

**GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES
LOK SABHA
UNSTARRED QUESTION NO. 628
TO BE ANSWERED ON WEDNESDAY, 23RD JULY, 2025**

CLOUD SEEDING

628. SHRI GURMEET SINGH MEET HAYER:

Will the Minister of EARTH SCIENCES be pleased to state:

- (a) the current status of country's cloud seeding capabilities including research, technology and operational readiness;
- (b) the details of any cloud seeding tests conducted during the last five years including locations, objectives, and outcomes;
- (c) the details of potential applications of cloud seeding in addressing droughts, enhancing agricultural productivity and mitigating extreme weather events;
- (d) whether studies have been conducted on the environmental and health hazards of cloud seeding and if so, the key findings thereof;
- (e) whether cloud seeding-induced rainfall can help reduce air pollution particularly in highly polluted urban areas and any trials have been conducted to assess its effectiveness and if so, the details thereof; and
- (f) the details of Government's policy on the regulation and future deployment of cloud seeding technology in the country?

ANSWER

THE MINISTER OF STATE (INDEPENDENT CHARGE) FOR
MINISTRY OF SCIENCE AND TECHNOLOGY
AND EARTH SCIENCES
(DR. JITENDRA SINGH)

- (a) The Indian Institute of Tropical Meteorology (IITM), under the Ministry of Earth Sciences (MoES), had conducted a research study named Cloud Aerosol Interaction and Precipitation Enhancement Experiment (CAIPEEX) during 2018-2019. The CAIPEEX study was carried out using specially hired cloud seeding and research aircraft over the rain shadow region of the Indian peninsula. The study has drawn guidelines for conducting cloud seeding over the rain shadow region.

IITM has developed the knowledge and expertise in the subject. The research and technology capabilities are being developed at IITM under the Mission Mausam Weather MoD vertical. This includes the development of a 16m tall cloud chamber, the hiring of seeding aircraft, the collaborative development of cloud seeding drones, seeding materials, and dispensers, and other relevant technology with industry and startup companies. There will be capacity development in the country. Operational readiness is hindered by not having the aircraft at disposal and the associated permissions required to operate in the areas relevant for weather modification applications. Although most of the relevant technology is available for import, more development is needed in India to achieve operational readiness.

(b) Cloud seeding tests during the CAIPEEX was conducted as a research experiment in 2018 and 2019 over the rain shadow region of Solapur, Maharashtra. The main objectives were:

- to investigate aerosol-cloud-precipitation interaction-the science of cloud seeding and
- to conduct the randomized cloud seeding to investigate the impact on surface rainfall as per the recommendations of the World Meteorological Organization (WMO).

The report was released to the public and is available at the below link:

<https://www.tropmet.res.in/~lip/Publication/Technical-Reports/CAIPEEX-Report-July2023.pdf>

The report gives a scientific experiment strategy for enhancing rainfall from warm-based clouds. It was found that rainfall can be enhanced by up to $\cong 46\pm 13$ per cent at some locations, as indicated by the Automatic Rain Gauges, and on average, and $\cong 18\pm 2.6$ per cent in a 100 square kilometres (km^2) area downwind of the seeding location. Detailed scientific publication is available <https://doi.org/10.1175/BAMS-D-21-0291.1>

(c) Potential applications include:

- A targeted cloud seeding effort for catchment-scale applications to enhance rainfall.
- The suppression of rainfall by overseeding.
- Other relevant targeted weather modification aspects include fog suppression, hail suppression, marine cloud brightening, etc.
- The intervention in extreme weather events has significant uncertainty.

(d) to (f) As replied to point (a), the Indian Institute of Tropical Meteorology (IITM), under Ministry of Earth Sciences (MoES) had conducted a research study named Cloud Aerosol Interaction and Precipitation Enhancement Experiment (CAIPEEX) and IITM had developed the knowledge and expertise in the subject and continuously working on this.

The environmental and health hazards of cloud seeding and whether cloud seeding-induced rainfall can help reduce air pollution particularly in highly polluted urban areas is an area of research to be investigated with proper documentation and investigation following the guidelines developed in the CAIPEEX. This is the prerequisite for Government policy on the regulation and future deployment of cloud seeding technology in the country.
