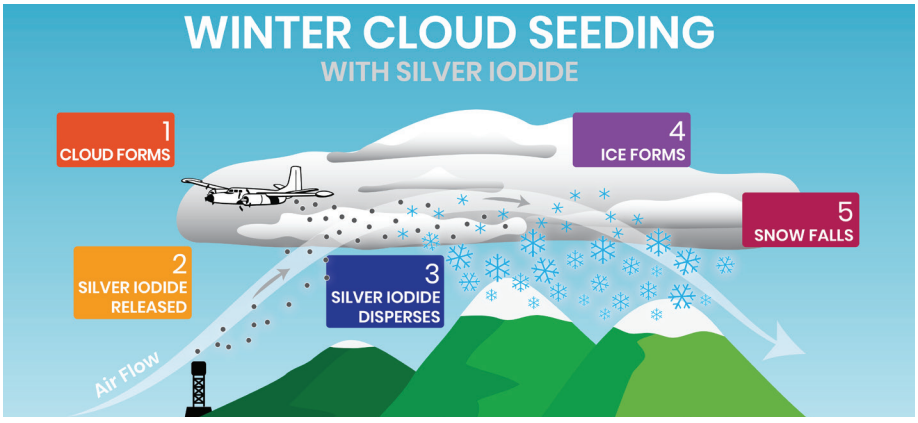
WINTER CLOUD SEEDING

INCREASING SNOWPACK

Enhancing Snowfall

In mountainous regions where water supply depends on winter snowpack, cloud seeding aims to enhance snowfall by dispersing silver iodide (AgI) particles into clouds to form ice and cause, or enhance, snowfall. Cloud seeding may use ground-based generators and/or airborne platforms to disperse silver iodide into the clouds. Targeting suitable conditions for cloud seeding occurs on short time scales (hours) and small spatial (50-100 km) scales and does not alter large-scale weather patterns or the climate. It cannot overcome a drought and variability in effectiveness occurs due to seasonal variations in weather patterns. Ultimately, cloud seeding should be viewed as one tool in a water resource manager's toolbox of mitigation strategies for long-term water management solutions under a changing climate and growing water scarcity. Specifically, cloud seeding can offer an effective strategy for increasing water supply.



Ground-based generators and/or aircraft are often used to disperse silver iodide into the clouds.

Recent Advances

- Scientifically-proven technology to enhance snowfall
- One tool as part of a broader strategy for water resource management
- Model simulations inform cloud-seeding program designs & estimate potential benefits

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NEW OPPORTUNITIES

Recent advances in computer modeling, based on the Weather Research and Forecasting (WRF) system, and documented observations of seeding benefits, through field programs such as the Seeded and Natural Orographic Wintertime clouds: the Idaho Experiment (SNOWIE), are providing new opportunities to understand and quantify the effects of cloud seeding and to more efficiently design and operate cloud-seeding programs. WRF-WxMod® was developed to simulate the effects of silver iodide in clouds. Coupling that with WRF-Hydro® allows for an assessment of the simulated precipitation impact from cloud seeding on streamflow.

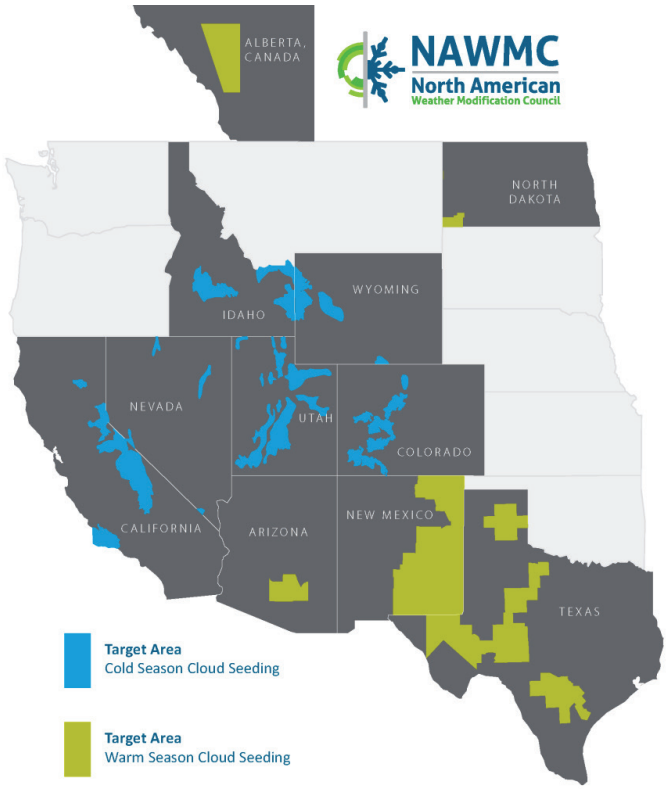
Clouds that contain supercooled liquid water are candidates for cloud seeding to enhance the efficiency of the snow formation process. However, weather systems in mountain watersheds can differ greatly. Therefore, it is necessary to study and understand the weather patterns and characteristics of clouds in a region of interest before starting a cloud-seeding program. This is often done through feasibility studies focused on the following objectives:

- Detailed analysis of aerosol, cloud, and precipitation characteristics in a basin of interest
- Assessment of the potential for cloud seeding to increase snowpack in the watershed
- Program design for an operational cloud seeding program
- Evaluation, cost-benefit analysis, and future optimization of cloud seeding programs

FREQUENTLY ASKED QUESTIONS

Where is cloud seeding being conducted in the United States? Many states in the Western U.S., including Idaho, Wyoming, Colorado, Utah, Nevada, and California.

Ground-based generator
PHOTO COURTESY IDAHO POWER COMPANY



What are the benefits and extra area effects of cloud seeding? The overall magnitude of impact due to cloud seeding is relatively small compared to natural precipitation, but it can be an important contributor to the water supply in some watersheds. While there is no evidence that suggests an increase in precipitation from cloud seeding directly leads to a systematic decrease elsewhere, this is an active area of further research.

Is cloud seeding cost effective? Though water costs vary across the region, cloud seeding through ground-based or airborne silver iodide release has been shown to be cost effective in most regions.

Is silver iodide released in cloud seeding harmful to the environment or humans? Measured concentrations of silver in snowpack are less than or similar to natural background levels of silver (e.g., due to mineral dust) and these trace values are orders of magnitude below the levels considered concerning by environmental regulatory agencies worldwide.

WRF·WxMod®

WRF-Hydro

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