Weather Modification International

Corporate Profile - 2019

"Whether identifying the potential benefits of cloud seeding or monitoring air quality, Weather Modification International is dedicated to providing sound, scientific atmospheric solutions."

WEATHER MODIFICATION INTERNATIONAL

In the beginning…

- *Weather Modification International (WMI)* was founded in Bowman, ND in 1961. WMI provides scientific atmospheric solutions and is a world leader in hail damage mitigation, precipitation augmentation, and the application of airborne remote and *in-situ* sensing.

- In 1993, WMI moved its headquarters to Fargo, ND. With a need to support many aircraft, Fargo Jet Center was established in 1995. Today, WMI has opened its doors to hundreds of pilots, meteorologists, technicians, engineers and scientists worldwide.

WEATHER MODIFICATION INTERNATIONAL

- Flight School
- Avionics
- Maintenance
- Passenger Terminal
  - Charter & Line Services
- Aircraft Storage
- US Customs
- Weather Modification International HQ

FARGO, ND FACILITIES TODAY

230,000 SQ. FT. ON 23 ACRES

WEATHER MODIFICATION INTERNATIONAL

WMI Provides Scientific Atmospheric Solutions and is a World Leader in:

- Hail Damage Mitigation
- Precipitation Augmentation
- Application of Airborne remote and *in-situ* Measurement
- Technology Transfer Programs
- Special Mission Aircraft Modification
- Digital Weather Radar Systems
- Atmospheric Feasibility Studies

LEADER IN ATMOSPHERIC SOLUTIONS

WEATHER MODIFICATION INTERNATIONAL

- Military Agencies
- International Federal & State Governments
- Government Research Institutes
- Transnational Commercial Business Interests
- University Research Departments
- Water Resource Management Boards
- Private & Public Insurance Agencies

WORLDWIDE SERVICES

ANTIGUA, ARGENTINA, AUSTRALIA, BURKINA FASO, CANADA, CHINA, GABON, GREECE, INDIA, INDONESIA, JORDAN, SOUTH KOREA, MALI, MEXICO, MOROCCO, SAUDI ARABIA, SENEGAL, SPAIN, THAILAND, TURKEY, UNITED ARAB EMIRATES, AND THE UNITED STATES OF AMERICA

WEATHER MODIFICATION INTERNATIONAL

Maintenance & Avionics

Part 145 Repair Station
US FAA Diamond & NATA AMT 5-Star Award
57 staff = mechanics, engineers, inspectors, Interior & Paint Specialists

WEATHER MODIFICATION INTERNATIONAL

Cloud seeding modifications

US FAA STC / Training / Operational Support
Multiple Category - normal & Restricted

WEATHER MODIFICATION
INTERNATIONAL

- Ejectable Flare Racks – Fuselage Mounted (capacity depends on aircraft size, average = 306 flares)
- Wing Mounted Flare Racks – Dual Purpose (glaciogenic & hygroscopic) with up to 24 flares per side
- Mounted Control Boxes
- Optional Telemetry Systems
- US FAA Installation Certified

Cloud seeding modifications

Beechcraft King Air C90A, B200, 350 series
Hawker 400XP, Citation II, LearJet

WEATHER MODIFICATION INTERNATIONAL

- Single & Dual Polarized Doppler Systems
- Receiver/Transmitter
- Digital Signal Processor
- Antenna, Radome, Custom Towers & Platforms
- Routine Calibration & Repair
- On-site Maintenance & 24/7 Operation Available
- Fixed/Mobile Units

Weather Radar Systems

New & Refurbished, On-site Maintenance & Installations Fixed or mobile option

WEATHER MODIFICATION INTERNATIONAL

- ICE Crystal Engineering LLC (ICE) of Kindred, ND
- Output as a function of cloud temperature established at Colorado State University Cloud Simulation and Aerosol Laboratory
- All ICE products are ISO9001 Certified, ensuring strict manufacturing processes are followed
- Field tested and excellent customer track record!
- Proven results, SNOWIE Experiment
- Learn more at : iceflares.com

ICE

ICE CRYSTAL ENGINEERING LLC

Cloud SEEDING Pyrotechnics

Glaciogenic (Agl) & Hygroscopic ($caci_2$)

WEATHER MODIFICATION INTERNATIONAL

Cloud SEEDING Pyrotechnics

Glaciogenic (AgI) & Hygroscopic ($caci_2$)

WEATHER MODIFICATION INTERNATIONAL

- Experienced Personnel
- Pilots, meteorologists, engineers, maintenance technicians, operations specialists
- Technology Training
- Feasibility Studies
- Calibration & Repair
- On-site Maintenance

Project management

Turn-key project setup, operation & Analysis

WEATHER MODIFICATION INTERNATIONAL

- Remote Sensing
- Environmental Monitoring
- Aerial Mapping / LiDar
- Air Quality and Aerosol
- Atmospheric Chemistry
- Cloud Physics
- US FAA STCs for Hawker 400, King Air 350, 200, C90, Lear Inlet

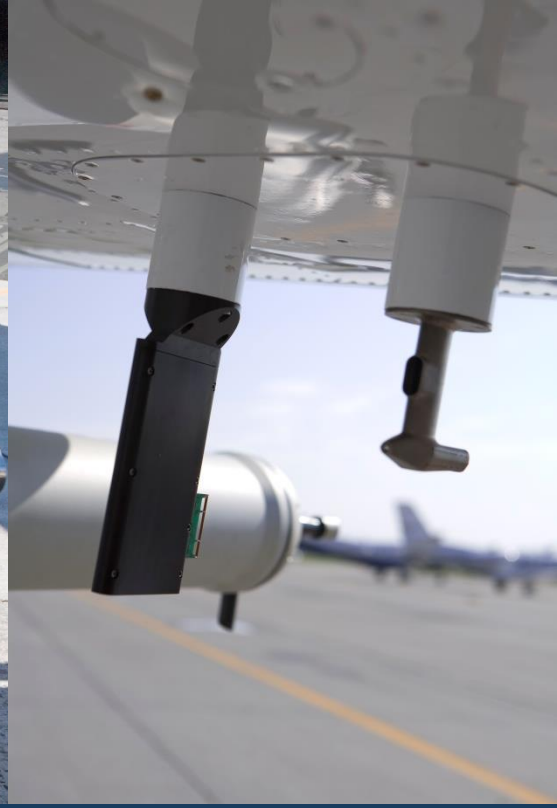
SPECIAL MISSION CONVERSIONS

WEATHER MODIFICATION INTERNATIONAL

Atmospheric Research modifications

US FAA STC / Training / Operational Support
Multiple Category - normal & Restricted

WEATHER MODIFICATION
INTERNATIONAL



Atmospheric Research modifications

Wing mounted hard point – capable of 125 lbs.
Flexible platform for A wide variety of instrumentation

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INTERNATIONAL

SPECIAL MISSION CONVERSIONS

CITATION - FIELD MILLS

WEATHER MODIFICATION
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Beechcraft King Air 350 – Interior

Operations Console/Hi RES PTZ Camera

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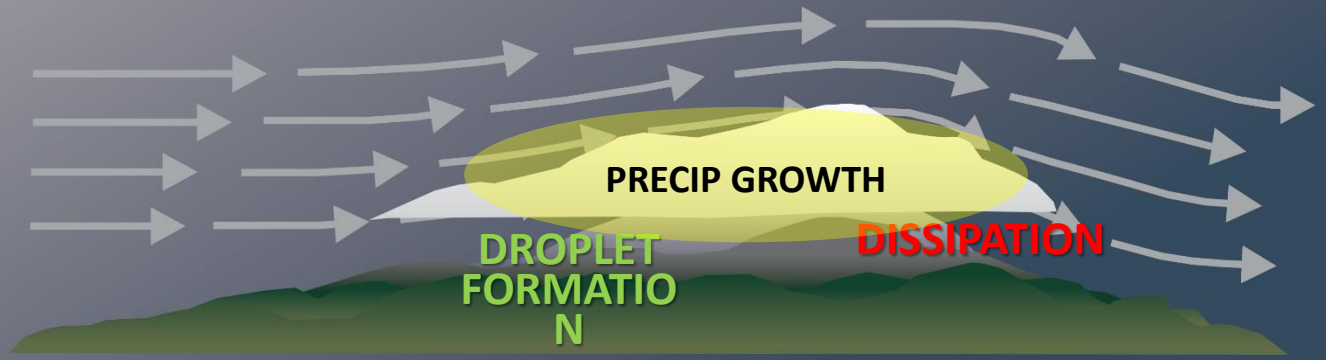
Winter Orographic Cloud Seeding

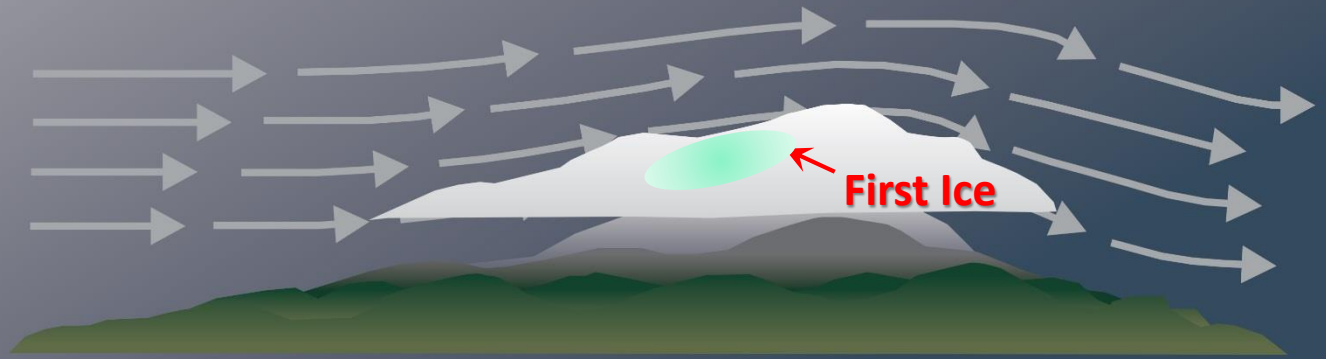
Air rises over mountains, cools and water droplets form.

In the leeward, the sinking air warms, and the droplets evaporate.



Winter Orographic Cloud Seeding

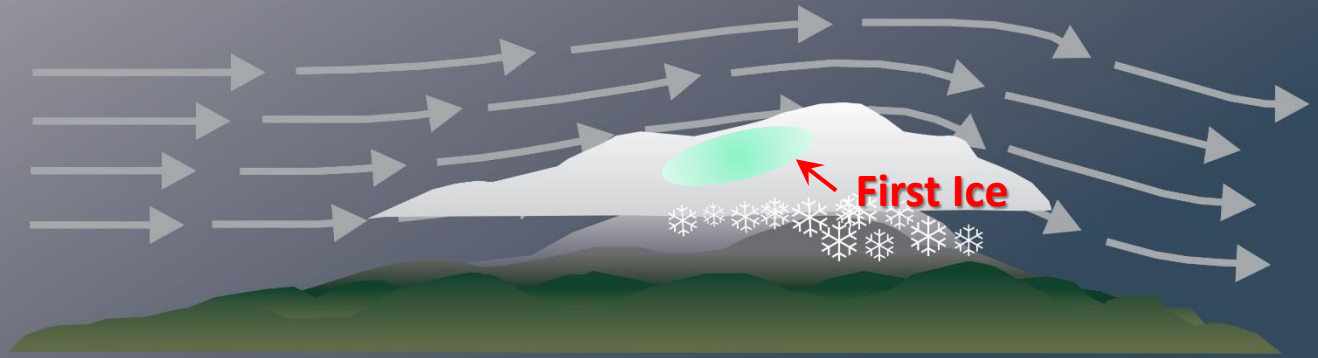
Water rarely freezes at 32°F (0°C). Instead, it supercools, remaining liquid at much colder temperatures. **Nature introduces ice at temperatures between -18 to -25°C.** This is induced by tiny particles called *ice nuclei*.



Winter Orographic Cloud Seeding

Once ice forms, the particles grow quickly, some forming flakes that become large enough to fall to the surface as snow.

Those that don't get large enough before moving beyond the peak encounter the descending, warming air, melt and evaporate = inefficient precipitation

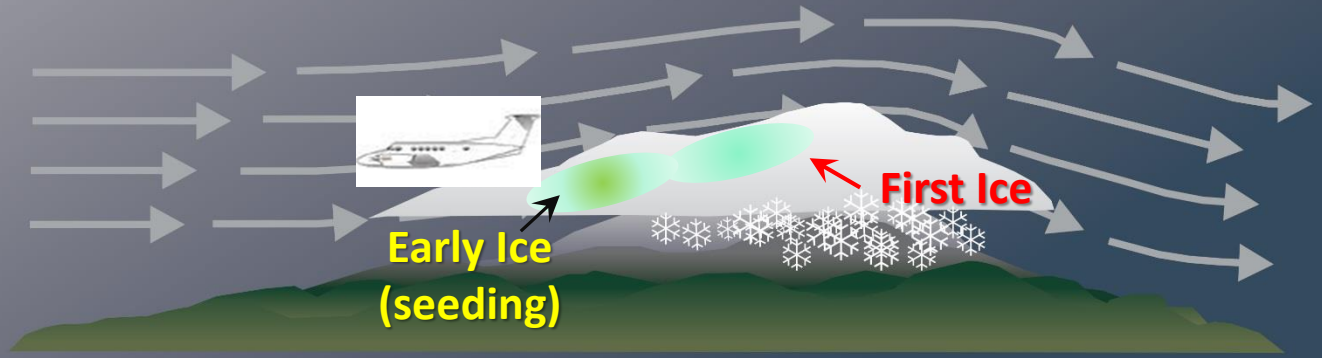


Winter Orographic Cloud Seeding

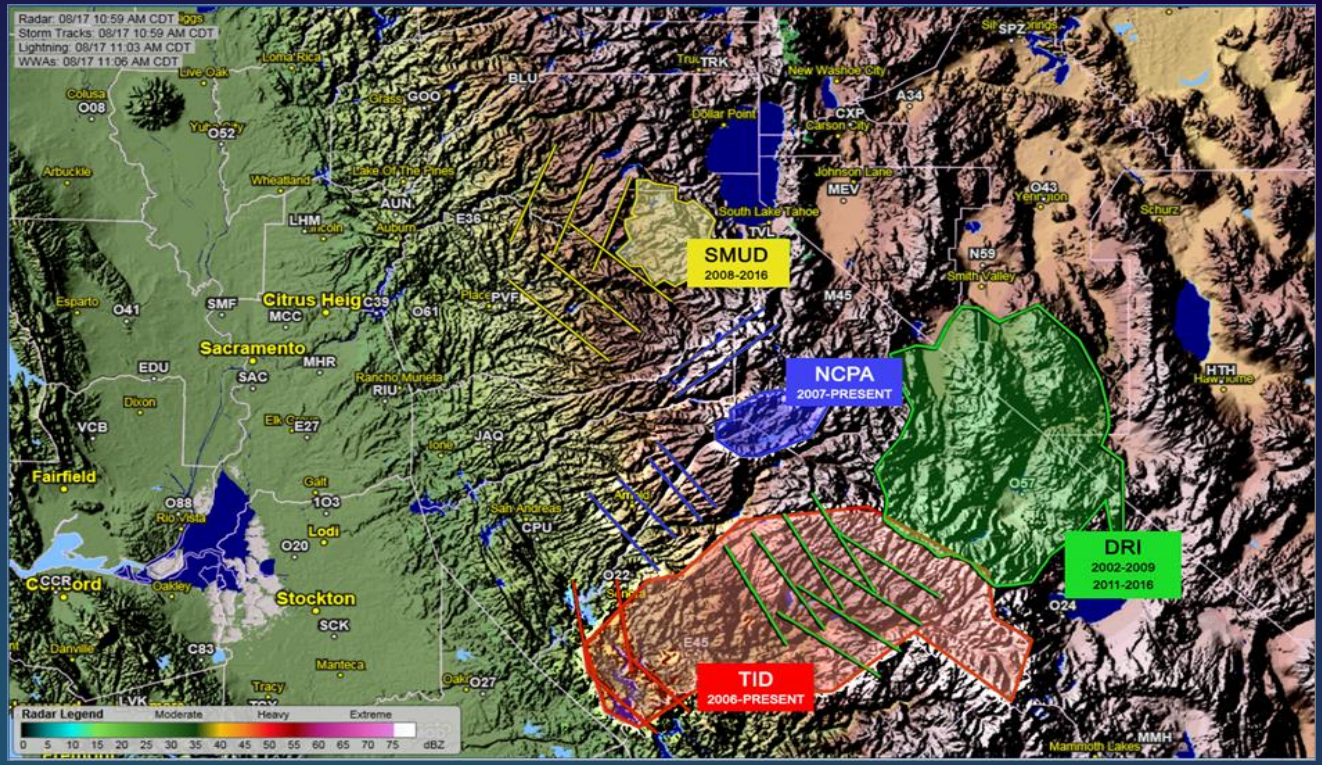
Cloud seeding provides ice nuclei that function at warmer temperatures, allowing ice formation to begin sooner, at temperatures as warm as -5°C.

Snowfall is thus increased incrementally because more ice crystals have more time to grow into snow

Cloud seeding converts supercooled liquid cloud water into snow, ***increasing cloud efficiency.***



WMI Project Samples: Flight Tracks



Note that the track directions and distances change for different winds speeds and directions.

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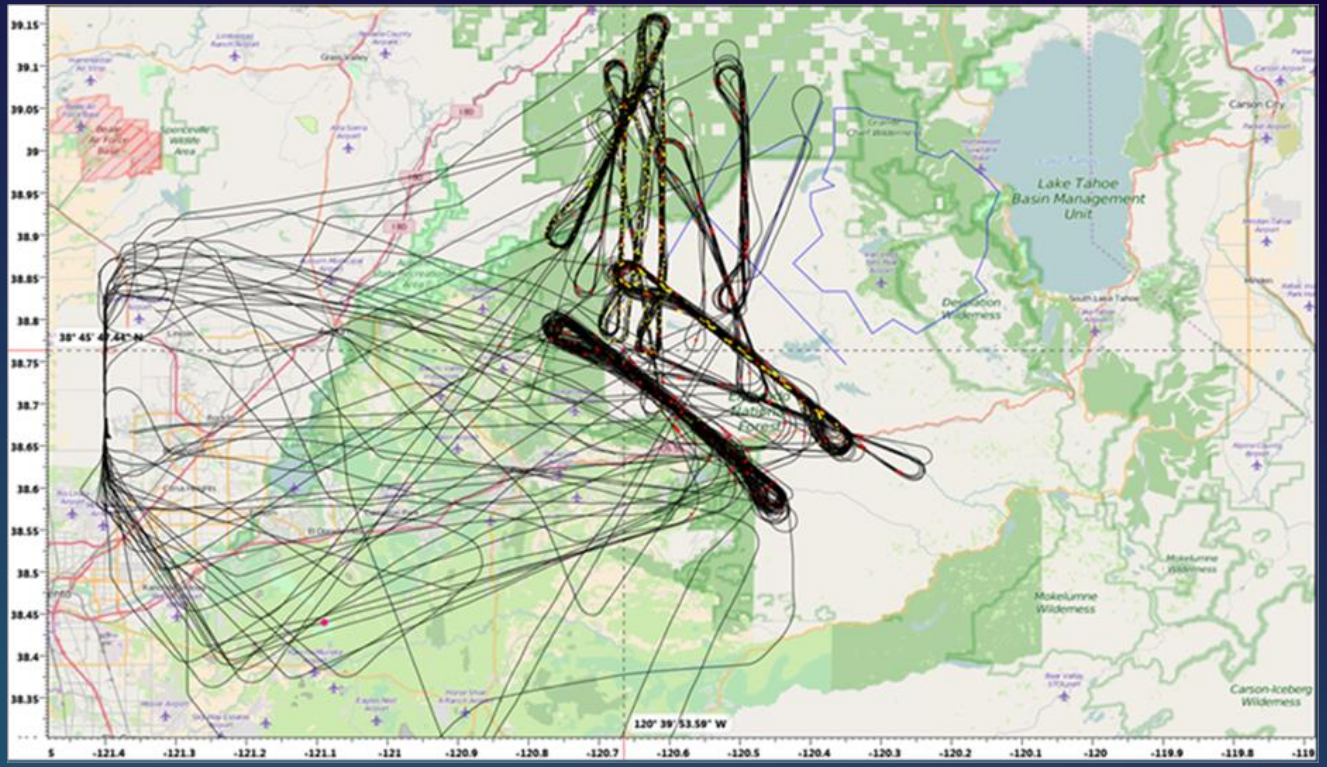
WMI Project Samples: Flight Tracks



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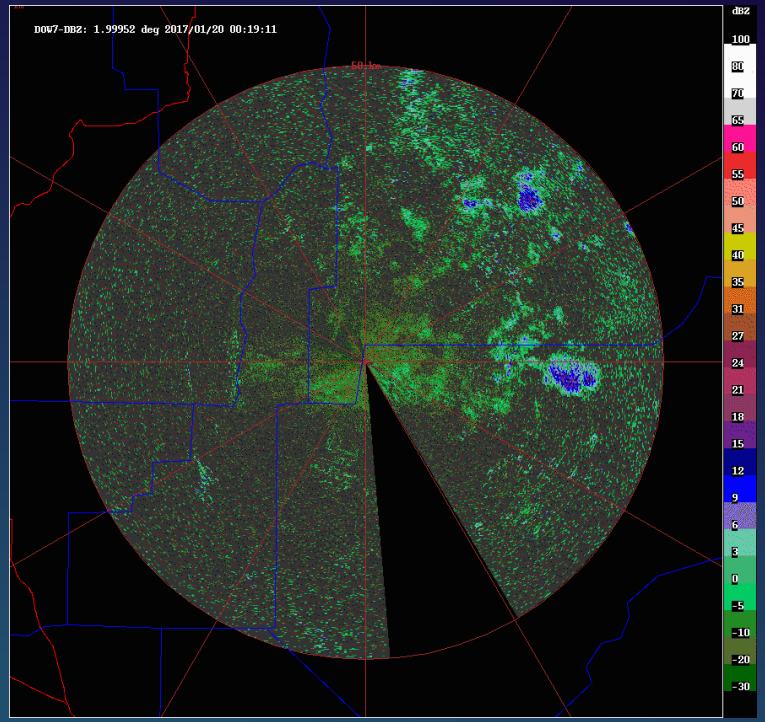
Radar Loop: Snow Precipitation from Cloud Seeding



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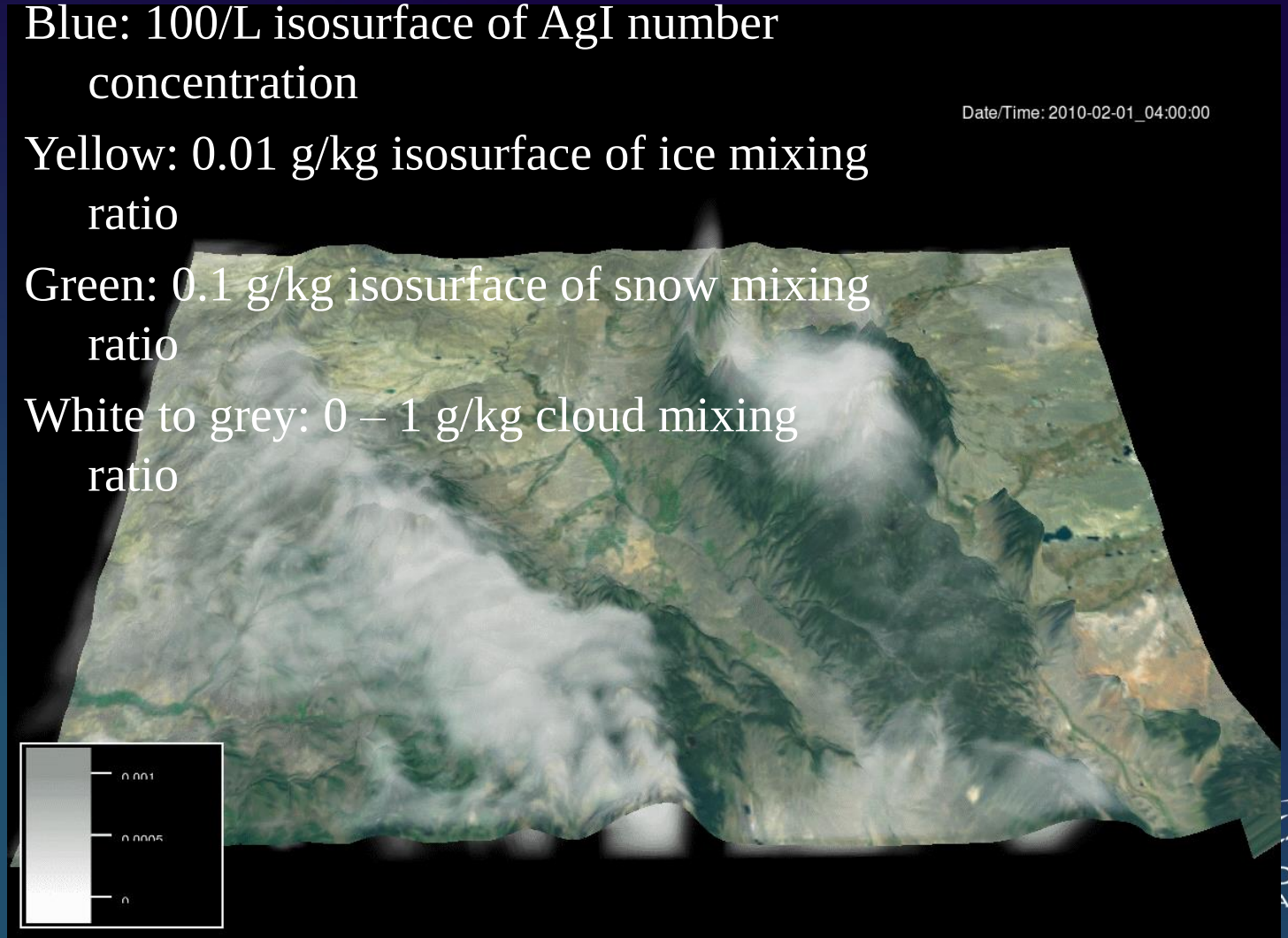
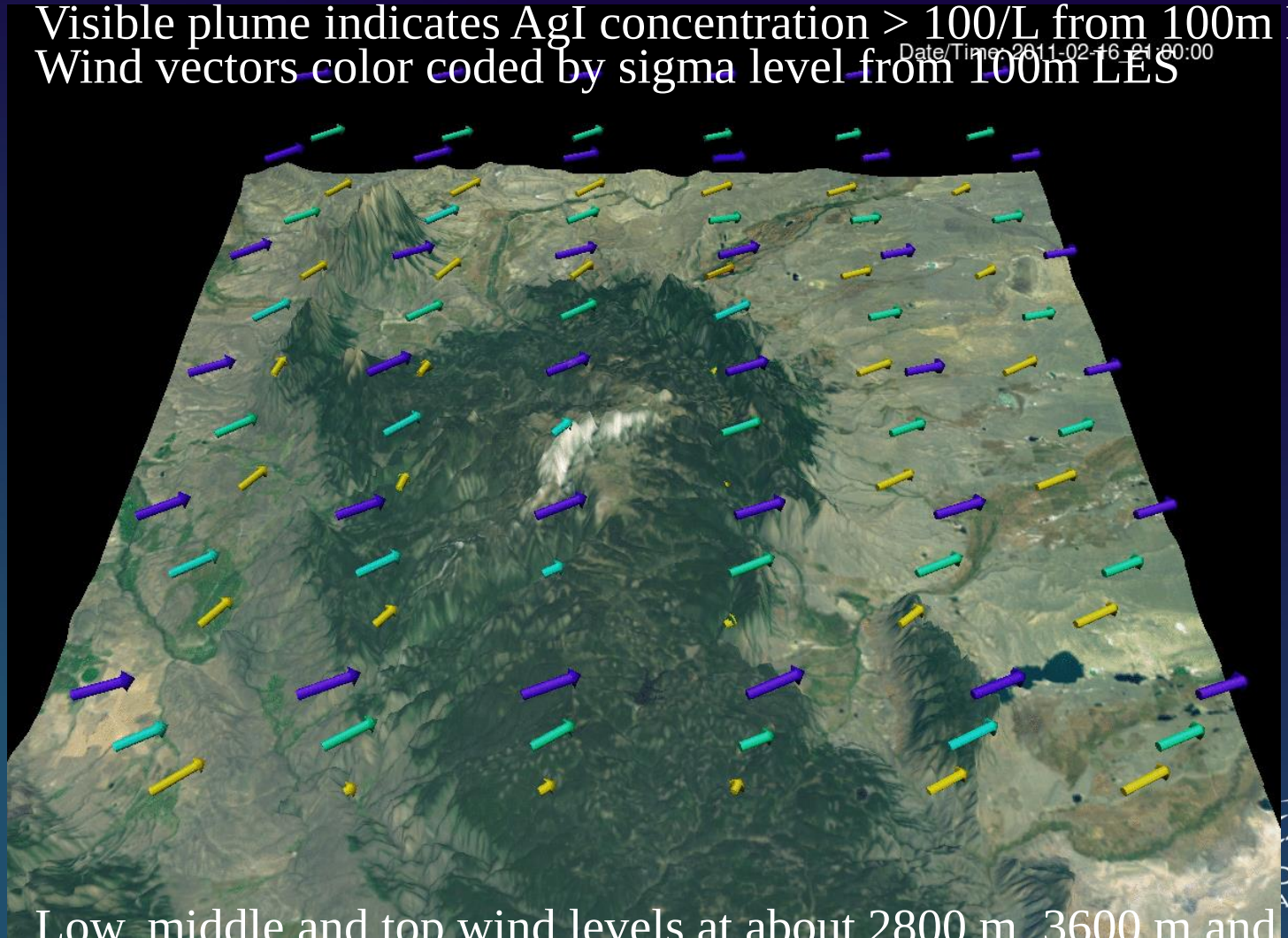
Operations Video

- Blue: 100/L isosurface of AgI number concentration
- Yellow: 0.01 g/kg isosurface of ice mixing ratio
- Green: 0.1 g/kg isosurface of snow mixing ratio
- White to grey: 0 – 1 g/kg cloud mixing ratio



Visible plume indicates AgI concentration > 100/L from 100m LES
Wind vectors color coded by sigma level from 100m LES



Low, middle and top wind levels at about 2800 m, 3600 m and 4400 m M

Cloud Seeding Facts

- World Meteorological Organization (WMO) recognizes **52 countries** that operate cloud seeding programs.
- USA Programs by WMI have demonstrated **10-20% increase** in snow
  - In moist, shallow clouds with minimum temperatures no colder than -15°C, the percentage could be significantly higher
- **Environmentally Friendly:** Numerous Positive Studies from EPA, Government and Academic organizations
- **Benefits All Water Users:** Recreation, Agriculture, Hydro-Power, Fire Risk Reduction, all consumers
- **Higher Cost/Benefit** per water unit than alternatives
  - $3.5 per Acre Foot (IPC)

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THANK YOU!

weathermodification.com

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