

METEOROLOGY

Overview

Offered by the Department of Geological and Atmospheric Sciences.
(<https://ge-at.iastate.edu/>)

The Bachelor of Science Major in Meteorology: The study of meteorology involves the description of the earth's atmosphere and the processes responsible for its behavior. Students majoring in Meteorology earn a bachelor of science. The major satisfies guidelines specified by the American Meteorological Society and meets education requirements for employment with the National Weather Service and the World Meteorological Organization. Successful preparation for professional or graduate work in Meteorology requires that the student develop and integrate a diverse range of skills and knowledge bases. These include weather observing, the physics and dynamics of the global atmosphere, application of new weather technologies, advanced mathematical tools, computer programming and modeling, and effective oral and written communication. The faculty view the senior thesis (MTEOR 499 Senior Research), in particular, as a capstone experience in which students demonstrate they have achieved this integration. Also, contemporary meteorology is an earth-system science with ties to a variety of human experiences. The electives and general education requirements of the college are further experiences that the meteorology student must integrate with their core meteorology knowledge in order to function effectively in a globally-oriented profession.

Meteorology as an Additional Major: The Meteorology program allows students in academic programs with affinity to meteorology to complete an additional major in meteorology through an accelerated pathway. Students earning a BS degree in electrical or aerospace engineering who complete the designated Meteorology coursework of at least 25 credit hours can earn an additional major in Meteorology. Students should work closely with their advisors in each department to ensure that all requirements are met. Please review the information on the department website or contact the current program head for more information and sample four-year plans to earn an additional major in Meteorology.

Student Learning Outcomes

Upon graduation, students should be able to:

- Demonstrate the ability to think critically;
- Exhibit a broad understanding of atmospheric systems and processes;
- Demonstrate scientific literacy and its application to scientific inquiry and societal concerns;
- Demonstrate proficiency in data collection, management, and analysis including understanding sources of error and/or uncertainty;
- Read and critically evaluate relevant literature and information;

- Use appropriate tools from chemistry, physics, biology, mathematics, and data science to solve discipline-specific problems;
- Present information effectively in written and oral forms;
- Work in a team environment in alignment with the ISU principles of community;
- Work independently;
- Attain employment in meteorology, atmospheric science or related fields, or pursue graduate studies.

Degree Requirements

The program requires the following courses:

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| MTEOR 111 | Synoptic Applications | 1 |
| MTEOR 201 | Introductory Seminar | R |
| MTEOR 206 | Introduction to Weather and Climate | 3 |
| MTEOR 227 | Computational Meteorology I | 3 |
| MTEOR 301 | General Meteorology | 4 |
| MTEOR 311 | Introduction to Synoptic Meteorology | 2 |
| MTEOR 341 | Atmospheric Physics I | 3 |
| MTEOR 342 | Atmospheric Physics II | 3 |
| MTEOR 399 | Writing for Research | 2 |
| MTEOR 411 | Synoptic Meteorology | 3 |
| MTEOR 417 | Mesoscale Forecasting Laboratory | 3 |
| MTEOR 432 | Instrumentation and Measurements | 3 |
| MTEOR 443 | Dynamic Meteorology I | 3 |
| MTEOR 454 | Dynamic Meteorology II | 3 |
| MTEOR 499 | Senior Research | 2 |
| Total Credits | | 38 |

An additional 9 credits must be chosen from:

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|------------|---------------------------------------|-----|
| MTEOR 402 | Watershed Hydrology | 3 |
| MTEOR 404 | Global Change | 3 |
| MTEOR 405 | Soil-Plant-Animal-Atmosphere Physics | 3 |
| MTEOR 406 | World Climates | 3 |
| MTEOR 407 | Mesoscale Meteorology | 3 |
| MTEOR 416 | Hydrologic Modeling and Analysis | 3 |
| MTEOR 435 | Radar Applications in Meteorology | 3 |
| MTEOR 440 | Tropical Meteorology | 3 |
| MTEOR 452 | Climate Modeling | 3 |
| MTEOR 489 | Survey of Remote Sensing Technologies | 3 |
| MTEOR 489L | Satellite Remote Sensing Laboratory | 1 |
| MTEOR 490 | Independent Study | 1-3 |
| GEOL 415 | Paleoclimatology | 3 |

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| GEOL 452 | Intro GIS for Geoscientists | 3 |
| C E 372 | Engineering Hydrology and Hydraulics | 3 |

Supporting work is required in areas at least equivalent to:

One of the following sequences 5

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| CHEM 163 & 163L | College Chemistry and Laboratory in College Chemistry | |
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Or

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| CHEM 177 & 177L | General Chemistry I and Laboratory in General Chemistry I | |
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| PHYS 231 & 231L | Introduction to Classical Physics I and Introduction to Classical Physics I Laboratory | 5 |
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| PHYS 232 | Introduction to Classical Physics II | 4 |
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| MATH 165 | Calculus I | 4 |
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| MATH 166 | Calculus II | 4 |
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| MATH 265 | Calculus III | 4 |
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| MATH 266 | Elementary Differential Equations | 3 |
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| STAT 305 | Engineering Statistics | 3 |
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|-----------|---------------------------------|---|
| SP CM 212 | Fundamentals of Public Speaking | 3 |
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Total Credits 35

A grade of C or better (not C-) is required in each of the following courses to meet minimum graduation requirements for a bachelor of science degree in Meteorology:

| | | |
|-----------|-------------------------------------|---|
| MTEOR 206 | Introduction to Weather and Climate | 3 |
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| MTEOR 301 | General Meteorology | 4 |
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Several co-op programs are available for upper-division undergraduates. Although a range of opportunities exists for men and women who terminate their studies with a bachelor of science, students who meet the necessary academic standards are encouraged to continue their studies in a graduate program. For these students, additional coursework is recommended in mathematics or physical science. Other students can choose a wide range of supporting courses that will contribute to their particular area of interest in meteorology.

Communication Proficiency requirement: According to the university-wide Communication Proficiency Grade Requirement, students must demonstrate their communication proficiency by earning a grade of C or better in ENGL 250.

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| ENGL 150 | Critical Thinking and Communication | 3 |
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| ENGL 250 | Written, Oral, Visual, and Electronic Composition | 3 |
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or ENGL 250H Written, Oral, Visual, and Electronic Composition: Honors

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| MTEOR 399 | Writing for Research | 2 |
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| MTEOR 499 | Senior Research | 2 |
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As majors in the College of Liberal Arts and Sciences, Climate Science students must meet College of Liberal Arts and Sciences (<http://catalog.iastate.edu/previouscatalogs/2023-2024/collegeofliberalartsandsciences/#lascollegerequirementstext>) and University-wide requirements (<http://catalog.iastate.edu/previouscatalogs/2023-2024/collegescurricula/>) for graduation in addition to those stated above for the major.

Liberal Arts and Sciences (LAS) majors require a minimum of 120 credits, **including a minimum of 45 credits at the 300/400 level**. You must also complete the Communication Proficiency, LAS world language requirements, and LAS career proficiency requirement. Six semesters of one foreign language in high school satisfies the World Language requirement.

Students in all ISU majors must complete a 3-credit course in U.S. diversity and a 3-credit course in international perspectives. Discuss with your advisor how the two courses that you select can be applied to address general education requirements. Check for a list of approved courses at: <http://www.registrar.iastate.edu/courses/div-ip-guide.html>.

Four Year Plans

These plans are examples only; students should discuss their graduation plans with their advisor.

Path 1 for students prepared to start in calculus

Freshman

| Fall | Credits Spring | Credits |
|--------------------------------|------------------------------------|-----------|
| MTEOR 111 | 1 MTEOR 113 | 1 |
| MTEOR 112 | 1 MTEOR 206 | 3 |
| MATH 165 | 4 MATH 166 | 4 |
| CHEM 163 or 177 ¹ | 4 PHYS 231 | 4 |
| CHEM 163L or 177L ¹ | 1 PHYS 231L | 1 |
| ENGL 150 | 3 Humanities/Social Science Choice | 3 |
| LIB 160 | 1 | |
| | 15 | 16 |

Sophomore

| Fall | Credits Spring | Credits |
|-----------|----------------|---------|
| MTEOR 201 | R MTEOR 301 | 4 |
| MTEOR 227 | 3 MATH 266 | 3 |
| ENGL 250 | 3 SP CM 212 | 3 |
| MATH 265 | 4 STAT 305 | 3 |

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|-----------|---------------------------------------|-----------|
| PHYS 232 | 4 Humanities/Social Science Choice | 3 |
| | LAS 203 | 1 |
| 14 | | 17 |

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| Junior | | |
| Fall | Credits Spring | Credits |
| MTEOR 311 | 2 MTEOR 342 | 3 |
| MTEOR 341 | 3 MTEOR 399 | 2 |
| MTEOR 443 | 3 MTEOR 454 | 3 |
| World Language/Elective | 3-4 World Language/Elective | 3-4 |
| Humanities/Social Science Choice | 3 Humanities/Social Science Choice | 3 |
| | Humanities/Social Science Choice | 3 |
| 14-15 | | 17-18 |

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|---|---|----------------|
| Senior | | |
| Fall | Credits Spring | Credits |
| MTEOR 411 | 3 MTEOR 417 | 3 |
| MTEOR 499 | 2 MTEOR 432 | 3 |
| Meteorology Elective/ elective Choice ^{2,3} | 3 Meteorology Elective/ Elective Choice ^{2,3} | 1-3 |
| Meteorology Elective/ Elective choice ^{2,3} | 3 Meteorology Elective/ Elective Choice ^{2,3} | 3 |
| Humanities/Social Science Choice | 3 Humanities/Social Science Choice | 3 |
| 14 | | 13-15 |

Total Credits: 120-124

- ¹ Students taking CHEM 177 should plan to take CHEM 178 as well.
- ² Students must select at least 9 credits from a list of optional courses.
- ³ Students should select a humanities or social science course based on need. If these LAS requirements have been satisfied, students may select a meteorology elective or alternate course. Students should discuss possible alternate course options with their advisor.

Path 2 for students needing preparatory mathematics

Freshman

| | | |
|-------------|---------------------------------------|----------------|
| Fall | Credits Spring | Credits |
| MTEOR 112 | 1 MTEOR 113 | 1 |
| MATH 143 | 4 MATH 165 | 4 |
| ENGL 150 | 3 MTEOR 206 | 3 |
| CHEM 163 | 4 SP CM 212 | 3 |
| CHEM 163L | 1 Humanities/Social Science Choice | 3 |

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|-----------|---------------------------------------|-----------|
| LIB 160 | 1 Humanities/Social Science Choice | 3 |
| 14 | | 17 |

Sophomore

| | | |
|-------------|-----------------------|----------------|
| Fall | Credits Spring | Credits |
| MTEOR 111 | 1 MATH 265 | 4 |
| MTEOR 201 | R MTEOR 301 | 4 |
| MTEOR 227 | 3 STAT 305 | 3 |
| ENGL 250 | 3 PHYS 232 | 4 |
| MATH 166 | 4 LAS 203 | 1 |
| PHYS 231 | 4 | |
| PHYS 231L | 1 | |
| 16 | | 16 |

Junior

| | | |
|-------------------------|---|----------------|
| Fall | Credits Spring | Credits |
| MTEOR 311 | 2 MTEOR 342 | 3 |
| MTEOR 341 | 3 MTEOR 399 | 2 |
| MTEOR 443 | 3 MTEOR 454 | 3 |
| MATH 266 | 3 World Language/Elective | 3-4 |
| World Language/Elective | 3-4 Humanities/Social Science Choice | 3 |
| | Humanities/Social Science Choice | 3 |
| 14-15 | | 17-18 |

Senior

| | | |
|---|---|----------------|
| Fall | Credits Spring | Credits |
| MTEOR 411 | 3 MTEOR 417 | 3 |
| MTEOR 499 | 2 MTEOR 432 | 3 |
| Meteorology Elective/ Elective Choice ^{2,3} | 3 Meteorology Elective/ Elective Choice ^{2,3} | 3 |
| Meteorology Elective/ Elective Choice ^{2,3} | 3 Meteorology Elective/Elective Choice ^{2,3} | 0-3 |
| Humanities/Social Science Choice | 3 Humanities/Social Science Choice | 3 |
| 14 | | 12-15 |

Total Credits: 120-125

- ¹ Students taking CHEM 177 should plan to take CHEM 178 as well.
- ² Students must select at least 9 credits from a list of optional courses.
- ³ Students should select a humanities or social science course based on need. If these LAS requirements have been satisfied, students may select a meteorology elective or alternate course. Students should discuss possible alternate course options with their advisor.

Minor

The department offers a minor in Meteorology which may be earned by completing 15 credits including MTEOR 111 Synoptic Applications (only 1 credit may count toward the minor), MTEOR 206 Introduction to Weather and Climate and MTEOR 301 General Meteorology. The minor must include at least 6 credits in the courses numbered 300 or above taken at Iowa State University and must include at least 9 credits that are not used to meet any other department, college or university requirement. Further information concerning programs of study, including sample degree programs, is available from the department.

Concurrent Programs

Combined Degrees: A concurrent program is offered which combines a bachelor of science degree in meteorology and a master of science degree in meteorology. This program gives well-qualified Iowa State juniors and seniors the opportunity to begin working on the M.S. degree before completing the B.S. degree, reducing by at least one year the normal time period necessary to complete both degrees separately. Additionally, a concurrent program exists that gives students the opportunity to receive a B.S. in meteorology and an M.B.A. (master of business administration) within five years. Review the department website or contact the current program head for more information regarding these options.

Graduate Meteorology

The department offers programs leading to the master of science (M.S.) and doctor of philosophy (Ph.D.) in Meteorology. Students desiring a major in Meteorology normally will have a strong undergraduate background in the physical and mathematical sciences. Individuals desiring to enter a graduate program are evaluated by considering their undergraduate preparation and performance along with their expressed goals in the statement of purpose. Prospective students are encouraged to reach out to individual faculty members who they wish to work with prior to applying.

Programs of study are designed on an individual basis in accordance with the requirements of the Graduate College and established requirements for each departmental major. Additional coursework is normally taken in complementary areas such as aerospace engineering, agronomy (soil science), chemistry, civil and construction engineering, computer engineering, computer science, engineering mechanics, environmental science, materials engineering, mathematics, mechanical engineering, microbiology, physics, or statistics. Departmental requirements provide a strong, broad background in the major and allow considerable flexibility in the program of each individual.

A thesis is required of all M.S. candidates, and a dissertation is required of all Ph.D. candidates.

Course requirements for the M.S. degree include MTEOR 542 and MTEOR 543, along with at least four courses from the graduate Meteorology

electives (MTEOR 502, MTEOR 504, MTEOR 505, MTEOR 507, MTEOR 516, MTEOR 518, MTEOR 535, MTEOR 540, MTEOR 552, MTEOR 568, MTEOR 589, or MTEOR 605) or from outside the department according to the students' professional goals and interests, in consultation with their advisor and POS committee. Students without prior synoptic meteorology course work must complete MTEOR 511 and may substitute these credits in place of other elective courses.

Graduates in Meteorology have a good comprehension of basic principles, a capacity for critical and independent thought, and an ability to communicate effectively with scientific colleagues. They have an appropriate breadth in their understanding of meteorology with a suitable specialization. Graduates are able to undertake thorough research and explain the results in a scientifically reasonable fashion.