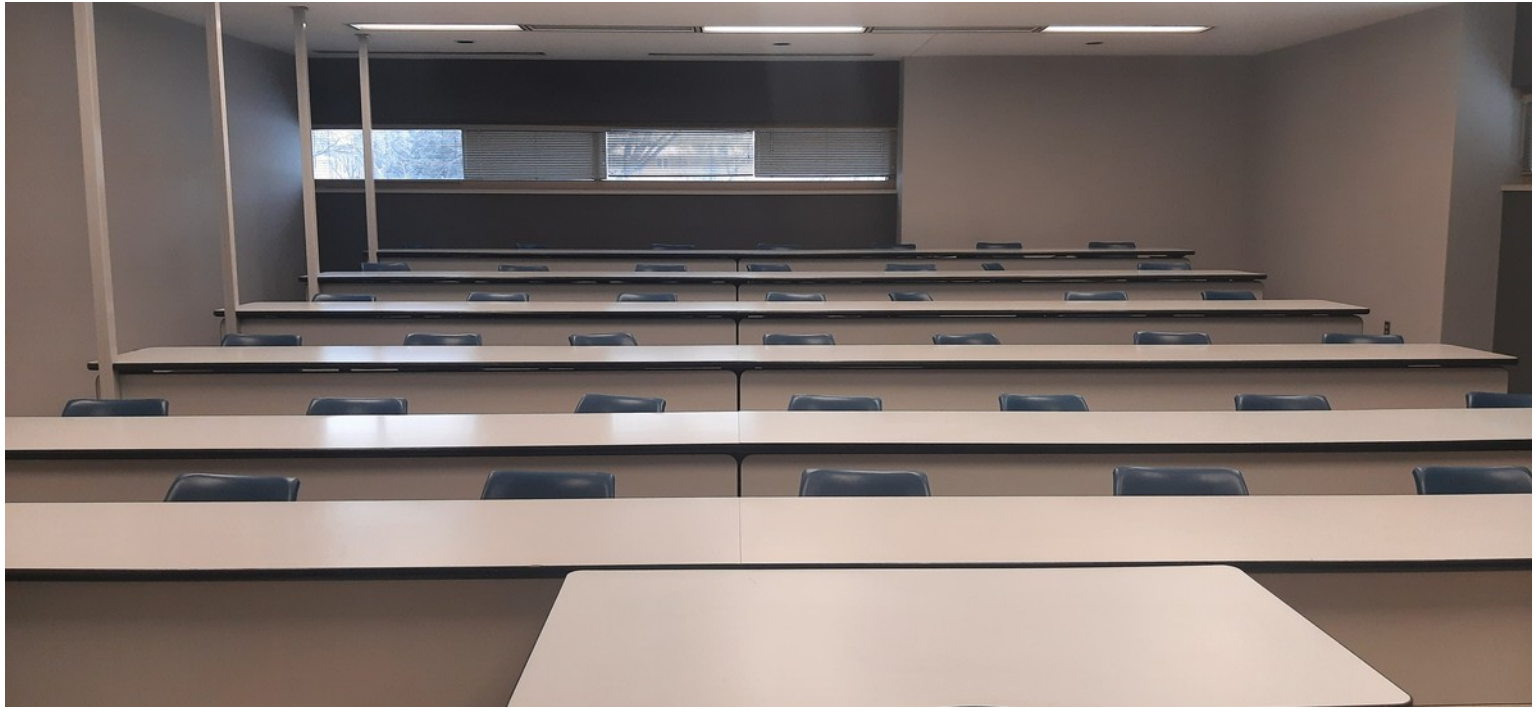
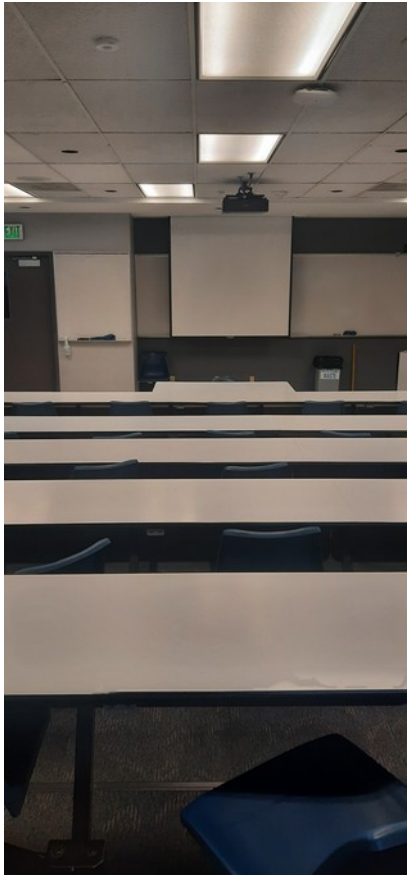
Applied Weather Modification: Course and Syllabus





Weather Modification Class Goals

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

Cloud seeding equipment used on the North Dakota Cloud Modification Project (NDCMP).

Class Learning Outcomes

- State why and where weather modification operations are conducted.
- Recognize the overall context and factors affecting application of cloud seeding.
- Explain the theoretical basis and assumption for weather modification.
- Explain what constitutes a seeding opportunity.
- Identify cloud seeding opportunities and select appropriate conditions for treatment.
- Describe how cloud seeding equipment works and what are its operational limitations.
- Conduct cloud seeding operations in a safe and effective manner.
- Distinguish between valid and false claims of cloud seeding success.

Weather Modification Class History

- University of North Dakota's weather modification and cloud physic's activates "took off" in 1974 when the school acquired its first weather radar.
- The State of North Dakota has a long history of funding a co-pilot internships program where UND students can be involved with North Dakota Cloud Modification Project (NDCMP) each summer.
  - See the "Leading Research IN THE CLOUDS" AeroCom Summer 2019 article for additional information.

North Dakota Cloud Modification 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.

Extent of the Weather Modification: Block 1

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

Pictures showing a King Air C-90 cloud seeding aircraft and cloud seeding equipment.

Extent of the Weather Modification: Block 2

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

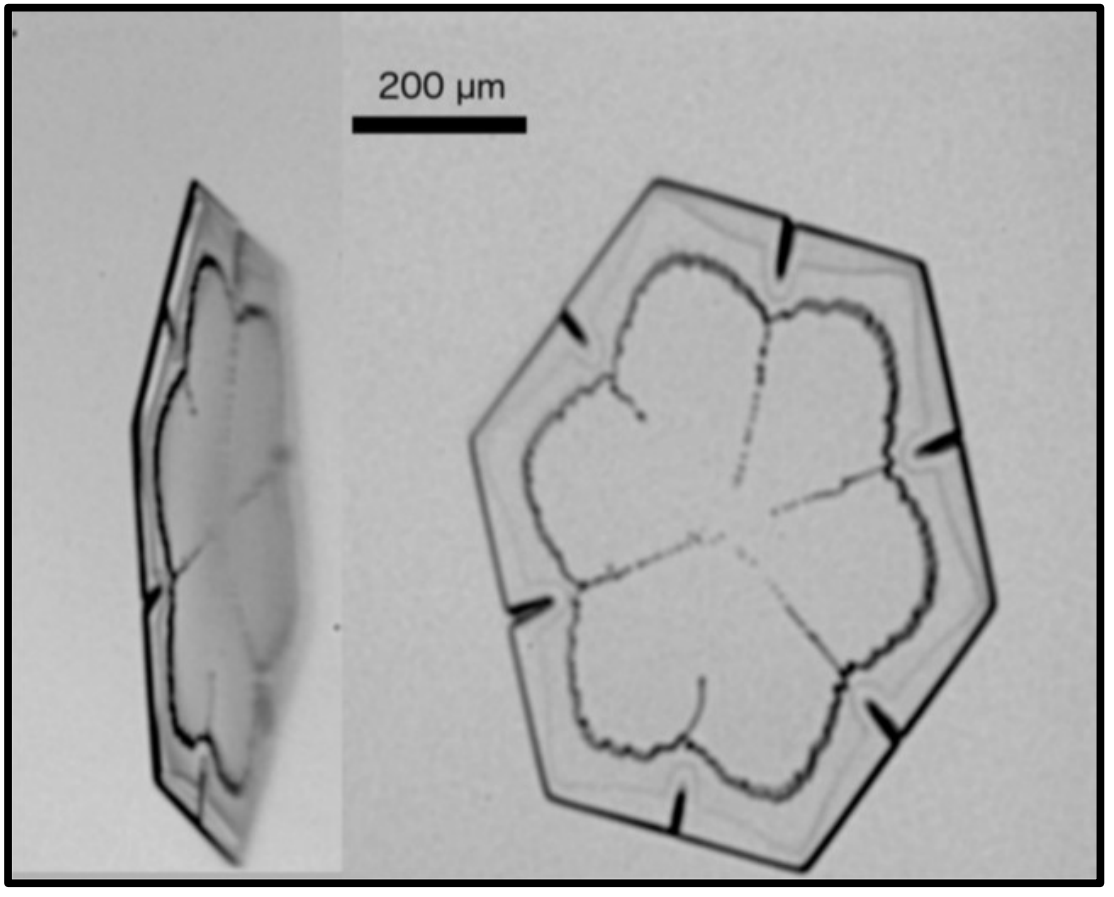


Image obtain of a ice crystal plate using the Particle Habit Imaging and Polar Scattering (PHIPS) probe during the 2019 CapeEx19 field project.

Extent of the Weather Modification: Block 3

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

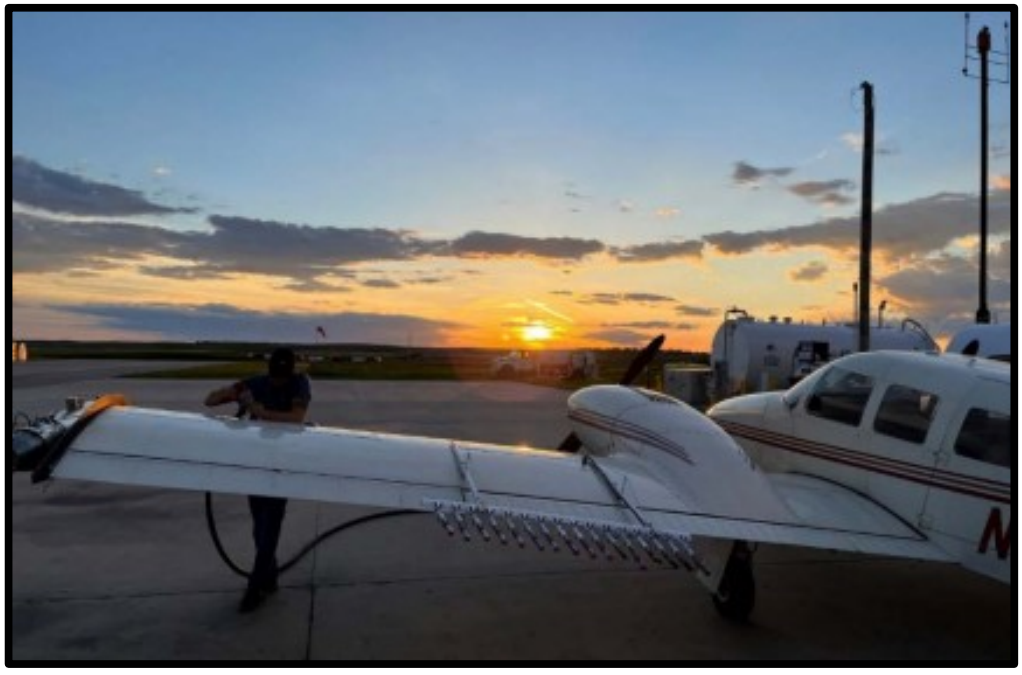


Image showing the fueling of a cloud seeding aircraft used in North Dakota Cloud Modification Project (NDCMP).

Extent of the Weather Modification: Block 4

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

Intern co-pilot Lucas Castro flying a cloud seeding mission during the summer of 2022 as part of the North Dakota Cloud Modification Project (NDCMP).

Extent of the Weather Modification: Block 5

- Radar Usage
- Record Keeping
- Weather Forecasting
- SkewT Basics
- Daily Operations
- Opportunity Recognition
- Flight Safety
- Put It All Together

Picture showing 2022 North Dakota Cloud Modification Project (NDCMP) Interns co-pilots in front of the King Air C-90 cloud seeding aircraft.