



# drishti

## Cities are turning into 'Lightening Magnets'

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Scientists believe that as the world gets warmer and more polluted, the frequency and intensity of lightning may rise. Estimates suggest that lightning kills over 2500 people annually in India.

### Factors that contribute

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- **Urban heat**

- The concretization of urban areas, paired with a decrease in open, green spaces turns cities into **heat sinks**.
- As this warm air from cities rises, cooler air rushes in to fill the space. This can form **convective clouds** if sufficient moisture is available, leading to **unstable weather**.
- **Convective clouds** are often associated with **increased lightning**.
- The **heat island effect** was the main reason for a five-fold increase in lightning activity during pre-monsoon months in Delhi.
- The recent findings also show that global warming could lead to stronger thunderstorms.

- **Pollution**

- **High concentration of aerosols** (pollutants suspended in the atmosphere) pumps up the incidence of lightning.
- Aerosols reduce the size of cloud droplets, turning more water into ice, which increases the electrical conductivity of clouds by up to 50%.
- Research says that **pre-monsoon rainfall is accompanied by more lightning flash counts than monsoonal rains**. The main reason for this is pollution.
  - The pre-monsoon season has higher concentration of suspended air pollutants. By comparison, the monsoon sees inflows of clean air from the ocean, which reduces pollution levels.
  - Also, since the clouds are at a much lower height during monsoon, it reduces convective energy within the cloud, thus abating lightning.
- Lightning flashes also create **pollutants - Ozone & Nitrogen Oxides** - that can

damage lung tissue and aggravate asthma. Nitrogen oxides get mixed with other gases in the atmosphere to produce ozone.

- Therefore, the risk of lightning is thus much bigger than what's visible: the electrocution that causes death and injury. With pollution and global warming on the rise, an increase in the frequency of lightning seems inevitable.

## What is Lightning?

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- Lightning is the **visible discharge of electricity** that occurs when a region of a cloud acquires an **excess electrical charge**, either positive or negative, that is sufficient to **break down the resistance of air**.
- Lightning is usually associated with **cumulonimbus clouds**, but it also occurs in stratiform clouds (layered clouds with a large horizontal extent), in **snowstorms** and **dust storms**, and sometimes in the dust and gases emitted by erupting volcanoes.
- During a thunderstorm, lightning can **occur within the cloud, between clouds, between the cloud and the air, or between the cloud and the ground**.
- Lightning occurs when regions of **excess positive and negative charge develop within the cloud**.
- Typically, there is a large volume of positive charge in the upper regions of the cloud, a large negative charge in the centre, and a small positive charge in the lower regions. These charges reside on water drops, ice particles, or both.

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- Thereby, sudden and violent **electrostatic discharges** within the cloud created the visible lightning.
- About one-third of the lightning flashes travel from the cloud to the ground.
- The potential difference between cloud and ground is of the order of 10 to 100 million volts.
- **Thunder** is produced by **rapid heating of the air in the lightning channel** and a consequent increase in air pressure. The overpressure causes the channel to expand at supersonic speeds, which ultimately produces a sound wave heard as thunder.

## What is Urban Heat Island Effect?

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- The **elevated temperature in urban areas as compared to rural, less developed areas** is referred to as the urban heat island effect. The process of urban development leads to this phenomenon.
- Urban climates are distinguished from those of less built-up areas by differences in air temperature, humidity, wind speed and direction, and amount of precipitation.
- These differences are attributable in large part to the altering of the natural terrain through the construction of artificial structures and surfaces.

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