

METEOROLOGY

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 the 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 a Secondary Major: The Meteorology program allows students in academic programs with affinity to meteorology to complete a secondary 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 a secondary major in Meteorology. Students should work closely with their advisors in each department to ensure that all requirements are met. Please review information on the department website or contact the current program head for more information and sample four year plans to earn a secondary major in Meteorology.

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.

Minor - Meteorology

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.

The program requires the following courses:

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 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		36

An additional 9 credits must be chosen from:

MTEOR 402	Watershed Hydrology	3
MTEOR 404	Global Change	3
MTEOR 405	Environmental Biophysics	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

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

Supporting work is required in areas at least equivalent to:

One of the following sequences 5

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

CHEM 177 & 177L	General Chemistry I and Laboratory in General Chemistry I	
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PHYS 221	Introduction to Classical Physics I	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.

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 399X	Writing for Research	1
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MTEOR 499	Senior Research	2
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Path 1 for students preparing 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 221	5
CHEM 163L or 177L ¹	1 Humanities/Social Science Choice	3
ENGL 150	3	
LIB 160	1	
PSYCH 131	1	
	16	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
PHYS 232	4 Humanities/Social Science Choice	3
	14	16

Junior

Fall	Credits Spring	Credits
MTEOR 311	2 MTEOR 342	3
MTEOR 341	3 MTEOR 399X	1
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	16-17

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}	3

Humanities/Social Science Choice	3 Humanities/Social Science Choice	3
14		15

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 and LAS World Language Requirements. 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>

- ¹ Students taking CHEM 177 should plan to take CHEM 178 as well.
- ² Students must select at least 12 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
LIB 160	1 Humanities/Social Science Choice	3
PSYCH 131	1	
15		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	
PHYS 221	5	
16		15

Junior		
Fall	Credits Spring	Credits
MTEOR 311	2 MTEOR 342	3
MTEOR 341	3 MTEOR 399X	1
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		16-17

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}	3
Humanities/Social Science Choice	3 Humanities/Social Science Choice	3
14		15

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 and LAS World Language Requirements. 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>

- ¹ Students taking CHEM 177 should plan to take CHEM 178 as well.
- ² Students must select at least 12 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.

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 543, along with at least four courses from the graduate Meteorology electives (502, 504, 505, 507, 516, 518, 535, 540, 552, 568, 589, or 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.

Courses primarily for undergraduates:

MTEOR 107: Severe and Hazardous Weather

(2-0) Cr. 1. F.

Understanding of atmospheric processes that play a role in creating severe and hazardous weather. Focus on thunderstorms, tornadoes, hurricanes, floods, blizzards, ice storms, and temperature extremes. Impacts on lives and property.

MTEOR 111: Synoptic Applications

(1-0) Cr. 1. Repeatable. F.

Prereq: Credit or enrollment in MATH 165

Current weather discussions and introduction to synoptic-scale interpretation of meteorology. Application and use of calculus in meteorology. Course restricted to majors. Others with permission of instructor.

MTEOR 112: Geoscience Orientation

(Cross-listed with GEOL). (1-0) Cr. 1. F.

Orientation course for students enrolled in the Earth, Wind and Fire Learning Community. Provides an introduction to Iowa State University and meteorology, geology, and Earth science programs for students enrolled in the department's learning community. Activities include academic and social activities, talks and presentations on academic success, resume writing, and study abroad, as well as research talks by faculty members.

MTEOR 113: Spring Geoscience Orientation for Earth, Wind and Fire Learning Community

(Cross-listed with GEOL). (1-0) Cr. 1. S.

Spring orientation course for students enrolled in the "Earth, Wind and Fire" Learning Community. Develop and apply quantitative, data-analysis, management, and communication skills on an authentic research project in a team to focus on professionalism and resilience. Introduction to interview strategies and the importance of creating a professional image on social media. Academic and social events, plus two field trips.

MTEOR 140: Climate and Society

(Cross-listed with AGRON, ENV S, GEOL). Cr. 3. F.S.

The climate system of our planet. How nature and our actions alter the existing energy balance leading to climate change. Past climates on our planet. The influence of climate on society and resource availability during the Holocene (~ 11,000 years ago to present) with focus on changes post industrial revolution. Significant climate events that have altered our way of life in the past. Projected changes in future climate and potential impacts on society, environment and resources. Adaption to and mitigation of climate change.

MTEOR 160: Water Resources of the World

(Cross-listed with AGRON, ENV S, GEOL). (3-0) Cr. 3. S.

Study of the occurrence, history, development, and management of world water resources. Basic hydrologic principles including climate, surface water, groundwater, and water quality. Historical and current perspectives on water policy, use, and the role of water in society and the environment. Meets International Perspectives Requirement.

MTEOR 201: Introductory Seminar

Cr. R. F.

Prereq: Credit or enrollment in PHYS 221

An overview of the atmospheric sciences, the meteorology program at Iowa State, and the major research journals used in the discipline.

MTEOR 206: Introduction to Weather and Climate

(Cross-listed with AGRON). (3-0) Cr. 3. F.S.

Basic concepts in weather and climate, including atmospheric measurements, radiation, stability, precipitation, winds, fronts, forecasting, and severe weather. Applied topics include global warming, ozone depletion, world climates and weather safety.

MTEOR 227: Computational Meteorology I

(3-1) Cr. 3. F.

Prereq: Credit or concurrent enrollment in MTEOR 206, credit or concurrent enrollment in PHYS 221

An introduction to computer programming using FORTRAN with focus on meteorological applications. Emphasis on basics of good programming techniques and style through extensive practice in top-down design, writing, running, and debugging small programs. Topics include operations and functions, selective execution, repetitive execution, arrays, input/output, file processing, and subprograms. This course is designed for majors.

MTEOR 265: Scientific Balloon Engineering and Operations

(Cross-listed with AER E). (0-2) Cr. 1. F.

Engineering aspects of scientific balloon flights. Integration of science mission objectives with engineering requirements. Operations team certification. FAA and FCC regulations, communications, and command systems. Flight path prediction and control.

MTEOR 290: Independent Study

Cr. 1-4. Repeatable.

Prereq: Permission of instructor

Independent study for freshman and sophomore students.

MTEOR 298: Cooperative Education

Cr. R. Repeatable. F.S.SS.

Prereq: Permission of the department cooperative education coordinator; sophomore classification

Required of all cooperative education students. Students must register for this course prior to commencing the work period.

MTEOR 301: General Meteorology

(4-0) Cr. 4. S.

Prereq: MATH 166, credit or enrollment in PHYS 232

Global distribution of temperature, wind, and atmospheric constituents; atmospheric thermodynamics, radiative transfer, global energy balance, storms and clouds, introductory dynamics.

MTEOR 311: Introduction to Synoptic Meteorology

(1-2) Cr. 2. F.

Prereq: MTEOR 301

Concepts of weather map plotting and analysis. Introduction to forecasting and to the use of real-time UNIDATA computer products.

MTEOR 321: Meteorology Internship

Cr. 1-2. Repeatable, maximum of 3 credits. F.S.SS.

Prereq: MTEOR 311; junior or senior standing; permission of co-op program coordinator; acceptance by sponsoring agency

Supervised practical experience in a professional meteorological agency. Experiences may include providing weather information for radio, TV, utilities, government agencies, construction, or agribusiness.

MTEOR 324: Energy and the Environment

(Cross-listed with ENSCI, ENV S, GEOL). (3-0) Cr. 3. S.

Prereq: CHEM 163 or CHEM 177, MATH 140

Exploration of the origin of Earth's energy resources and the environmental and climatic impacts of energy acquisition and consumption. Renewable and non-renewable energy resources within an Earth-system context. Various environmentally-relevant topics such as water quality and availability, habitat destruction, greenhouse-gas emissions, and health and safety hazards to wildlife and human communities.

MTEOR 341: Atmospheric Physics I

(3-0) Cr. 3. F.

Prereq: PHYS 232, credit or enrollment in MATH 266, MTEOR 301.

Basic laws of thermodynamics, thermodynamics of water vapor, mixtures of gases, stability, hydrostatics, cloud physics.

MTEOR 342: Atmospheric Physics II

(3-0) Cr. 3. S.

Prereq: MTEOR 341

Precipitation physics, radar, atmospheric radiation, atmospheric optics, atmospheric electricity.

MTEOR 398: Cooperative Education

Cr. R. Repeatable. F.S.SS.

Prereq: Permission of the department cooperative education coordinator; junior classification

Required of all cooperative education students. Students must register for this course prior to commencing the work period.

MTEOR 402: Watershed Hydrology

(Dual-listed with MTEOR 502). (Cross-listed with ENSCI, GEOL, NREM). (2-3) Cr. 3. F.

Prereq: Four courses in physical or biological sciences or engineering; junior standing

Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes.

MTEOR 404: Global Change

(Dual-listed with MTEOR 504). (Cross-listed with AGRON, ENSCI, ENV S). (3-0) Cr. 3. F.S.

Prereq: Four courses in physical or biological sciences or engineering; junior standing

Recent changes in global biogeochemical cycles and climate; models of future changes in the climate system; impacts of global change on agriculture, water resources and human health; ethical issues of global environmental change.

MTEOR 405: Environmental Biophysics

(Dual-listed with MTEOR 505). (Cross-listed with AGRON, ENSCI). (3-0) Cr. 3. Alt. S., offered odd-numbered years.

Prereq: MATH 165 and some exposure to computer programming (any language)

The movement of energy and mass among the soil, vegetation, and atmosphere. The heat and water budget of humans, other animals, plants, and plant communities. Relevance to weather and climate, the effect of climate change on organisms, and remote sensing.

MTEOR 406: World Climates

(Cross-listed with AGRON, ENSCI). (3-0) Cr. 3. S.

Prereq: AGRON 206/MTEOR 206

Distribution and causes of different climates around the world. Effects of climate and climate variations on human activities including society, economy and agriculture. Current issues such as climate change and international efforts to assess and mitigate the consequences of a changing climate. Semester project and in-class presentation required. Meets International Perspectives Requirement.

MTEOR 407: Mesoscale Meteorology

(Dual-listed with MTEOR 507). (Cross-listed with AGRON). (3-0) Cr. 3. Alt. S., offered even-numbered years.

Prereq: Math 166 and Mteor 443

Physical nature and practical consequences of mesoscale atmospheric phenomena. Mesoscale convective systems, fronts, terrain-forced circulations. Observation, analysis, and prediction of mesoscale atmospheric structure.

MTEOR 411: Synoptic Meteorology

(Dual-listed with MTEOR 511). (1-4) Cr. 3. F.

Prereq: MTEOR 311, Credit or enrollment in MTEOR 454

Current weather forecasting and discussion. Applications of atmospheric physics and dynamics in real-time weather situations. Use of UNIDATA computer products.

MTEOR 416: Hydrologic Modeling and Analysis

(Dual-listed with MTEOR 516). (Cross-listed with ENSCI, GEOL). (2-3) Cr. 3. Alt. S., offered odd-numbered years.

Prereq: Four courses in Earth science, meteorology, or engineering; junior standing

Study of the basic principles of hydrologic modeling, including rainfall-runoff analysis, lumped and distributed modeling, conceptual and physical models, parameter estimation and sensitivity analysis, input and validation data, uncertainty analysis, and the use of models in surface water hydrology. A range of common models are applied to study hydrologic topics such as flood forecasting and land use change impacts. Previous experience with Matlab or other programming language is needed.

MTEOR 417: Mesoscale Forecasting Laboratory

(1-5) Cr. 3. S.

Prereq: Credit or enrollment in MTEOR 411

Real-time computer analysis of current weather, with emphasis on small-scale features. Studies of severe weather, lake-effect snow, CSI, cold-air damming.

MTEOR 432: Instrumentation and Measurements

(2-2) Cr. 3. S.

Prereq: Credit or enrollment in MATH 266, PHYS 232

Principles of meteorological sensing and data analysis. Thermometry, barometry, hygrometry, anemometry, precipitation measurements, radiometry, radar, remote sensing, visibility, and cloud height. Calibration and measurement uncertainties. Digital signal processing. Field trip to the National Weather Service. Labs emphasize dataloggers and modern weather stations.

MTEOR 435: Radar Applications in Meteorology

(Dual-listed with MTEOR 535). (3-0) Cr. 3. F.

Prereq: Credit or enrollment in MTEOR 341

Fundamentals of radar meteorology with emphasis on applications.

Topics presented include theory of radar, engineering principles, Doppler radar, polarimetric radar, and applications to remote sensing of clouds and precipitation.

MTEOR 440: Tropical Meteorology

(Dual-listed with MTEOR 540). Cr. 3. Alt. F., offered odd-numbered years.

Prereq: Credit or enrollment in MTEOR 341

Weather and climate of the tropical atmosphere. Weekly forecast discussions related to the development of tropical cyclones and teleconnection patterns between the tropics and higher latitudes. Topics covered include easterly waves, tropical cyclogenesis (i.e., hurricanes, typhoons, cyclones), equatorial waves, El Niño-Southern oscillation, Madden-Julian oscillation, and monsoons.

MTEOR 443: Dynamic Meteorology I

(3-0) Cr. 3. S.

Prereq: MTEOR 341

Conservation laws, governing equations, circulation and vorticity. Development of quasi-geostrophic theory.

MTEOR 452: Climate Modeling

(Dual-listed with MTEOR 552). (3-0) Cr. 3. Alt. F., offered odd-numbered years.

Prereq: Mteor 301

Developing and working with climate models based on fundamental physical principles that govern the climate systems of the Earth and other planets. Emphasis on coupled, nonlinear-system interactions of physical processes such as circulation dynamics, radiative transfer, and cloud/precipitation physics, starting with fairly simple 0- and 1-dimensional analytical and numerical models based on energy, mass, and momentum conservation. Observational study of seasonally evolving weather patterns that form climates around the world.

MTEOR 454: Dynamic Meteorology II

(3-0) Cr. 3. F.

Prereq: MTEOR 443

Planetary boundary layer, linear perturbation theory, atmospheric wave motions, baroclinic and convective instability, mesoscale circulations.

MTEOR 468: Applied Geostatistics for Geoscientists

(Dual-listed with MTEOR 568). (Cross-listed with ENSCI, GEOL). Cr. 3. Alt. F., offered even-numbered years.

Prereq: GEOL 452, C R P 351, C R P 452, NREM 345, or NREM 446

Introduction to geospatial data collection, analysis, interpretation, and presentation. Geospatial techniques including geographic information systems (GIS), remote sensing (RS), and global positioning systems (GPS). Study of applied geostatistical analysis (e.g., interpolation and spatial regression).

MTEOR 489: Survey of Remote Sensing Technologies

(Dual-listed with MTEOR 589). (Cross-listed with E E, ENSCI, GEOL, NREM). (3-0) Cr. 3. F.

Prereq: Four courses in physical or biological sciences or engineering

Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S.

MTEOR 489L: Satellite Remote Sensing Laboratory

(Dual-listed with MTEOR 589L). (Cross-listed with E E, GEOL, NREM). (0-3) Cr. 1. F.

Prereq: Completion or concurrent enrollment in MTEOR/GEOL/NREM/EE 489/589

Processing and analysis of satellite sensor data (optical and radar). Provides practical applications in an environmental context.

MTEOR 490: Independent Study

Cr. 1-3. Repeatable, maximum of 9 credits.

Prereq: 6 credits in meteorology, permission of instructor

No more than 9 credits in Mteor 490 may be counted toward graduation.

MTEOR 490A: Independent Study: Synoptic Meteorology.

Cr. 1-3. Repeatable, maximum of 9 credits.

Prereq: 6 credits in meteorology, permission of instructor

No more than 9 credits in Mteor 490 may be counted toward graduation.

MTEOR 490B: Independent Study: Dynamic Meteorology.

Cr. 1-3. Repeatable, maximum of 9 credits.

Prereq: 6 credits in meteorology, permission of instructor

No more than 9 credits in Mteor 490 may be counted toward graduation.

MTEOR 490C: Independent Study: Physical Meteorology.

Cr. 1-3. Repeatable, maximum of 9 credits.

Prereq: 6 credits in meteorology, permission of instructor

No more than 9 credits in Mteor 490 may be counted toward graduation.

MTEOR 490D: Independent Study: Instrumentation.

Cr. 1-3. Repeatable, maximum of 9 credits.

Prereq: 6 credits in meteorology, permission of instructor

No more than 9 credits in Mteor 490 may be counted toward graduation.

MTEOR 490E: Independent Study: Hydrology.

Cr. 1-3. Repeatable, maximum of 9 credits.

Prereq: 6 credits in meteorology, permission of instructor

No more than 9 credits in Mteor 490 may be counted toward graduation.

MTEOR 490F: Independent Study: Climate/Atmospheric Water Cycle.

Cr. 1-3. Repeatable, maximum of 9 credits.

Prereq: 6 credits in meteorology, permission of instructor.

No more than 9 credits in MTEOR 490 may be counted toward graduation.

MTEOR 490G: Independent Study: Atmosphere/Ocean Interactions.

Cr. 1-3. Repeatable, maximum of 9 credits.

Prereq: 6 credits in meteorology, permission of instructor

No more than 9 credits in MTEOR 490 may be counted toward graduation.

MTEOR 498: Cooperative Education

Cr. R. F.S.SS.

Prereq: Permission of the department cooperative education coordinator; senior classification

Required of all cooperative education students. Students must register for this course prior to commencing each work period.

MTEOR 499: Senior Research

(2-0) Cr. 2. F.

Required of all senior meteorology majors. Research projects in collaboration with faculty. Written and oral presentations of results at the end of the semester.

Courses primarily for graduate students, open to qualified undergraduates:**MTEOR 502: Watershed Hydrology**

(Dual-listed with MTEOR 402). (Cross-listed with ENSCI, GEOL, NREM).

(2-3) Cr. 3. F.

Prereq: Four courses in physical or biological sciences or engineering; junior standing

Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes.

MTEOR 504: Global Change

(Dual-listed with MTEOR 404). (Cross-listed with AGRON, ENSCI). (3-0) Cr. 3. F.S.

Prereq: Four courses in physical or biological sciences or engineering; junior standing

Recent changes in global biogeochemical cycles and climate; models of future changes in the climate system; impacts of global change on agriculture, water resources and human health; ethical issues of global environmental change.

MTEOR 505: Environmental Biophysics

(Dual-listed with MTEOR 405). (Cross-listed with AGRON, ENSCI). (3-0) Cr. 3. Alt. S., offered odd-numbered years.

Prereq: MATH 165 and some exposure to computer programming (any language)

The movement of energy and mass among the soil, vegetation, and atmosphere. The heat and water budget of humans, other animals, plants, and plant communities. Relevance to weather and climate, the effect of climate change on organisms, and remote sensing.

MTEOR 507: Mesoscale Meteorology

(Dual-listed with MTEOR 407). (Cross-listed with AGRON). (3-0) Cr. 3. Alt. S., offered even-numbered years.

Prereq: Math 166 and Mteor 443

Gallus. The physical nature and practical consequences of mesoscale atmospheric phenomena. Mesoscale convective systems, fronts, terrain-forced circulations. Observation, analysis, and prediction of mesoscale atmospheric structure. Semester project and in-class presentation required.

MTEOR 511: Synoptic Meteorology

(Dual-listed with MTEOR 411). (1-4) Cr. 3. F.

Prereq: MTEOR 311, Credit or enrollment in MTEOR 454

Current weather forecasting and discussion. Applications of atmospheric physics and dynamics in real-time weather situations. Use of UNIDATA computer products.

MTEOR 516: Hydrologic Modeling and Analysis

(Dual-listed with MTEOR 416). (Cross-listed with ENSCI, GEOL). (2-3) Cr. 3. Alt. S., offered odd-numbered years.

Prereq: Four courses in Earth science, meteorology, or engineering; junior standing

Study of the basic principles of hydrologic modeling, including rainfall-runoff analysis, lumped and distributed modeling, conceptual and physical models, parameter estimation and sensitivity analysis, input and validation data, uncertainty analysis, and the use of models in surface water hydrology. A range of common models are applied to study hydrologic topics such as flood forecasting and land use change impacts. Previous experience with Matlab or other programming language is needed.

MTEOR 518: Microwave Remote Sensing

(Cross-listed with AGRON, E E). (3-0) Cr. 3. Alt. S., offered even-numbered years.

Prereq: Math 265

Microwave remote sensing of Earth's surface and atmosphere using satellite-based or ground-based instruments. Specific examples include remote sensing of atmospheric temperature and water vapor, precipitation, ocean salinity, and soil moisture.

MTEOR 535: Radar Applications in Meteorology

(Dual-listed with MTEOR 435). (3-0) Cr. 3. F.

Prereq: Credit or enrollment in MTEOR 341

Fundamentals of radar meteorology with emphasis on applications. Topics presented include theory of radar, engineering principles, Doppler radar, polarimetric radar, and applications to remote sensing of clouds and precipitation.

MTEOR 540: Tropical Meteorology

(Dual-listed with MTEOR 440). Cr. 3. Alt. F., offered odd-numbered years.

Prereq: Credit or enrollment in MTEOR 341

Weather and climate of the tropical atmosphere. Weekly forecast discussions related to the development of tropical cyclones and teleconnection patterns between the tropics and higher latitudes. Topics covered include easterly waves, tropical cyclogenesis (i.e., hurricanes, typhoons, cyclones), equatorial waves, El Niño-Southern oscillation, Madden-Julian oscillation, and monsoons.

MTEOR 542: Physical Meteorology

(3-0) Cr. 3. Alt. F., offered odd-numbered years.

Prereq: MTEOR 342, MATH 266, PHYS 232

Planetary atmospheres, radiative equilibrium models, radiative transfer, the upper atmosphere, remote sounding from satellites.

MTEOR 543: Advanced Dynamic Meteorology I

(3-0) Cr. 3. Alt. F., offered even-numbered years.

Prereq: MTEOR 455

The first half of a two semester sequence. Governing equations, scale analysis, simple types of wave motion in the atmosphere, instability theory.

MTEOR 544: Advanced Dynamic Meteorology II

(3-0) Cr. 3. Alt. S., offered odd-numbered years.

Prereq: MTEOR 543

Continuation of 543. General circulation and dynamics of zonally symmetric circulations, atmospheric energetics, nonlinear dynamics of planetary waves.

MTEOR 552: Climate Modeling

(Dual-listed with MTEOR 452). (3-0) Cr. 3. Alt. F., offered odd-numbered years.

Prereq: Mteor 301

Developing and working with climate models based on fundamental physical principles that govern the climate systems of the Earth and other planets. Emphasis on coupled, nonlinear-system interactions of physical processes such as circulation dynamics, radiative transfer, and cloud/precipitation physics, starting with fairly simple 0- and 1-dimensional analytical and numerical models based on energy, mass, and momentum conservation. Observational study of seasonally evolving weather patterns that form climates around the world.

MTEOR 568: Applied Geostatistics for Geoscientists

(Dual-listed with MTEOR 468). (Cross-listed with ENSCI, GEOL). Cr. 3. Alt. F., offered even-numbered years.

Prereq: GEOL 452, C R P 351, C R P 452, NREM 345, or NREM 446

Introduction to geospatial data collection, analysis, interpretation, and presentation. Geospatial techniques including geographic information systems (GIS), remote sensing (RS), and global positioning systems (GPS). Study of applied geostatistical analysis (e.g., interpolation and spatial regression).

MTEOR 589: Survey of Remote Sensing Technologies

(Dual-listed with MTEOR 489). (Cross-listed with E E, ENSCI, GEOL, NREM). (3-0) Cr. 3. F.

Prereq: Four courses in physical or biological sciences or engineering

Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S.

MTEOR 589L: Satellite Remote Sensing Laboratory

(Dual-listed with MTEOR 489L). (Cross-listed with E E, GEOL, NREM). (0-3) Cr. 1. F.

Prereq: Completion or concurrent enrollment in MTEOR/GEOL/NREM/EE 489/589

Processing and analysis of satellite sensor data (optical and radar). Provides practical applications in an environmental context.

MTEOR 590: Special Topics

Cr. 1-3. Repeatable.

Prereq: Permission of instructor

Topics of current interest.

MTEOR 590A: Special Topics: Boundary-layer Meteorology

Cr. 1-3. Repeatable.

Prereq: Permission of instructor

Topics of current interest.

MTEOR 590B: Special Topics: Tropical Meteorology

Cr. 1-3. Repeatable.

Prereq: Permission of instructor

Topics of current interest.

MTEOR 590C: Special Topics: Mesoscale Meteorology

Cr. 1-3. Repeatable.

Prereq: Permission of instructor

Topics of current interest.

MTEOR 590D: Special Topics: Global Climate Systems

Cr. 1-3. Repeatable.

Prereq: Permission of instructor

Topics of current interest.

MTEOR 590E: Special Topics: Climate Modeling

Cr. 1-3. Repeatable.

Prereq: Permission of instructor

Topics of current interest.

MTEOR 590F: Special Topics: Numerical Weather Prediction

Cr. 1-3. Repeatable.

Prereq: Permission of instructor

Topics of current interest.

MTEOR 590G: Special Topics: Satellite Observations

Cr. 1-3. Repeatable.

Prereq: Permission of instructor

Topics of current interest.

MTEOR 590H: Special Topics: Statistical Methods in Meteorology

Cr. 1-3. Repeatable.

Prereq: Permission of instructor

Topics of current interest.

MTEOR 590I: Special Topics: Field Observations

Cr. 1-3. Repeatable.

Prereq: Permission of instructor

Topics of current interest.

MTEOR 590J: Special Topics: Low Frequency Modes

Cr. 1-3. Repeatable.

Prereq: Permission of instructor

Topics of current interest.

MTEOR 590K: Special Topics: Cloud Physics

Cr. 1-3. Repeatable.

Prereq: Permission of instructor

Topics of current interest.

MTEOR 590L: Special Topics: Atmospheric Radiation

Cr. 1-3. Repeatable.

Prereq: Permission of instructor

Topics of current interest.

MTEOR 590M: Special Topics: Hydrology

Cr. 1-3. Repeatable.

Prereq: Permission of instructor

Topics of current interest.

MTEOR 590N: Special Topics: Geophysical Fluid Dynamics

Cr. 1-3. Repeatable.

Prereq: Permission of instructor

Topics of current interest.

MTEOR 590O: Special Topics: Radar Meteorology

Cr. 1-3. Repeatable.

Prereq: Permission of instructor

Topics of current interest.

MTEOR 595: Graduate Seminar

(Cross-listed with GEOL). Cr. 1. Repeatable. F.S.

Prereq: Senior or graduate classification

Weekly seminar on topics of current research interest. All students seeking a graduate degree must enroll during each semester of residence. Students pursuing a non-thesis option for the M.S. in Earth Science must enroll for one semester. Offered on a satisfactory-fail basis only.

MTEOR 595A: Graduate Seminar: Presentation Required

(Cross-listed with GEOL). (1-0) Cr. 1. Repeatable. F.S.

Prereq: Senior or graduate classification

Weekly seminar on topics of current research interest. All students seeking a graduate degree must enroll during each semester of residence. Students pursuing a non-thesis option for the M.S. in Earth Science must enroll for one semester. Offered on a satisfactory-fail basis only.

MTEOR 595B: Graduate Seminar: Attendance Only

(Cross-listed with GEOL). Cr. R. Repeatable. F.S.

Prereq: Senior or graduate classification

Attendance only. Weekly seminar on topics of current research interest. All students seeking a graduate degree must enroll during each semester of residence. Students pursuing a non-thesis option for the M.S. in Earth Science must enroll for one semester. Offered on a satisfactory-fail basis only.

Courses for graduate students:

MTEOR 605: Boundary-Layer Meteorology

(Cross-listed with AGRON). (3-0) Cr. 3. Alt. F., offered odd-numbered years.

Prereq: MTEOR 443 or equivalent-level course in engineering fluids

Atmospheric boundary-layer structure and dynamics. Diurnal and seasonal variations, turbulent fluxes and turbulence kinetic energy. Measurements and empirical relations for wind and temperature near the ground. Numerical simulation and applications to wind energy.

MTEOR 699: Research

Cr. arr. Repeatable.