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LIGHTNING STRIKES & CLIMATE CHANGE

Gist of RSTV RAJYA SABHA Debate

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LIGHTNING STRIKES & CLIMATE CHANGE

INTRODUCTION

- Lightning strikes have claimed more than 70 lives in few days in the states of Rajasthan, Uttar Pradesh and Madhya Pradesh.
- Despite rapid advancement in technology, lightning strikes remain the most common reason for deaths by forces of nature.
- According to the last available statistics from the **National Crime Records Bureau**,
  - There were 8,145 deaths in the country attributable to forces of nature in 2019. Of these, 35.3% deaths were reported due to 'lightning'.
- While between April 2020 to March 2021, lightning strikes have killed 1,619 people, according to **India's second annual Lightning Report.**
  - The report also says that there has been a 34% rise in lightning strikes in the country.
  - And just five states - Odisha, Madhya Pradesh, Chhattisgarh, West Bengal and Jharkhand - have witnessed the maximum lightning strikes.

In this article, the following aspects of lightning strikes are discussed:

- What is causing an increase in lightning strike incidents in India?
- Why does it kill so many people?
- What can be done to minimize deaths caused by lightning strikes?

EDITED EXCERPTS FROM THE DEBATE

What is causing an increase in lightning strike incidents in India?

- Climate crisis: The spike in lightning strike incidents can certainly be linked to the climate crisis. Rapid degradation of the environment like global warming, deforestation, depletion of water bodies, concretisations, rising pollution and aerosol levels have cumulatively pushed the environment to extremes
- Increase in temperature: Both surface temperature and moisture levels have increased significantly in recent years.
- Loss of tree cover: Urbanisation leading to loss of tree cover also contributes to the rise in surface temperature.
- Monsoon season: During pre-monsoon to initial monsoon, fatalities are more for farmers as they are out in the agricultural fields or in orchards.

Lightning hotspots

Africa is the continent with the most lightning hotspots, followed by Asia, South America, North America, and Australia.

How serious is the lightning issue?

- As a whole, India sees 2,000-2,500 lightning deaths every year on average.
- Lightning is the biggest contributor to accidental deaths due to natural causes.
- A few years ago, over 300 people were reported killed by lightning in just three days — a number that surprised officials and scientists.

Despite being a serious issue, lightning remains among the least studied atmospheric phenomena in the country. Just one group of scientists, at the Indian Institute of Tropical Management (IITM) in Pune, works full-time on thunderstorms and lightning.

What can be done to minimize deaths caused by lightning strikes?

- Occurrences of lightning are not tracked in India. The focus should be on tracking the phenomenon.
- Area specific lightning warnings should be provided in advance.

VALUE ADDITION

What is Lightning?

- Lightning is a very rapid and massive discharge of electricity in the atmosphere, some of which is directed towards the Earth's surface.
- These discharges are generated in **giant moisture-bearing clouds** that are 10-12 km tall.
- The base of these clouds typically lies within 1-2 km of the Earth's surface, while their top is 12-13 km away.
- Temperatures towards the top of these clouds are in the range of minus 35 to minus 45 degrees Celsius.

Forms of Lightning

- Inter-cloud
- Intra-cloud
- Cloud-to-ground

It is the cloud-to-ground form of lightning that kills humans, as well as animals and livestock, and can substantially damage property.

How does Lightning actually strike?

- **Condensation**: As water vapour moves upward in the cloud, the falling temperature causes it to condense.
- **Heat generation:** Heat is generated in the process, which pushes the molecules of water further up.
- **Formation of ice crystals:** As they move to temperatures below zero degrees celsius, the water droplets change into small ice crystals. They continue to move up, gathering mass — until they are so heavy that they start to fall to Earth.
  - This leads to a system in which, simultaneously, smaller ice crystals are moving up and bigger crystals are coming down.
- **Release of electrons:** Collisions follow, and trigger the release of electrons — a process that is very similar to the generation of sparks of electricity. As the moving free electrons cause more collisions and more electrons, a chain reaction ensues.
- **Positive and negative charge:** This process results in a situation in which the top layer of the cloud gets positively charged, while the middle layer is negatively charged.
  - The electrical potential difference between the two layers is huge — of the order of a billion to 10 billion volts.
- **Flow of current:** In very little time, a massive current, of the order of 100,000 to a million amperes, starts to flow between the layers.

How does current travel from cloud to Earth?\

- While the Earth is a good conductor of electricity, it is electrically neutral.
- However, in comparison to the middle layer of the cloud (**negatively charged**), it becomes positively charged.
- As a result, about 15%-20% of the current gets directed towards the Earth as well.
  - It is this flow of current that results in damage to life and property on Earth.
  - There is a greater probability of lightning striking tall objects such as trees, towers or buildings.
- Once it is about 80-100 m from the surface, lightning tends to change course towards these taller objects.
  - This happens because **air is a poor conductor of electricity**, and electrons that are travelling through air seek both a better conductor and the shortest route to the relatively positively charged Earth's surface.

- **Heating of air column:** An enormous amount of heat is produced, and this leads to the heating of the air column between the two layers of the cloud. This heat gives the air column a reddish appearance during lightning.
- **Shock waves:** As the heated air column expands, it produces shock waves that result in thunder.

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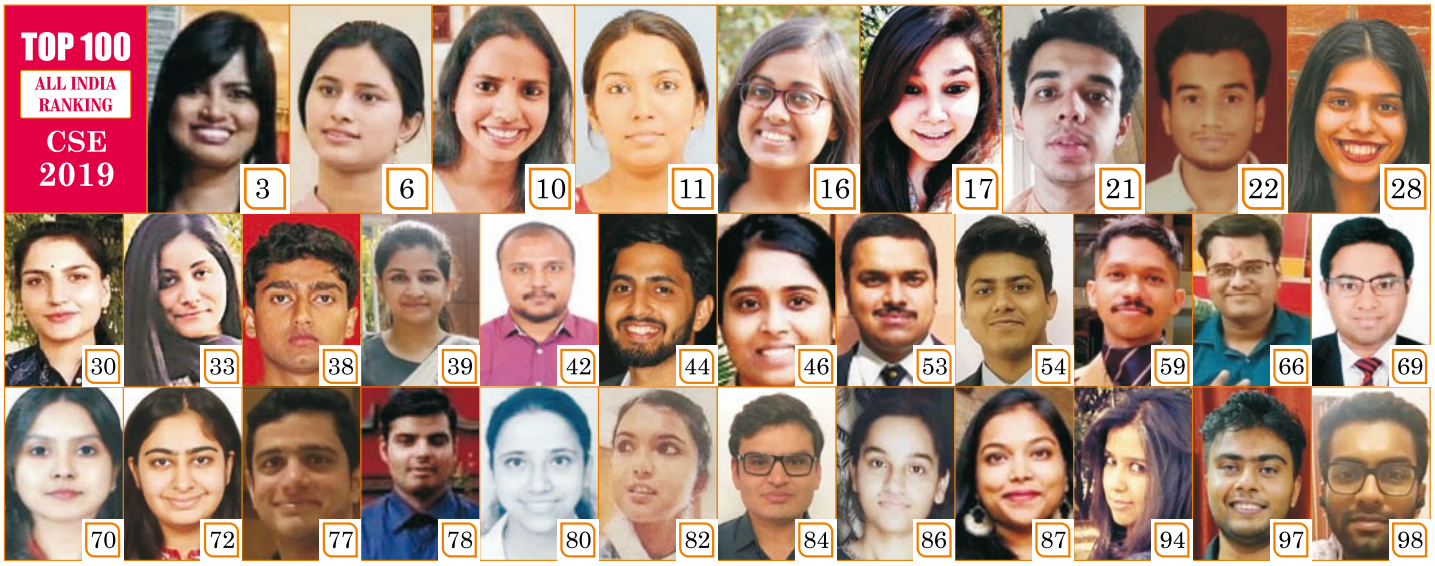

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