

ATMOSPHERIC AND OCEANIC SCIENCES - BACHELOR OF SCIENCE (BS)

The Atmospheric and Oceanic Sciences (ATOC) Bachelor of Science degree is for students interested in an in-depth understanding of the physical basis for the role of the atmosphere and oceans in Earth's climate system. An ATOC degree will prepare students to pursue a wide range of careers in areas as diverse as the energy sector, insurance, military, air and water quality monitoring, weather and aerospace industries. It will provide a solid foundation for advanced degrees in the atmospheric and oceanic sciences and for professions in scientific research and academia.

ATOC's curriculum responds to demands of current students for more interactive learning opportunities and to demands of employers for graduates who have been trained to provide quantitative solutions to real-world problems. It is designed to provide students with a core set of knowledge and skills related to atmospheric and oceanic sciences and to engage students in hands-on, interactive learning early and often. To that end, it requires students to take several "methods" courses that emphasize quantitative problem-solving by focusing on some combination of data analysis, observations and/or modeling; all of these courses incorporate some level of computer programming or scientific computing. ATOC strongly recommends that every student have a laptop computer if it is financially feasible. Students who intend to purchase a computer and wish to have its cost included in their financial aid calculations are strongly encouraged to consult the Office of Financial Aid before purchase.

ATOC's curriculum is also designed to take advantage of CU Boulder's unique position as a university in the center of a world-renowned mecca for earth system science. Scientists from the local community contribute their expertise to the ATOC curriculum, particularly in the interactive methods courses, and mentor seniors in their thesis research.

Requirements

Graduation with a BS in Atmospheric and Oceanic Sciences will require the completion of the curriculum presented below, consisting of 120 credit hours passed with a cumulative grade point average of 2.000 or higher. Grades of C- or better will be required in all ATOC courses.

The requirements for the ATOC major include 34 credits of ancillary science and mathematics, 21 credits of core atmospheric and oceanic science courses, 12 credits of methods in atmospheric and oceanic sciences, and 12 credits of designated upper division electives. All ATOC courses and all required ancillary courses must be passed with a C- or better.

Required Courses and Credits

ATOC Major Requirements

Code	Title	Credit Hours
Introductory Atmospheric and Oceanic Sciences Requirement		
Select one of the following:		3
ATOC 1050	Weather and the Atmosphere	
ATOC 1060	Our Changing Environment: El Nino, Ozone, and Climate	

ATOC 2050	Introduction to Atmospheric Research	
ATOC 2500	Special Topics in Atmospheric and Oceanic Sciences - Lower Division	
FYSM 1000	First Year Seminar (ATOC offered sections)	
Core Atmospheric and Oceanic Sciences Requirements		
Select three of the following courses:		9
ATOC 3050	Principles of Weather	
ATOC/ERTH 3070	Introduction to Oceanography	
ATOC 3300	Analysis of Climate and Weather Observations	
or ATOC 3700	Course-Based ATOC Research Experience	
ATOC 3500/ CHEM 3151	Air Chemistry and Pollution	
ATOC 3600	Principles of Climate	
Fundamentals of Atmospheric and Oceanic Sciences		
Select three of the following courses:		9
ATOC 4200	Biogeochemical Oceanography	
ATOC 4710	Introduction to Atmospheric Physics	
ATOC 4720	Atmospheric Dynamics	
ATOC 4730	Physical Oceanography and Climate	
Methods in Atmospheric and Oceanic Sciences ¹		
Select 12 credit hours of the following, 6 of which can be from independent research (ATOC 4900, ATOC 4950 or ATOC 4990). Some courses offered as ATOC 4500 Special Topics may satisfy this requirement.		12
ATOC 4500	Special Topics in Atmospheric and Oceanic Sciences - Upper Division (Choose from the following: topics: Weather Modeling Lab, Instrument Lab, Remote Sensing, Field Observations and Measurements, Numerical Methods and Modeling, Objective Data Analysis, Synoptic Dynamic Meteorology, and Applications of Numerical Models)	
ATOC 4700	Weather Analysis & Forecasting	
ATOC 4815	Scientific Programming, Data Analysis and Visualization Laboratory	
ATOC 4830	Remote Sensing Lab	
ATOC 4840	Field Observations and Measurements Laboratory	
ATOC 4850	Numerical Methods Laboratory	
ATOC 4860	Data Science Lab	
ATOC 4870	Climate Modeling Laboratory	
ATOC 4875	Weather Modeling Laboratory	
ATOC 4890	Synoptic Dynamic Meteorology	
ATOC 4900	Independent Study	
ATOC 4950	Honors Thesis	
ATOC 4990	Internship	
ATOC Electives ¹		
At least 12 credit hours in ATOC courses not used to fulfill a requirement above.		
Upper-Division ATOC Electives		9

Upper- or Lower-Division ATOC Elective	3
Total Credit Hours	45

¹ No more than a total of 9 credit hours of ATOC 4900 Independent Study, ATOC 4950 Honors Thesis, and/or ATOC 4990 Internship may be applied towards BOTH the Methods and ATOC Electives areas.

Required Ancillary Coursework from Outside ATOC

Code	Title	Credit Hours
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Ancillary Science and Mathematics Requirements

The field of atmospheric and oceanic sciences is highly interdisciplinary; therefore, students must develop a basic understanding of physics, chemistry, and mathematics to be successful. The required courses in the physical sciences and math departments outside of ATOC are a critical part of the major; they are needed to build a strong foundation upon which the remaining curriculum is based. All courses must be passed with a grade of C- or better required.

APPM 1350 or MATH 1300	Calculus 1 for Engineers Calculus 1	4-5
APPM 1360 or MATH 2300	Calculus 2 for Engineers Calculus 2	4-5
APPM 2350 or MATH 2400	Calculus 3 for Engineers Calculus 3	4-5
APPM 2360	Introduction to Differential Equations with Linear Algebra (Or MATH 2130 and MATH 3430)	4-6
CHEM 1113	General Chemistry 1	4
PHYS 1110	General Physics 1	4
PHYS 1120	General Physics 2	4

Ancillary Computing Coursework Requirement

Select one of the following courses:	3-4
CSCI 1300	Computer Science 1: Starting Computing
ASTR 2600	Introduction to Scientific Programming
INFO 1701	Programming for Information Science 1
APPM 1650	Python for Math and Data Science Applications
ERTH 3600	Introduction to Python Programming for Earth Scientists

Total Credit Hours	31-37
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Graduating in Four Years

Consult the Four-Year Guarantee Requirements for information on eligibility. The concept of "adequate progress" as it is used here only refers to maintaining eligibility for the four-year guarantee; it is not a requirement for the major. To maintain adequate progress in ATOC, students should meet the following requirements:

- In the first semester, declare the Atmospheric and Oceanic Sciences major.

Students must consult with a major advisor to determine adequate progress toward completion of the major.

Sample Four-Year Plan of Study

A general sample curriculum for Atmospheric and Oceanic Sciences majors is presented below. The curriculum here includes the required

physical science, math, and ATOC courses, but it does not include specifics on general education requirements or non-ATOC electives.

Through the required coursework for the major, students will complete all 12 credits of the Natural Sciences area of the Gen Ed Distribution Requirement and the QRMS component of the Gen Ed Skills Requirement.

Not all ATOC 4500 courses satisfy all requirements. See department for more information.

(See requirements section or degree audit for list of courses approved to count for ATOC Core, Fundamental of ATOC and Methods in ATOC.)

Year One

Fall Semester		Credit Hours
ATOC 1050 or ATOC 1060 or ATOC 2050 or ATOC 2500	Weather and the Atmosphere or Our Changing Environment: El Nino, Ozone, and Climate or Introduction to Atmospheric Research or Special Topics in Atmospheric and Oceanic Sciences - Lower Division	3
APPM 1350 or MATH 1300	Calculus 1 for Engineers or Calculus 1	4-5
PHYS 1110	General Physics 1	4
Gen. Ed. Skills course (example: Lower-division Written Communication)		3
Credit Hours		14-15

Spring Semester

ATOC Elective		3
APPM 1360 or MATH 2300	Calculus 2 for Engineers or Calculus 2	4-5
PHYS 1120	General Physics 2	4
Gen. Ed. Distribution/Diversity course (example: Arts & Humanities/US Perspective)		3
Credit Hours		14-15

Year Two

Fall Semester		Credit Hours
ATOC Core		3
APPM 2350 or MATH 2400	Calculus 3 for Engineers or Calculus 3	4-5
CSCI 1200	Introduction to Computational Thinking	3
Gen. Ed. Distribution course (example: Arts & Humanities)		3
Gen. Ed. Distribution course (example: Social Sciences)		3
Credit Hours		16-17
Spring Semester		Credit Hours
ATOC Core		3
ATOC Core		3
APPM 2360	Introduction to Differential Equations with Linear Algebra	4
CHEM 1113	General Chemistry 1	4
Gen. Ed. Distribution/Diversity course (example: Social Sciences/Global Perspective)		3
Credit Hours		17

Year Three**Fall Semester**

Fundamentals of ATOC	3
Methods in ATOC	3
Gen. Ed. Distribution course (example: Social Sciences)	3
Gen. Ed. Distribution course (example: Arts & Humanities)	3
Elective	3
Credit Hours	15

Spring Semester

Fundamentals of ATOC	3
Fundamentals of ATOC	3
Methods in ATOC	3
Gen. Ed. Skills course (example: Upper-division Written Communication)	3
Elective	3
Credit Hours	15

Year Four**Fall Semester**

ATOC Upper Division Elective	3
ATOC Upper Division Elective	3
Methods in ATOC	3
Gen. Ed. Distribution course (example: Arts & Humanities)	3
Elective	3
Credit Hours	15

Spring Semester

ATOC Upper Division Elective	3
Methods in ATOC	3
Gen. Ed. Distribution course (example: Social Sciences)	3
Upper Division Elective	3
Elective	2
Credit Hours	14

Total Credit Hours	120-123
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Learning Outcomes

By the completion of the program, students will be able to:

- Acquire a foundational understanding of physical, chemical, mathematical, and computational concepts.
- Demonstrate understanding of core atmospheric, oceanic, and climate processes and their interactions across multiple temporal and spatial scales.
- Apply critical thinking and objective analysis methods to design experiments, test scientific relationships, and predict future outcomes.
- Integrate modern computational tools, data visualization techniques, and model results to solve complex scientific problems.
- Develop specialized skills in laboratory work, instrumentation, modelling, or forecasting that align with modern atmospheric and oceanic applications.
- Communicate scientific content, methodology, and implications effectively to a diverse audience.