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CLOUD SEEDING THECHNOLOGY

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Abstract

Water is one of the most basic commodities on earth sustaining human life. A modeling method for evaluating rain enhancement of cloud seeding with liquid carbon dioxide coolant and silver iodide (AgI) ice nuclei has been developed. The method has been used to stimulate a field experiment. Modeling results indicate that cloud seeding with carbon dioxide coolant and silver iodide in appropriate part of can induce notable change to cloud micro physical and dynamical processes, accelerating updraft velocity, seeding up formation of rain water. The mechanism of seeding to increase rainfall is analyzed this has prompted scientist and engineers to explore the possibility of augmenting water supplies by means of cloud seeding. This warm could seeding technique would enhance could albedo.

Keywords: *rain enhancement, cloud seeding, liquid carbon dioxid*

1.INTRODUCTION

For sometime glycogenic cloud seeding had been proposed as an efficient technique for inducing artificial rainfall in super cooled clouds. The results of many such experiments have been varied, however. Enhancement of existing clouds accompanied by increases in precipitation has been reported in several case studies whereas others have reported decreased or no precipitation due to an increased number of ice particles (eg. Hobbs and polytovich 1980). In addition, randomized experiments have been carried out with inconclusive results. Thus many researchers have some doubts to the efficiency of cloud seeding or artificial rainfall.

The above mentioned studies that focused on demonstrating the efficiency of artificial cloud seeding have involved statistical and physical analysis on an observational basis. One statistical method is to compare the results obtained in randomized experiments from both artificially seeded and unseeded clouds. Over a long period in which large samples sizes can accumulate. Because there are numerous variations (cloud vertical and horizontal scales, cloud life, entrainment, etc) among natural clouds even if the weather conditions are homogeneous in a seeding target region, however, it is difficult to obtain samples with an even distribution of storm intensities, that is, that are lacking bias in storms between seeded and non-seeded days.

2. WHAT IS CLOUD SEEDING?

Cloud seeding is a technique for increasing precipitation (e.g. Rain or Snow) using naturally occurring clouds. It involves the introduction of addition particles into suitable clouds to encourage the formation and growth of ice crystals or raindrops and thus increase the amount of precipitation that will fall from the cloud. Cloud seeding only occurs when the bureau of meteorology forecasts rain and even then only if conditions are favorable for cloud seeding to be successful. Cloud seeding is only effective if suitable clouds are present. There are regions in west Asia that could potentially benefit from this technology, including the coastal mountains in the eastern Mediterranean, Yemen and Saudi Arabia along the Red Sea and some internal regions. Despite the diversity of opinions on the feasibility of the technology, primarily because of difficulties in assessing its results, the prevailing opinion is that it has reached a relatively advanced stage of application and it can be considered one of the technologies capable of contributing to the augmentation of fresh water supplied in semi arid regions.

2.1TYPES OF CLOUD SEEDING

There are two main types of cloud seeding

A. Dynamic
B. Static seeding

Dynamic – It is more commonly used for worm latitude clouds that are more capable of releasing the latent heat to add the freezing process of the ice nuclei in clouds.

Static – Involves cumulous clouds travelling west to east through mountain ranges that are picking up water and other microscopic particles like soil, dust, smoke, that

then are cooled because of high altitudes. As the water or condensation nuclei cool more, ice nuclei form and grow bigger. Introducing certain chemicals such as silver iodide helps the condensation nuclei to freeze thus forming more ice nuclei. This is more common in areas like Colorado.

3.TECHNOLOGY DESCRIPTION

Cloud seeding mainly requires advanced equipments and facilities, including aircraft, a meteorological station network to monitor the clouds, a rainfall monitoring ground network, a network for data collection and processing, and a satellite image transmission networks.

Materials used for cloud seeding includes silver iodide (in the form of pyrotechnique) azotic cooling liquid, dry ice (CO2) and propane. Cooling materials and silver iodide are usually used at a concentration of 2%, for seeding clouds with a graded microstructure. Dispensing the material from the top of the cloud produces better results than dispensing it from the bottom. This is typically done by airplanes or ground generators, with the goal of facilitating the optimal distribution of seeding material among the clouds components containing the largest portion of super cooled water. Cloud seeding projects require establishment of a technical and administrative organization containing-

1. A radar and electronic maintenance division. An
2. Aviation affairs division.
3. A data collection.
4. An education and training division.

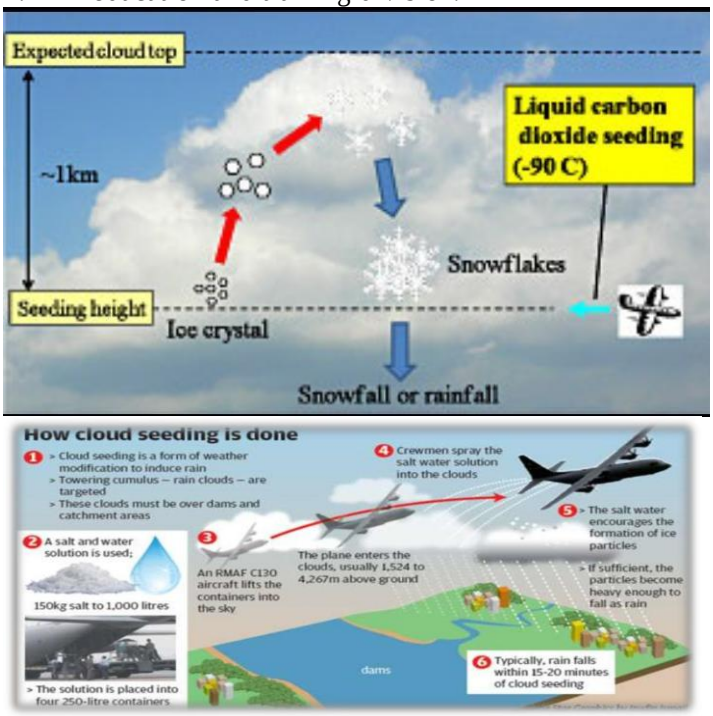


Fig 1 – Diagrammatic representation of cloud seeding for rain enhancement by an aircraft

4. EXTENT OF USE

Cloud seeding experiments were carried out in the mountains of Saudi Arabia, UAE, Jordan and Syria. Field studies were conducted in the sultanate of Oman. Cloud seeding experiments in Syria continued between 1991 to 1997 and the project carried out by the ministry of agriculture and land reclamation is considered one of the most important projects carried out in this topic in the west Asia region, as well as being a pioneering projects in the on Arabic and international level. The project objectives include -

1. Improving the rainfall distribution in agricultural region to ensure that the economic return on rain fed agriculture did not relay only on the quantity of rain during the agricultural season.
2. Improving rainfall distribution at different plant growth stages.
3. Increasing the volumes and intensities of rainfall for charging ground water aquifers as well as increasing the water volume in stored surface dams.

The estimated additional rainfall attributable to cloud seeding ranged between 7 to 16% of the natural annual rainfall. The use of this technology is in an experimental stage in the other Arab countries but generally is exhibiting encouraging results.

5. OPERATION AND MAINTENANCE

Use of this technology includes long term monitoring of rainfall and other meteorological parameters, based on conventional and satellite meteorological recording networks. Information from weather predicting centers is typically used in the initial operations of this technology in specific target areas. Because available prediction methods are inadequate, artificial tracers are typically used to follow the development and motion of the clouds. This is done with the use of infrared rays, visual images and water pressure images. Meteorological radars are generally used to determine cloud microstructure and especially cloud heights. Radar is used to monitor precipitation from the clouds as well as the cloud development prior to and after the seeding process. When all the physical information on the cloud is obtained, it is seeded with silver iodide. The required maintenance work focuses on the mechanical and electronic equipments, which requires skilled staff with multiple specialties

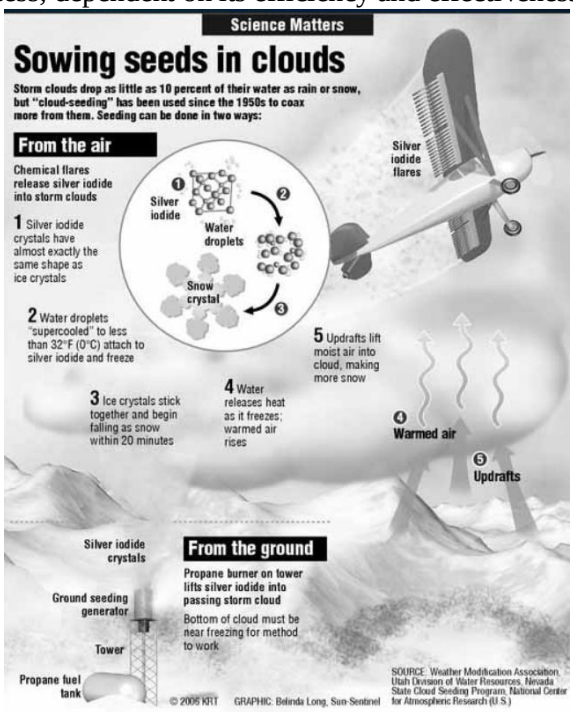
6.LEVEL OF INVOLVEMENT

Cloud seeding in the west Asia region is conducted by Government institutions, with contributions from such executing organizations as civil aviation, meteorology, water resources and agriculture. The main beneficiary is the ministry of agriculture, and its institutions, central

directorates and municipalities. The private sector has not yet shown significant interest in this cloud seeding technology. This lack if attention is attributed to the fact that, in addition to high capital cost, private companies will not achieve their economic goals unless they are established on a regional level.

7.COSTS

Cloud seeding technology is generally an expensive process, dependent on its efficiency and effectiveness.



8. EFFECTIVENESS OF THE TECHNOLOLGY

Under certain circumstances data suggests that natural rainfall can be increased through the use of Orographic clouds. Statistical analysis of the rainfall records of several suggests a rainfall increased 10% over the natural level. Cloud seeding experiments are still limited in the countries of west Asia and the technology is currently undergoing analysis and scientific research. Because the cloud seeding technology is still in a developmental stage, its fruitful applications are still limited. Further, ongoing research currently concentrates on the meteorological aspects, with inadequate attention being given to the hydro geological aspects. Due to increasing water shortages in West Asia region, this technology is nevertheless consider promising under suitable conditions for facilitating increased rainfall resulting in improved water resources and economical benefits.

9.SUITABILITY

The proper and beneficial use of the technology requires certain appropriate conditions including –

1. Suitable sites.
2. Suitable cloud seeding material.
3. A means of dispensing the seeding material in the super cooled clouds.

10. ADVANTAGES OF CLOUD SEEDING

1. It creates rain.
2. It makes all area more hospitable.
3. It could regulate the weather.
4. It would allow economic improvement.
5. It can provided relief to those drought hit areas.
6. It allows successful dissipation of fogs.
7. It contributes to improve the productivity of rain fed agricultural areas.

11. DISADVANTAGES OF CLOUD SEEDING

1. It uses potentially harmful chemicals.
2. It is not really proven to be effective.
3. It may affect the weather in a negative way.
4. It can pose a negative risk for living organisms.
5. It requires huge amount of investments.

12. CULTURAL ACCEPTANCE

There are different opinions on the acceptability and effectiveness of cloud seeding. Due to an increasing need to increase water resources and supplement existing supplies I the arid and semi arid areas of West Asia, the technology has received increasing attention from the public and government institutions. This increasing attention is accompanied by the need to be varied of any negative impacts that may occur in some rain fed agricultural areas as a result of positive result in other areas, thereby resulting in unstable agricultural grain production.

13. CONCLUSIONS

1. Finally it should be pointed out that the whole matter of cloud seeding to increase precipitation is considered largely in the experimental stage by the meteorological profession.
2. There is no doubt that in the next few years, a gradual development of operational techniques will permit a significant increase in the control of precipitation.
3. Cloud seeding can be used to cause rain instead of hail.
4. The source of water in the acquifers comes from rainfall that fall to the ground on surrounding area. Cloud seeding could improve the aquifers fullness by introducing more water while the current use of could remain unchanged.

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