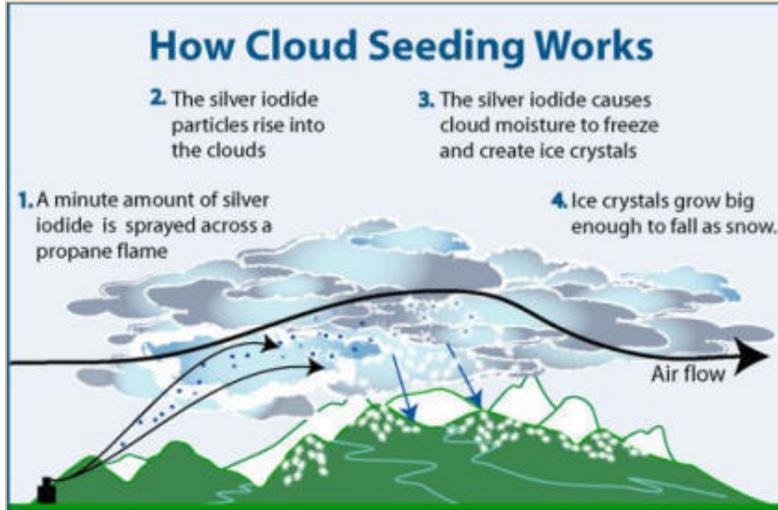


Cloud Seeding



How it Works

In 1946 Vincent Shafer scattered dry ice onto the top of a super cooled stratified cloud over the mountains of Schenectady, New York. Within minutes, the seeded portion of the cloud was transformed into a mass of snow crystals. This experiment gave clear cut evidence that crystals could be created in non-precipitating super cooled clouds by introducing artificial ice nucleants. This type of seeding is called glaciogenic seeding and uses silver iodide or dry ice as seeding agents.

The Premises: (1) That efficiency in some clouds is limited by a shortage

of natural ice nuclei and (2) increased buoyancy resulting from seeding induces the conversion of super cooled drops into ice particles. This enables clouds to grow larger, process more water vapor, and yield more precipitation.

Methods

There are many types of weather modification: ground based snowpack augmentation, airplane based snowpack augmentation, airplane rain augmentation; & hail suppression are the primary means. There is also fog suppression but this is not used in Colorado. The permitted projects in Colorado are based around ground based operations with the goal of snowpack augmentation.

There is also a form of weather modification called acoustical hail suppression that uses sound cannons to disrupt cloud processes. There are permits for these hail cannons in Weld County and in the San Luis Valley.

Effectiveness

Policy statements by the American Meteorological Society and the World Meteorological Organization support the effectiveness of winter orographic cloud seeding projects (between 5-20% more snow is produced in a target watershed).

As a result, the American Society of Civil Engineers (ASCE) is developing guidelines entitled "Standard Practice for the Design and Operation of Precipitation Enhancement Projects." The ASCE also has Manual No. 81: "Guidelines for Cloud Seeding to Augment Precipitation" (published in 1995 and updated in 2005).

Hail Cannons

The State of Colorado permits all forms of commercial "cloud seeding" or "weather modification" activities. Although most of Colorado's weather modification permits are based around ground based silver iodide seeding to increase wintertime precipitation; a new form of weather modification is being utilized. Recently, farmers in the San Luis Valley and Weld County have bought hail cannons and currently have permits to protect high value cash crops in relatively small target areas from hail damage.



In the San Luis Valley, Southern Colorado Farms operates a network of hail cannons and the added insurance against hail damage has enabled the production of spinach and lettuce crops. A hail cannon manufacturer's website states "Hail cannons ignite a charge of acetylene gas in a specially designed blast chamber releasing an explosive pressure wave creating a cavitation effect which disrupts the formation process of the hail stone embryo."

In 2006 Southern Colorado Farms renewed a weather modification permit for hail cannon use in the San Luis Valley near Center, Colorado. In response to local concerns about the effects of the hail cannon operations, the CWCB required data collection in and out of the target area as part of the terms and conditions of the permit renewal. The final report for the rain and hail data collection required by the permit can be found on the Watershed Protection & Flood Mitigation Section's Publications page.

States Conducting Weather Modification Operations

The following map was created by the Weather Modification Association in 2005. It shows the states with WM operational programs in the United States. Please visit the North [American Interstate Weather Modification Council](http://www.americaninterstateweathermodificationcouncil.org/) for a larger version of this map.

