Introduction to Applied Weather Modification

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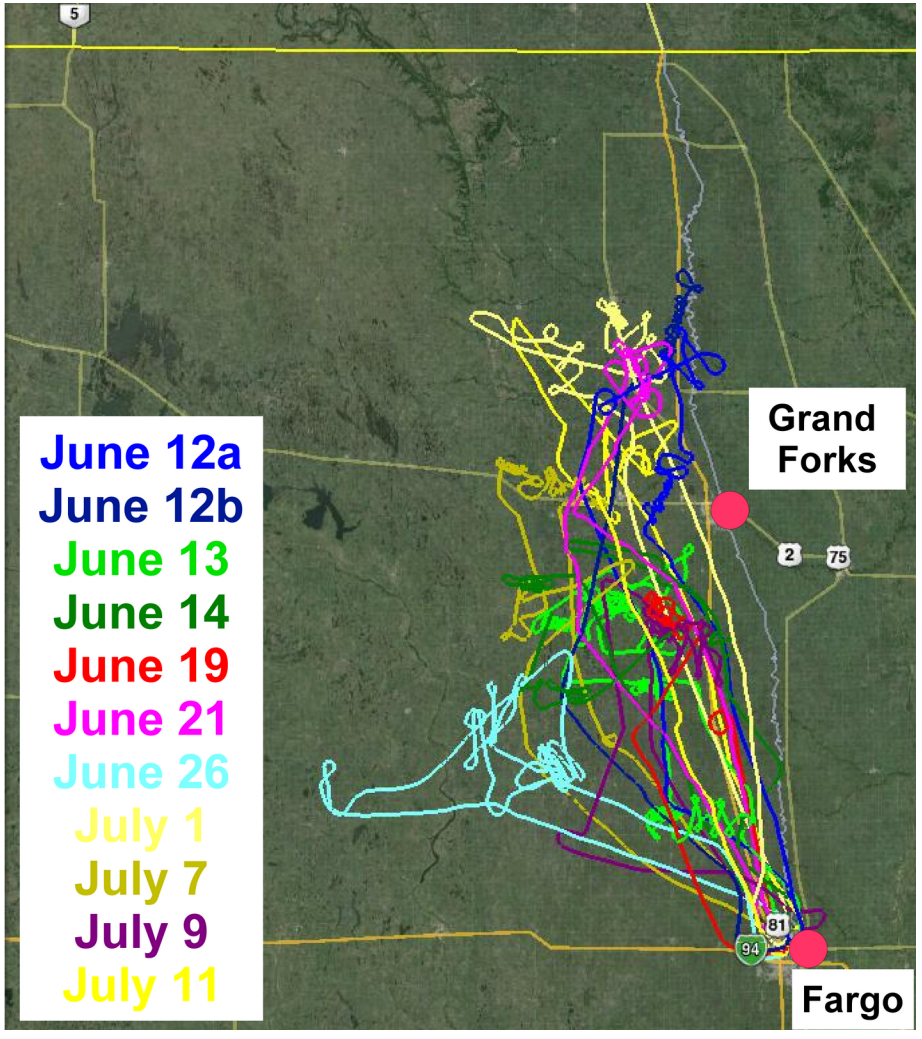
Field Projects and Scientific Publications



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Light at the end of the tunnel – April 2011

Weather Modification Association

Promoting research, development and understanding of weather modification for beneficial uses

Start of Weather Modification Research

- Experiments during World War II built on aircraft icing work at General Electric.
- Aircraft icing experiments directed by Irving Langmuir.
- Additional group involved Vincent Schaefer and Bernard Vonnegut.

Wilson Hunter, the Head of the Icing Research Section is shown demonstrating the dangerous icing of the propellers of a P-39 after a wind tunnel test. General Arnold (left) and George Lewis (far left).

Weather Modification Class Goals

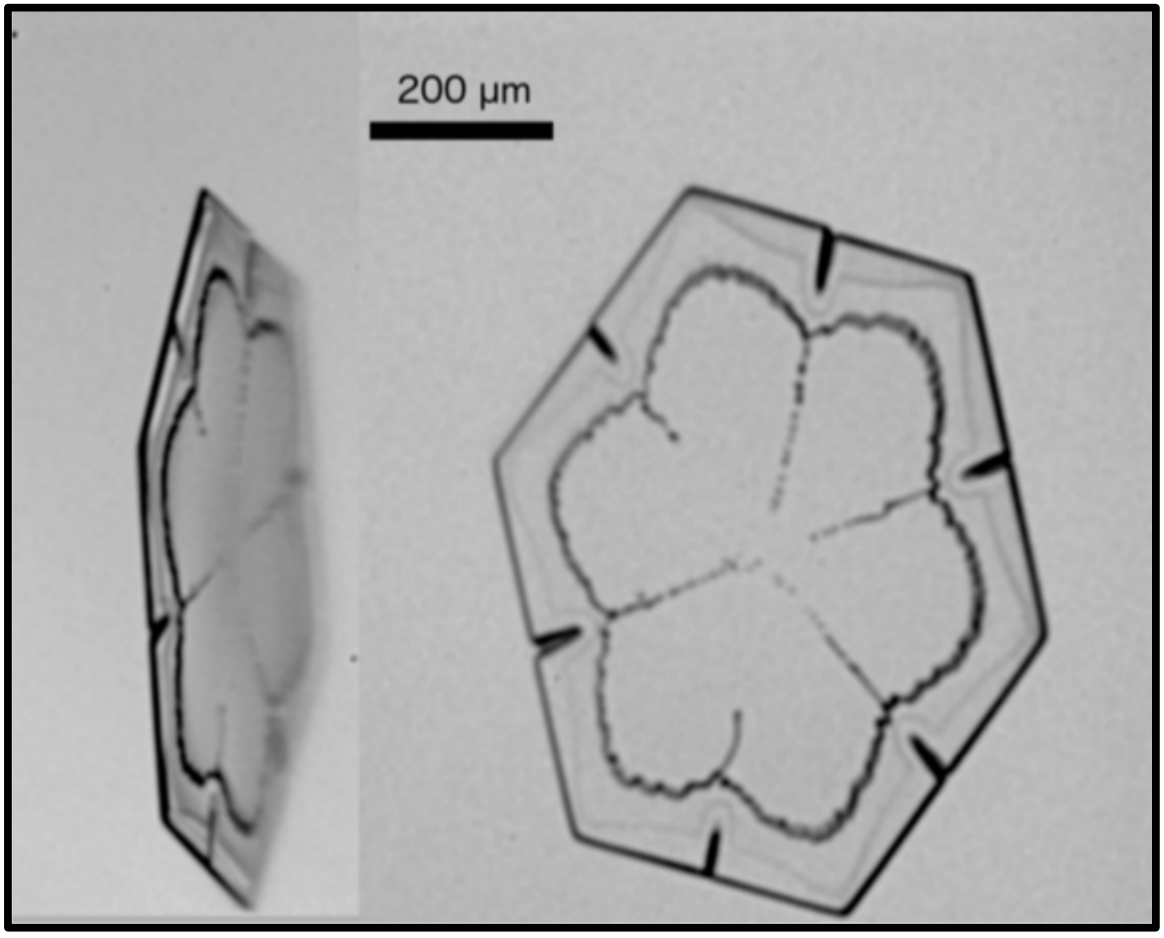
- To learn the theoretical basis for weather modification.
- To learn how cloud weather modification projects are established and conducted
- To learn how to effectively participate in operational programs.

Extent of the Weather Modification: Block 1

- History of Weather Modification
- Critical Thinking& Legal Aspects
- Environmental Concern
- Sociological Issues
- Economic Impacts
- Unintended Weather Modification

Extent of the Weather Modification: Block 2

- Statistical Evaluations
- Atmospheric Aerosols
- Atmospheric Water Vapor
- Particle Nucleation
- Droplet Growth
- Ice Crystal Growth



Extent of the Weather Modification: Block 3

- Basic Clouds and Cloud Formation
- Precipitation Processes
- Cloud Dynamics
- Conceptual Models
- Precipitation Conceptual Models
- Hail Suppression Conceptual Models
- North Dakota Cloud Modification Project Model

Extent of the Weather Modification: Block 4

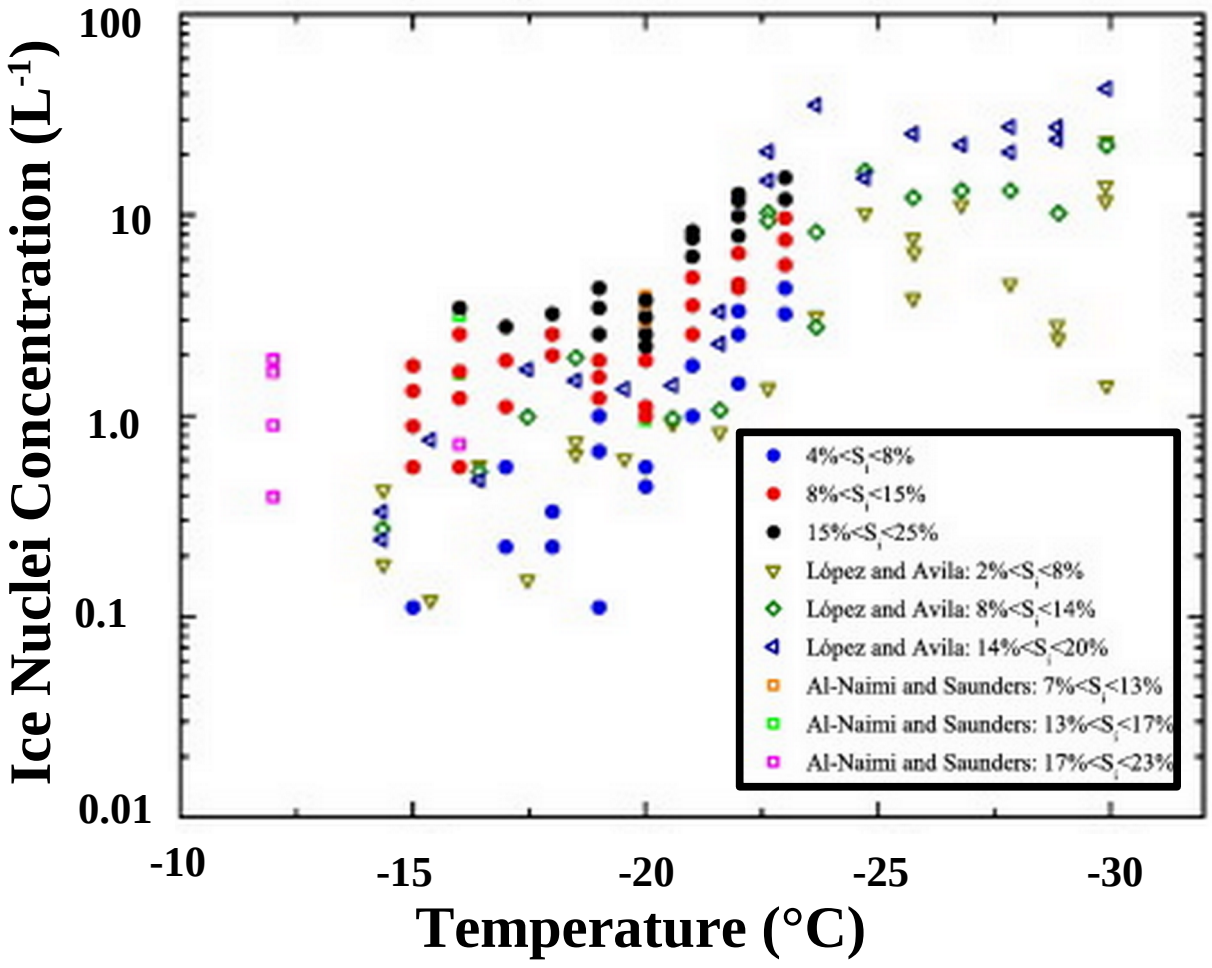
- Winer-time Precipitation Enhancement
- Fog Abatement
- Lightning Suppression
- Hurricane Modification
- Seeding Materials
- Dry Ice as Seeding Agent
- Seeding Agent Dispersal: Equipment and Methods

Extent of the Weather Modification: Block 5

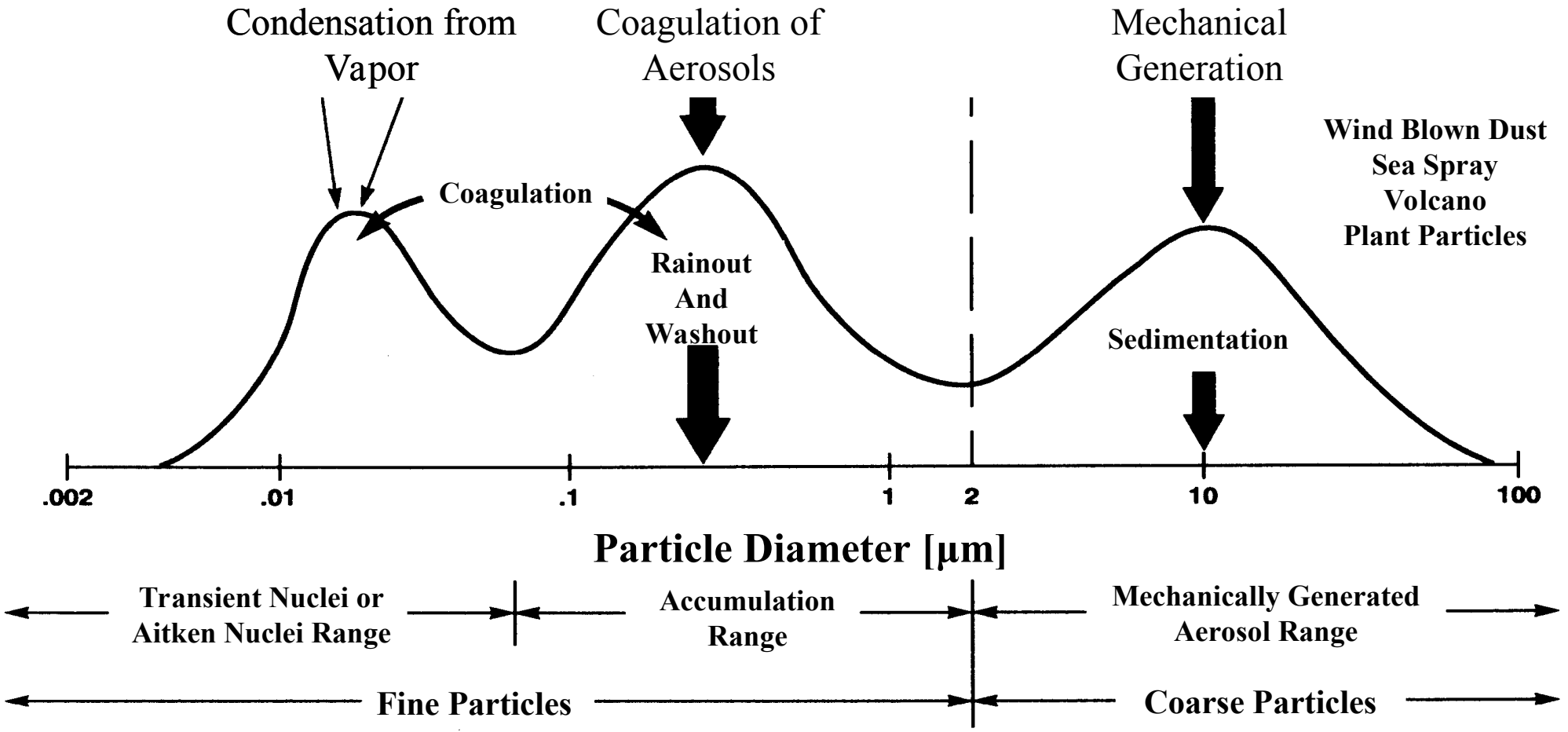
- Radar for Weather Modification
- Record Keeping
- Weather Forecasting and SkewT Basics
- Daily Operations
- Opportunity Recognition
- Flight Safety
- Case Example: Put All Together

Glaciogenic (Silver Iodine) Cloud Seeding

- Effectiveness is often measured by “threshold temperature”.
- Threshold temperature is when 1 in 10,000 produce an ice crystal.
- Different substances have different threshold temperatures ranging from about -5 to -40 °C.
- Sliver Iodine (AgI) threshold temperature is -5 °C.

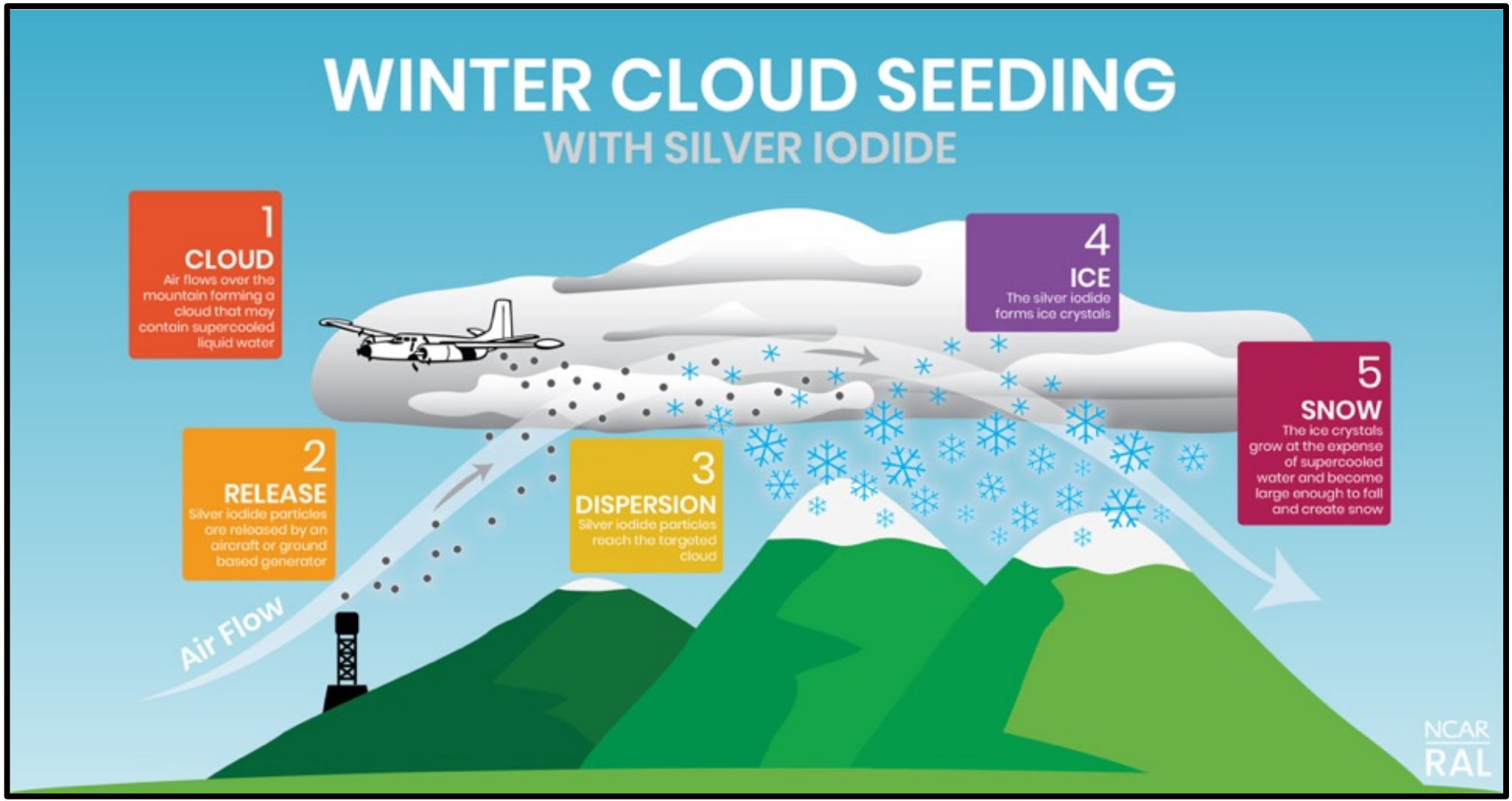


Hygroscopic Cloud Seeding



- Few number of large sized atmospheric particles.

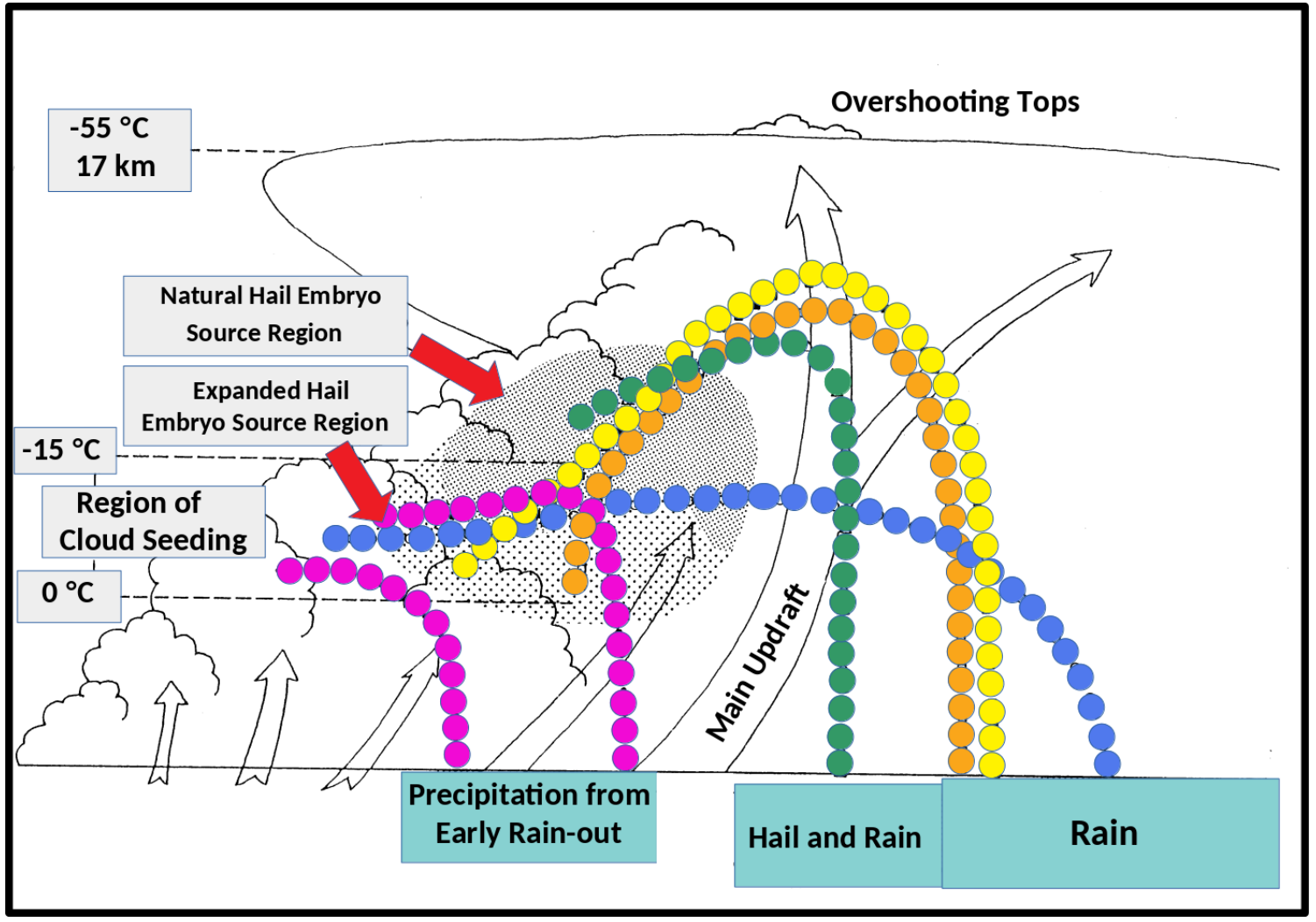
Snowfall Enhancement



Precipitation Augmentation

- Enhancing the cold rain process through addition of ice particles.
- Enhancing the warm rain process by addition of giant Cloud Condensation Nuclei (CCN).
- Increasing the cloud depth by release of latent heat of fusion.
- Promoting the merger of small clouds into larger clouds through release of latent heat of fusion.

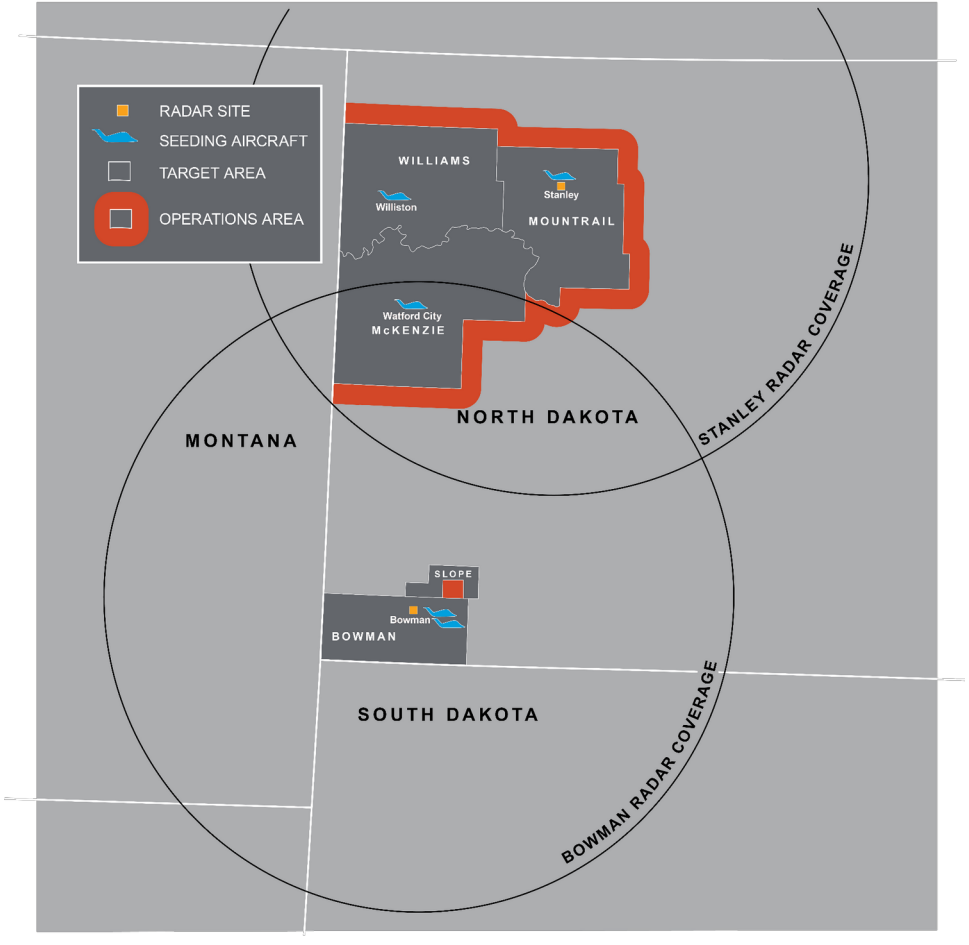
Hail Suppression Conceptual Models

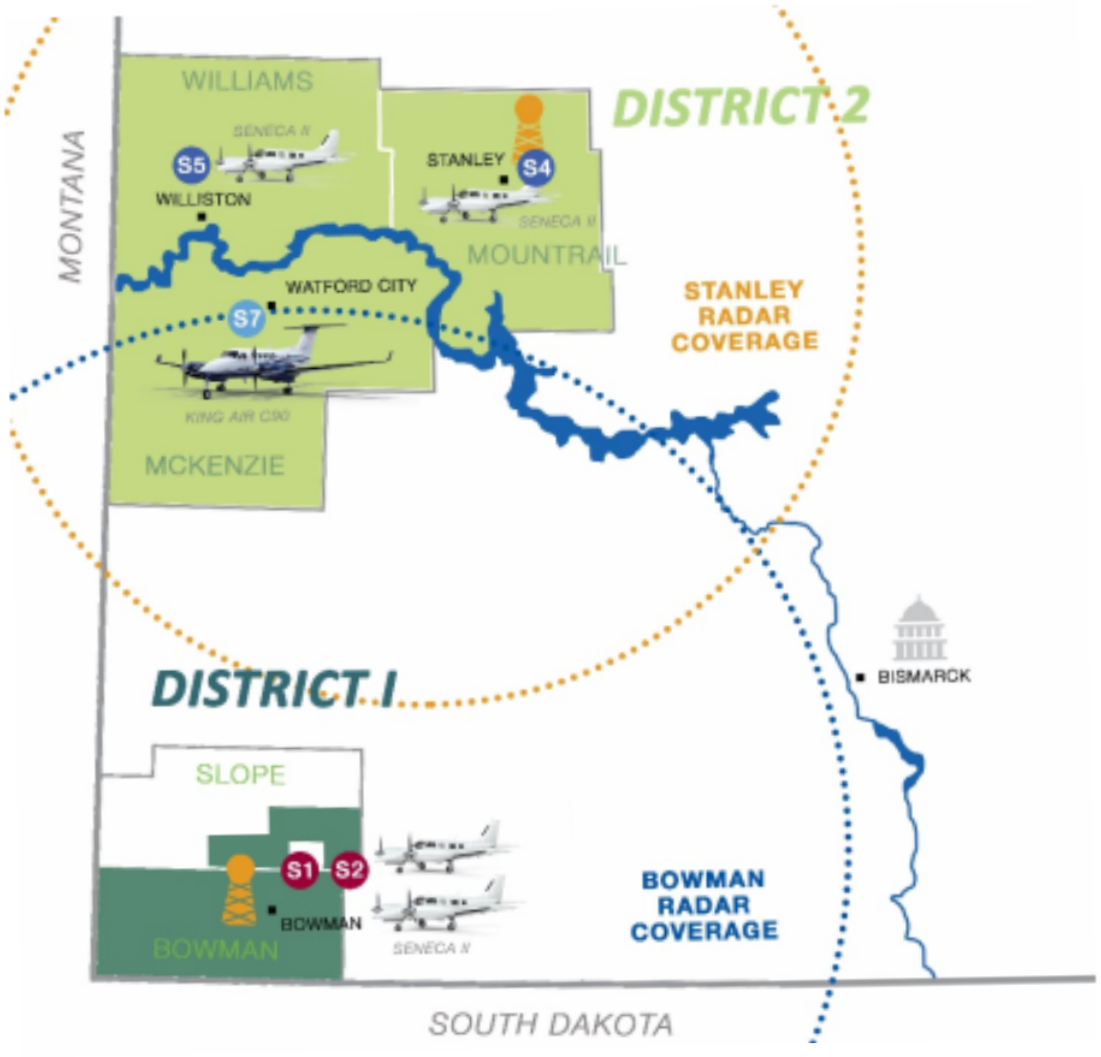


- Natural Hail Trajectory
- Beneficial Competition
- Early Rain-out
- Trajectory Lowering
- Promotion of Coalescence

Current North Dakota Cloud Modification Program

- Program started in 1977.





North Dakota Cloud Modification Program Internship

- Students have the opportunity to be project meteorological interns.
- UND students can obtain co-pilot internships due to our MOU.
- 400+ student pilots have participated in the internship program.

Weather Modification Operational Program