ATMOSPHERIC SCIENCE, BS

Atmospheric Science is the study of short-term weather and long-term climate, involving activities such as weather forecasting, climate projections, air quality modeling, data analysis, and basic and applied research.

Some universities may call this major "Meteorology". We call it Atmospheric Science because our program is much broader than just weather forecasting. Students in our program will obtain a solid foundation in the mathematical modeling that forms the basis of analysis not just of tomorrow's expected weather but also long-term climate change, storm impact and predictability, pollution patterns and impact, and the consequences of weather to people and organizations.

While TV weather forecasters may be the most visible job outcome for an Atmospheric Science major, the fact is that there are a very limited number of these jobs nationally. Most majors work in other areas of the field such as research, government agencies such as NASA and NOAA, consulting firms, and schools. As more and more companies realize the impact weather can have on business operations, more job opportunities are opening in the private sector, and this is the sector with the greatest projected job growth.

Atmospheric Science students at UWM have unique opportunities not found at any other university in the state or region. Our Innovative Weather program (http://innovativeweighter.com) is hired by numerous businesses such as the Milwaukee Brewers and We Energies that need to make decisions based on the weather, and students work to provide these clients with customized forecasts and risk analyses. Our program also offers students research internships in areas such as cloud modeling, weather analysis, and data science. Our program is also home to the first-of-its-kind faculty-led Mexico "Air Pollution and Ancient Cultures" Study Abroad program and an active student-led club. Finally, the Atmospheric Science major provides distinct tracks that help prepare students for careers in weather forecasting, natural hazard risk assessment, and data analytics, or for graduate study.

Requirements
Course of Study – Bachelor of Science Degree

Complete 120 credits including 90 credits in the College of Letters & Science and with 36 of the 90 credits in L&S upper-level (numbered above 300) courses and 30 of those 36 credits in designated Advanced Natural Science courses (https://uwm.edu/letters-science/advising/degree-requirements/advanced-natural-science-approved-courses-list). The College requires that students must complete in residence at UWM at least 15 credits in upper-division (numbered 300 or above) courses in their major. Students are also required to complete University-wide General Education Requirements and the specific L&S requirements listed below.

To complete a major, students must satisfy all the requirements of the major as stated in this catalog. Students who declare their majors within five years of entering the UW System as a degree candidate may satisfy the requirements outlined in any catalog issued since the time they entered. Credits used to satisfy the major also may be used to satisfy other degree requirements.

University General Education Requirements (GER)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Oral and Written Communication</td>
<td></td>
</tr>
<tr>
<td>Part A</td>
<td>Achieve a grade of C or better in the following course:</td>
<td></td>
</tr>
<tr>
<td>ENGLISH 102</td>
<td>College Writing and Research (or equivalent)</td>
<td></td>
</tr>
<tr>
<td>Part B</td>
<td>Course designated as OWC-B; may be completed through a major-specific course requirement</td>
<td></td>
</tr>
<tr>
<td>Quantitative Literacy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part A</td>
<td>Achieve a grade of C or better in one of the following:</td>
<td></td>
</tr>
<tr>
<td>MATH 102</td>
<td>Mathematical Literacy for College Students II</td>
<td></td>
</tr>
<tr>
<td>MATH 103</td>
<td>Contemporary Applications of Mathematics</td>
<td></td>
</tr>
<tr>
<td>MATH 105</td>
<td>Introduction to College Algebra</td>
<td></td>
</tr>
<tr>
<td>MATH 108</td>
<td>Algebraic Literacy II</td>
<td></td>
</tr>
<tr>
<td>MATH 111</td>
<td>Introduction to Logic - Critical Reasoning</td>
<td></td>
</tr>
<tr>
<td>PHILOS 111</td>
<td>Introduction to Logic - Critical Reasoning</td>
<td></td>
</tr>
<tr>
<td>MATH 116</td>
<td>College Algebra</td>
<td></td>
</tr>
<tr>
<td>Or equivalent course</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part B</td>
<td>Course designated as QL-B; may be completed through a major-specific course requirement</td>
<td></td>
</tr>
<tr>
<td>Arts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Select 3 credits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humanities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Select 6 credits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Sciences</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Select 6 credits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural Sciences</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Select 6 credits (At least two courses including one lab)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UWM Foreign Language Requirement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete Foreign Language Requirement through:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two years (high school) of a single foreign language</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two semesters (college) of a single foreign language</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Or equivalent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UWM Cultural Diversity Requirement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One course from the Arts, Humanities, or Social Sciences must also satisfy UWM’s Cultural Diversity requirement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Math 111 and Philosophy 111 are jointly offered and count as repeats of one another. Students cannot receive credit for both courses.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

College of Letters & Science Requirements
I. English Composition Requirement

Students must satisfy the English Composition Requirement with one of the following options:

1) Completing ENGLISH 102 with a grade of C or higher; or
Atmospheric Science, BS

2) placing beyond English 102 on the English Placement Test (EPT) (or other assessment as determined by the English Department); or

3) transferring a course of at least 2.5 equivalent credits from another institution that is equivalent to English 102, or a UWM higher-level expository writing course, with a grade of C or higher.

Note: This requirement is the same as the University General Education Requirement for Oral and Written Communication Part A. The College of Letters & Science does not have a specific requirement for a writing course beyond English 102, but students must complete the university-wide requirement for Oral and Written Communication Part B listed above.

II. Mathematics and Formal Reasoning
To satisfy the Mathematics and Formal Reasoning Requirement, Bachelors of Sciences degree students must satisfy the following two requirements:

1. Complete one of the following courses or an equivalent course:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 211</td>
<td>Survey in Calculus and Analytic Geometry</td>
<td>4</td>
</tr>
<tr>
<td>MATH 213</td>
<td>Calculus with Life Sciences Applications</td>
<td>4</td>
</tr>
<tr>
<td>MATH 221</td>
<td>Honors Calculus I</td>
<td>5</td>
</tr>
<tr>
<td>MATH 231</td>
<td>Calculus and Analytic Geometry I</td>
<td>4</td>
</tr>
</tbody>
</table>

2. Complete one course (at least 3 credits) at the 200 level or above chosen from courses in Mathematics, PHILOS 211, or Letters and Science statistics courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completed in one of the following:</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>3 or more credits in any 200-level or above Math course</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AFRIC 220</td>
<td>Introduction to Statistics in African and African Diaspora Studies</td>
<td></td>
</tr>
<tr>
<td>ANTHRO 568</td>
<td>Introduction to Anthropological Statistics</td>
<td></td>
</tr>
<tr>
<td>ATM SCI 500</td>
<td>Statistical Methods in Atmospheric Sciences</td>
<td></td>
</tr>
<tr>
<td>BIO SCI 465</td>
<td>Biostatistics</td>
<td></td>
</tr>
<tr>
<td>ECON 210</td>
<td>Economic Statistics</td>
<td></td>
</tr>
<tr>
<td>GEOG 247</td>
<td>Quantitative Analysis in Geography</td>
<td></td>
</tr>
<tr>
<td>HIST 595</td>
<td>The Quantitative Analysis of Historical Data</td>
<td></td>
</tr>
<tr>
<td>MTHSTAT 215</td>
<td>Elementary Statistical Analysis</td>
<td></td>
</tr>
<tr>
<td>PHILOS 211</td>
<td>Elementary Logic</td>
<td></td>
</tr>
<tr>
<td>POL SCI 390</td>
<td>Political Data Analysis</td>
<td></td>
</tr>
<tr>
<td>POL SCI 392</td>
<td>Survey Research</td>
<td></td>
</tr>
<tr>
<td>PSYCH 210</td>
<td>Psychological Statistics</td>
<td></td>
</tr>
<tr>
<td>SOCIOL 261</td>
<td>Introduction to Statistical Thinking in Sociology</td>
<td></td>
</tr>
</tbody>
</table>

Note: This requirement is NOT the same as the University General Education Requirement for Quantitative Literacy Part B. Not all of the courses listed here will satisfy the QL-B requirement.

III. Foreign Language Requirement
Two courses (minimum of 6 credits) in a language (including American Sign Language) other than English at the 100 level or above are required. Placement testing may be used to satisfy all or part of this requirement. Language courses (including American Sign Language) other than English taken in high school may be used to satisfy all or part of this requirement. One year of high school language equates to one semester of college work.

Completion of the L&S Language Requirement also satisfies the university-wide Foreign Language GER, but not vice versa.

IV. International Requirement
See Approved Courses for the L&S International Requirement (http://catalog.uwm.edu/letters-science/approved-courses-international-requirement) for course options.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completed in one of the following ways:</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>3 or more credits in any 200-level or above Math course</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete 3 courses (min. 9 cr) in a single foreign language (not including literature-in-translation or American Sign Language) at the 3rd semester level and above</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete 3 non-language courses (min. 9 credits) with an international content chosen from at least 2 curricular areas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complete 9 credits in combination of the two options above</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

V. Breadth Requirement
Along with completing the University General Education Requirements of 3 credits in the Arts (A); 6 credits in the Humanities (HU), Social Sciences (SS), and Natural Sciences (NS/NS+); and a course with the Cultural Diversity (CD/+) designation, L&S students must complete the Breadth requirement.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completed in one of the following:</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>3 or more credits in any 200-level or above Math course</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ARTS 101</td>
<td>Art and Science Survey</td>
<td></td>
</tr>
<tr>
<td>HUM 101</td>
<td>Introduction to Humanities</td>
<td></td>
</tr>
<tr>
<td>SOC 101</td>
<td>Introduction to Sociology</td>
<td></td>
</tr>
<tr>
<td>POL SCI 490</td>
<td>Principles of Political Science</td>
<td></td>
</tr>
<tr>
<td>PSYCH 210</td>
<td>Psychological Statistics</td>
<td></td>
</tr>
</tbody>
</table>

Note: This requirement is NOT the same as the University General Education Requirement for Quantitative Literacy Part B. To complete the BS, students must take one of the L&S approved
* Students should check their course selections carefully with the list of approved L&S Breadth Courses (http://catalog.uwm.edu/letters-science/breadth-requirement-course-list). Students are advised to select at least 6 credits worth of courses in each of the Humanities, Social Science, and Natural Sciences areas that can satisfy both the campus-wide General Education Requirements and the L&S Breadth requirement.

** Students are advised to select a course that satisfies the Cultural Diversity requirement as well as a Humanities or Social Science breadth/GER requirement.

VI. The Major

The College requires that students attain at least a 2.0 GPA in all credits in the major attempted at UWM. In addition, students must attain a 2.0 GPA on all major credits attempted, including any transfer work. Individual departments or programs may require higher GPAs for graduation. Some departmental majors require courses from other departments. Contact your major department for information on whether those credits will count as part of the major GPA. The College requires that students complete in residence at UWM at least 15 credits in upper-division (numbered 300 or above) courses in their major.

Research Requirement

Within their majors, students must complete a research experience approved by the L&S faculty. A list of courses satisfying the research requirement in each major can be found here (http://catalog.uwm.edu/letters-science/approved-courses-research-requirement).

VII. The Minor

The College requires that students attain at least a 2.0 GPA in all credits in the minor attempted at UWM. In addition, students must attain a 2.0 GPA on all minor credits attempted, including any transfer work. Individual departments or programs may require higher GPAs for graduation.

Atmospheric Science (BS) Major Requirements

Preparatory Curriculum

Students in all majors in the Department of Mathematical Sciences must complete MATH 231 (or MATH 213), MATH 232, and MATH 233 (or equivalent). MATH 221 and MATH 222 are equivalent to MATH 231, MATH 232, and MATH 233. All majors must take either MATH 234 or MATH 240. Atmospheric science majors must complete additional preparatory curricula, as indicated below.

Capstone Experience

Students in all majors and major options in the Department of Mathematical Sciences must complete a "Capstone Experience." The aim of the department's capstone experience is to encourage independent learning. Students complete a research paper in the context of this course, which satisfies the L&S research requirement. For Atmospheric Science majors, the capstone is ATM SCI 599. Students must obtain consent of a professor to enroll in ATM SCI 599.

Requirements

Students must complete at least 15 upper-division (numbered 300 and above) credits in the major in residence at UWM. The College of Letters & Science requires that students attain at least a 2.0 GPA on all credits in the major attempted at UWM. In addition, students must attain a 2.0 GPA on all major credits attempted, including any transfer work. The following courses are required for the atmospheric science major:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYSICS 209 &amp; PHYSICS 214</td>
<td>Physics I (Calculus Treatment) and Lab Physics I (Calculus Treatment)</td>
<td>5</td>
</tr>
<tr>
<td>PHYSICS 210 &amp; PHYSICS 215</td>
<td>Physics II (Calculus Treatment) and Lab Physics II (Calculus Treatment)</td>
<td>5</td>
</tr>
<tr>
<td>COMPSCI 151</td>
<td>Introduction to Scientific Programming in Fortran</td>
<td>3</td>
</tr>
<tr>
<td>ATM SCI 240</td>
<td>Introduction to Meteorology</td>
<td>3</td>
</tr>
<tr>
<td>ATM SCI 330</td>
<td>Air-Pollution Meteorology</td>
<td>3</td>
</tr>
<tr>
<td>ATM SCI 350</td>
<td>Atmospheric Thermodynamics</td>
<td>3</td>
</tr>
<tr>
<td>ATM SCI 351</td>
<td>Dynamic Meteorology I</td>
<td>3</td>
</tr>
<tr>
<td>ATM SCI 352</td>
<td>Dynamic Meteorology II</td>
<td>3</td>
</tr>
<tr>
<td>ATM SCI 360</td>
<td>Synoptic Meteorology I</td>
<td>4</td>
</tr>
<tr>
<td>ATM SCI 361</td>
<td>Synoptic Meteorology II</td>
<td>4</td>
</tr>
<tr>
<td>ATM SCI 464</td>
<td>Physical Meteorology: Cloud Physics</td>
<td>3</td>
</tr>
<tr>
<td>ATM SCI 511</td>
<td>Seminar in Atmospheric Radiation and Remote Sensing</td>
<td>3</td>
</tr>
<tr>
<td>ATM SCI 599</td>
<td>Capstone Experience</td>
<td>1</td>
</tr>
<tr>
<td>MATH 320</td>
<td>Introduction to Differential Equations</td>
<td>3</td>
</tr>
</tbody>
</table>

Electives

Select at least 9 credits of the following:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATM SCI 460</td>
<td>Mesoscale Circulations</td>
</tr>
<tr>
<td>ATM SCI 470</td>
<td>Tropical Meteorology</td>
</tr>
<tr>
<td>ATM SCI 480</td>
<td>The General Circulation and Climate Dynamics</td>
</tr>
<tr>
<td>ATM SCI 497</td>
<td>Study Abroad:</td>
</tr>
<tr>
<td>ATM SCI 500</td>
<td>Statistical Methods in Atmospheric Sciences</td>
</tr>
<tr>
<td>ATM SCI 505</td>
<td>Micrometeorology</td>
</tr>
<tr>
<td>ATM SCI 690</td>
<td>Seminar in Atmospheric Sciences:</td>
</tr>
<tr>
<td>MATH 313</td>
<td>Linear Programming and Optimization</td>
</tr>
<tr>
<td>MATH 315</td>
<td>Mathematical Programming and Optimization</td>
</tr>
<tr>
<td>MATH 321</td>
<td>Vector Analysis</td>
</tr>
<tr>
<td>MATH 322</td>
<td>Introduction to Partial Differential Equations</td>
</tr>
<tr>
<td>MATH 405</td>
<td>Mathematical Models and Applications</td>
</tr>
<tr>
<td>MATH 413</td>
<td>Introduction to Numerical Analysis</td>
</tr>
<tr>
<td>MATH 415</td>
<td>Introduction to Scientific Computing</td>
</tr>
<tr>
<td>MATH 417</td>
<td>Computational Linear Algebra</td>
</tr>
<tr>
<td>MATH 521</td>
<td>Advanced Calculus I</td>
</tr>
<tr>
<td>MATH 522</td>
<td>Advanced Calculus II</td>
</tr>
<tr>
<td>MATH 535</td>
<td>Linear Algebra</td>
</tr>
<tr>
<td>MATH 571</td>
<td>Introduction to Probability Models</td>
</tr>
<tr>
<td>MATH 581</td>
<td>Introduction to the Theory of Chaotic Dynamical Systems</td>
</tr>
<tr>
<td>MATH 601</td>
<td>Advanced Engineering Mathematics I</td>
</tr>
<tr>
<td>MATH 602</td>
<td>Advanced Engineering Mathematics II</td>
</tr>
<tr>
<td>MATH 615</td>
<td>Numerical Solution of Partial Differential Equations</td>
</tr>
<tr>
<td>MATH 617</td>
<td>Optimization</td>
</tr>
</tbody>
</table>
In addition to the preparatory curriculum required of all mathematical sciences majors, these courses are required, but do not count in calculating the major GPA.

### Atmospheric Science Advising

Students considering a major in Atmospheric Science need to contact the Atmospheric Science Program Chair (https://uwm.edu/math/people/evans-clark) to declare their major and be assigned a faculty advisor. All courses selected for the major must be approved by the advisor, and students should check regularly (at least once per semester) with their faculty advisor to plan their courses of study in a coherent and timely fashion.

### Letters & Science Advising

The College of Letters and Science provides general academic advising for all students with a major in the College, particularly as it relates to campus' general education requirements and the College's degree requirements. We also provide specialized advising for pre-professional students (pre-med, pre-dental, pre-pharmacy, etc.) regardless if their major is in Letters and Science or not. Prospective students, including high school students and students seeking to transfer to a program in Letters and Science may also receive advising from our admissions counselors.

Upon admission, students are assigned an advisor in the College advising office. Academic advising is available Monday through Friday from 8:30 a.m. to 4:30 p.m. by appointment. Appointments outside of these times may be available and phone appointments are available for online students. The advising office (https://uwm.edu/letters-science/advising/contact-advising) is located on the first floor of Holton Hall. Current students should call (414) 229-4654 to schedule an appointment or use the Student Success Collaborative website (https://uwmilwaukee.campus.eab.com) to make an appointment with your assigned advisor; online scheduling is only available if you already have a Letters & Science advisor assigned to you. Prospective students should call (414) 229-7711 or email let-sci@uwm.edu.

When students declare a major, they will receive an additional faculty advisor located within the major department who will assist with requirements for that major. Students should read the "Declaration of Major" information on the website of the major that they are interested in. In some cases, the student will need to choose a faculty advisor as part of the declaration process.

All students are cautioned to consult their Letters & Science academic advisor AND their major advisor prior to each registration period to ensure they understand all requirements. Do not rely on pre-printed sample plans, as they are intended to be samples only and may not be right for your particular situation.

### Honors in the Major

Students in Atmospheric Sciences who meet all of the following criteria can be awarded honors in the major upon graduation:

1. A 3.000 cumulative GPA in all UWM graded credits;
2. A 3.500 GPA over all UWM courses counting toward the Atmospheric Sciences major;
3. A 3.500 GPA over all upper-division UWM courses counting toward the Atmospheric Sciences major; and
4. Successful completion of at least two semesters of research and/or internship experiences. The research and internship experiences can include one or more of the Capstone Experience (ATM SCI 599), a directed independent study for credit (ATM SCI 699), an internship for credit (ATM SCI 695), the Atmospheric Sciences Study Abroad course (ATM SCI 297/ATM SCI 497), undergraduate research for compensation, and participation in the Innovative Weather program at the staff level. The staff level of Innovative Weather is the third level of participation, coming after a pre-internship (several weeks in one semester) and an internship (one semester at 5-10 hours per week). Staff positions are paid, and staff members typically work around 10 hours per week during the fall or spring semesters, more in the summer session.

Students who believe they may qualify for honors in Atmospheric Sciences should apply to the Mathematical Sciences Department during their last semester of study.

### Honors in the College of Letters and Science

#### Dean's Honor List

GPA of 3.750 or above, earned on a full-time student’s GPA on 12 or more graded credits in a given semester.

#### Honors Degree and Honors Degree with Thesis

Granted to graduating seniors who complete Honors College requirements, as listed in the Honors College (http://catalog.uwm.edu/opportunities-resources/honors-college) section of this site.

#### Commencement Honors

Students with a cumulative GPA of 3.500 or above, based on a minimum of 40 graded UWM credits earned prior to the final semester, will receive all-university commencement honors and be awarded the traditional gold cord at the December or May Honors Convocation. Please note that for honors calculation, the GPA is not rounded and is truncated at the third decimal (e.g., 3.499).

#### Final Honors

Earned on a minimum of 60 graded UWM credits: Cum Laude - 3.500 or above; Magna Cum Laude - 3.650 or above; Summa Cum Laude - 3.800 or above.

### Contact Information

Current Students contact Associate Professor Clark Evans, evans36@uwm.edu
Prospective Students contact a Letters & Science Admissions Counselor at (414) 229-7711 or let-sci@uwm.edu

http://uwm.edu/atmospheric-science/undergraduate/