

METEOROLOGY (MTEOR)

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 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 222

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 222, 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. 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. Also offered online Alt. F, even-numbered years.

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 or MATH 182 or equivalent and some computer programming experience (any language)

Description of the physical microenvironment in which organisms live. Emphasis on the movement of energy (heat and radiation) and mass (water and carbon) among organisms, the soil, and atmosphere. Applications to humans, other animals, plants, and plant communities.

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 222

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

(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 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 471: History of Modern Meteorology

(Dual-listed with MTEOR 571). (1-0) Cr. 1. Alt. S., offered even-numbered years.

Prereq: MTEOR 341, MTEOR 342, MTEOR 411, MTEOR 443, MTEOR 452

Development of meteorological theories and numerical weather prediction, discoveries of important meteorological phenomena, and impact of weather and climate on important historical events.

MTEOR 489: Survey of Remote Sensing Technologies

(Dual-listed with MTEOR 589). (Cross-listed with E E, 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 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. 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. Also offered online Alt. F, even-numbered years.

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 or MATH 182 or equivalent and some computer programming experience (any language)

Description of the physical microenvironment in which organisms live. Emphasis on the movement of energy (heat and radiation) and mass (water and carbon) among organisms, the soil, and atmosphere. Applications to humans, other animals, plants, and plant communities.

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 or equivalent

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 542: Physical Meteorology

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

Prereq: MTEOR 342, MATH 266, PHYS 222

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 571: History of Modern Meteorology

(Dual-listed with MTEOR 471). (1-0) Cr. 1. Alt. S., offered even-numbered years.

Prereq: MTEOR 341, MTEOR 342, MTEOR 411, MTEOR 443, MTEOR 452

Development of meteorological theories and numerical weather prediction, discoveries of important meteorological phenomena, and impact of weather and climate on important historical events.

MTEOR 589: Survey of Remote Sensing Technologies

(Dual-listed with MTEOR 489). (Cross-listed with E E, 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 in geology 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 in geology 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 in geology 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.