WET International
Hydro-meteorology for the 21st century

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Silver Iodide vs. Liquid Propane Seeding

For both airborne and ground-based seeding, silver iodide has become the dominant method, while dry ice and liquid propane are less used. The reason for this situation has several historical and technical roots. Nevertheless, the release of liquid propane into gaseous form has several advantages that make it a desirable alternative for ground use, as discussed below.

Silver Iodide (AgI)

Even with the best chemical solutions available, the air temperature must be -5°C or colder for AgI to begin forming ice crystals by artificial nucleation of supercooled liquid water (SLW), and perhaps -8°C or colder to produce enough crystals to generate significant snowfall. Since natural ice nuclei dramatically increase at -10°C or colder, there is a narrow temperature "window" in which AgI can augment precipitation where nature cannot. This narrow window may reduce the period for crystals to grow in the proper temperature and SLW conditions, thereby decreasing the precipitation increase from seeding.

AgI generators can clog, so AgI-in-solution flow should be monitored to ensure release of the material, particularly if the generator is remotely controlled.

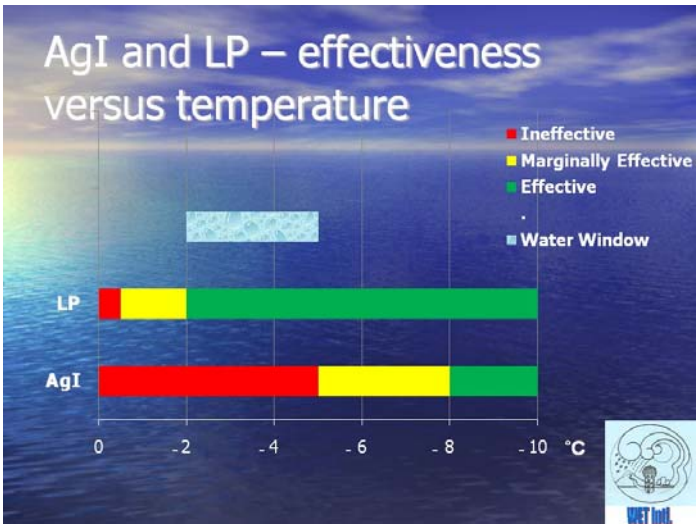
Liquid Propane (LP)

Release of liquid propane as a gas from a LP dispenser chills the air to as cold as -100°C. This immediately condenses water vapor and then freezes it, effectively creating vast numbers of tiny ice crystals that act as seeding material. Because of the tremendous local chilling, LP release can generate ice crystals at temperatures as warm as -0.5°C, and enough crystals to produce significant precipitation (downwind) at -2°C. This means that there is a 4.5 to 6°C bigger temperature window of effectiveness for LP versus AgI. Since water vapor and therefore SLW increases with temperature, this warm temperature window will usually possess more of the SLW "fuel" necessary for more crystal growth and resultant precipitation. This LP technology is used to disperse cold fog at airports and is consistently successful.

LP dispensers are simpler than AgI generators, in large part because no chemical solution or flame are required. This simplicity also makes for greater reliability of operation and lower cost compared to AgI generators. The propane gas release has low flammability and is safe for the environment because of rapid oxidative decay. Propane is colorless and odorless, does not harm plant or animals, and is released in very small quantities (~ 1.9 g/sec).

Implications of these Comparative Facts for Choice of Ground Seeding Method

The main consideration in the choice between LP and AgI is the greater warm temperature window of opportunity for seeding - see figure below. There are many mountain ranges that, either because of relatively low elevations or latitudes, do not frequently experience temperatures of about -6°C or colder. Examples of such ranges would be the Sierra Nevada of California and the Mediterranean Sea region. Moreover, the current period of climate warming is decreasing the cold temperature episode frequency. So even locales that currently have frequent cold conditions, such as the northern/central Rocky Mountains and the Alps, will likely see shifts toward the warm temperature window. This trend has already been shown by research that indicate more long-term rainfall than snowfall at given elevations, and earlier snowmelts in spring. The result is major negative impacts on water supplies and activities like snow skiing. Given these trends, its simplicity and lower costs, we recommend the use of LP dispensers for all but the coldest and highest (above ~ 3 km) mountains to take full advantage of the "water window."



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