

# Atmospheric Sciences (AtSc)

<http://www.atmos.und.edu/>

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The Department of Atmospheric Sciences offers a comprehensive education in the atmospheric sciences leading to the degree of Bachelor of Science in Atmospheric Sciences and the Master of Science and Doctor of Philosophy degrees (see School of Graduate Studies (<http://und-public.courseleaf.com/graduatestudies>) listing). The degree is awarded in the John D. Odegard School of Aerospace Sciences. A minimum of a 2.50 GPA is required for graduation. The degree is designed to prepare graduates for professional careers in applied meteorology or for graduate studies.

New students who wish to declare a major in Atmospheric Sciences are first enrolled in the pre-professional program, Pre-Atmospheric Sciences (Pre-AtSc), which is a set of preparatory courses that includes Math 166 (Calculus II), Physics 251 (University Physics I), and AtSc 210 (Introduction to Synoptic Meteorology). Once a student has completed these courses, they may change their major to Atmospheric Sciences (AtSc).

## Facilities

The Department of Atmospheric Sciences has several unique research and teaching facilities. Four primary research facilities are used in national and international research programs: a C-band dual-polarization Doppler weather radar; a surface transportation weather test site; an atmospheric and hydrologic observations ground site; and a Cessna Citation II research jet (through an agreement with a private company). Teaching facilities include laboratories for use in cloud physics and instrumentation and a high performance computing cluster. The Regional Weather Information Center supports weather analysis and forecasting classes, along with operational research efforts. Current research areas include clouds and climate change, ground/satellite remote sensing, atmospheric aerosols, radar meteorology, mesoscale numerical modeling, atmospheric transport, data assimilation, and surface transportation weather. Students also have the opportunity to produce and broadcast weather segments for cable television and the Internet.

## B.S. in Atmospheric Sciences

Requires 125 credits (36 of which must be number 300 or above, and 60 of which must be from a 4-year institution) including:

I. Essential Studies Requirements (see University ES listing).

II. Center for Aerospace Sciences requirements, see Aerospace Sciences (<http://und-public.courseleaf.com/aerospacesciences>) listing.

III. The Following Curriculum:

### Freshman Year

First Semester		Credits
ATSC 100	Atmospheric Sciences Orientation	1
ATSC 110	Meteorology I <sup>+</sup>	3
ATSC 110L	Meteorology I Laboratory <sup>+</sup>	1
ENGL 110	College Composition I	3
MATH 165	Calculus I	4
Essential Studies		3
Free Electives		1
Credits		16

### Second Semester

ENGL 130	Composition II: Writing for Public Audiences	3
MATH 166	Calculus II	4
CSCI 130	Introduction to Scientific Programming	4
Essential Studies		3

Free Electives		2
Credits		16

### Sophomore Year

#### First Semester

ATSC 210	Introduction to Synoptic Meteorology <sup>+</sup>	4
MATH 265	Calculus III	4
PHYS 251	University Physics I	4
Essential Studies		3
Credits		15

#### Second Semester

PHYS 252	University Physics II	4
CHEM 121 & 121L	General Chemistry I and General Chemistry I Laboratory	4
ATSC 240	Meteorological Instrumentation <sup>+</sup>	4
ATSC 270	Computer Concepts in Meteorology <sup>+</sup>	3
Credits		15

### Junior Year

#### First Semester

MATH 266	Elementary Differential Equations	3
ATSC 345	Remote Sensing of the Atmosphere <sup>+</sup>	3
ATSC 350	Atmospheric Thermodynamics <sup>+</sup>	3
PHIL 250	Ethics in Engineering and Science	3
Career Electives <sup>*#</sup>		4
Credits		16

#### Second Semester

MATH 321 or ECON 210	Applied Statistical Methods or Introduction to Business and Economic Statistics	3
ATSC 353	Physical Meteorology <sup>+</sup>	3
ATSC 360	Dynamic Meteorology <sup>+</sup>	4
Essential Studies		3
Essential Studies		3
Credits		16

### Senior Year

#### First Semester

ATSC 405	Numerical Methods in Meteorology <sup>+</sup>	3
ATSC 411	Synoptic Meteorology <sup>+</sup>	4
ATSC 492	Senior Project	1
Essential Studies		3
Career Electives		4
Free Elective		1
Credits		16

#### Second Semester

ATSC 492	Senior Project	2
Free Electives		5
ATSC 460	Mesoscale Dynamics <sup>+</sup>	4
Career Electives <sup>*#</sup>		4
Credits		15
Total Credits		125

\* Career Electives are courses that students take to gain additional knowledge and skills that would allow them to develop their chosen career interest. A total of 12 credit hours are required from an approved list of classes. Only one lower level Atmospheric Sciences course will be allowed as a Career Elective.

# A maximum combined limit of 6 credit hours of ATSC 397 Cooperative Education, and ATSC 497 Internship, may be used as Career Electives.

+ Grade of 'C' or higher required.

## Minor in Atmospheric Sciences

Requires 20 credits including:

ATSC 110	Meteorology I	3
ATSC 110L	Meteorology I Laboratory	1
ATSC 210	Introduction to Synoptic Meteorology	4
ATSC 310	Introduction to Weather Forecasting	3
Atmospheric Science Electives		9
Total Credits		20

The following courses may not count towards the Atmospheric Sciences Electives for the minor:

ATSC 100	Atmospheric Sciences Orientation	1
ATSC 120	Severe and Hazardous Weather	3
ATSC 397	Cooperative Education	1-8
ATSC 494	Special Studies in Meteorology	1-4
ATSC 497	Internship	1-8

## Courses

### ATSC 100. Atmospheric Sciences Orientation. 1 Credit.

This course is required for all atmospheric sciences majors. Its purpose is to prepare new students for their university and professional careers by discussing university policies, the advising process, and career options. S/U grading. F.

### ATSC 110. Meteorology I. 3 Credits.

Elements of the atmosphere with emphasis on those processes that affect the global atmospheric circulation. Includes laboratory. Corequisite: ATSC 110L. F,S.

### ATSC 110L. Meteorology I Laboratory. 1 Credit.

Laboratory to accompany ATSC 110. Corequisite: ATSC 110. F,S.

### ATSC 120. Severe and Hazardous Weather. 3 Credits.

A survey of extreme weather events, their impact on society, and the technology used in their detection and forecasting. F.

### ATSC 210. Introduction to Synoptic Meteorology. 4 Credits.

The analysis and portrayal of synoptic weather information. Kinematic flow analyses of barotropic and baroclinic systems. Introduction to many of the products produced by NWS. Includes laboratory. Prerequisites: ATSC 110 and MATH 146 or MATH 165. F.

### ATSC 231. Aviation Meteorology. 4 Credits.

A study of weather hazards, meteorological flight planning, aviation weather equipment and human factors in weather flying safety. Prerequisite: ATSC 110. F,S.

### ATSC 240. Meteorological Instrumentation. 4 Credits.

A study of the theory, design, and accuracy of instrumentation for the measurement of temperature, pressure, humidity, wind, and radiation. In addition, topics such as radar, and the use of aircraft and balloons as instrument platforms are also discussed. Includes laboratory. Prerequisites: ATSC 110 and MATH 103. S.

### ATSC 252. Applied Weather Modification. 4 Credits.

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 program design and evaluation, care and use of seeding materials and equipment, identification of seeding opportunities, and airborne delivery of seeding materials. Prerequisite: ATSC 110. S.

### ATSC 270. Computer Concepts in Meteorology. 3 Credits.

The course introduces students to the programming knowledge needed for manipulating observational and model data in the earth sciences. Topics include data visualization, Linux and shell scripting, advanced file I/O, and memory management. The example problems utilize datasets commonly found in the atmospheric sciences. Prerequisites: ATSC 110 and CSCI 130. S.

### ATSC 310. Introduction to Weather Forecasting. 3 Credits.

An operations approach to application of practical methodologies of weather analysis using computer textual and graphic analysis systems. Involves routine weather laboratory activities commonly found within the operational sector of meteorology. Prerequisite: ATSC 210. S.

### ATSC 315. Broadcast Meteorology. 3 Credits.

An introduction to the field of broadcast meteorology which provides an overview of television production, the profession of broadcast meteorology, AMS Seal requirements, ethics and the production, organization, critique, and presentation of weather information. Prerequisites: ATSC 310 and Communication or Atmospheric Sciences major. F, even years.

### ATSC 345. Remote Sensing of the Atmosphere. 3 Credits.

Fundamental remote sensing concepts and tools including fundamental radiative processes in the atmosphere. Principles and applications of satellite and radar and their uses as meteorological observation and research tools. Additional instruments may be discussed including lidar, wind profilers, radio acoustic profilers, and other profiling systems. Prerequisites: ATSC 210 and MATH 166. F.

### ATSC 350. Atmospheric Thermodynamics. 3 Credits.

An introduction into the theory and application of atmospheric thermodynamics used in synoptic, meso- and microscale meteorology. The course covers the principles of classical thermodynamics and how they are applied to atmospheric processes. Prerequisites: ATSC 270, MATH 166, and PHYS 251. F.

### ATSC 353. Physical Meteorology. 3 Credits.

A study of atmospheric processes and properties from a physical standpoint. Includes atmospheric radiation, aerosols, cloud microphysics, and climate dynamics. Prerequisite: ATSC 345. S.

### ATSC 355. Surface Transportation Weather I. 3 Credits.

An introduction to the concepts, practices and methodologies used in the surface transportation weather industry. Includes configuration, siting, and data management/quality control of environmental sensor stations, fundamentals of surface transportation weather forecasting, overview of winter road maintenance methods, and applications of geographical information systems technologies in a weather and road maintenance environment. Prerequisites: ATSC 210 and ATSC 240. F, odd years.

### ATSC 360. Dynamic Meteorology. 4 Credits.

Basic equations of motion, atmospheric thermodynamics, balanced motions, and atmospheric disturbances are examined on an introductory level. Prerequisite: ATSC 350. Prerequisite or Corequisite: MATH 266. S.

### ATSC 397. Cooperative Education. 1-8 Credits.

The student will receive credit for on-the-job compensated work experience in various areas of meteorology available within the government, university or private sectors. May be repeated to a total of 12 credits. Prerequisites: Overall GPA of 2.5 or higher and approval of the Coordinator of Atmospheric Sciences cooperative education. Repeatable to 12 credits. S/U grading. F,S,SS.

### ATSC 405. Numerical Methods in Meteorology. 3 Credits.

This course is designed to introduce students to numerical methods used to solve mathematical problems that are difficult to solve analytically. The course is designed to focus on numerical problems encountered in the field of atmospheric science. Prerequisites: ATSC 360 and MATH 266. F.

### ATSC 411. Synoptic Meteorology. 4 Credits.

Development and application of quasi-geostrophic theory, including its application to the development and propagation of surface and upper-level systems, isentropic analysis, IPV theory, fronts, jets, and the relation between the synoptic environment and convection. Includes a laboratory in which concepts are reinforced through map discussion, map analysis, forecasting exercises and forecasting techniques. Prerequisites: ATSC 210 and ATSC 360. F.

### ATSC 441. Radar Meteorology. 4 Credits.

Advanced radar theory, including basic radar principles, digital processing of radar signals, Doppler radar principles, displays, polarization techniques, and characteristic returns. Includes laboratory. Prerequisite: ATSC 345 or consent of instructor. S, odd years.

### ATSC 450. Introduction to Cloud Physics Meteorology. 4 Credits.

A study of the physics of clouds with emphasis on microphysical processes involved in cloud formation, precipitation production, and dissipation. Includes Laboratory. Prerequisites: ATSC 350 and ATSC 353. F, odd years.

### ATSC 455. Surface Transportation Weather II. 3 Credits.

An in-depth exploration of surface transportation meteorology designed to prepare students for a career in operational surface transportation meteorology. Includes application of mesoscale weather prediction models in a surface transportation environment, introduction to pavement condition modeling, forecast verification methods, and an introduction to methods of maintenance decision-making. Prerequisites: ATSC 310 and ATSC 355. S, even years.

**ATSC 456. Introduction to Professional Meteorology. 3 Credits.**

A survey of the structure and methods found within the operational and private sector weather community. Provide orientation of professional meteorology methods. While the government sector of operational meteorology will be discussed, the emphasis of the course will focus on aspects of private sector meteorology. Prerequisite: ATSC 310. Corequisite: ATSC 411. F, odd years.

**ATSC 460. Mesoscale Dynamics. 4 Credits.**

An introduction to mesoscale dynamics and forecasting. Topics include mesoscale circulations, warm and cold season weather systems, terrain induced weather systems, tropical systems and mesoscale models. Prerequisite: ATSC 360. S.

**ATSC 492. Senior Project. 1-2 Credits.**

A capstone project demonstrating a breadth and depth of knowledge in atmospheric sciences. An original student investigation of a topic to be selected in consultation with a supervising faculty member of the department. Students will demonstrate the ability to communicate their research through both oral and written communication at an advanced level. Must be repeated for a total of 3 credits. Prerequisites: Senior Standing in Atmospheric Sciences and consent of advisor. Repeatable to 3 credits. S/U grading. F,S.

**ATSC 494. Special Studies in Meteorology. 1-4 Credits.**

Designed for those students who wish to pursue advanced topics in meteorology on an individual basis. May be repeated with change of subject matter to a maximum of four credit hours. Prerequisites: Upper division status and consent of the instructor. Repeatable to 4 credits. F,S,SS.

**ATSC 497. Internship. 1-8 Credits.**

Field experiences in various areas of meteorology will be offered as available. May be repeated up to a total of 12 credits. Prerequisite: Permission of instructor and dean. Repeatable to 12 credits. S/U grading. F,S,SS.

**ATSC 499. Topics in Meteorology. 2-4 Credits.**

This course will cover one or more topics in meteorology of special interest to upper division students. Course may be repeated up to a maximum of 6 credits. Prerequisite: Consent of instructor. Repeatable to 6 credits. F,S.