

Role of Aerosols in Indian Monsoon

Why in news?

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

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What is an Aerosol?

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- 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.

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What are the direct effects of Aerosols?

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

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What are the indirect effects of Aerosols?

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 - 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.
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 - Aerosols also can act as sites for chemical reactions to take place.
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 - The most significant of these reactions are those that **lead to the destruction of stratospheric ozone.**
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 - On a global scale, these aerosol “indirect effects” typically work in opposition

to greenhouse gases and cause cooling.

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- Broadly speaking, aerosols are thought to suppress precipitation because the particles decrease the size of water droplets in clouds.

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What did the IITM Pune study say?

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- 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.
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- But, this recent research by IITM Pune focusses on **effect of aerosols on Indian monsoon.**
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- Monsoon is weakening over the last 50 years. The recent reseach report that a mix of GHGs, aerosols and changes in forest and agricultural cover was affecting the strength of the monsoon.
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- 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.**
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- A good monsoon is produced by the difference in temperature between land and sea.
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- But, the dust clouds shield the earth from the sun's rays, depressing land and sea temperatures and reducing the variation between the two.
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- Because of this, the Indian monsoon is getting weakened by aerosol accumulation.

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Source: The Hindu

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