Radiation Fog over Northwestern India

Why in news?

Dense fog has enveloped northwestern India, including Delhi, Punjab, Haryana, parts of Uttar Pradesh, and parts of Rajasthan.

How does fog form?

- Fog forms like clouds do - when **water vapour condenses**.
- The key factors for the formation of fog are,
    - The presence of moisture and
    - A fall in the temperature.
- **Formation process** - With the land surface cooling down at night, the air close to the surface also cools down.
- Since cooler air cannot hold as much moisture as warm air, the water vapour in the air condenses to form fog.
- Fog begins to form in the early hours of the morning, when the temperature is at its lowest.
- **Impacts** - Fog can have “high spatial variability”, and its intensity can depend on factors like humidity, wind, and temperature.
- Areas near water bodies may see denser fog because of the higher humidity.

What are the different types of fogs?

- **Radiation fog** (or ground fog) episodes last for a few mornings on account of calm winds and western disturbances, resulting in localised fog formation.
- **Advection fog**, in contrast, is larger in scale both in terms of the area covered and duration.
- It forms when warm, moist air passes over a cool surface, causing water vapour to condense.
- It mostly occurs where warm, tropical air meets cooler ocean water.
- If the wind blows in the right direction, sea fog can be transported over coastal land areas.
- **Valley fog** is the result of mountains preventing dense air from escaping, and in which the fog is trapped in the bowl of the valley and can last for several days.
- **Freezing fog** is the result of liquid droplets freezing on solid surfaces.
- Cloud-covered mountaintops often see freezing fog. These are not applicable to the Indo Gangetic Plain.

What’s been happening over northwestern India?

- Cold wave conditions, in which the minimum temperature is significantly lower than normal, have been recorded recently over northwestern India inn Punjab, Haryana,

and parts of Rajasthan.
- The fall in temperature along with moisture and light winds over the Indo Gangetic Plain has resulted in dense fog over the region.

Western disturbances are storms that originate in the Mediterranean Sea.

- Western disturbances bring moisture-bearing winds to northwest India. This can result in increased moisture levels over the region.
- In the absence of western disturbances, local moisture sources like water vapour from rivers and soil moisture can also cause fog.
- Indo Gangetic Plain is most vulnerable to fog occurrences, with major, weeks-long spells of dense fog in the months of December and January.
- These foggy spells are linked to wind and temperature patterns.

What are the characteristics of the fog over Delhi?

- Delhi saw a warmer start to the winter in 2022, with maximum temperatures remaining above normal till around mid-December.
- This is attributed to a lower number of western disturbances affecting the city. The lower number of western disturbances means that they did not bring much moisture and didn't lead to any significant fog formation.
- An update from the SAFAR forecasting system categorised the fog episode in Delhi on Monday as "radiation fog".

What is the link between pollution levels and fog?

- As temperature declines, local wind speed also falls. The inversion layer comes down and vertical mixing reduces.
- This results in fog formation and particulate matter hangs on the boundary layer, increasing pollution levels.
- Once the temperature increases during the day, the fog dissipates. This is the radiation fog that was seen in Delhi.
- Pollution levels can also impact fog in a situation that Delhi is yet to witness this year.

What is the road ahead?

- The second situation which has not yet arrived, but which we are likely to see in the last week of December 2022 and in January 2023, is advection fog, when the humidity is much higher.
- These fog episodes last longer and secondary particulate formation then begins leading to rapid buildup of pollutants.
- Lower temperatures across the Indo Gangetic Plain in January can cause such fog episodes. Also, winter has only just arrived in Delhi.

Reference

1. Indian Express | As fog comes to Delhi, a look at the phenomenon, and what causes it



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