Cloud Seeding

For Prelims: Cloud Seeding and Types, Artificial Rain, Rainfall, Precipitation, Condensation.

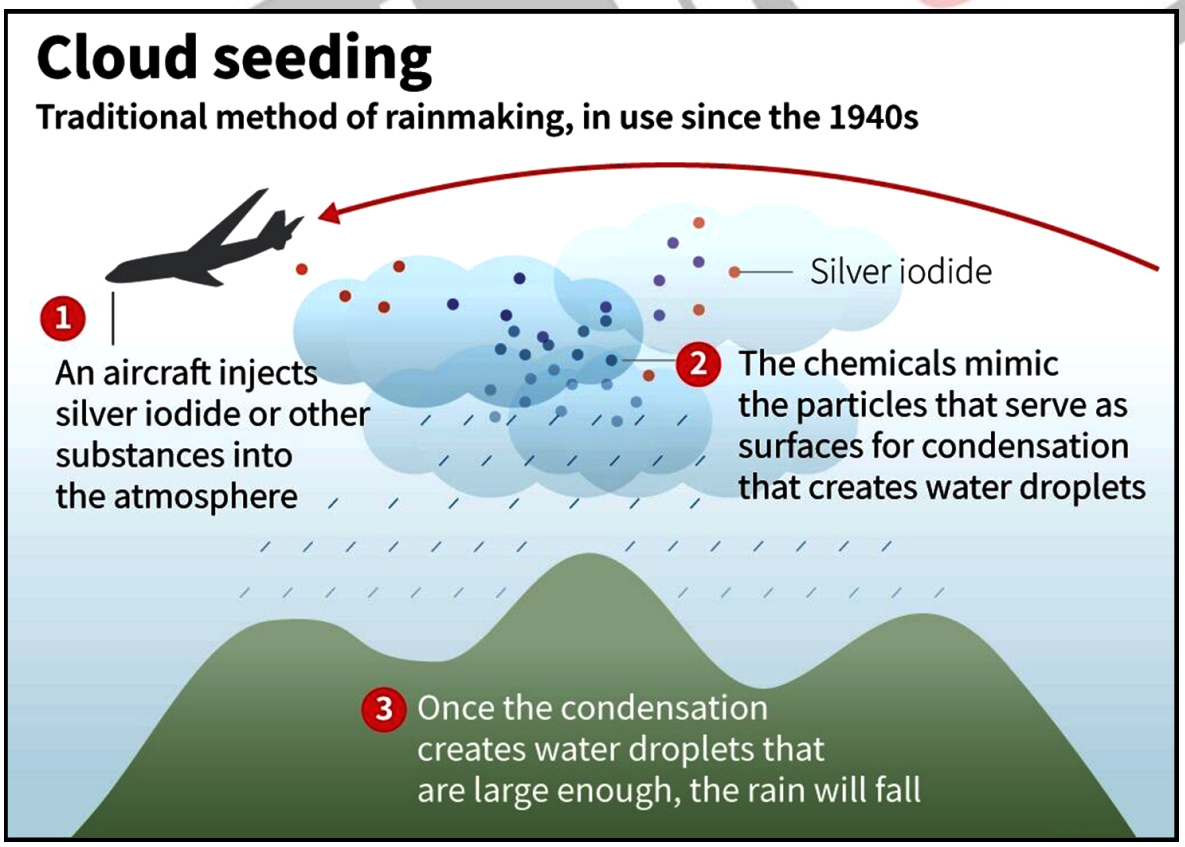
For Mains: Application of Cloud Seeding and Concerns.

Why in News?

Recently, the United Arab Emirates (UAE) which is located in **one of the hottest and driest regions on earth,** has been leading the effort to **seed clouds and increase precipitation,** which remains at less than 100 millimetres a year on average.

- UAE combined **shooting water-attracting salt flares with releasing salt nanoparticles,** a newer technology, into the clouds to **stimulate and accelerate the condensation process** and hopefully produce droplets big enough to then fall as rain.

What is Cloud Seeding?



- **About:**

- 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 Methods:**
  - **Hygroscopic Cloud Seeding:**
    - Disperses salts through flares or explosives in the lower portions of clouds. The salt grows in size as water joins with them.
  - **Static Cloud Seeding:**
    - It involves spreading a **chemical like silver iodide into clouds.** The silver iodide provides a crystal around which moisture can condense.
    - The moisture is already present in the clouds, but silver iodide essentially makes rain clouds more effective at dispensing their water.
  - **Dynamic Cloud Seeding:**
    - It aims to boost vertical air currents, which encourages more water to pass through the clouds, translating into more rain.
    - The process is considered more complex than static cloud seeding because it depends on a sequence of events working properly.
- **Applications of Cloud Seeding:**
  - **Agriculture:**
    - It creates rain, providing relief to drought**-stricken areas**.
      - E.g.: 'Project Varshadhari' in Karnataka in 2017.
  - **Power Generation:**
    - Cloud seeding experiments have shown to augment production of **hydroelectricity** during the last 40 years in Tasmania, Australia.
  - **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.
  - **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.
  - **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.**
  - **Tourism:**
    - Cloud seeding can transform **typically dry areas much more hospitable to enhance tourism.**

What are the Challenges involved in Cloud Seeding?

- **Potential Side-effects:**
  - The chemicals used in cloud seeding might be **potentially harmful to plants, animals, and people, or the environment.**
- **Abnormal Weather Patterns:**
  - It might ultimately change climatic patterns on the planet. Places that normally receive moisture might start experiencing drought due to the artificial process of adding chemicals to the atmosphere to stimulate rain.
- **Costly:**
  - 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.

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

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Q. In the context of which of the following do some scientists suggest the use of cirrus cloud thinning technique and the injection of sulphate aerosol into stratosphere? (2019)

(a) Creating the artificial rains in some regions
(b) Reducing the frequency and intensity of tropical cyclones
(c) Reducing the adverse effects of solar wind on the Earth
(d) Reducing the global warming

Ans: (d)

Exp:

- Cirrus cloud thinning is a kind of technology that involves thinning the wispy, elongated cirrus clouds of high altitudes. Cirrus clouds do not reflect a lot of solar radiation back into space, but as these are formed at high altitudes and cold temperatures, these clouds trap long-wave radiation and have a climate impact similar to greenhouse gases. **Thinning cirrus clouds would be achieved by injecting ice nuclei (such as dust) into regions** where there are cirrus clouds, making the ice crystals bigger and reducing the cirrus optical depth. Thinning the clouds would allow more heat to escape into space and thereby cool the planet.
- **Stratospheric Aerosol Injection (SAI)** is a technique that would involve spraying large quantities of **inorganic particles (e.g., Sulphur dioxide) into the stratosphere** to act as a reflective barrier against incoming sunlight, thus helping to reduce the global warming.
- **Therefore, option (d) is the correct answer.**

Source: IE