

# 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 4990 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 B.S. 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:

|                      |                                      |           |
|----------------------|--------------------------------------|-----------|
| MTEOR 1110           | Synoptic Applications                | 1         |
| MTEOR 2010           | Introductory Seminar                 |           |
| MTEOR 2060           | Introduction to Weather and Climate  | 3         |
| MTEOR 2270           | Computational Meteorology I          | 3         |
| MTEOR 3010           | General Meteorology                  | 4         |
| MTEOR 3110           | Introduction to Synoptic Meteorology | 2         |
| MTEOR 3410           | Atmospheric Physics I                | 3         |
| MTEOR 3420           | Atmospheric Physics II               | 3         |
| MTEOR 3990           | Writing for Research                 | 2         |
| MTEOR 4110           | Synoptic Meteorology                 | 3         |
| MTEOR 4170           | Mesoscale Forecasting Laboratory     | 3         |
| MTEOR 4320           | Instrumentation and Measurements     | 3         |
| MTEOR 4430           | Dynamic Meteorology I                | 3         |
| MTEOR 4540           | Dynamic Meteorology II               | 3         |
| MTEOR 4990           | Senior Research                      | 2         |
| <b>Total Credits</b> |                                      | <b>38</b> |

An additional 9 credits must be chosen from:

|             |                                       |     |
|-------------|---------------------------------------|-----|
| NREM 4020   | Watershed Hydrology                   | 3   |
| MTEOR 4040  | Global Change                         | 3   |
| MTEOR 4050  | Soil-Plant-Animal-Atmosphere Physics  | 3   |
| MTEOR 4060  | World Climates                        | 3   |
| MTEOR 4070  | Mesoscale Meteorology                 | 3   |
| MTEOR 4160  | Hydrologic Modeling and Analysis      | 3   |
| MTEOR 4350  | Radar Applications in Meteorology     | 3   |
| MTEOR 4400  | Tropical Meteorology                  | 3   |
| MTEOR 4520  | Climate Modeling                      | 3   |
| MTEOR 4890  | Survey of Remote Sensing Technologies | 3   |
| MTEOR 4890L | Satellite Remote Sensing Laboratory   | 1   |
| MTEOR 4900  | Independent Study                     | 1-3 |
| GEOL 4150   | Paleoclimatology                      | 3   |

|           |                                      |   |
|-----------|--------------------------------------|---|
| GEOL 4520 | Intro GIS for Geoscientists          | 3 |
| CE 3720   | Engineering Hydrology and Hydraulics | 3 |

Supporting work is required in areas at least equivalent to:

One of the following sequences 5

|                   |                                                       |  |
|-------------------|-------------------------------------------------------|--|
| CHEM 1630 & 1630L | College Chemistry and Laboratory in College Chemistry |  |
|-------------------|-------------------------------------------------------|--|

Or

|                   |                                                           |  |
|-------------------|-----------------------------------------------------------|--|
| CHEM 1770 & 1770L | General Chemistry I and Laboratory in General Chemistry I |  |
|-------------------|-----------------------------------------------------------|--|

|                   |                                                                                        |   |
|-------------------|----------------------------------------------------------------------------------------|---|
| PHYS 2310 & 2310L | Introduction to Classical Physics I and Introduction to Classical Physics I Laboratory | 5 |
|-------------------|----------------------------------------------------------------------------------------|---|

|           |                                      |   |
|-----------|--------------------------------------|---|
| PHYS 2320 | Introduction to Classical Physics II | 4 |
|-----------|--------------------------------------|---|

|           |            |   |
|-----------|------------|---|
| MATH 1650 | Calculus I | 4 |
|-----------|------------|---|

|           |             |   |
|-----------|-------------|---|
| MATH 1660 | Calculus II | 4 |
|-----------|-------------|---|

|           |              |   |
|-----------|--------------|---|
| MATH 2650 | Calculus III | 4 |
|-----------|--------------|---|

|           |                                   |   |
|-----------|-----------------------------------|---|
| MATH 2660 | Elementary Differential Equations | 3 |
|-----------|-----------------------------------|---|

|           |                        |   |
|-----------|------------------------|---|
| STAT 3050 | Engineering Statistics | 3 |
|-----------|------------------------|---|

|           |                                 |   |
|-----------|---------------------------------|---|
| SPCM 2120 | Fundamentals of Public Speaking | 3 |
|-----------|---------------------------------|---|

**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 2060 | Introduction to Weather and Climate | 3 |
| MTEOR 3010 | General Meteorology                 | 4 |

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 (<http://catalog.iastate.edu/academics/#communicationproficiencytext>), students must demonstrate their communication proficiency by earning a grad of C or better in ENGL 2500.

|           |                                     |   |
|-----------|-------------------------------------|---|
| ENGL 1500 | Critical Thinking and Communication | 3 |
|-----------|-------------------------------------|---|

|           |                                                                         |   |
|-----------|-------------------------------------------------------------------------|---|
| ENGL 2500 | Written, Oral, Visual, and Electronic Composition                       | 3 |
|           | or ENGL 2500H Written, Oral, Visual, and Electronic Composition: Honors |   |

|            |                      |   |
|------------|----------------------|---|
| MTEOR 3990 | Writing for Research | 2 |
|------------|----------------------|---|

|            |                 |   |
|------------|-----------------|---|
| MTEOR 4990 | Senior Research | 2 |
|------------|-----------------|---|

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/collegeofliberalartsandsciences/#lascollegerequirementstext>) and University-wide requirements (<http://catalog.iastate.edu/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 3000/4000 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 1110                       | 1 MTEOR 1130                       | 1         |
| MTEOR 1120                       | 1 MTEOR 2060                       | 3         |
| MATH 1650                        | 4 MATH 1660                        | 4         |
| CHEM 1630 or 1770 <sup>1</sup>   | 4 PHYS 2310                        | 4         |
| CHEM 1630L or 1770L <sup>1</sup> | 1 PHYS 2310L                       | 1         |
| ENGL 1500                        | 3 Humanities/Social Science Choice | 3         |
| LIB 1600                         | 1                                  |           |
|                                  | <b>15</b>                          | <b>16</b> |

#### Sophomore

| Fall       | Credits Spring                     | Credits |
|------------|------------------------------------|---------|
| MTEOR 2010 | R MTEOR 3010                       | 4       |
| MTEOR 2270 | 3 MATH 2660                        | 3       |
| ENGL 2500  | 3 SPCM 2120                        | 3       |
| MATH 2650  | 4 STAT 3050                        | 3       |
| PHYS 2320  | 4 Humanities/Social Science Choice | 3       |

|           |           |
|-----------|-----------|
| LAS 2030  | 1         |
| <b>14</b> | <b>17</b> |

| <b>Junior</b>                    |                                    |                |
|----------------------------------|------------------------------------|----------------|
| <b>Fall</b>                      | <b>Credits Spring</b>              | <b>Credits</b> |
| MTEOR 3110                       | 2 MTEOR 3420                       | 3              |
| MTEOR 3410                       | 3 MTEOR 3990                       | 2              |
| MTEOR 4430                       | 3 MTEOR 4540                       | 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              |
| <b>14-15</b>                     |                                    | <b>17-18</b>   |

| <b>Senior</b>                                       |                                                       |                |
|-----------------------------------------------------|-------------------------------------------------------|----------------|
| <b>Fall</b>                                         | <b>Credits Spring</b>                                 | <b>Credits</b> |
| MTEOR 4110                                          | 3 MTEOR 4170                                          | 3              |
| MTEOR 4990                                          | 2 MTEOR 4320                                          | 3              |
| Meteorology Elective/elective Choice <sup>2,3</sup> | 3 Meteorology Elective/Elective Choice <sup>2,3</sup> | 1-3            |
| Meteorology Elective/Elective choice <sup>2,3</sup> | 3 Meteorology Elective/Elective Choice <sup>2,3</sup> | 3              |
| Humanities/Social Science Choice                    | 3 Humanities/Social Science Choice                    | 3              |
| <b>14</b>                                           |                                                       | <b>13-15</b>   |

**Total Credits: 120-124**

- <sup>1</sup> Students taking CHEM 1770 should plan to take CHEM 1780 as well.
- <sup>2</sup> Students must select at least 9 credits from a list of optional courses.
- <sup>3</sup> 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

| <b>Fall</b> | <b>Credits Spring</b>              | <b>Credits</b> |
|-------------|------------------------------------|----------------|
| MTEOR 1120  | 1 MTEOR 1130                       | 1              |
| MATH 1430   | 4 MATH 1650                        | 4              |
| ENGL 1500   | 3 MTEOR 2060                       | 3              |
| CHEM 1630   | 4 SPCM 2120                        | 3              |
| CHEM 1630L  | 1 Humanities/Social Science Choice | 3              |

|           |                                    |           |
|-----------|------------------------------------|-----------|
| LIB 1600  | 1 Humanities/Social Science Choice | 3         |
| <b>14</b> |                                    | <b>17</b> |

| <b>Sophomore</b> |                       |                |
|------------------|-----------------------|----------------|
| <b>Fall</b>      | <b>Credits Spring</b> | <b>Credits</b> |
| MTEOR 1110       | 1 MATH 2650           | 4              |
| MTEOR 2010       | R MTEOR 3010          | 4              |
| MTEOR 2270       | 3 STAT 3050           | 3              |
| ENGL 2500        | 3 PHYS 2320           | 4              |
| MATH 1660        | 4 LAS 2030            | 1              |
| PHYS 2310        | 4                     |                |
| PHYS 2310L       | 1                     |                |
| <b>16</b>        |                       | <b>16</b>      |

| <b>Junior</b>           |                                      |                |
|-------------------------|--------------------------------------|----------------|
| <b>Fall</b>             | <b>Credits Spring</b>                | <b>Credits</b> |
| MTEOR 3110              | 2 MTEOR 3420                         | 3              |
| MTEOR 3410              | 3 MTEOR 3990                         | 2              |
| MTEOR 4430              | 3 MTEOR 4540                         | 3              |
| MATH 2660               | 3 World Language/Elective            | 3-4            |
| World Language/Elective | 3-4 Humanities/Social Science Choice | 3              |
|                         | Humanities/Social Science Choice     | 3              |
| <b>14-15</b>            |                                      | <b>17-18</b>   |

| <b>Senior</b>                                       |                                                       |                |
|-----------------------------------------------------|-------------------------------------------------------|----------------|
| <b>Fall</b>                                         | <b>Credits Spring</b>                                 | <b>Credits</b> |
| MTEOR 4110                                          | 3 MTEOR 4170                                          | 3              |
| MTEOR 4990                                          | 2 MTEOR 4320                                          | 3              |
| Meteorology Elective/Elective Choice <sup>2,3</sup> | 3 Meteorology Elective/Elective Choice <sup>2,3</sup> | 3              |
| Meteorology Elective/Elective Choice <sup>2,3</sup> | 3 Meteorology Elective/Elective Choice <sup>2,3</sup> | 0-3            |
| Humanities/Social Science Choice                    | 3 Humanities/Social Science Choice                    | 3              |
| <b>14</b>                                           |                                                       | <b>12-15</b>   |

**Total Credits: 120-125**

- <sup>1</sup> Students taking CHEM 1770 should plan to take CHEM 1780 as well.
- <sup>2</sup> Students must select at least 9 credits from a list of optional courses.
- <sup>3</sup> 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 1110 Synoptic Applications (only 1 credit may count toward the minor), MTEOR 2060 Introduction to Weather and Climate and MTEOR 3010 General Meteorology. The minor must include at least 6 credits in the courses numbered 3000 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 5420 and MTEOR 5430, along with at least four courses from the graduate Meteorology

electives (MTEOR 5020, MTEOR 5040, MTEOR 5050, MTEOR 5070, MTEOR 5160, MTEOR 5180, MTEOR 5350, MTEOR 5400, MTEOR 5520, MTEOR 5680, MTEOR 5890, or MTEOR 6050) 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 5110 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.