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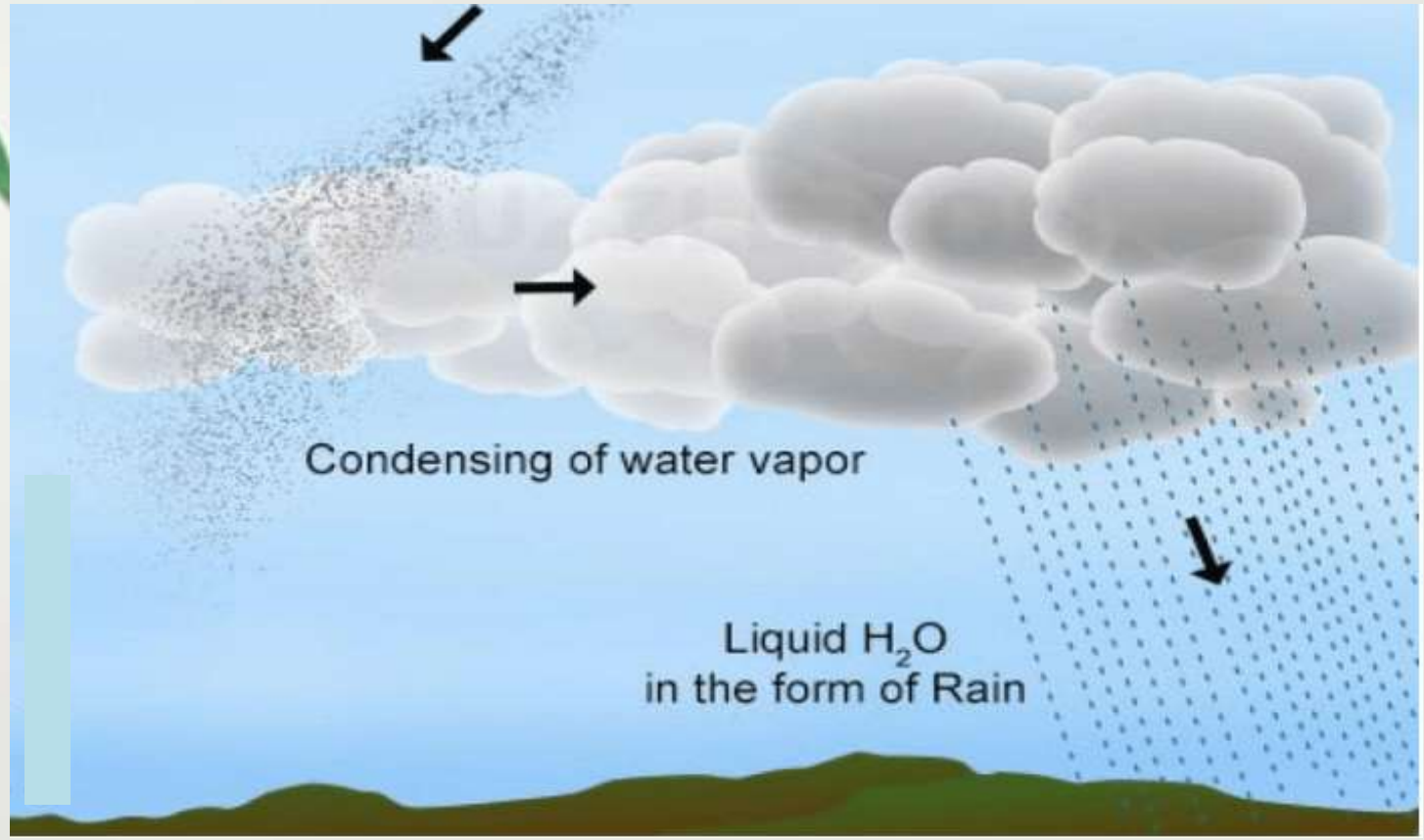
CLOUD SEEDING



Cloud Seeding has been used to resolve environmental issues

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 10 cm a year on average.

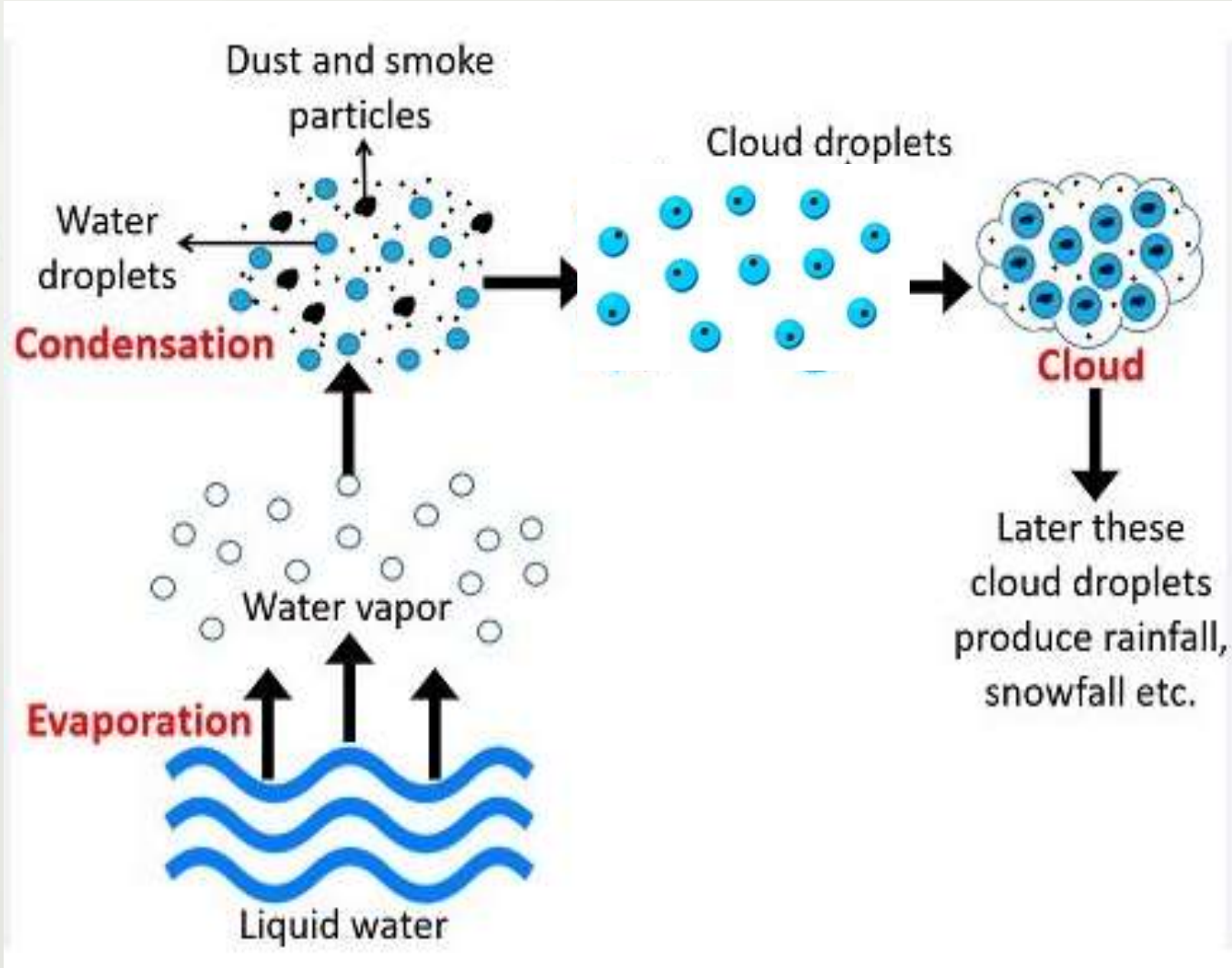
- **Use of Cloud Seeding to induce artificial rain, was being explored as an option by the Delhi Government to combat the rising air pollution levels in Delhi.**

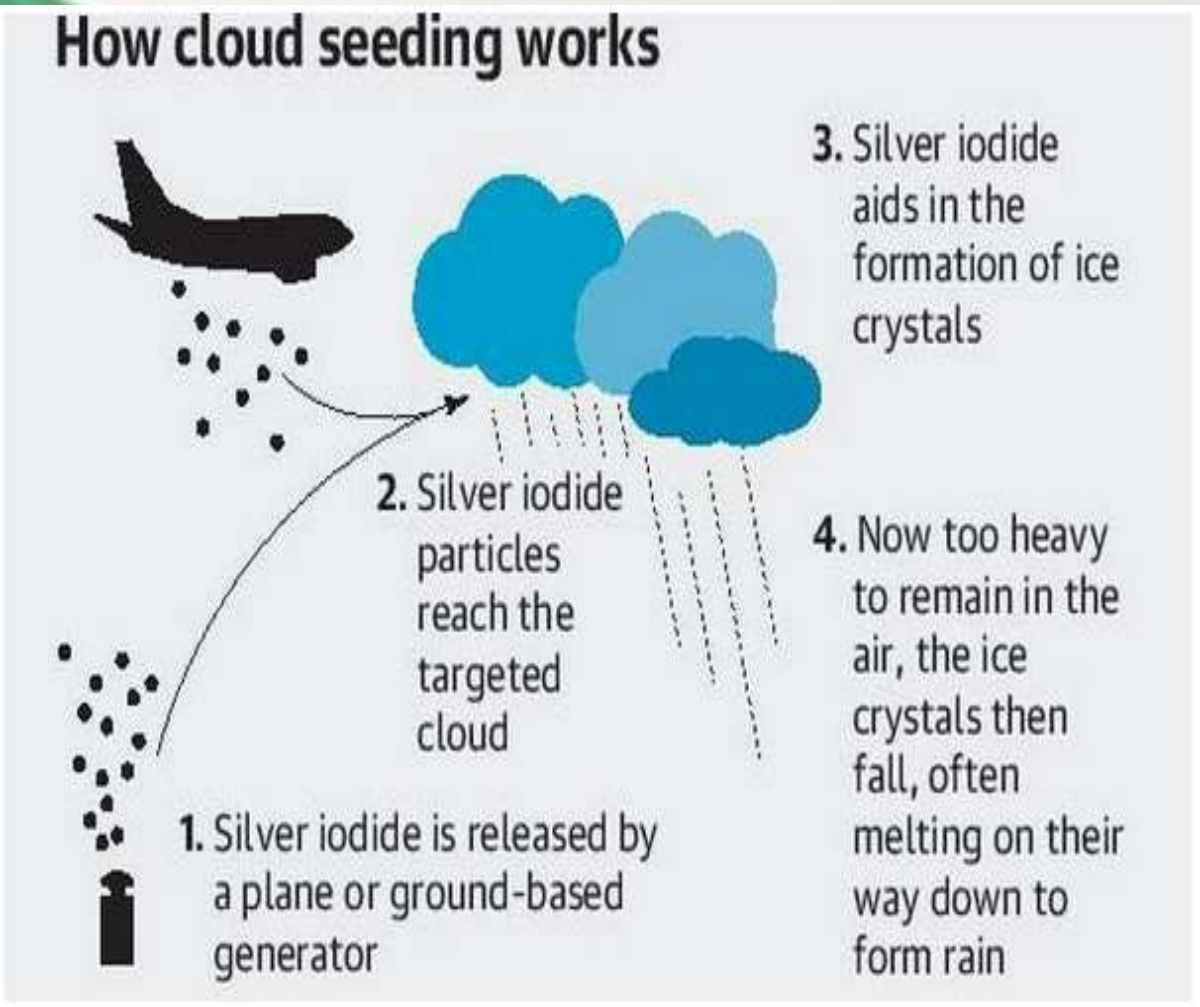
- **Indian Institute of Technology (IIT) Kanpur has successfully conducted a test flight for cloud seeding**

What is Cloud Seeding ?

- Cloud seeding is a kind of a weather modification technology to create artificial rainfall.

Cloud Formation Process





Cloud Formation By Cloud Seeding

- **Cloud seeding aims to facilitate and accelerate process of cloud formation by making available chemical 'nuclei' around which condensation can take place.**

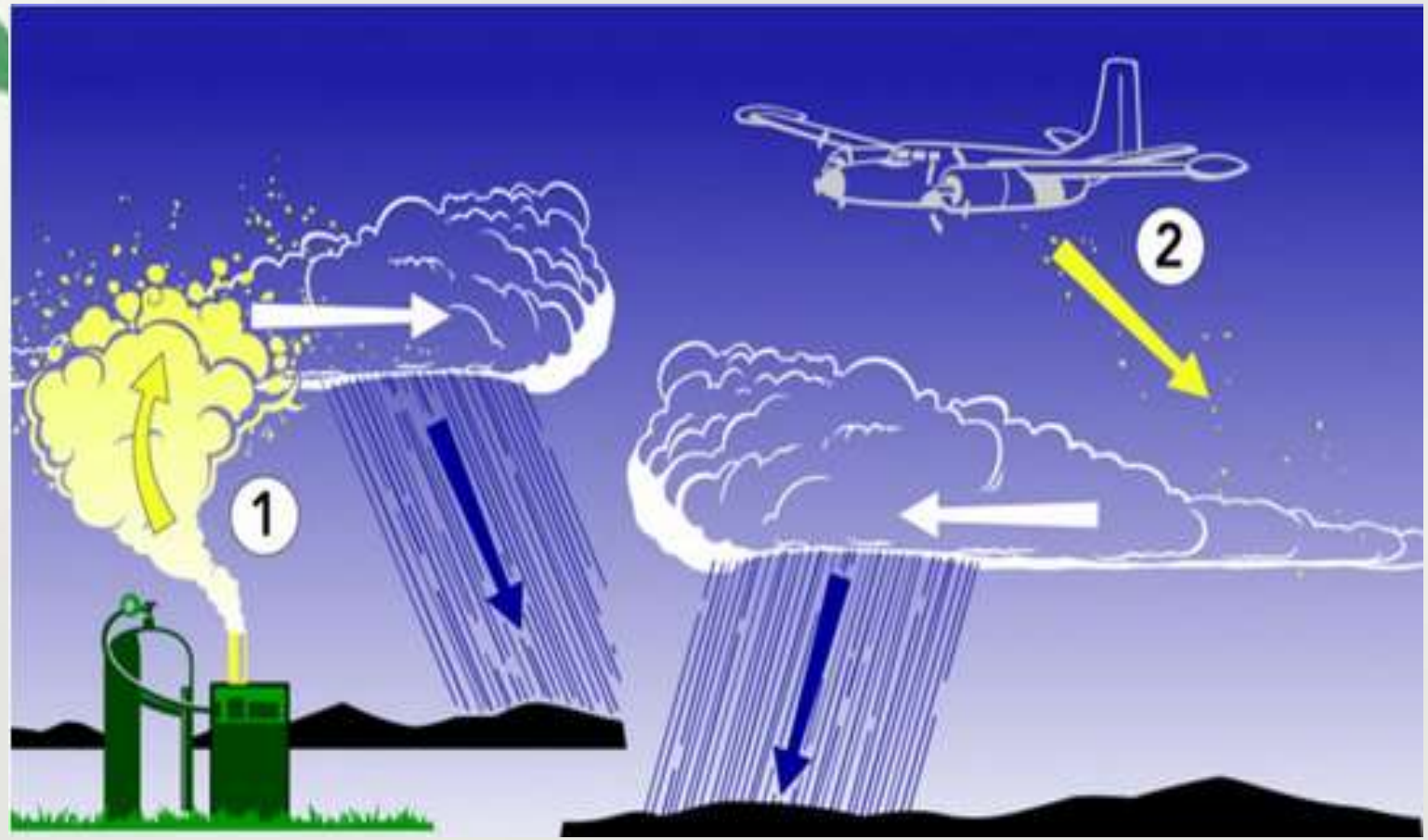
- **It works only when there is enough pre-existing clouds in the atmosphere.**

- **Mainly 8 Chemicals are used in Cloud seeding:**

  - **Silver iodide,**
  - **dry ice,**
  - **Potassium Iodide,**
  - **Propane,**
  - **Calcium Carbide,**
  - **Ammonium Nitrate,**
  - **Sodium Chloride,**
  - **Urea Compound.**

Two ways of adding nuclei particles to clouds:

- o Using **large cannons** that shoot particles into the sky
- o Using **airplanes** that drop the particles from above.



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:

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.

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

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

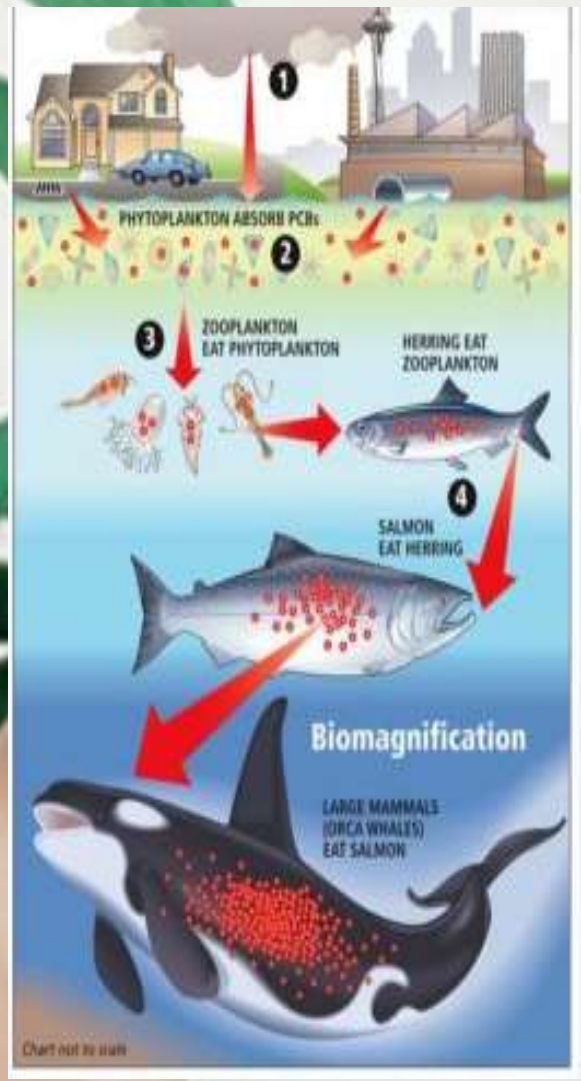
- Calcium chloride flare was used for seeding the clouds. The seeding was done at the base of the warm convective clouds and at a time when the clouds were growing
- The study was carried out for two years to understand the microphysics and characteristics of convective clouds that can be targeted to enhance rainfall
- The work provides elaborate protocols and technical guidance to plan and conduct cloud seeding in India

Challenges involved in Cloud Seeding

- **Abnormal Weather Patterns:**
  - It might ultimately change climatic patterns on the planet.
  - Cloud seeding requires the presence of moisture-filled clouds, which are not always available or predictable.

- **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 From Cloud Seeding



- **Bioaccumulation:**

For example Silver iodide chemical is most commonly used to seed a cloud is known to be toxic for aquatic life because of bioaccumulation.

o Bioaccumulation is a process of accumulation of chemicals in an organism that takes place if the rate of intake exceeds the rate of excretion.

- **Increasing Carbon footprint: Cloud seeding through dry ice (Carbon di oxide) is source of Greenhouse Gases and affects the climate change.**

- **Not all types of clouds are suitable for seeding: Clouds must be deep enough and of a suitable temperature (between -10 and - 12 degrees Celsius) to be seeded effectively.**

- **Disturbing the Hydrological cycles: Cloud seeding simply redistributes rain in drought affected areas which can ultimately affect the Hydrological cycles**

Conclusion

- Cloud seeding technology holds significant promise for addressing water scarcity and mitigating drought conditions. However, to fully unlock its potential, further improvements are needed.

- Such as incorporating nanotechnology-based Titanium dioxide coating on salt particles can enhance the effectiveness of cloud seeding operations.

- Nevertheless, it is imperative to conduct extensive research to fully comprehend the long-term implications and potential risks associated with cloud seeding.

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