The study of atmospheric and oceanic sciences includes all aspects of the atmosphere and physical oceanography, their mutual interaction, and their interaction with space and the rest of the earth system. Although a primary goal is to understand the atmosphere and ocean for the purpose of predicting the weather, atmospheric and oceanic sciences embraces much more: motions at large, medium, and small scales; past, present, and future climates; air chemistry and quality; clouds and precipitation; and solar and terrestrial radiation. In many areas, new remote-sensing technology including satellites is used to provide circulation patterns at both global and local scales.

Many undergraduates take an elementary atmospheric and oceanic sciences course to meet part of their natural or physical science breadth requirements. Other students, who have had sufficient mathematics and physics preparation, take higher-level atmospheric and oceanic sciences courses to complement their major work in other fields of natural science. An atmospheric and oceanic sciences major receives a thorough introduction to the basic concepts and tools in the core courses, which cover the physics and dynamics of the atmosphere and ocean. An array of elective courses are offered in the senior year, with tracks in the areas of weather systems, earth/environmental science, and general and applied atmospheric and oceanic sciences. Elective groups are tailored individually. Some students will want preparation for careers in areas such as operational forecasting, environmental consulting, and broadcasting. Others will seek preparation for graduate work leading to a broader range of careers.

HOW TO GET IN

There are no admissions requirements for the major. Students wishing to declare the Atmospheric & Oceanic Sciences major should meet with the Undergraduate Academic Advising Manager listed in the Contact Box on the right sidebar of this page.

REQUIREMENTS

UNIVERSITY GENERAL EDUCATION REQUIREMENTS

All undergraduate students at the University of Wisconsin–Madison are required to fulfill a minimum set of common university general education requirements to ensure that every curricula acquires the essential core of an undergraduate education. This core establishes a foundation for living a productive life, being a citizen of the world, appreciating aesthetic values, and engaging in lifelong learning in a continually changing world. Various schools and colleges will have requirements in addition to the requirements listed below. Consult your advisor for assistance, as needed. For additional information, see the university Undergraduate General Education Requirements [http://guide.wisc.edu/undergraduate/#requirementsforundergraduatetestudytext] section of the Guide.

<table>
<thead>
<tr>
<th>Category</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics</td>
<td>Complete two courses of 3+ credits at the Intermediate or Advanced level in MATH, COMP SCI, or STAT subjects. A maximum of one course in each of COMP SCI and STAT subjects counts toward this requirement.</td>
</tr>
<tr>
<td>Language</td>
<td>Complete the third unit of a language other than English.</td>
</tr>
</tbody>
</table>
| LS Breadth | Complete:  
  - 12 credits of Humanities, which must include at least 6 credits of Language; and  
  - 12 credits of Social Science; and  
  - 12 credits of Natural Science, which must include 6 credits of Biological Science and 6 credits of Physical Science. |
| Liberal Arts and Science Coursework | Complete at least 108 credits. |
| Depth of Intermediate/Advanced Coursework | Complete at least 60 credits at the Intermediate or Advanced level. |
| Major | Declare and complete at least one major. |
| Total Credits | Complete at least 120 credits. |
| UW-Madison Experience | Complete both:  
  - 30 credits in residence, overall, and  
  - 30 credits in residence after the 86th credit. |
| Quality of Work |  
  - 2.000 in all coursework at UW-Madison  
  - 2.000 in Intermediate/Advanced level coursework at UW-Madison |
NON-L&S STUDENTS PURSUING AN L&S MAJOR
Non-L&S students who have permission from their school/college to pursue an additional major within L&S only need to fulfill the major requirements. They do not need to complete the L&S Degree Requirements above.

REQUIREMENTS FOR THE MAJOR

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Calculus (complete all):</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATH 221</td>
<td>Calculus and Analytic Geometry 1</td>
<td>5</td>
</tr>
<tr>
<td>MATH 222</td>
<td>Calculus and Analytic Geometry 2</td>
<td>4</td>
</tr>
<tr>
<td>MATH 234</td>
<td>Calculus--Functions of Several Variables</td>
<td>4</td>
</tr>
<tr>
<td><strong>Physics (complete one course from each group):</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHYSICS 207</td>
<td>General Physics</td>
<td>5</td>
</tr>
<tr>
<td>or PHYSICS 201</td>
<td>General Physics</td>
<td></td>
</tr>
<tr>
<td>or PHYSICS 247</td>
<td>A Modern Introduction to Physics</td>
<td></td>
</tr>
<tr>
<td>PHYSICS 208</td>
<td>General Physics</td>
<td>5</td>
</tr>
<tr>
<td>or PHYSICS 202</td>
<td>General Physics</td>
<td></td>
</tr>
<tr>
<td>or PHYSICS 248</td>
<td>A Modern Introduction to Physics</td>
<td></td>
</tr>
<tr>
<td><strong>Computer Sciences (complete one):</strong></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>COMP SCI 220</td>
<td>Data Science Programming I</td>
<td></td>
</tr>
<tr>
<td>COMP SCI 310</td>
<td>Problem Solving Using Computers</td>
<td></td>
</tr>
<tr>
<td>COMP SCI 320</td>
<td>Data Science Programming II</td>
<td></td>
</tr>
<tr>
<td>COMP SCI/ E C E 354</td>
<td>Machine Organization and Programming</td>
<td></td>
</tr>
<tr>
<td>COMP SCI 412</td>
<td>Introduction to Numerical Methods</td>
<td></td>
</tr>
<tr>
<td>COMP SCI/I SY E/ I SY E 425</td>
<td>Introduction to Combinatorial Optimization</td>
<td></td>
</tr>
<tr>
<td>MATH 425</td>
<td>Optimization</td>
<td></td>
</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td></td>
<td>26</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Core Sequence (complete all):</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATM OCN 310</td>
<td>Dynamics of the Atmosphere and Ocean I</td>
<td>3</td>
</tr>
<tr>
<td>ATM OCN 311</td>
<td>Dynamics of the Atmosphere and Ocean II</td>
<td>3</td>
</tr>
<tr>
<td>ATM OCN 330</td>
<td>Physics of the Atmosphere and Ocean I</td>
<td>3</td>
</tr>
<tr>
<td>ATM OCN 340</td>
<td>Physics of the Atmosphere and Ocean II</td>
<td>3</td>
</tr>
<tr>
<td><strong>Quantitative Analysis (complete one):</strong></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>COMP SCI 412</td>
<td>Introduction to Numerical Methods</td>
<td></td>
</tr>
<tr>
<td>COMP SCI/ MATH/STAT 475</td>
<td>Introduction to Combinatorics</td>
<td></td>
</tr>
<tr>
<td>COMP SCI/ MATH 514</td>
<td>Numerical Analysis</td>
<td></td>
</tr>
<tr>
<td>COMP SCI/I SY E/ MATH/STAT 525</td>
<td>Linear Optimization</td>
<td></td>
</tr>
<tr>
<td>MATH/STAT 309</td>
<td>Introduction to Probability and Mathematical Statistics I</td>
<td></td>
</tr>
<tr>
<td>MATH/STAT 310</td>
<td>Introduction to Probability and Mathematical Statistics II</td>
<td></td>
</tr>
</tbody>
</table>

**MATH 319** Techniques in Ordinary Differential Equations
**MATH 320** Linear Algebra and Differential Equations
**MATH 321** Applied Mathematical Analysis
**MATH 322** Applied Mathematical Analysis
**MATH 331** Introductory Probability
**MATH 340** Elementary Matrix and Linear Algebra
**MATH 341** Linear Algebra
**MATH 375** Topics in Multi-Variable Calculus and Linear Algebra
**MATH 376** Topics in Multi-Variable Calculus and Differential Equations
**MATH 407** Topics in Mathematics Study Abroad
**MATH 415** Applied Dynamical Systems, Chaos and Modeling
**MATH 421** The Theory of Single Variable Calculus
**MATH/ COMP SCI/ I SY E 425** Introduction to Combinatorial Optimization
**MATH/STAT 431** Introduction to the Theory of Probability
**MATH/ COMP SCI/ I SY E 435** Introduction to Cryptography
**MATH 441** Introduction to Modern Algebra
**MATH 443** Applied Linear Algebra
**MATH 461** College Geometry I
**MATH 467** Introduction to Number Theory
**MATH/ CURRIC 471** Mathematics for Secondary School Teachers
**MATH/ HIST SCI 473** History of Mathematics
**MATH/ COMP SCI/ STAT 475** Introduction to Combinatorics
**MATH 490** Undergraduate Seminar
**MATH 491** Topics in Undergraduate Mathematics
**MATH/ COMP SCI 513** Numerical Linear Algebra
**MATH/ COMP SCI 514** Numerical Analysis
**MATH 519** Ordinary Differential Equations
**MATH 521** Analysis I
**MATH 522** Analysis II
**MATH/ COMP SCI/I SY E/ STAT 525** Linear Optimization
**MATH 531** Probability Theory
**MATH 535** Mathematical Methods in Data Science
**MATH 540** Linear Algebra II
**MATH 541** Modern Algebra
MATH 542  Modern Algebra
MATH 551  Elementary Topology
MATH 552  Elementary Geometric and Algebraic Topology
MATH 561  Differential Geometry
MATH 567  Modern Number Theory
MATH/PHILOS 571  Mathematical Logic
MATH 605  Stochastic Methods for Biology
MATH 607  Topics in Mathematics Study Abroad
MATH/B M I/BIOCHEM/BMOLCHEM 609  Mathematical Methods for Systems Biology
MATH 619  Analysis of Partial Differential Equations
MATH 621  Introduction to Manifolds
MATH 623  Complex Analysis
MATH 627  Introduction to Fourier Analysis
MATH 629  Introduction to Measure and Integration
MATH/ISY E/OTM/STAT 632  Introduction to Stochastic Processes
STAT/MATH 309  Introduction to Probability and Mathematical Statistics I
STAT/MATH 310  Introduction to Probability and Mathematical Statistics II
STAT 311  Introduction to Theory and Methods of Mathematical Statistics I
STAT 312  Introduction to Theory and Methods of Mathematical Statistics II
STAT 324  Introductory Applied Statistics for Engineers
STAT 333  Applied Regression Analysis
STAT 340  Data Science Modeling II
STAT 349  Introduction to Time Series
STAT 351  Introductory Nonparametric Statistics
STAT 360  Topics in Statistics Study Abroad
STAT 371  Introductory Applied Statistics for the Life Sciences
STAT 411  An Introduction to Sample Survey Theory and Methods
STAT/MATH 424  Applied Categorical Data Analysis
STAT/MATH 431  Statistical Experimental Design
STAT 456  Applied Multivariate Analysis
STAT 461  Financial Statistics
STAT/COMP SCI 471  Introduction to Computational Statistics
STAT/COMP SCI/MATH 475  Introduction to Combinatorics
STAT 479  Special Topics in Statistics
STAT/COMP SCI/ISY E/MATH 525  Linear Optimization
STAT/B M I 541  Introduction to Biostatistics
STAT/B M I 542  Introduction to Clinical Trials I
STAT/F&W ECOL/HORT 571  Statistical Methods for Bioscience I
STAT/F&W ECOL/HORT 572  Statistical Methods for Bioscience II
STAT 575  Statistical Methods for Spatial Data
STAT 601  Statistical Methods I
STAT 602  Statistical Methods II
STAT 605  Data Science Computing Project
STAT 609  Mathematical Statistics I
STAT 610  Introduction to Statistical Inference
STAT 615  Statistical Learning
STAT 627  Professional Skills in Data Science
STAT 628  Data Science Practicum
STAT/ISY E/MATH/OTM 632  Introduction to Stochastic Processes
STAT/B M I 641  Statistical Methods for Clinical Trials
STAT/B M I 642  Statistical Methods for Epidemiology
STAT 679  Special Topics in Statistics
STAT 681  Senior Honors Thesis
STAT 682  Senior Honors Thesis

**Capstone**

ATM OCN 405  AOS Senior Capstone Seminar 1

**Electives** 11

ATM OCN 401  Topics in Meteorology
ATM OCN 404  Meteorological Measurements
ATM OCN 425  Global Climate Processes
ATM OCN 441  Radar and Satellite Meteorology
ATM OCN 452  Synoptic Laboratory I: The Frontal Cyclone
ATM OCN 453  Synoptic Laboratory II: Mesoscale Meteorology
ATM OCN/ENVIR ST 520  Bioclimatology
ATM OCN 522  Tropical Meteorology
ATM OCN/AGRonomy/SOIL SCI 532  Environmental Biophysics
ATM OCN/ENVIR ST 535  Atmospheric Dispersion and Air Pollution
ATM OCN 573  Computational Methods in Atmospheric and Oceanic Sciences
ATM OCN 575  Climatological Analysis
ATM OCN 610  Geophysical Fluid Dynamics I
ATM OCN 611  Geophysical Fluid Dynamics II
ATM OCN 615  Laboratory in Rotating Fluid Dynamics
ATM OCN 630  Introduction to Atmospheric and Oceanic Physics
ATM OCN 637  Cloud Physics
LEARNING OUTCOMES

1. Recognize and describe the fundamental principles and processes associated with the dynamics and thermodynamics of geophysical fluid flows, the basic physics of clouds, aerosols, and precipitation.

2. Recognize and describe the fundamental principles and processes associated with radiation and atmospheric and oceanic radiative transfer.

3. Demonstrate critical thinking skills by identifying a problem, identifying the required information to solve that problem; and formulating and interpreting solutions to that problem using appropriate analytical and/or computational techniques.

4. Apply diagnostic tools to analyses and numerical model output to diagnose, describe, and interpret the fundamental dynamical and thermodynamical processes at work in synoptic-scale, mesoscale, and large-scale weather systems and climate circulations.

5. Apply fundamental radiative transfer theory to interpret remotely-sensed observations of atmospheric and oceanic phenomena.

6. Design and conduct experiments and/or analyze data to test hypotheses in an area of atmospheric or climate sciences.

7. Demonstrate effective scientific communication skills through development and delivery of oral presentations (including poster presentations) and written reports and case studies.

FOUR-YEAR PLAN

This Four-Year Plan is only one way a student may complete an L&S degree with this major. Many factors can affect student degree planning, including placement scores, credit for transferred courses, credits earned by examination, and individual scholarly interests. In addition, many students have commitments (e.g., athletics, honors, research, student organizations, study abroad, work and volunteer experiences) that necessitate they adjust their plans accordingly. Informed students engage in their own unique Wisconsin Experience by consulting their academic advisors, Guide, DARS, and Course Search & Enroll for assistance making and adjusting their plan.

First Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 221 (QR-B)</td>
<td>5</td>
<td>MATH 222</td>
<td>4</td>
</tr>
<tr>
<td>ATM OCN 100 or 101</td>
<td>4</td>
<td>ATM OCN/ENVIR ST 171 (Comm B)</td>
<td>3</td>
</tr>
</tbody>
</table>
ADVISING AND CAREERS

GENERAL ADVISING
Any student interested in the Atmospheric and Oceanic Sciences or Environmental Sciences major should meet with the Undergraduate Academic Advising Manager listed in the Contact Box on the right sidebar of this page to discuss steps to complete the necessary prerequisite coursework for the major.

CAREER ADVISING
The Department of Atmospheric and Oceanic Sciences encourages majors to begin working on their career exploration and preparation soon after arriving on campus. We partner with SuccessWorks at the College of Letters & Science to help students turn the academic skills learned in their major, certificates, and other coursework into fulfilling lives after graduation, whether that means jobs, public service, graduate school or other career pursuits.

In addition to providing basic support like resume reviews and interview practice, SuccessWorks offers ways to explore interests and build career skills from their very first semester/term at UW all the way through graduation and beyond.

Students can explore careers in one-on-one advising, try out different career paths, complete internships, prepare for the job search and/or graduate school applications, and connect with supportive alumni and even employers in the fields that inspire them.

- SuccessWorks (https://careers.ls.wisc.edu/)
- Set up a career advising appointment (https://successworks.wisc.edu/make-an-appointment/)
- Enroll in a Career Course (https://successworks.wisc.edu/career-courses/) – a great idea for first- and second-year students:
  - INTER-LS 210 L&S Career Development: Taking Initiative (1 credit)
  - INTER-LS 215 Communicating About Careers (3 credits, fulfills Comm B General Education Requirement)
- Learn about internships and internship funding (https://successworks.wisc.edu/finding-a-job-or-internship/)
- Activate your Handshake account (https://successworks.wisc.edu/handshake/) to apply for jobs and internships from 200,000+ employers recruiting UW-Madison students
- Learn about the impact SuccessWorks has on students’ lives (https://successworks.wisc.edu/about/mission/)

LEADERSHIP

L&S CAREER RESOURCES
Every L&S major opens a world of possibilities. SuccessWorks (https://successworks.wisc.edu/) at the College of Letters & Science helps students turn the academic skills learned in their major, certificates, and other coursework into fulfilling lives after graduation, whether that means jobs, public service, graduate school or other career pursuits.

In addition to providing basic support like resume reviews and interview practice, SuccessWorks offers ways to explore interests and build career skills from their very first semester/term at UW all the way through graduation and beyond.

Students can explore careers in one-on-one advising, try out different career paths, complete internships, prepare for the job search and/or graduate school applications, and connect with supportive alumni and even employers in the fields that inspire them.

- SuccessWorks (https://careers.ls.wisc.edu/)
- Set up a career advising appointment (https://successworks.wisc.edu/make-an-appointment/)
- Enroll in a Career Course (https://successworks.wisc.edu/career-courses/) – a great idea for first- and second-year students:
  - INTER-LS 210 L&S Career Development: Taking Initiative (1 credit)
  - INTER-LS 215 Communicating About Careers (3 credits, fulfills Comm B General Education Requirement)
- Learn about internships and internship funding (https://successworks.wisc.edu/finding-a-job-or-internship/)
- Activate your Handshake account (https://successworks.wisc.edu/handshake/) to apply for jobs and internships from 200,000+ employers recruiting UW-Madison students
- Learn about the impact SuccessWorks has on students’ lives (https://successworks.wisc.edu/about/mission/)

LEADERSHIP

PEOPLE

PROFESSORS
Back, Larissa
Desai, Ankur (Chair)
Hitchman, Matt
Holloway, Tracey
L’Ecuyer, Tristan
Martin, Jonathan
Morgan, Michael (On leave)
Pierce, Brad
Vimont, Dan

ASSOCIATE PROFESSORS
Adames-Corraliza, Ángel
Lang, Andrea Lopez

ASSISTANT PROFESSORS
Henderson, David
Henderson, Stephanie
Maroon, Elizabeth
Oyola-Merced, Mayra
Rowe, Angela
Wagner, Till
Zanowski, Hannah