Applied Weather Modification
Course Syllabus: Spring 2022

Overview

This syllabus describes the requirements and procedures for ATSC 252 Applied Weather Modification. You are responsible for knowing this material, so please read carefully. Any changes will be announced through email to your UND email account. You will be responsible for any changes. Your continued enrollment in this course is your implicit agreement to abide by the requirements of this class.

Course Information

AtSc 252: Applied Weather Modification (3 credits)
Prerequisite: ATSC 110
Class Meeting Time: Tuesday/Thursday 2:00 – 3:15 p.m.
Class Meeting Location: Odegard Hall, Room 111
Class Format: Hybrid (Zoom ID 932 3295 2837)

Contact Information

Professor: David Delene
Office: Clifford Hall 420
Office Hours: Tuesday/Thursday 3:30 – 4:30 p.m. or by Arrangement
Phone Number: 701-777-4847
Email: **delene@aero.und.edu**
Zoom: 365-040-0756 Meeting ID

Graduate TeachingAssistant: Julia Poblotzki
Office: Clifford Hall 457
Office Hours: Tuesday/Thursday 10 – 11:30 a.m. or by appointment
Email: julia.poblotzki@und.edu

Welcome

I would like to welcome you to ATSC 252 Applied Weather Modification for the Spring 2022 semester. Like almost every activity, this course is being modified because of the ongoing pandemic. It is my first priority to offer a great in person classroom experience. I feel that this is a better learning environment than online and you are welcome to attend in person as often as possible. To accommodate those who are not always able to attend, the course will be delivered in a hybrid mode. This means that course material will be posted online, including assignments and video recordings of classroom lectures. In the event of changes in recommended or required accommodations for COVID-19, the course is structured to facilitate a switch to fully online mode should that become necessary. It is my hope that all of us in the UND community can follow the recommended Covid-19 guidelines and help keep our on-campus experience possible. If at any time you have questions or concerns, please do not hesitate to contact me.

Policies and Procedures

Attendance

Attendance is important for this class; however, student attendance will not be used in calculating grades. We'll have a recorded Zoom session so if you can't make the class in-

person, please login to the Zoom Session or listen to the recording. Please try hard to make it to class on time; however, if this is not possible, please come in late if necessary, without disturbing the class. Students are responsible for finding out what material they missed if they do not attend class. This includes class handouts and assignments.

Student Resources

Information on the student resources (UND's Notice of Nondiscrimination; Disability Access Statement; Reporting Sexual Violence; and Faculty Reporting Obligations Regarding Sexual Violence) is located on the Atmospheric Sciences Wiki page at http://atmoswiki.aero.und.edu/_media/atmos/student_resources.doc.

Also included is information on the UND Cares Program, as well as how to seek help when in distress, and how to recognize when students are in distress.

Missed Exams or Assignments

Exams or Assignments can only be made up if students make arrangements beforehand. Students are responsible to find out about assignments and upcoming exams if they cannot attend a class. **No late assignments will be accepted!**

Scholastic Dishonesty

Please refer to the code of student life for information on cheating and plagiarism. Each student is expected to complete assignments and exams individually. Students are encouraged to work together to learn the material but must complete assigned work individually. Turning in identical assignments will result in zeros for both assignments and may result in failure of the course.

Grading

Class grades are determined from assignments (50 %), quizzes (10 %) and exams (40 %). Course grading scale is as follows: 90% A, 80% B, 70% C, 60% D.

Class Participation

Active student participation is expected during class and may be considered if a student's grade is borderline. Please ask questions during class and I will try to address the question. However, if the question requires a long explanation, we may have to wait until after class to talk about it. I will research questions that I don't know the answer to and address the question during the next class meeting. Please let me know of topics that interest you that are not being covered.

Class Format

A typical class meeting will be broken up between short quiz, discussions, and lectures. The class will cover several different major topics in applied weather modification. Assignments will be given that build upon classroom work to illustrate how numerical techniques are used in meteorology. Concepts and tools will be introduced in a problematic fashion. This means that things will be presented when and to such an extent that they are necessary to address the assignments given in applied scientific programming.

Course Objectives

Provides a comprehensive introduction to basic concepts of weather modification as currently practiced around the world. It includes a study of cloud physics and seeding theory, a review of past and current programs, and a discussion of related legal, societal, economic, and environmental issues. Provides students exposure to the practical aspects of weather modification operations, including operational program design and evaluation, care and use of seeding materials and equipment, identification of seeding opportunities, and methods of airborne delivery of seeding materials.

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

Learning Outcomes

By the end of this course each student should be able to

- State why and where weather modification operations are conducted
- Recognize the overall context and external factors affecting application of this technology
- Explain the theoretical basis for weather modification by cloud seeding, including underlying assumptions
- 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

Reference Material

This course makes use of open educational resources (OER). Open educational resources are freely accessible, openly licensed documents and media that are useful for teaching and learning. These required resources are available to students at no cost and will be used in place of physical textbooks. All of these required resources are available from the course management website (Blackboard) as PDF files:

North Dakota Cloud Modification Project Operations Manual
Weather Modification Association Facts brochure

Course Objectives

1. Block 1
   Introduction
   History, Unintended Weather Modification
   Field Experience
   Ecological, Societal Aspects
   Critical Thinking, Legal Aspects
   Economic Aspects, Evaluation
2. Block 2
   Aerosols, Cloud Formation
   Precipitation Formation

Cloud Dynamics
Cloud Modification Models
NDCMP Model

3. Block 3
   - Seeding Materials
   - Seeding Equipment
   - Project Operations - Calgary
   - Project Operations - NDARB
   - Weather Radar
4. Block 4
   - Weather Forecasting
   - Weather Forecasting - Soundings
   - Opportunity Recognition
   - Seeding Techniques
   - Flight Safety
   - iPARS
   - Research Project, for example POLCAST

Minimum Technical Skills Needed

In order to succeed in this course, at a minimum, you should be able to:

- Navigate in and use basic Blackboard functions
- Download and open electronic documents (specifically, PDF and Word files)
- Open and watch YouTube videos
- Send, receive, and manage email