

CLOUD SEEDING TECHNOLOGY – SCI & TECH (MAINS)

Q. What is cloud seeding? Critically analyse the impact of cloud seeding in the present day environmental consequences. (10 marks, 150 words)

News: *Delhi govt plans 'cloud seeding' to induce rains amid pollution*

What's in the news?

- Even as Delhi-NCR witnessed light showers, the Delhi government had announced earlier this week that it was considering cloud seeding or 'artificial rain' to wash away pollutants in the air.

Key takeaways:

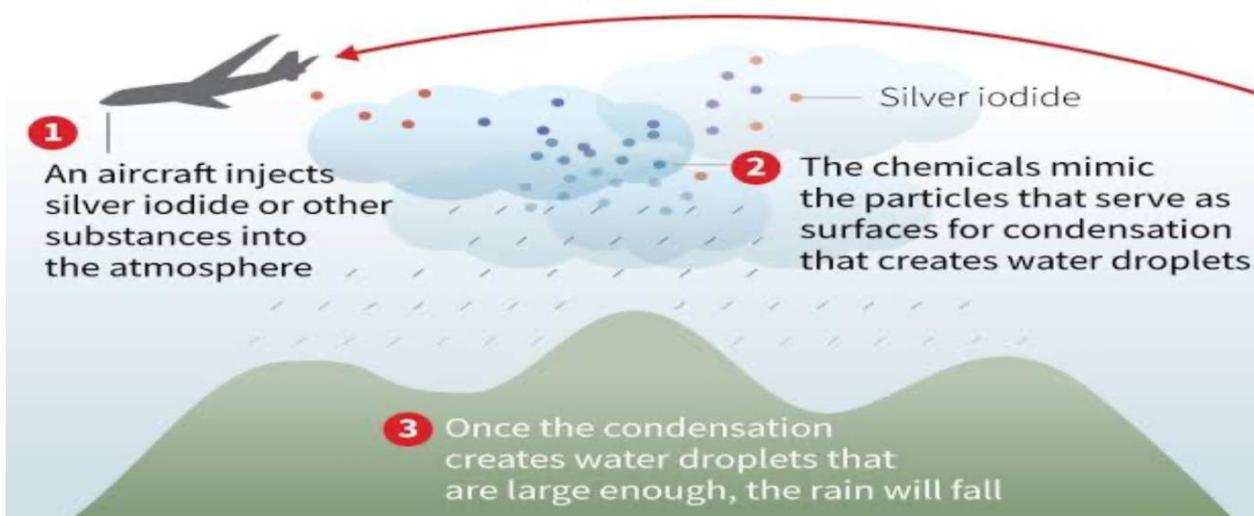
- Cloud seeding has only been done earlier with the purpose of bringing rainfall to drought-prone areas and not to mitigate pollution.

Cloud Seeding:

- Cloud seeding is the **process of spreading either dry ice or more commonly, silver iodide aerosols, into the upper part of clouds to try to stimulate the precipitation process and form rain.**
- Cloud seeding uses planes to spray clouds with chemicals to condense smaller particles into larger rain droplets.
- Cloud seeding **increases rainfall rates by approximately 10% to 30% per year** and cloud seeding operations cost much less than the desalination process.

Cloud seeding

Traditional method of rainmaking, in use since the 1940s



Significance of Cloud seeding

1. Agriculture:

- It creates rain, providing relief to drought-stricken areas.
- E.g.: 'Project Varshadhari' in Karnataka in 2017.

2. Power Generation:

- Cloud seeding experiments have shown to augment production of hydroelectricity during the last 40 years in Tasmania, Australia.

3. Water Pollution Control:

- Cloud seeding can help to maintain minimum summer flows of the rivers and dilute the impact of treated wastewater discharges from municipalities and industries.

4. Fog Dispersal, Hail Suppression and Cyclone Modification:

- During the winter the cloud seeding programme is used to increase the mountain snowpack so that additional runoff is received during the spring melt season.
- "Project Sky Water" of the U.S.A. in 1962 for weather modification through cloud seeding aimed at fog dispersal, hail suppression, and cyclone modification.

5. Tackle Air Pollution:

- Cloud seeding can potentially be used to settle down toxic air pollutants through the rain.
- E.g.: Recently, the Central Pollution Control Board along with other researchers mulled the use of cloud seeding to tackle Delhi's air pollution.

6. Tourism:

- Cloud seeding can transform typically dry areas much more hospitable to enhance tourism.

7. Fight against climate change:

- To nullify the effects of climate change induced droughts and heat waves.

8. Fight against Water scarcity:

- To tackle the issues like zero water day and other water availability issues.
- Cloud seeding will induce artificial rain for storage of enough water in tanks as well as hydration of ground (recharge to groundwater).

Recent case study and its results regards cloud seeding which was conducted by Indian Institute of Tropical Meteorology:

Challenges:

1. Potential Side-effects:

- a. The chemicals used in cloud seeding might be potentially harmful to plants, animals and people or the environment.

2. Abnormal Weather Patterns:

- a. It might ultimately change climatic patterns on the planet.
- b. Places that normally receive moisture might start experiencing drought due to the artificial process of adding chemicals to the atmosphere to stimulate rain.

3. Costly:

- a. It involves processes such as delivering chemicals to the sky and releasing them into the air by flare shots or airplanes, which involves huge costs and logistic preparation.

4. Pollution:

- a. As artificial rain falls, seeding agents like silver iodide, dry ice or salt will also fall.
- b. Residual silver discovered in places near cloud-seeding projects is considered toxic.
- c. As for dry ice, it can also be a source of greenhouse gas that contributes to global warming, as it is basically carbon dioxide.

Cloud seeding works if done correctly

Cloud seeding experiments were carried out in Solapur city, which gets less rainfall, from June to September in 2018 and 2019

- There was 18% increase in rainfall over a 100 sq.km area in Solapur city due to cloud seeding

- Approximate cost of producing water through cloud seeding was 18 paisa per litre. The cost can drop by over 50% if indigenous seeding aircraft are used

- 20-25% of cumulus clouds produce rainfall if cloud seeding is done correctly

- Cloud seeding alone cannot mitigate droughts but can help produce additional rainfall that can partially address water requirements

- Calcium chloride flare was used for seeding the clouds. The seeding was done at the base of the warm convective clouds and at a time when the clouds were growing

- The study was carried out for two years to understand the microphysics and characteristics of convective clouds that can be targeted to enhance rainfall

- The work provides elaborate protocols and technical guidance to plan and conduct cloud seeding in India

Not all:
As microphysics of clouds vary widely, not all clouds produce rainfall through cloud seeding

