Role of Aerosols in Indian Monsoon

Why in news?

Researchers from Indian Institute of Tropical Meteorology, Pune, think that aerosols may be weakening the rainy season.

What is an Aerosol?

- Aerosols are minute particles suspended in the atmosphere.
- When these particles are sufficiently large, we notice their presence as they scatter and absorb sunlight.
- Their scattering of sunlight can reduce visibility (haze) and redden sunrises and sunsets.
- Aerosols are short-lived, unlike greenhouse gases that persist and accumulate in the atmosphere for longer period.
- The bulk of aerosols — about 90% by mass have natural origins. Ex: Volcanoes.
- The remaining 10% of aerosols are considered anthropogenic, or human-made, and they come from a variety of sources.
- **Automobiles, incinerators, smelters, and power plants** are prolific producers of sulfates, nitrates, black carbon, and other particles.
- Deforestation, overgrazing, drought, and excessive irrigation can alter the land surface, increasing the rate at which dust aerosols enter the atmosphere.
What are the direct effects of Aerosols?

- Aerosols interact both directly and indirectly with the Earth's radiation budget and climate.
- Different aerosols scatter or absorb sunlight to varying degrees, depending on their physical properties. Although **most aerosols reflect sunlight, some also absorb it.**
- Aerosol's effect on light depends primarily on the composition and color of the particles.
- Pure sulfates and nitrates reflect nearly all radiation they encounter, cooling the atmosphere.
- Black carbon absorbs radiation readily, warming the atmosphere but also shading the surface.
- Brown carbon or organic matter has a warming influence on the atmosphere depending on the brightness of the underlying ground.
- Salt particles tend to reflect all the sunlight they encounter.
- In addition to scattering or absorbing radiation, **aerosols can alter the reflectivity, or albedo, of the planet.**

What are the indirect effects of Aerosols?

- As an indirect effect, aerosols in the lower atmosphere can **modify the size of cloud particles**, changing how the clouds reflect and absorb sunlight, thereby affecting the Earth's energy budget.
- Aerosols also can act as sites for chemical reactions to take place.
- The most significant of these reactions are those that **lead to the destruction of stratospheric ozone.**
- On a global scale, these aerosol “indirect effects” typically work in opposition
Broadly speaking, aerosols are thought to suppress precipitation because the particles decrease the size of water droplets in clouds.

**What did the IITM Pune study say?**

A study by IIT Kanpur that came out in April, previously found that higher aerosol loading results in delayed but more rainfall over Central and Northern India.

But, this recent research by IITM Pune focusses on **effect of aerosols on Indian monsoon.**

Monsoon is weakening over the last 50 years. The recent research report that a mix of GHGs, aerosols and changes in forest and agricultural cover was affecting the strength of the monsoon.

Their computer simulations suggest that aerosols may be a far more important factor than GHGs and it is the **major cause of weakening of the monsoon.**

A good monsoon is produced by the difference in temperature between land and sea.

But, the dust clouds shield the earth from the sun’s rays, depressing land and sea temperatures and reducing the variation between the two.

Because of this, the Indian monsoon is getting weakened by aerosol accumulation.

**Source: The Hindu**