

# METEOROLOGY (MTEOR)

Courses primarily for undergraduates:

## MTEOR 1070: Severe and Hazardous Weather

Credits: 1. Contact Hours: Lecture 1.

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. (Typically Offered: Fall)

## MTEOR 1110: Synoptic Applications

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

*Prereq: Credit or Enrollment in MATH 1650*

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. (Typically Offered: Fall, Spring, Summer)

## MTEOR 1120: Geoscience Orientation

(Cross-listed with GEOL 1120).

Credits: 1. Contact Hours: Lecture 1.

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. (Typically Offered: Fall)

## MTEOR 1130: Spring Geoscience Orientation for Earth, Wind and Fire Learning Community

(Cross-listed with GEOL 1130).

Credits: 1. Contact Hours: Lecture 1.

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. (Typically Offered: Spring)

## MTEOR 1400: Climate and Society

(Cross-listed with AGRON 1400/ ENVS 1400/ GEOL 1400).

Credits: 3. Contact Hours: Lecture 3.

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. Adaptation to and mitigation of climate change. Meets International Perspectives Requirement. (Typically Offered: Fall, Spring)

## MTEOR 1600: Water Resources of the World

(Cross-listed with AGRON 1600/ ENVS 1600/ GEOL 1600).

Credits: 3. Contact Hours: Lecture 3.

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. (Typically Offered: Spring)

## MTEOR 2010: Introductory Seminar

Credits: Required. Contact Hours: Lecture 1.

*Prereq: Credit or enrollment in PHYS 2310 or 2310H*

An overview of the atmospheric sciences, the meteorology program at Iowa State, and the major research journals used in the discipline. (Typically Offered: Fall)

## MTEOR 2060: Introduction to Weather and Climate

(Cross-listed with AGRON 2060).

Credits: 3. Contact Hours: Lecture 3.

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. (Typically Offered: Fall, Spring)

## MTEOR 2270: Computational Meteorology I

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

*Prereq: Credit or concurrent enrollment in MTEOR 2060; Credit or concurrent enrollment in PHYS 2310*

An introduction to computer programming using FORTRAN and Python 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. (Typically Offered: Fall)

**MTEOR 2900: Independent Study**

Credits: 1-4. Repeatable.

*Prereq: Instructor Permission for Course*

Independent study for freshman and sophomore students.

**MTEOR 2980: Cooperative Education**

Credits: Required. Repeatable.

*Prereq: Department Cooperative Education Coordinator Permission for Course*

Required of all cooperative education students. Students must register for this course prior to commencing the work period. (Typically Offered: Fall, Spring, Summer)

**MTEOR 3010: General Meteorology**

Credits: 4. Contact Hours: Lecture 4.

*Prereq: MATH 1660, credit or enrollment in PHYS 2320*

Global distribution of temperature, wind, and atmospheric constituents; atmospheric thermodynamics, radiative transfer, global energy balance, storms and clouds, introductory dynamics. (Typically Offered: Spring)

**MTEOR 3110: Introduction to Synoptic Meteorology**

Credits: 2. Contact Hours: Lecture 1, Laboratory 2.

*Prereq: MTEOR 3010*

Concepts of weather map plotting and analysis. Introduction to forecasting and to the use of real-time UNIDATA computer products. (Typically Offered: Fall)

**MTEOR 3210: Meteorology Internship**

Credits: 1-2. Repeatable, maximum of 3 credits.

*Prereq: MTEOR 3110; Permission of the Department Cooperative Education Coordinator*

Supervised practical experience in a professional meteorological agency. Experiences may include providing weather information for radio, TV, utilities, government agencies, construction, or agribusiness. Offered on a satisfactory-fail basis only. (Typically Offered: Fall, Spring, Summer)

**MTEOR 3240: Energy and the Environment**

(Cross-listed with ENSCI 3240/ ENVS 3240/ GEOL 3240).

Credits: 3. Contact Hours: Lecture 3.

*Prereq: CHEM 1630, CHEM 1670, or CHEM 1770*

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. (Typically Offered: Spring)

**MTEOR 3410: Atmospheric Physics I**

Credits: 3. Contact Hours: Lecture 3.

*Prereq: PHYS 2320, credit or enrollment in MATH 2660, MTEOR 3010.*

Basic laws of thermodynamics, thermodynamics of water vapor, mixtures of gases, stability, and hydrostatics. (Typically Offered: Fall)

**MTEOR 3420: Atmospheric Physics II**

Credits: 3. Contact Hours: Lecture 3.

*Prereq: MTEOR 3410*

Cloud and precipitation physics, radar meteorology, and atmospheric radiation. (Typically Offered: Spring)

**MTEOR 3600: Ocean-Atmosphere Interactions**

Credits: 3.

*Prereq: MTEOR 2060*

The physical interactions between the atmosphere and ocean, and their influence on weather and climate; coupled modes of climate variability and their teleconnections; air-sea feedback in the tropics and mid-latitudes. Applied topics include seasonal prediction and climate data analysis. Offered odd-numbered years. (Typically Offered: Spring)

**MTEOR 3980: Cooperative Education**

Credits: Required. Repeatable.

*Prereq: Department Cooperative Education Coordinator Permission for Course*

Required of all cooperative education students. Students must register for this course prior to commencing the work period. (Typically Offered: Fall, Spring, Summer)

**MTEOR 3990: Writing for Research**

Credits: 2. Contact Hours: Lecture 2.

*Prereq: ENGL 2500; SPCM 2120; MTEOR 3110; Junior classification;*

*MTEOR major*

Principles of effective scientific writing and communication. Concepts covered are intended to be applied in MTEOR 4990: Senior Research. (Typically Offered: Spring)

**MTEOR 4020: Watershed Hydrology**

(Dual-listed with GEOL 5020/ ENSCI 5020/ MTEOR 5020/ NREM 5020).

(Cross-listed with ENSCI 4020/ GEOL 4020/ NREM 4020).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

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. (Typically Offered: Fall)

**MTEOR 4040: Global Change**

(Dual-listed with MTEOR 5040/ AGRON 5040/ ENSCI 5040). (Cross-listed with AGRON 4040/ ENSCI 4040/ ENVS 4040).

Credits: 3. Contact Hours: Lecture 3.

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. (Typically Offered: Fall, Spring)

**MTEOR 4050: Soil-Plant-Animal-Atmosphere Physics**

(Dual-listed with AGRON 5050/ ENSCI 5050/ MTEOR 5050). (Cross-listed with ENSCI 4050/ AGRON 4050).

Credits: 3. Contact Hours: Lecture 3.

*Prereq:* MATH 1600 or MATH 1650

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. Some exposure to computer programming (any language) recommended. Offered odd-numbered years. (Typically Offered: Spring)

**MTEOR 4060: World Climates**

(Cross-listed with ENSCI 4060/ AGRON 4060).

Credits: 3. Contact Hours: Lecture 3.

*Prereq:* AGRON 2060 or MTEOR 2060

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. (Typically Offered: Spring)

**MTEOR 4070: Mesoscale Meteorology**

(Dual-listed with MTEOR 5070/ AGRON 5070). (Cross-listed with AGRON 4070).

Credits: 3. Contact Hours: Lecture 3.

*Prereq:* MATH 1660; MTEOR 4430

Physical nature and practical consequences of mesoscale atmospheric phenomena. Mesoscale convective systems, fronts, terrain-forced circulations. Observation, analysis, and prediction of mesoscale atmospheric structure. Offered even-numbered years. (Typically Offered: Spring)

**MTEOR 4080X: Numerical Weather and Climate Prediction**

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

*Prereq:* MTEOR 2270 or equivalent; MTEOR 4430

Numerical solutions of the differential equations that describe weather and climate. Survey of numerical solution techniques with focus on advantages and limitations of different methods. Physical parameterizations for turbulence, clouds, and land surface processes. Forecast verification. Applications including designing and running simulations on high-performance computing systems. (Typically Offered: Spring)

**MTEOR 4110: Synoptic Meteorology**

(Dual-listed with MTEOR 5110).

Credits: 3. Contact Hours: Lecture 1, Laboratory 4.

Current weather forecasting and discussion. Applications of atmospheric physics and dynamics in real-time weather situations. Use of UNIDATA computer products. (Typically Offered: Fall)

**MTEOR 4160: Hydrologic Modeling and Analysis**

(Dual-listed with GEOL 5160/ ENSCI 5160/ MTEOR 5160). (Cross-listed with ENSCI 4160/ GEOL 4160).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

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. Offered odd-numbered years. (Typically Offered: Spring)

**MTEOR 4170: Mesoscale Forecasting Laboratory**

Credits: 3. Contact Hours: Laboratory 6.

*Prereq:* Credit or concurrent enrollment in MTEOR 4110

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

**MTEOR 4320: Instrumentation and Measurements**

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

*Prereq:* (Credit or concurrent enrollment in MATH 2660); PHYS 2320

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. (Typically Offered: Spring)

**MTEOR 4350: Radar Applications in Meteorology**

(Dual-listed with MTEOR 5350).

Credits: 3. Contact Hours: Lecture 3.

*Prereq: Credit or concurrent enrollment in MTEOR 3410*

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. (Typically Offered: Spring)

**MTEOR 4400: Tropical Meteorology**

(Dual-listed with MTEOR 5400).

Credits: 3. Contact Hours: Lecture 3.

*Prereq: Credit or concurrent enrollment in MTEOR 3410*

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. Offered odd-numbered years. (Typically Offered: Fall)

**MTEOR 4430: Dynamic Meteorology I**

(Dual-listed with MTEOR 5430X).

Credits: 3. Contact Hours: Lecture 3.

*Prereq: MTEOR 3410*

An introduction to the mathematical description and theory of atmospheric flows. Topics include coordinate systems and vectors; forces and rotating reference frames; governing equations of atmospheric motion; mass and energy conservation; force balance and stability; circulation, vorticity, and potential vorticity. (Typically Offered: Fall)

**MTEOR 4520: Climate Modeling**

(Dual-listed with MTEOR 5520).

Credits: 3. Contact Hours: Lecture 3.

*Prereq: MTEOR 3010*

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. An understanding of atmospheric physics comparable to MTEOR 3010 is advantageous. Offered even-numbered years. . (Typically Offered: Spring)

**MTEOR 4540: Dynamic Meteorology II**

(Dual-listed with MTEOR 5540).

Credits: 3. Contact Hours: Lecture 3.

*Prereq: MTEOR 4430*

Planetary boundary layer, linear perturbation theory, atmospheric wave motions, baroclinic and convective instability, mesoscale circulations. (Typically Offered: Spring)

**MTEOR 4600X: Atmospheric Chemistry**

Credits: 3. Contact Hours: Lecture 3.

Fundamental concepts in atmospheric chemistry. Topics include: atmospheric gaseous and aerosol constituents, sources, and chemical reactions; impact of atmospheric gases and aerosols on global climate, climate change, air quality, and public health; transport of atmospheric constituents; and tropospheric and stratospheric chemistry. (Typically Offered: Spring)

**MTEOR 4680: Applied Geostatistics for Geoscientists**

(Dual-listed with GEOL 5680/ ENSCI 5680/ MTEOR 5680). (Cross-listed with ENSCI 4680/ GEOL 4680).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

*Prereq: GEOL 4520; CRP 3510; CRP 4520; (NREM 3450 or NREM 4470)*  
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). Offered even-numbered years. (Typically Offered: Fall)**MTEOR 4890: Survey of Remote Sensing Technologies**

(Dual-listed with MTEOR 5890/ EE 5890/ ENSCI 5890/ GEOL 5890/ NREM 5890). (Cross-listed with EE 4890/ ENSCI 4890/ GEOL 4890/ NREM 4890).

Credits: 3. Contact Hours: Lecture 3.

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

**MTEOR 4890L: Satellite Remote Sensing Laboratory**

(Dual-listed with MTEOR 5890L/ EE 5890L/ GEOL 5890L/ NREM 5890L). (Cross-listed with EE 4890L/ GEOL 4890L/ NREM 4890L).

Credits: 1. Contact Hours: Laboratory 3.

*Prereq: Completion or concurrent enrollment in MTEOR/GEOL/ NREM/EE 4890/5890*

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

**MTEOR 4900A: Independent Study: Synoptic Meteorology**

Credits: 1-3. Repeatable, maximum of 9 credits.

*Prereq: Six credits in MTEOR, Permission of Instructor*

Graduation Restriction: No more than 9 credits in MTEOR 4900 may be counted toward graduation. (Typically Offered: Fall, Spring, Summer)

**MTEOR 4900B: Independent Study: Dynamic Meteorology**

Credits: 1-3. Repeatable, maximum of 9 credits.

*Prereq: Six credits in MTEOR, Permission of Instructor*

(Typically Offered: Fall, Spring, Summer)

**MTEOR 4900C: Independent Study: Physical Meteorology**

Credits: 1-3. Repeatable, maximum of 9 credits.

*Prereq: Six credits in MTEOR, Permission of Instructor*

Graduation Restriction: No more than 9 credits in MTEOR 4900 may be counted toward graduation. (Typically Offered: Fall, Spring, Summer)

**MTEOR 4900D: Independent Study: Instrumentation**

Credits: 1-3. Repeatable, maximum of 9 credits.

*Prereq: Six credits in MTEOR, Permission of Instructor*

Graduation Restriction: No more than 9 credits in MTEOR 4900 may be counted toward graduation. (Typically Offered: Fall, Spring, Summer)

**MTEOR 4900E: Independent Study: Hydrology**

Credits: 1-3. Repeatable, maximum of 9 credits.

*Prereq: Six credits in MTEOR, Permission of Instructor*

Graduation Restriction: No more than 9 credits in MTEOR 4900 may be counted toward graduation. (Typically Offered: Fall, Spring, Summer)

**MTEOR 4900F: Independent Study: Climate/Atmospheric Water Cycle**

Credits: 1-3. Repeatable, maximum of 9 credits.

*Prereq: Six credits in MTEOR, Permission of Instructor*

Graduation Restriction: No more than 9 credits in MTEOR 4900 may be counted toward graduation. (Typically Offered: Spring, Summer)

**MTEOR 4900G: Independent Study: Atmosphere/Ocean Interactions**

Credits: 1-3. Repeatable, maximum of 9 credits.

*Prereq: Six credits in MTEOR, Permission of Instructor*

Graduation Restriction: No more than 9 credits in MTEOR 4900 may be counted toward graduation.

**MTEOR 4980: Cooperative Education**

Credits: Required. Repeatable.

*Prereq: Permission of Department Cooperative Education Coordinator; Senior classification*

Required of all cooperative education students. Students must register for this course prior to commencing each work period. (Typically Offered: Fall, Spring, Summer)

**MTEOR 4990: Senior Research**

Credits: 2. Contact Hours: Lecture 2.

*Prereq: MTEOR 3990*

Required of all senior meteorology majors. Research projects in collaboration with faculty. Written and oral presentations of results at the end of the semester. (Typically Offered: Fall)

**Courses primarily for graduate students, open to qualified undergraduates:**

**MTEOR 5020: Watershed Hydrology**

(Dual-listed with GEOL 4020/ ENSCI 4020/ MTEOR 4020/ NREM 4020).

(Cross-listed with ENSCI 5020/ GEOL 5020/ NREM 5020).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

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. (Typically Offered: Fall)

**MTEOR 5040: Global Change**

(Dual-listed with ENVS 4040/ MTEOR 4040/ AGRON 4040/ ENSCI 4040).

(Cross-listed with AGRON 5040/ ENSCI 5040).

Credits: 3. Contact Hours: Lecture 3.

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. (Typically Offered: Fall, Spring)

**MTEOR 5050: Soil-Plant-Animal-Atmosphere Physics**

(Dual-listed with AGRON 4050/ ENSCI 4050/ MTEOR 4050). (Cross-listed with ENSCI 5050/ AGRON 5050).

Credits: 3. Contact Hours: Lecture 3.

*Prereq: MATH 1600 or MATH 1650*

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. Some exposure to computer programming (any language) recommended. Offered odd-numbered years. (Typically Offered: Spring)

**MTEOR 5070: Mesoscale Meteorology**

(Dual-listed with MTEOR 4070/ AGRON 4070). (Cross-listed with AGRON 5070).

Credits: 3. Contact Hours: Lecture 3.

*Prereq: MATH 1660; MTEOR 4540 OR Graduate Classification*

Physical nature and practical consequences of mesoscale atmospheric phenomena. Mesoscale convective systems, fronts, terrain-forced circulations. Observation, analysis, and prediction of mesoscale atmospheric structure. Offered even-numbered years. (Typically Offered: Spring)

**MTEOR 5080X: Numerical Weather and Climate Prediction**

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

Numerical solutions of the differential equations that describe weather and climate. Survey of numerical solution techniques with focus on advantages and limitations of different methods. Physical parameterizations for turbulence, clouds, and land surface processes. Forecast verification. Applications including designing and running simulations on high-performance computing systems. (Typically Offered: Spring)

**MTEOR 5110: Synoptic Meteorology**

(Dual-listed with MTEOR 4110).

Credits: 3. Contact Hours: Lecture 1, Laboratory 4.

*Prereq: (MTEOR 3110 and MTEOR 4540) OR Graduate Classification*

Current weather forecasting and discussion. Applications of atmospheric physics and dynamics in real-time weather situations. Use of UNIDATA computer products. (Typically Offered: Fall)

**MTEOR 5160: Hydrologic Modeling and Analysis**

(Dual-listed with GEOL 4160/ ENSCI 4160/ MTEOR 4160). (Cross-listed with ENSCI 5160/ GEOL 5160).

Credits: 3. Contact Hours: Lecture 2, Laboratory 3.

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. Offered odd-numbered years. (Typically Offered: Spring)

**MTEOR 5180: Microwave Remote Sensing**

(Cross-listed with AGRON 5180/ EE 5180).

Credits: 3. Contact Hours: Lecture 3.

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. Offered even-numbered years. (Typically Offered: Spring)

**MTEOR 5350: Radar Applications in Meteorology**

(Dual-listed with MTEOR 4350).

Credits: 3. Contact Hours: Lecture 3.

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. (Typically Offered: Spring)

**MTEOR 5400: Tropical Meteorology**

(Dual-listed with MTEOR 4400).

Credits: 3. Contact Hours: Lecture 3.

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. Offered odd-numbered years. (Typically Offered: Fall)

**MTEOR 5420: Physical Meteorology**

Credits: 3. Contact Hours: Lecture 3.

Basic dynamic equations, moist convection, interaction of convection with large-scale environment, parameterization of convection, and cloud-resolving models. Offered odd-numbered years. (Typically Offered: Fall)

**MTEOR 5430X: Dynamic Meteorology I**

(Dual-listed with MTEOR 4430).

Credits: 3. Contact Hours: Lecture 3.

Conservation laws, governing equations, circulation and vorticity. Development of quasi-geostrophic theory. (Typically Offered: Fall)

**MTEOR 5520: Physics Of Climate**

(Dual-listed with MTEOR 4520).

Credits: 3. Contact Hours: Lecture 3.

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. An understanding of atmospheric physics comparable to MTEOR 3010 is advantageous.

Offered even-numbered years. (Typically Offered: Spring)

**MTEOR 5540: Dynamic Meteorology II**

(Dual-listed with MTEOR 4540).

Credits: 3. Contact Hours: Lecture 3.

Planetary boundary layer, linear perturbation theory, atmospheric wave motions, baroclinic and convective instability, mesoscale circulations. (Typically Offered: Spring)

**MTEOR 5680: Applied Geostatistics for Geoscientists**

(Dual-listed with GEOL 4680/ ENSCI 4680/ MTEOR 4680). (Cross-listed with ENSCI 5680/ GEOL 5680).

Credits: 3. Contact Hours: Lecture 2, Laboratory 2.

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). Offered even-numbered years. (Typically Offered: Fall)

**MTEOR 5890: Survey of Remote Sensing Technologies**

(Dual-listed with MTEOR 4890/ EE 4890/ ENSCI 4890/ GEOL 4890/ NREM 4890). (Cross-listed with EE 5890/ ENSCI 5890/ GEOL 5890/ NREM 5890).

Credits: 3. Contact Hours: Lecture 3.

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

**MTEOR 5890L: Satellite Remote Sensing Laboratory**

(Dual-listed with MTEOR 4890L/ EE 4890L/ GEOL 4890L/ NREM 4890L). (Cross-listed with EE 5890L/ GEOL 5890L/ NREM 5890L).

Credits: 1. Contact Hours: Laboratory 3.

Processing and analysis of satellite sensor data (optical and radar).

Provides practical applications in an environmental context. (Typically Offered: Fall)

**MTEOR 5900A: Special Topics: Boundary-layer Meteorology**

Credits: 1-3. Repeatable.

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

**MTEOR 5900B: Special Topics: Tropical Meteorology**

Credits: 1-3. Repeatable.

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

**MTEOR 5900C: Special Topics: Mesoscale Meteorology**

Credits: 1-3. Repeatable.

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

**MTEOR 5900D: Special Topics: Global Climate Systems**

Credits: 1-3. Repeatable.

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

**MTEOR 5900E: Special Topics: Climate Modeling**

Credits: 1-3. Repeatable.

Topics of current interest.

**MTEOR 5900F: Special Topics: Numerical Weather Prediction**

Credits: 1-3. Repeatable.

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

**MTEOR 5900G: Special Topics: Satellite Observations**

Credits: 1-3. Repeatable.

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

**MTEOR 5900H: Special Topics: Statistical Methods in Meteorology**

Credits: 1-3. Repeatable.

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

**MTEOR 5900I: Special Topics: Field Observations**

Credits: 1-3. Repeatable.

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

**MTEOR 5900J: Special Topics: Low Frequency Modes**

Credits: 1-3. Repeatable.

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

**MTEOR 5900K: Special Topics: Cloud Physics**

Credits: 1-3. Repeatable.

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

**MTEOR 5900L: Special Topics: Atmospheric Radiation**

Credits: 1-3. Repeatable.

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

**MTEOR 5900M: Special Topics: Hydrology**

Credits: 1-3. Repeatable.

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

**MTEOR 5900N: Special Topics: Geophysical Fluid Dynamics**

Credits: 1-3. Repeatable.

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

**MTEOR 59000: Special Topics: Radar Meteorology**

Credits: 1-3. Repeatable.

Topics of current interest. (Typically Offered: Fall, Spring, Summer)

**MTEOR 5950A: Graduate Seminar: Presentation Required**

(Cross-listed with GEOL 5950A).

Credits: 1. Contact Hours: Lecture 1.

Repeatable.

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. (Typically Offered: Fall, Spring)

**MTEOR 5950B: Graduate Seminar: Attendance Only**

(Cross-listed with GEOL 5950B).

Credits: Required. Contact Hours: Lecture 1.

Repeatable.

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. (Typically Offered: Fall, Spring)

**Courses for graduate students:**

**MTEOR 6050: Boundary-Layer Meteorology**

(Cross-listed with AGRON 6050).

Credits: 3. Contact Hours: Lecture 3.

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. Offered odd-numbered years. (Typically Offered: Fall)

**MTEOR 6990: Research**

Credits: 1-30. Repeatable.

*Prereq: Instructor Permission for Course*

(Typically Offered: Fall, Spring, Summer)