**METEOROLOGY (METR)**

**METR 808 Microclimate: The Biological Environment**
Crosslisted with: AGRO 408, GEOG 408, HORT 408, METR 408, NRES 408, WATS 408, AGRO 808, GEOG 808, HORT 808, NRES 808

**Prerequisites:** Junior standing, MATH 106 or equivalent, 5 hrs physics, major in any of the physical or biological sciences or engineering.

**Description:** Physical factors that create the biological environment. Radiation and energy balances of earth's surfaces, terrestrial and marine. Temperature, humidity, and wind regimes near the surface. Control of the physical environment through irrigation, windbreaks, frost protection, manipulation of light, and radiation. Applications to air pollution research. Instruments for measuring environmental conditions and remote sensing of the environment.

**Credit Hours:** 3
**Max credits per semester:** 3
**Max credits per degree:** 3

**Format:** LEC

**Prerequisite for:** AGRO 907, HORT 907, METR 907, NRES 907; BS EN 954, NRES 954

**Groups:** Physical Geography

**METR 811 Dynamic Meteorology I**

**Prerequisites:** CSCE 150E; MATH 208/208H; METR 205; PHYS 211/211H

**Description:** Equations of thermodynamics, momentum, and continuity are derived and applied to atmospheric motion. Energy conservation, flows, and conversions.

**Credit Hours:** 3
**Max credits per semester:** 3
**Max credits per degree:** 3

**Format:** LEC

**Prerequisite for:** METR 943

**METR 812 Dynamic Meteorology II**

**Prerequisites:** CSCE 150E; MATH 221/821; METR 311; PHYS 211/211H

**Description:** Applications of the principles of dynamic meteorology to the problems of forecasting and meteorological problems.

**Credit Hours:** 3
**Max credits per semester:** 3
**Max credits per degree:** 3

**Format:** LEC

**Prerequisite for:** METR 943

**METR 815 General Circulation of the Atmosphere**

**Crosslisted with:** METR 415

**Prerequisites:** Junior standing; METR 475/875; PHYS 211/211H; and PHYS 221.

**Description:** Development of the atmospheric circulation regimes, from planetary scale (e.g., the planetary waves) to synoptic scale (e.g., the cyclones and anticyclones) and mesoscale, their seasonal variations, and their roles in horizontal vertical energy and water transport and budgets in the Earth system.

**Credit Hours:** 3
**Max credits per semester:** 3
**Max credits per degree:** 3

**Format:** LEC

**METR 821 Cloud Physics**

**Crosslisted with:** METR 421

**Prerequisites:** METR 223 and METR 323 or equivalent.

**Description:** METR 223 and MATH 323 or equivalent. Buoyancy and parcel mixing, cloud physics instrumentation, the role of aerosols in precipitation processes, growth of liquid cloud droplets/raindrops/ice crystals, processes associated with falling precipitation particles, droop size distributions and their moments, applications to convection, and parameterizations of cloud microphysical processes for numerical modeling applications.

**Credit Hours:** 3
**Max credits per semester:** 3
**Max credits per degree:** 3

**Format:** LEC

**METR 823 Physical Meteorology**

**Prerequisites:** CSCE 150E; METR 205; PHYS 212/212H

**Description:** Physical principles that provide the foundation for meteorology. Absorption, scattering, and transmission of radiation in the atmosphere, cloud physics, precipitation process, atmospheric optics, atmospheric electricity, and lightning.

**Credit Hours:** 4
**Max credits per semester:** 4
**Max credits per degree:** 4

**Format:** LEC

**Prerequisite for:** METR 924

**METR 828 Air Pollution**

**Crosslisted with:** METR 428

**Prerequisites:** 6 hrs. METR and CHEM 109.

**Description:** Basic processes (e.g., emission, transport, first-order chemical reaction, and deposition) associated with air pollution and their combination with meteorology for air quality forecasting. Environmental topics: acid rain; smog; air pollution; ozone hole; greenhouse gases; aerosols; long-range transport; civic regulations and international treaties on air pollution; and climate change.

**Credit Hours:** 3
**Max credits per semester:** 3
**Max credits per degree:** 3

**Format:** LEC

**METR 833 Boundary-layer Meteorology**

**Crosslisted with:** METR 433

**Prerequisites:** METR 223 and MATH 208/208H

**Description:** Basic concepts of atmospheric turbulence and fundamental dynamics, thermodynamics, and structure of the atmospheric boundary layer are discussed. Atmospheric boundary layer parameterizations used in modern weather and climate models are presented.

**Credit Hours:** 3
**Max credits per semester:** 3
**Max credits per degree:** 3

**Format:** LEC

**Prerequisite for:** METR 933

**METR 841 Synoptic Meteorology**

**Prerequisites:** METR 205

**Description:** Dynamic and thermodynamic concepts and principles applied to synoptic-scale weather forecasting. Dynamics, energetics, structure, evolution, and motion of extra-tropical cyclones. Meteorological communications, interpretation and analysis of weather maps, and thermodynamic diagrams.

**Credit Hours:** 4
**Max credits per semester:** 4
**Max credits per degree:** 4

**Format:** LEC
METR 842 Advanced Synoptic Meteorology-Climatology
Crosslisted with: METR 442
Prerequisites: METR 341.
Description: Analysis and forecasting of subsynoptic-scale weather systems. Convection, thunderstorm models, severe local storm forecasting techniques, mesoscale convective complexes, vertical cross-sections, isentropic analysis, and weather radar.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC
Prerequisite for: METR 944

METR 843 Severe Storms Meteorology-Climatology
Crosslisted with: METR 443
Prerequisites: METR 311, METR 341 or parallel
Description: Dynamics of various types of severe weather (blizzards, flash floods, lightning, thunderstorms and winter and summer tornado outbreaks). Interpretation of the numerical and statistical models utilized to forecast these phenomena. Synoptic case studies of severe weather occurrences. Recent research on severe weather.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

METR 844 Mesoscale Meteorology
Crosslisted with: METR 444
Prerequisites: METR 311
Description: Dynamics and conceptual models of mesoscale meteorological phenomena and processes.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

METR 850 Climate and Society
Crosslisted with: AGRO 450, GEOG 450, METR 450, NRES 452, AGRO 850, GEOG 850, NRES 852
Prerequisites: Junior standing or above.
Notes: Offered spring semester of even-numbered calendar years.
Description: Impact of climate and extreme climatic events on society and societal responses to those events. Global in scope and interdisciplinary.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Offered: SPRING
Groups: Physical Geography

METR 854 Statistical Analysis of Atmospheric Data
Crosslisted with: METR 454
Prerequisites: 6 hrs METR and MATH 107/107H.
Description: Application of univariate statistics, hypothesis testing, statistical forecasting, forecast verification, time-series analysis, principal component analysis, and cluster/multivariate analysis to atmospheric data for different applications in the atmospheric sciences (from short-term weather forecast to long-term climate prediction).
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: METR 965

METR 863 Radar Meteorology
Crosslisted with: METR 463
Prerequisites: METR 323.
Description: The fundamental principles of weather radars and the basic application of these principles.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

METR 864 Satellite Meteorology
Crosslisted with: METR 464
Prerequisites: METR 223.
Description: Concepts and principles related to meteorological observations from satellites. Applications for weather analysis and forecasting.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

METR 865 Satellite Remote Sensing of Atmosphere
Crosslisted with: METR 465
Prerequisites: METR 323.
Description: Principles of atmospheric radiation and techniques for satellite image processing. Application of data calibration, image registration and enhancement, noise filtering and multi-spectral classification of satellite images. Survey of various satellite sensors used for monitoring different atmospheric processes and constituents.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

METR 869 Bio-Atmospheric Instrumentation
Crosslisted with: AGRO 469, GEOG 469, HORT 407, METR 469, MSYM 469, NRES 469, AGRO 869, GEOG 869, HORT 807, MSYM 869, NRES 869
Prerequisites: Junior standing; MATH 106; 4 hrs physics; physical or biological science major.
Description: Discussion and practical application of principles and practices of measuring meteorological and related variables near the earth's surface including temperature, humidity, precipitation, pressure, radiation and wind. Performance characteristics of sensors and modern data collection methods are discussed and evaluated.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Physical Geography

METR 870 The Climate System: Analysis and Prediction
Crosslisted with: METR 470
Description: Maintenance of the climate system and climate change over time. Global budgets of energy, water, and momentum and their balance. Development of simple, physically-based models of climate and of climate change.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
METR 871 Tropical Meteorology
Crosslisted with: METR 471
Prerequisites: METR 223 and METR 311.
Description: Atmospheric phenomena unique to the tropics, and their connection to the global circulation.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

METR 875 Physical Climatology
Crosslisted with: METR 475
Prerequisites: METR 205.
Description: Global energy and water balance regimes of the earth and its atmosphere. Utilization of physical laws to reveal causes and effects of interrelationships in the climatic system.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

METR 878 Regional Climatology
Crosslisted with: METR 478, NRES 478, NRES 878
Prerequisites: NRES/METR 370.
Description: Regional differentiation of the climates of the earth on both a descriptive and dynamic basis. The chief systems of climatic classification.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

METR 879 Hydroclimatology
Crosslisted with: NRES 479, METR 479, WATS 479, BSEN 479, NRES 879, BSEN 879
Prerequisites: NRES 208 or METR 100 or METR/NRES 370.
Notes: Offered spring semester of even-numbered calendar years.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

METR 880 Theory of Climate
Prerequisites: MATH 221/821 or MATH 221H; PHYS 142 or equivalent
Description: Foundation and maintenance of earth's climate system and its variation over time. Climate modeling.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

METR 883 Global Climate Change
Crosslisted with: METR 483, NRES 467, NRES 867
Prerequisites: Junior standing; and METR 475/875.
Notes: Offered fall semester of even-numbered calendar years.
Description: Elements of climate systems, El Nino/LaNina cycle and monsoons, natural variability of climate on interannual and interdecadal scales. Paleoclimate, and future climate, developed climate change scenarios and climate change impacts on natural resources and the environment.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

METR 885 Earth's Climate: Past, Present, Future
Crosslisted with: METR 487
Prerequisites: 6 hrs METR or 6 hrs GEOL.
Description: How the Earth's climate has varied and the forcing mechanisms related to those changes. Themes that reappear through Earth's climate history and into the future; causes of climate change; the natural response times of the multiple components; and the role of greenhouse gases within the climate system at differing time scales.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

METR 895 Internship in Meteorology-Climatology
Crosslisted with: METR 495
Prerequisites: Permission.
Description: Application of meteorology-climatology learning with on-the-job training.
Credit Hours: 1-6
Min credits per semester: 1
Max credits per semester: 6
Max credits per degree: 6
Format: FLD

METR 898 Special Topics in Meteorology-Climatology
Crosslisted with: METR 498
Prerequisites: Permission.
Description: Application of meteorology-climatology learning with on-the-job training.
Credit Hours: 1-24
Min credits per semester: 1
Max credits per semester: 24
Max credits per degree: 24
Format: LEC

METR 903 Seminar in Meteorology and Climatology
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

METR 907 Agricultural Climatology
Crosslisted with: AGRO 907, HORT 907, NRES 907
Prerequisites: NRES 808; STAT 801A or equivalent
Description: Offered spring semester of odd-numbered calendar years. Analysis and use of climatological data as applied to agricultural activities and the use of climatological information to assist in decision making.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
METR 908 Research Practicum
Prerequisites: Graduate standing.
Description: A cohort of students from a variety of STEM disciplines will apply concepts in interdisciplinary science collaboration and communication, data analytics, and research methods. This application will occur in a real-world context as students work together to develop and carry out a research project leading to results suitable for publication in the peer-reviewed literature, or to a high-quality proposal suitable for submission to a funding agency. Students will learn about writing and reviewing proposals for funding, and about writing and reviewing manuscripts for the peer-reviewed literature.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

METR 924 Atmospheric Radiative Transfer
Prerequisites: METR 423/823; MATH 221/221H/821; and permission
Description: Theory of scattering by atmospheric particles (e.g., clouds, aerosols, and molecules), atmospheric radiative transfer equations, and techniques for solving these equations. Atmospheric transfer of both solar and terrestrial radiation. Numerical experiments with radiative transfer models and comparison with observations.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

METR 933 Land-atmosphere Interactions
Prerequisites: METR 433/833, or equivalent
Description: Investigate the physical processes involved in land-atmosphere interactions, focusing on the coupling between land surfaces (especially the soil and vegetation cover) and the atmospheric boundary layer.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

METR 943 Dynamics of Severe Convective Storms
Prerequisites: METR 411/811 and 412/812, or equivalent
Description: Advanced concepts related to severe convective storms. Tornado-genesis, super-cell formation, rotation, movement, morphology, quasi-linear convective systems, deep convective initiation, hail, mesoscale convective systems, and RKW (Rotunno-Klemp-Weisman) theory.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

METR 944 Advanced Synoptic Theory and Application
Prerequisites: METR 842 or equivalent
Description: Advanced theoretical background in synoptic meteorology, and opportunities to apply these concepts to real-world problems. Topics include the quasi-geostrophic equations, static stability effects, midlatitude cyclones, upper-level waves, frontogenesis, semi-geostrophic theory, potential vorticity, and IPV thinking.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

METR 965 Radar Signal Processing and Applications
Prerequisites: MATH 322/822 or equivalent, METR 454/854 or equivalent, METR 323 or equivalent
Description: Hands-on signal processing experience designed to build understanding of radar signal processing methods and radar data limitations. Topics include propagation of radiation, pulse modulation, application of the radar equations, signal statistics and Fourier methods, advanced methods to gather atmospheric data using radar and radar polarimetry.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

METR 987 Seminar in Climatic Change
Description: Climates of the past emphasizing the Quaternary period. Paleogeographic changes in response to climatic fluctuations. Techniques for recording and reconstructing past climatic variations. Modeling the changing climate. Climatic changes and human affairs.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC