

# Atmospheric Sciences (AtSc)

B.S. in Atmospheric Sciences (<https://catalog.und.edu/undergraduateacademicinformation/departments/courses/programs/atmosphericciences/at-sc-bs/>)

Minor in Atmospheric Sciences (<https://catalog.und.edu/undergraduateacademicinformation/departments/courses/programs/atmosphericciences/at-sc-minor/>)

## Four Year Plan - B.S. in Atmospheric Sciences

### Freshman Year

Fall		Credits
ATSC 100	Atmospheric Sciences Orientation	1
ATSC 110	Meteorology I	3
ATSC 110L	Meteorology I Laboratory	1
ENGL 110	College Composition I	3
MATH 165	Calculus I	4
ES Elective		3
<b>Credits</b>		<b>15</b>

### Spring

MATH 166	Calculus II	4
CSCI 160	Computer Science I	4
ENGL 130	Composition II: Writing for Public Audiences	3
ES Elective		3
General Elective		1
<b>Credits</b>		<b>15</b>

### Sophomore Year

Fall		Credits
ATSC 210	Introduction to Synoptic Meteorology	4
MATH 265	Calculus III	4
PHYS 251	University Physics I	4
ES Elective		3
<b>Credits</b>		<b>15</b>

### Spring

ATSC 240	Meteorological Instrumentation	4
ATSC 270	Computer Concepts in Meteorology	3
PHYS 252	University Physics II	4
CHEM 121	General Chemistry I	3
CHEM 121L	General Chemistry I Laboratory	1
<b>Credits</b>		<b>15</b>

### Junior Year

Fall		Credits
ATSC 345	Remote Sensing of the Atmosphere	3
ATSC 350	Atmospheric Thermodynamics	3
MATH 266	Elementary Differential Equations	3
*#Career Electives		3
ES Elective		3
<b>Credits</b>		<b>15</b>

### Spring

ATSC 353	Physical Meteorology	3
ATSC 360	Dynamic Meteorology	4
MATH 321 or ECON 210	Applied Statistical Methods or Introduction to Business and Economic Statistics	3

ES Elective	6
<b>Credits</b>	<b>16</b>

### Senior Year

#### Fall

ATSC 405	Numerical Methods in Meteorology	3
ATSC 411	Synoptic Meteorology	4
ATSC 492	Senior Project I	1
*#Career Electives		4
ES Electives		3

#### Credits

15

#### Spring

ATSC 460	Mesoscale Dynamics	4
ATSC 493	Senior Project II	2
*#Career Electives		5
General Electives		3

#### Credits

14

#### Total Credits

120

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

Students must complete enough electives to bring total credit hours up to the 120. Special Emphasis courses can fulfill an essential studies requirement (example-History 104, US History, will count toward the US Diversity as well as the Humanities area). Please Note: Every student must fulfill all University, Departmental, and Essential Studies requirements. (<https://und.edu/academics/essential-studies/>)

### 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. Prerequisite: MATH 98 or any higher-level math course. Corequisite: ATSC 110L. F,S.

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

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

### 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. Prerequisite: ATSC 110 and MATH 146 or MATH 165. F.

### ATSC 220. Extreme Weather and Climate. 3 Credits.

Severe weather is a leading cause of death, injury and property damage. Students will gain an understanding and appreciation of extreme weather events, their impact on society, minimizing risk and the use of technology in detection and forecasting. Students will also learn how climate change impacts the occurrence and severity of extreme weather events. Prerequisite: ATSC 110. F,S.

### 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 and either AVIT 102 or AVIT 105 or AVIT 142. 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. Prerequisite: ATSC 110 and MATH 103. S.

**ATSC 252. Applied Weather Modification. 3 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 atmospheric sciences. Topics include programming environments, data visualization, coding and debugging strategies, programming modules, and advanced file I/O. The example problems utilize datasets commonly found in the atmospheric sciences. Prerequisite: ATSC 110 and CSCI 160. 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 and science communication which provides an overview of television production, the profession of broadcast meteorology, AMS Seal requirements, role of the station scientist, ethics and the production, organization, critique, and presentation of weather and other science information for a public audience. Prerequisite: 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. Prerequisite: ATSC 210, ATSC 270, 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. Prerequisite: CHEM 121, 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. Prerequisite: 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. Prerequisite: Overall GPA of 2.5 or higher and approval of the Coordinator of Atmospheric Sciences cooperative education. Repeatable to 12.00 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. Prerequisite: 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. Prerequisite: ATSC 210 and ATSC 360. F.

**ATSC 420. Advanced Weather Forecasting. 4 Credits.**

This course is designed to give students hands on experience in the elements of the modernized forecast process required for operational forecasting both individually and collaboratively. This course includes in-depth real-time analysis of weather from the planetary scale to mesoscale, advanced forecasting techniques and strategies at various timescales for diverse clients, and the examination of predictability. A key component of the course will be the development and communication of forecasts through text products, graphics, decision support services, and weather briefings. Prerequisite: ATSC 411. S.

**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. Prerequisite: ATSC 350 and ATSC 353. F, odd 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 or Corequisite: ATSC 350. 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 I. 1 Credit.**

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. Prerequisite: ECON 210 or MATH 321, senior standing in Atmospheric Sciences and consent of advisor. F,S.

**ATSC 493. Senior Project II. 2 Credits.**

This is the second semester of a capstone course intended to be a culminating experience. Students are expected to demonstrate a breadth and depth of knowledge in atmospheric sciences. Students will continue to investigate an original 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. Prerequisite: ATSC 492. 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. Prerequisite: Upper division status and consent of the instructor. Repeatable to 4.00 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 12.00 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 6.00 credits. F,S.