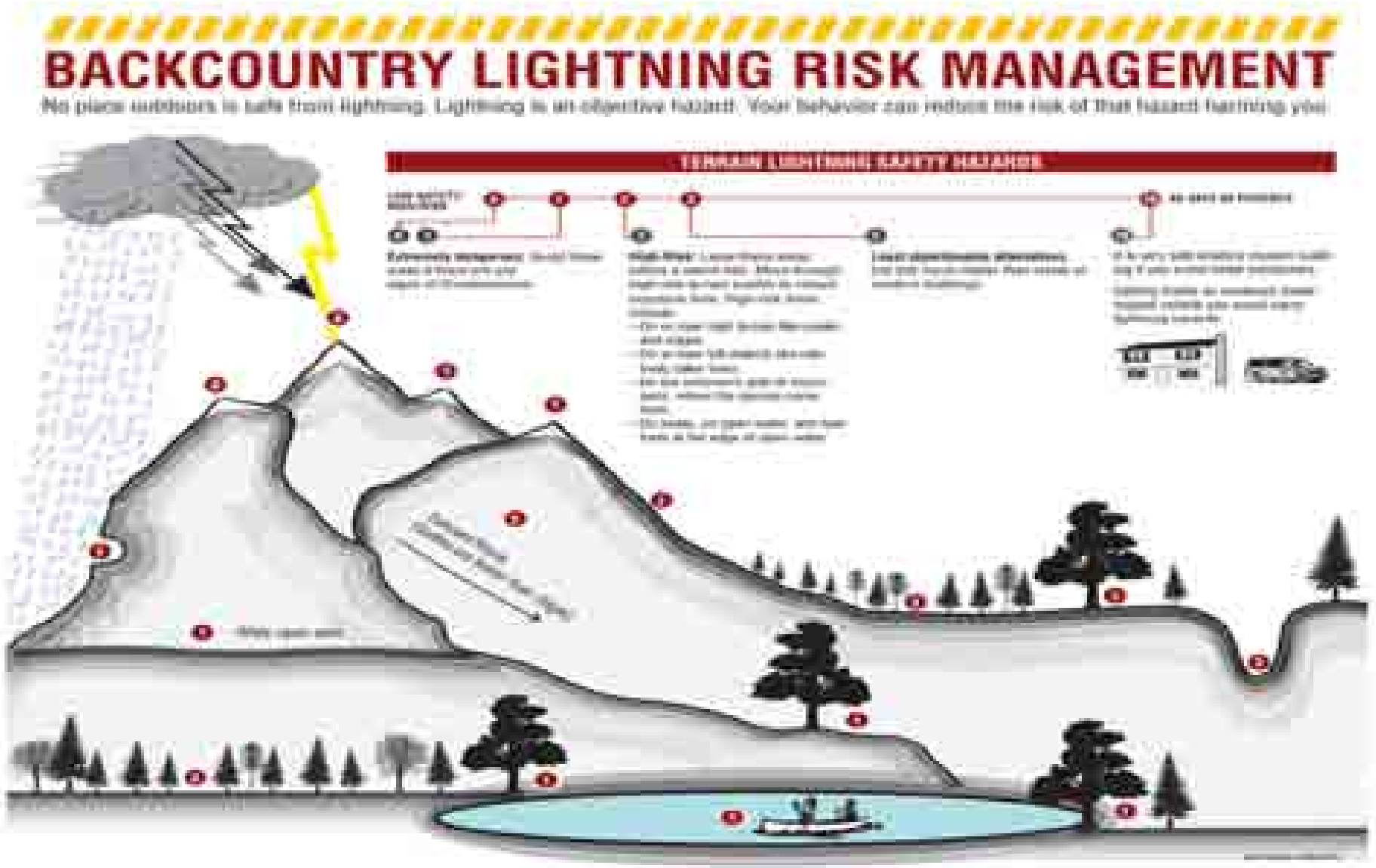
Natural art Early Warning

Warning Signs

- If you feel your hair stand on end, skin tingle, or hear crackling noises (signs of an imminent lightning strike) assume a "lightning-safe position."

If you can see it (lightning), flee it;
If you can hear it (thunder), clear it.

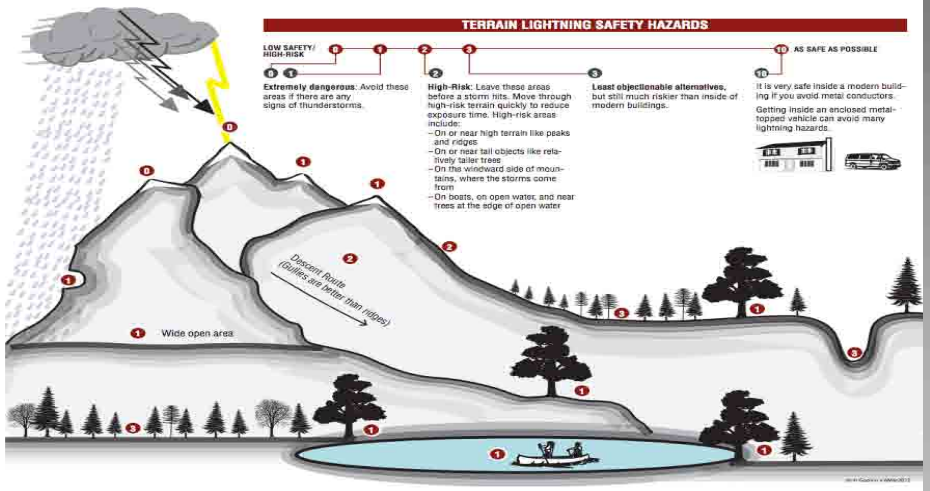
Backcountry Lightning Risk Management



Backcountry Management of Lightning Risk

BACKCOUNTRY LIGHTNING RISK MANAGEMENT

No place outdoors is safe from lightning. Lightning is an objective hazard. Your behavior can reduce the risk of that hazard harming you.



REDUCING LIGHTNING RISK IN THE BACKCOUNTRY

Backcountry settings are at least a 30-minute walk from the nearest vehicles or modern buildings, where you can easily find safe shelter. There are four actions that can reduce your lightning risk in the backcountry, but none of them can make you as safe as getting in a modern building or a metal-topped vehicle. These behaviors are listed in order, and each is roughly twice as important as the next.

1. TIME YOUR VISITS TO HIGH-RISK AREAS WITH LOCAL WEATHER PATTERNS.

Timing activities with safe weather requires knowledge of both typical and recent local weather patterns. There is no such thing as a *surprise* or *freak* storm. You must set turnaround times that will get you off of exposed terrain before storms arrive. You need to observe the changing weather and discuss its status with your group. If you have logistical delays, you may need to change your plan rather than summiting a peak or crossing open ground during a thunderstorm. Begin your turnaround if you hear thunder (which means lightning is less than 10 miles away).

2. FIND SAFER TERRAIN IF YOU HEAR THUNDER.

Safer terrain in the backcountry can decrease your chances of being struck. Lightning tends to hit high points and the surrounding terrain. Avoid peaks, ridges, and significantly higher ground during an electrical storm. If you have a choice, descend a mountain on the side that has no clouds over it, since strikes tend to be less frequent on that side until the clouds move over it. Once you get down to low, rolling terrain, strikes are so random you shouldn't worry about terrain as much. Move to safer terrain as soon as you hear thunder, not when the storm is upon you.

Select tent sites that may reduce your chances of being struck or affected by ground current. If you are in a tent in "safer terrain" and you hear thunder, you at least need to be in the lightning position. Lying flat increases the risk of injury by ground current.

If your tent is in a more dangerous location, such as on a ridge, in a broad open area, or near a tall tree, you must exit the tent and get to safer terrain before the storm arrives, and stay there until it has passed.

In gently rolling hills, lower flat areas are not safer than the higher flat areas because none of the gentle terrain attracts leaders. Strikes are random in this terrain. Look for a dry ravine or other significant depression to reduce risk.

The flash-bang ranging system measures how far away a thunderstorm is, but sometimes it is impossible to tell which flash is associated with which bang. The flash of light travels fast enough that it is virtually instantaneous. The sound travels a mile every five seconds (1km/3 sec) so ideally you just count the number of seconds between the obvious flash and the obvious bang, and divide by five to determine how many miles away the storm is. Divide the time by three to see how many kilometers distant the storm is. Do not stake your life on the reliability of this ranging system.

3. AVOID TREES AND LONG CONDUCTORS ONCE LIGHTNING GETS CLOSE.

Wide open ground offers high exposure to lightning. Avoid trees and bushes that rise above others, since the highest objects tend to generate upward leaders. Your best bet is to look for an obvious ravine or depression before the storm hits, then spread out your group at 20 foot (7m) intervals to reduce the risk of multiple injuries. Assume the lightning position.

Cavers (Fig. 3) should avoid cave entrances during thunderstorms. Small overhangs can allow arcs to cross the gap. Natural caves that go far into the ground can be struck, either via the entrance or through the ground. People have been shocked standing in water half a mile inside caves. If you are caving near an entrance during electrical activity, don't stand in water, avoid metal conductors like ladders, cables, and railings, and avoid bridging the gap between ceiling and floor.

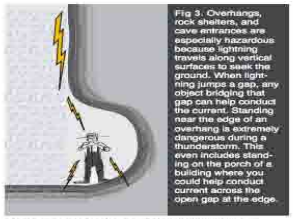


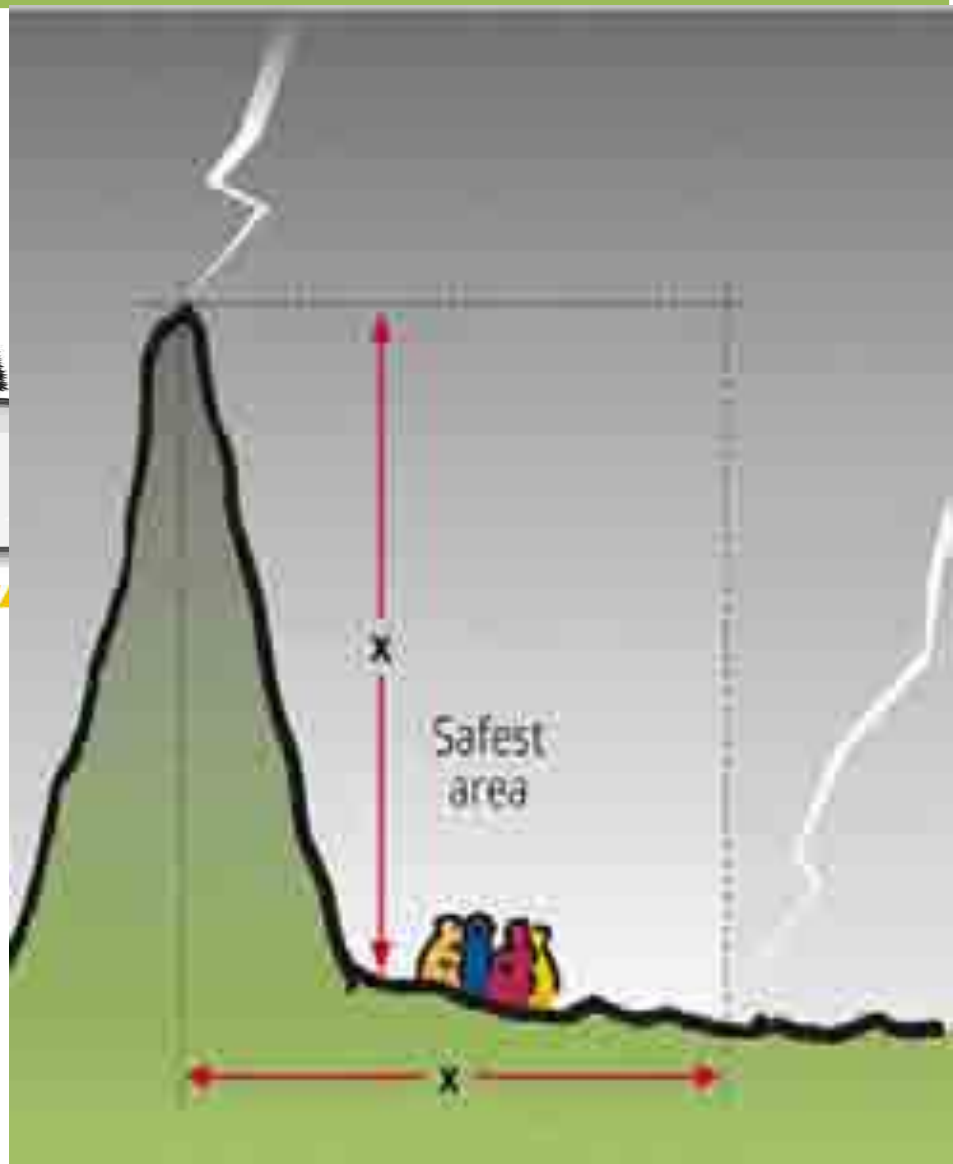
Fig 3. Overhangs, rock shelters, and cave entrances are especially hazardous because lightning travels along vertical surfaces to seek the ground. When lightning jumps a gap, any object bridging that gap can help conduct the current. Standing near the edge of an overhang is extremely dangerous during a thunderstorm. This even includes standing on the porch of a building where you could help conduct current across the open gap at the edge.

Boaters need to start getting off the water long before a storm arrives. Avoid tall trees near the edge of the water.

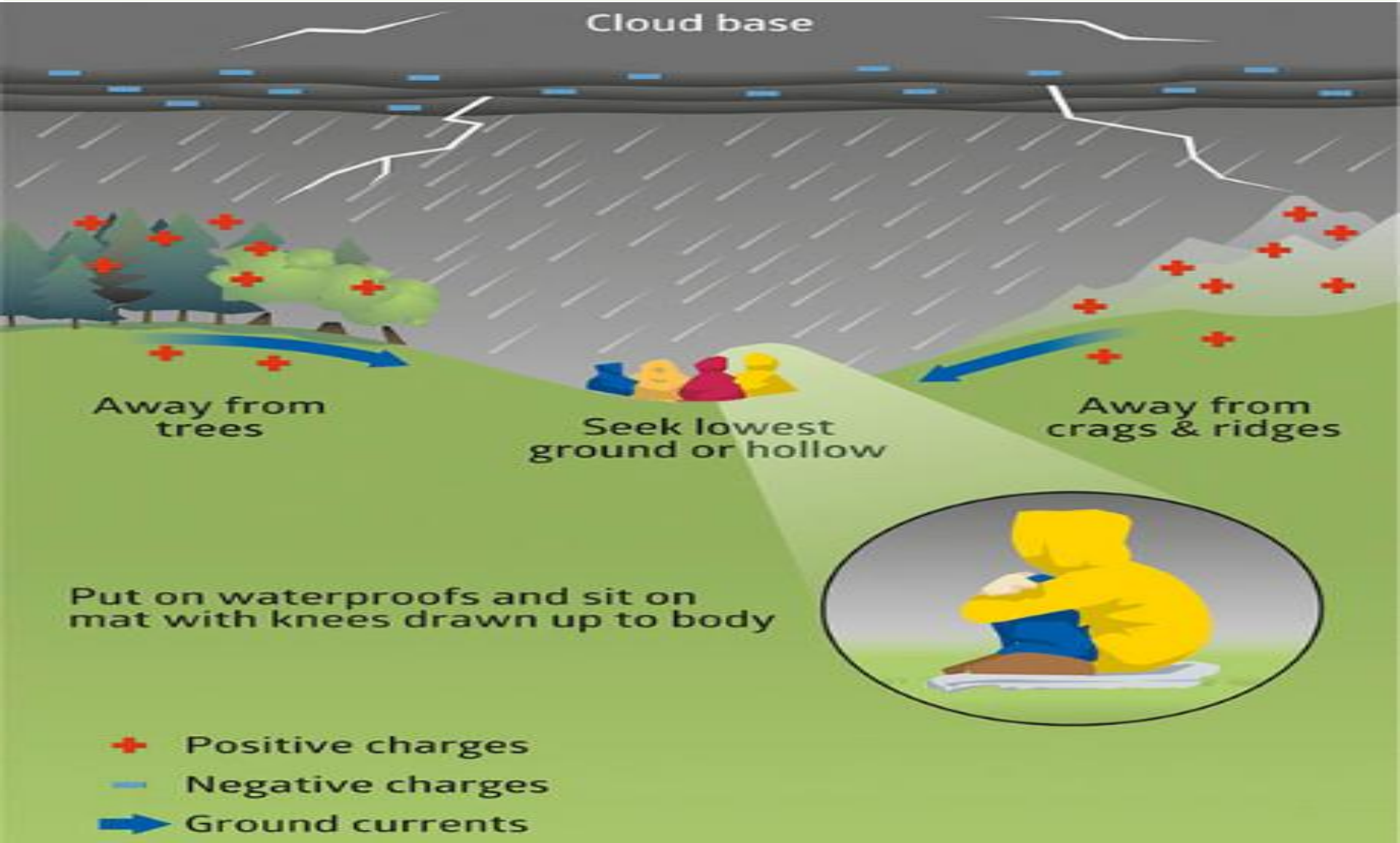
4. GET IN THE LIGHTNING POSITION IF LIGHTNING IS STRIKING NEARBY AND YOU CAN'T GET TO SAFER TERRAIN.

The lightning position **(Fig. 4)** is for waiting out storms in stationary situations when it is impractical to move to a safer location. It is important to reduce your overall footprint on the ground **(Fig.1)**.

Fig. 4 Lightning positions: Put your feet together to significantly reduce the effects of ground current. If you have a foam pad to stand on or a pack to sit on, get on it. Crouch or sit to slightly reduce the effects of side flash and upward leaders.



Lightning Safe areas



Capacity Building Drive

- States need to build capacity of community by carrying out comprehensive training program at District, Block and village level, especially far flung rural population

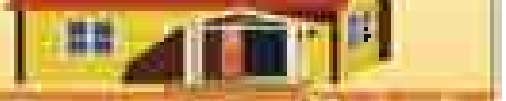
- Regular and extensive training of rural masses involving PRIs,ULBs, NGOs School teachers and students, Aanganwadi ,health and water & sanitation workers , Govt. Institutions ,

Capacity Building Drive in University / Colleges and Schools

- States need to collaborate with academia / University
- University to adopt schools
- Lightning and thunderstorm be included in school curricullum
- Local School children be imparted extenstive education, training and awareness
- Aanganwadi , primary schools be the focus
- School children be ambassdor to rural areas

वज्रपात–एक जानलेवा प्रहार

यहाँ दिए जा रहे हैं कि कैसे स्वयं एवं अपने परिवार की सुरक्षा वज्रपात से की जाए



CROPC

Lightning Resilient India Campaign

Lightning Safe Position

Lightening-safe Position

If outside:

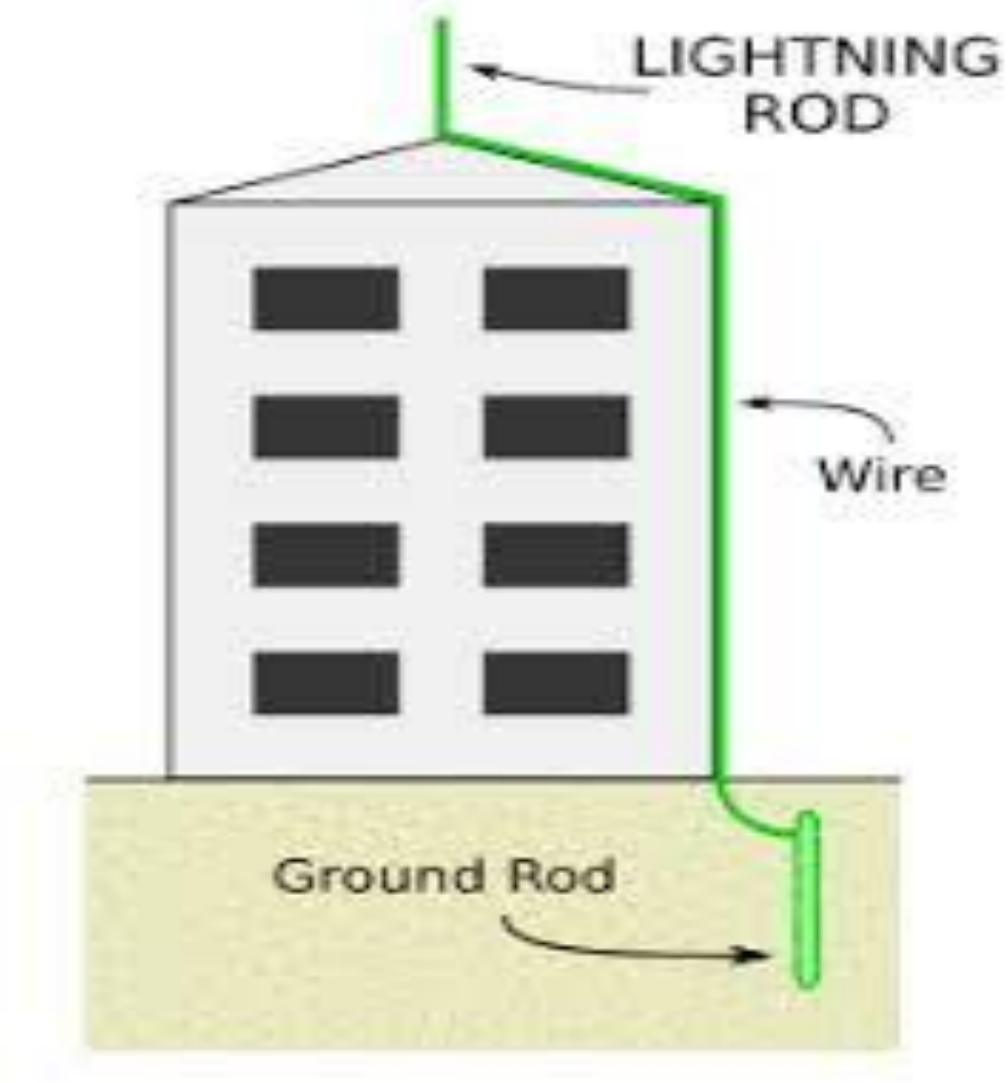
- Crouch on the ground
- Weight on the balls of your feet
- Heels together
- Head lowered
- Eyes closed
- Ears covered

CAUTION : If you are in a group, don’t crouch together, disperse and maintain distance from each other

Lightning Protection Device

- Lightning Conductor – passive device
- Lightning Arrestor – Active device
- NBC 2016 – IEC 63202
- BIS – revising electrical parameters for wiring and appliances

Lightning Protection Device



Lightning Protection Device : Highest Point

Lightning Protection to Solar Panels

Lightning Safe Grid

- Lightning arresters are devices which arrest the lightning before it is formed and hence there is no sound and light.
- Based on expected intensity of lightning , Lightning arresters are installed in series to make the lightning safe
- However, Lightning is recorded by an electronic counter .
- Babadham and Nandan Pahar Deoghar, JSCA Stadium Ranchi, Birsa Munda Airpor are safe grids

CROPC

Cyclone Shelters

- 879 Safe Cyclone Shelters made out of World Bank fund & GoJ
- Safety
  - Flood upto 5 meters
  - Wind speed 200 kmph
  - Lightning 200 K A
  - Heavy rain
- Early warning Dissemination System EWDS

How odisha ensured zero Lightning deaths

https://www.preventionweb.net/news/view/65197.

CROPC

How Odisha ensured Fani caused no lightning-related deaths

Lightning arresters mounted over cyclone shelters helped save lives

VINSON KURIAN

Thiruvananthapuram, May 6

The Odisha Government has come in for all-round praise for its state of preparedness that helped minimise loss of life and property during Cyclone Fani.'

The early warning inputs by the Indian Meteorological Department (IMD) were promptly utilised to execute the mammoth task of evacuation of more than 11 lakh people to 879 cyclone-safe shelters. This was a major achievement.

This went to prove how the State has come a long way since its calamitous tryst with the Super Cyclone of 1999 that claimed nearly 10,000 lives, besides causing extensive damage to means of livelihood and property.

New benchmark

The State has also set a benchmark for itself and other vulnerable States by achieving 'zero death' from lightning associated with the cyclone.

Lightning surge is integral part of any cyclone and a large number of deaths are always attributed to it. Based on past experience, cyclone shelters along the coastline are most vulnerable.

'Fani' sparked more than lakh lightning strikes in Odisha but did not kill because of the lightning arresters

'Fani' sparked more than lakh lightning strikes in Odisha but did not kill thanks to lightning arresters mounted over the cyclone shelters. But, a weakened 'Fani' claimed 10 lives from lightning, four in Chandauli Uttar Pradesh and six in Bangladesh. Odisha is an exception here, notes Col Sanjay Srivastava, Convener of the New Delhi-based Lightning-Resilient India Campaign. Srivastava is also Chairperson of the Climate-Resilient Observing Systems Promotion Council.

Installation of lightning arresters at the cyclone shelters constructed under the World Bank-funded National Cyclone Risk Mitigation Project was a major challenge, Srivastava told *Businessline*.

Odisha is one of the most lightning-prone State having incurred 1,256 deaths during the last three years from 2015-2016 to 2017-2018.

After cyclone Fani , the State Disaster Management Authority reviewed the status of lightning arresters. Out of the 879 installed, only one was found damaged, which was repaired immediately. This sort of sensitivity alone yields results, Srivastava said.

Major killer

Lightning has become the biggest killer in India claiming almost more than 2,500 lives per year and as per inputs available, the country has meagre lightning-safe infrastructure.

In addition to loss of human life , there are huge unreported losses of livestock and wild animals and damage to electrical equipment running into crore of rupees.

Building Code

The National Building Code 2016 has laid down detailed norms for installation of lightning and protection devices and each building supposed to be catered for lightning protection against vertical and lateral strikes.

The Lightning Resilient India Campaign launched jointly by the Climate Resilient Observing Systems Promotion Council, IMD, Delhi and World Vision India stresses on the need for installation of protection system in vulnerable building assets.

Adherence to IBC timeline

CROPC

Lightning Resilient India Campaign

वज्रपात सुरक्षित भारत अभियान

When lightning roars Never stand under tree or outdoor

जब बिजली करें गर्जना पेड़ के नीचे कभी ना रहना

Lightning Resilient India Campaign

वज्रपात सुरक्षित भारत अभियान

जब बिजली
करें गर्जना
तब पक्के छत
के नीचे ही रहना

www.lightningsafeindia.com
www.cropc.in

CROPC

Lightning Resilient India Campaign

वज्रपात सुरक्षित भारत अभियान

CROPC

Lightning Resilient India Campaign

वज्रपात सुरक्षित भारत अभियान

ENSURE PROPER LIGHTNING ARRESTER AT HOME, SCHOOL , HOSPITALS , COMMUNITY CENTERS

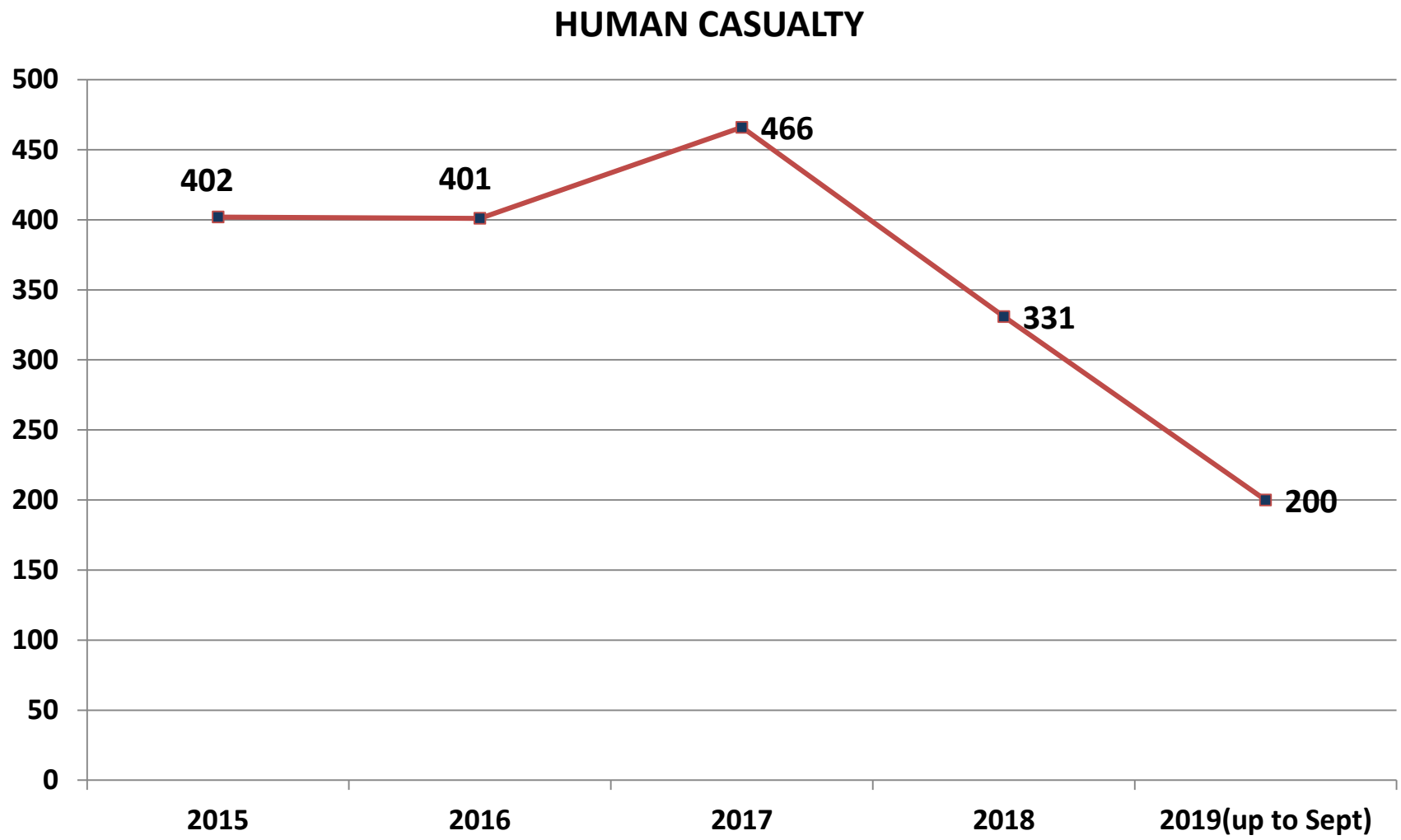
Advantage of Mapping Lightning

- Severe weather detection and warning - Cyclone , hurricane , tornado, cloudburst
- Convective rain fall estimation
- Storm tracking
- Predicting aviation hazard
- Warning to Power Companies, Refineries, Fuel and Explosive Depot, Chemical Industries, Golf courses, outdoor sports , Beaches etc.
- Forest Fire forecasting
- Wild Life Protection
- Study of Nox generation
- Study of electrical sensitivity
- Magnetospheric- ionospheric research
- Solar Atmospheric studies

Prevention and Mitigation

- Elaborate guidelines issued to Government and non government organisations
- Jharkhand Building Bye Laws 2016 makes it mandatory for all G+2 and above building to install lightning conductors /arresters
- Schools , Industry , Government buildings to install lightning conductors / arresters
- Included in the school and college curricullum
- Part of Life saving skills programme
- Review and monitoring

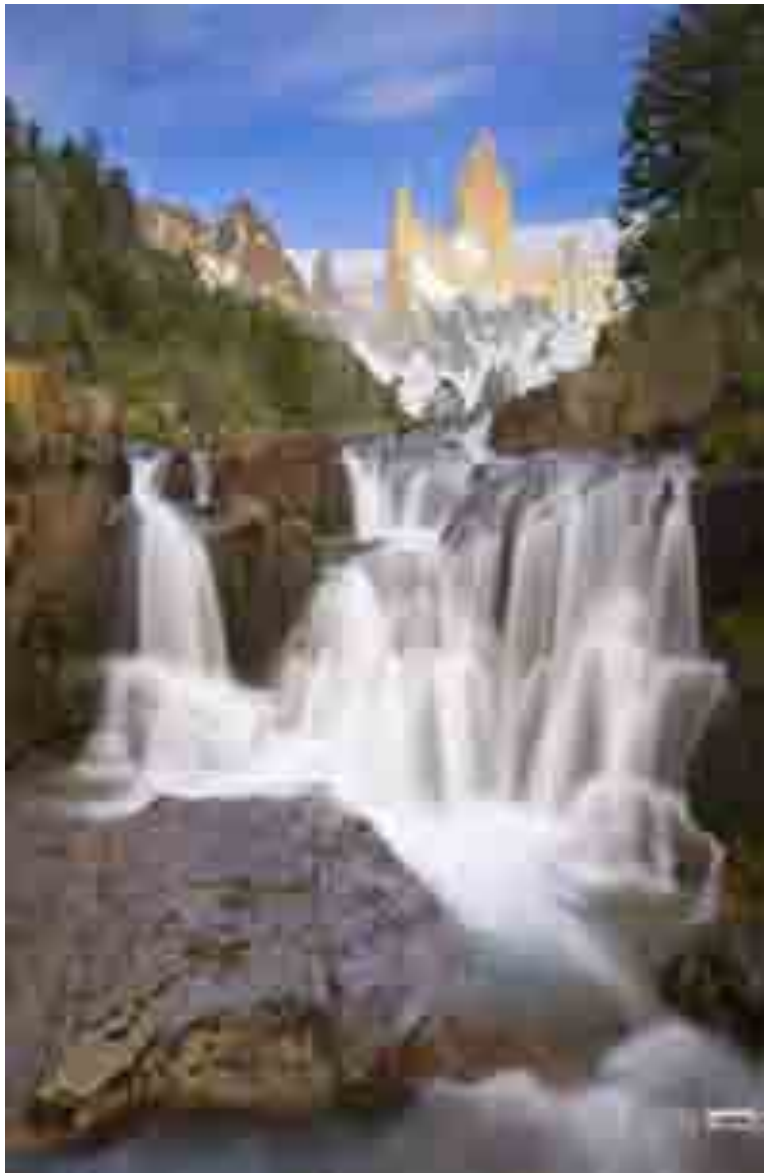
ODISHA : IMPACTS



Enhance Preparedness

- Check serviceability of Lightning conductors
- Impact assessment and corrective measures
- Awareness campaign
- Research and Development
- Monitoring and evaluation

Lightning Early Warning Framework for SAARC Countries

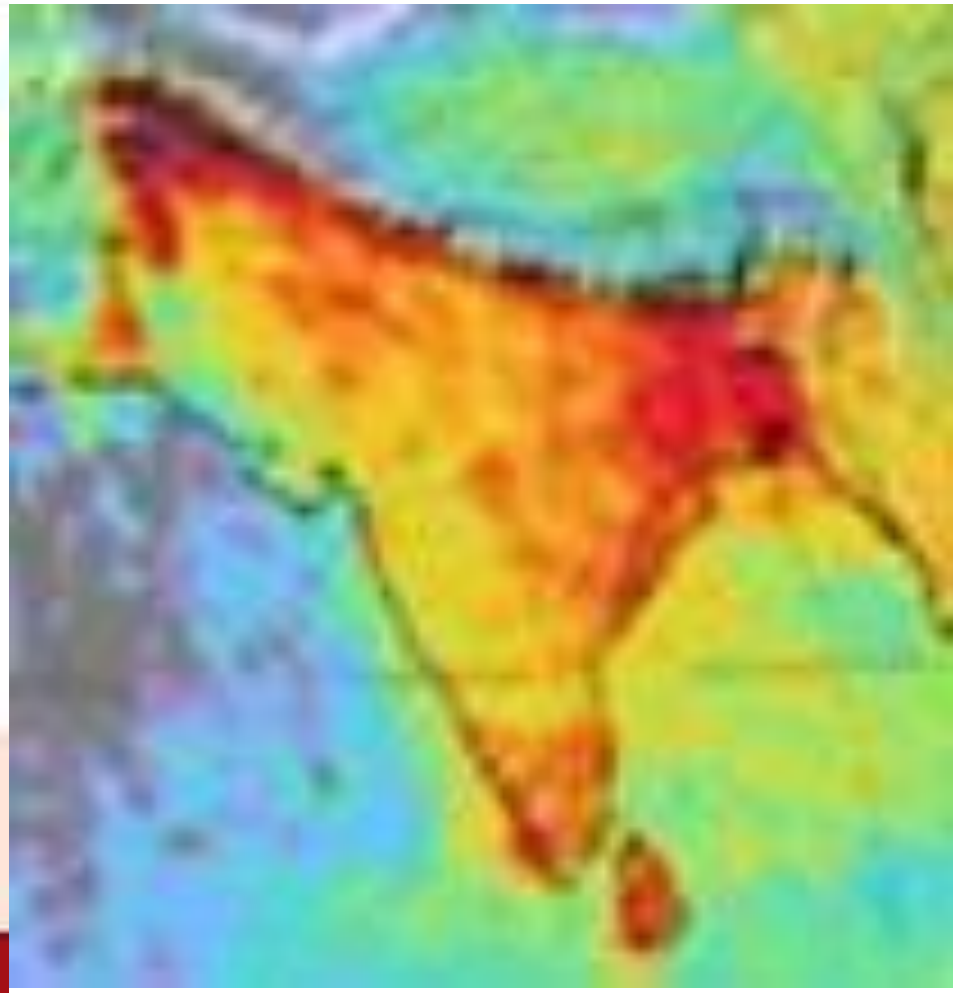


- HRVC Mapping of Lightning
- Zone mapping of Lightning prone areas
- Early Warning systems
  - * Early Detection of Lightning /storms
  - * Alert / warning system
- Enhance preparedness
- Prevention and Mitigation - Bye laws
- Capacity Building
  - * Training
  - *Awareness
- Lightning Protection- Creation of safe grid
- Monitoring, evaluation and Review.

Lightning Early Warning System

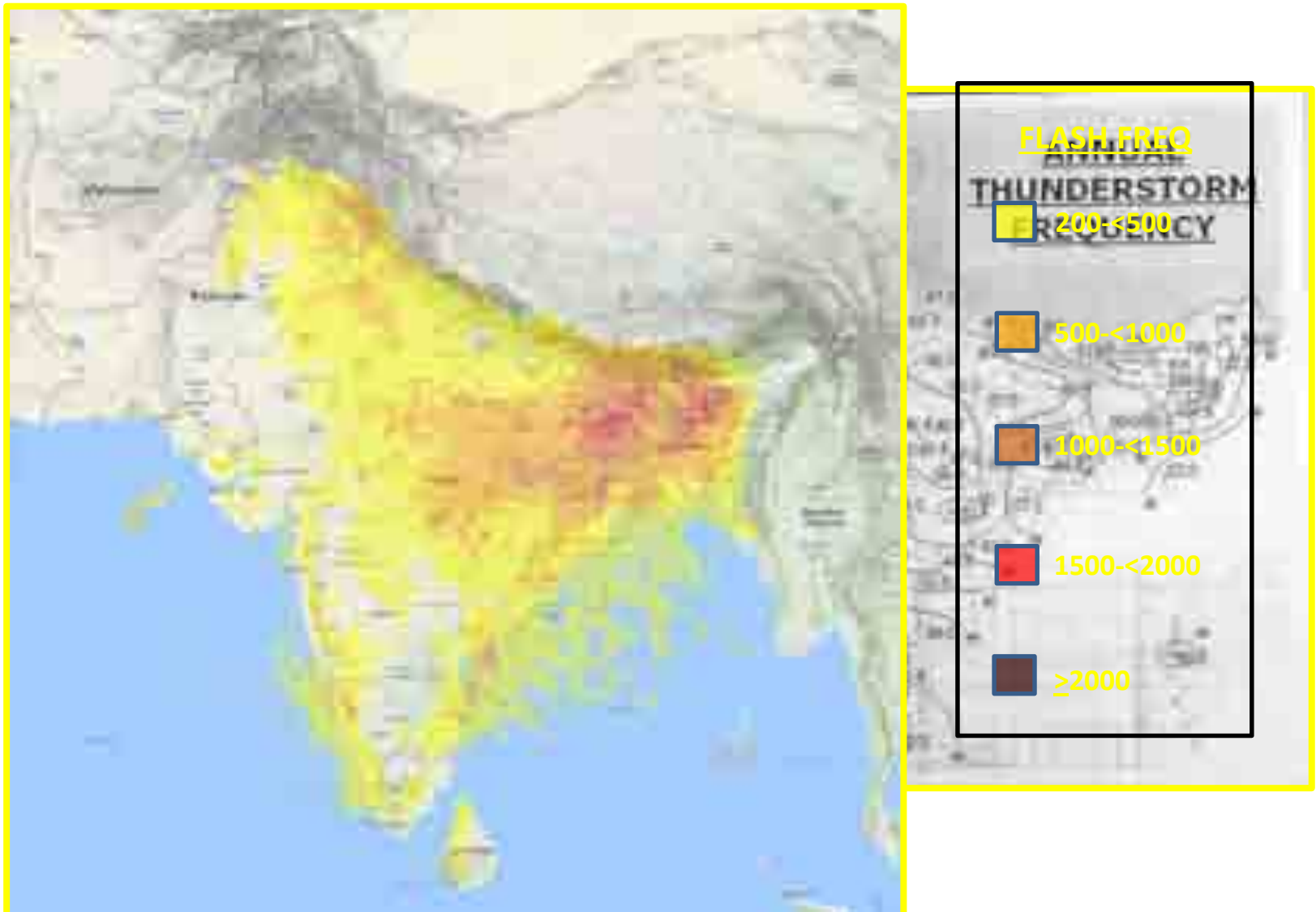
- World Meteorological Organisation (WMO) Conference June 2019 – decided India to undertake Regional services
- Severe Weather Forecast Demonstration Project on on-same to be converted into service
- Products needs Orientation and interpretation as per local needs
- SDMC can think of leveraging the same - Climate Resilient Observing Systems Promotion Council (CROPC) can render necessary service.

SAARC Countries Lightning Vulnerability Map



CUMULATIVE (FOUR YEAR) AVERAGE

(2013 - 2016)



Lightning Early Warning Framework for SAARC Countries

CROPC

Lightning Resilient India Campaign

वज्रपात सुरक्षित भारत अभियान

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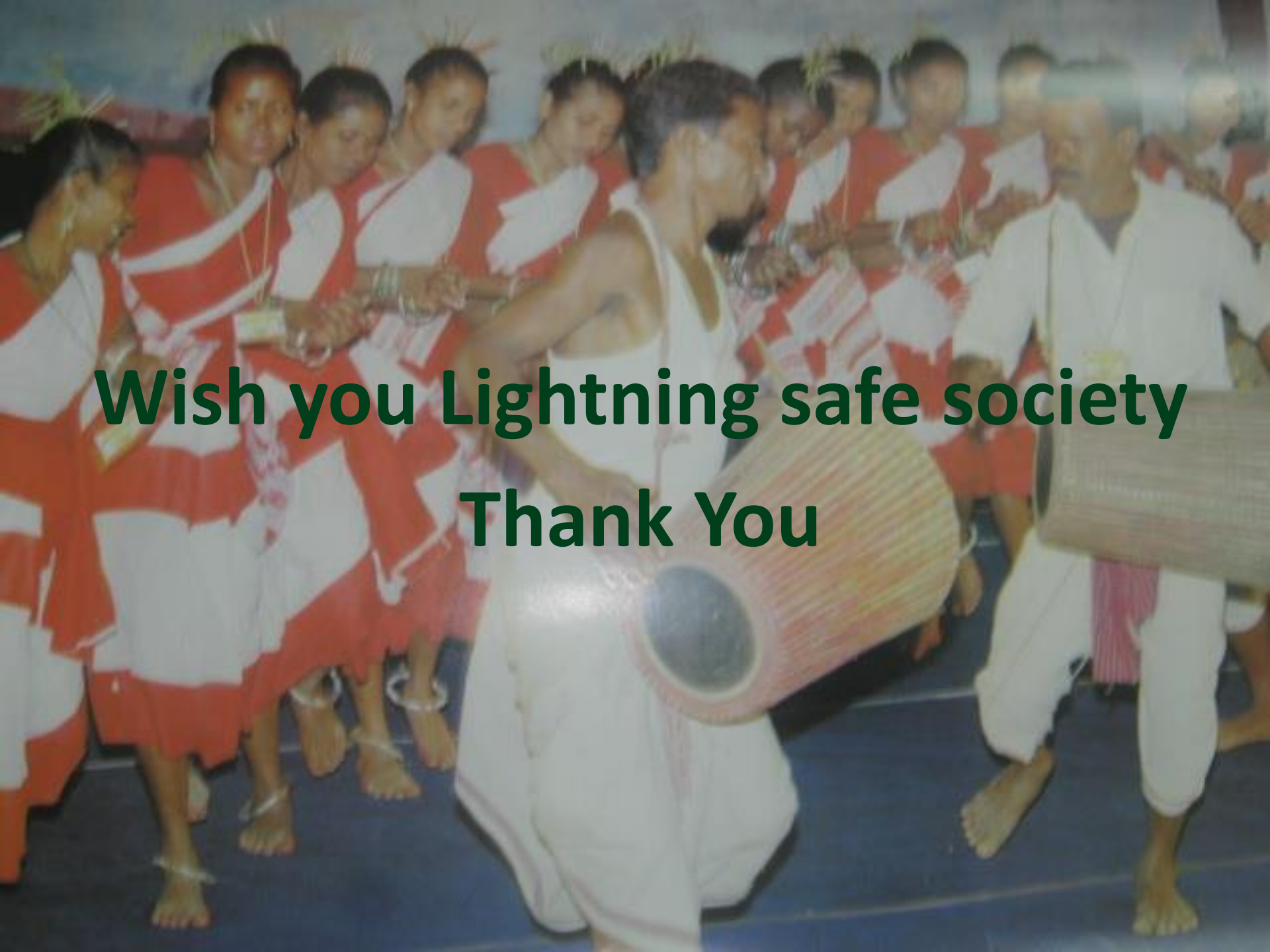
Wish you Lightning safe society
Thank You

Lightning Resilient India Campaign
Major Challenges

- Early Warning dissemination to last miles
- Common Alert Protocols (CAP) and flow of action
- Capacity Building-
  - * Education
  - * Training
  - * Awareness
- Lightning Protection System
- Non scientific based Actions
- Awareness towards Automatic Weather Station / spatial variability

Mid Monsoon 2019 Lightning Report

- Scientific Approach
- Identify Lightning Hotspot
- Early Warning
- Operationalise EW
- Dissemination to target group
- Awareness and education
- Lightning Protection
- Review and monitoring

Mid Monsoon 2019
Lightning Report

Road Map Ahead

- Lightning Hot spot – Lightning Risk Atlas
- National Lightning Research Programme
- Lightning EW – Max outreach
- Promotion to Lightning Protection
- Capacity Building – training & awareness
- Medical treatment
- Long term initiatives
- Lightning Safety audit
- Lightning Resilience Index
- Lightning Sensors deployment coordination