

# METEOROLOGY (METR)

## METR 808 Microclimate: The Biological Environment

**Crosslisted with:** PLAS 408, GEOG 408, METR 408, NRES 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

**Grading Option:** Grade Pass/No Pass Option

**Prerequisite for:** BSEN 954, NRES 954

## 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

**Grading Option:** Grade Pass/No Pass Option

**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

**Grading Option:** Grade Pass/No Pass Option

**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

**Grading Option:** Grade Pass/No Pass Option

## METR 821 Cloud Physics

**Crosslisted with:** METR 421

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

**Description:** 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, drop 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

**Grading Option:** Grade Pass/No Pass Option

## 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

**Grading Option:** Grade Pass/No Pass Option

## 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

**Grading Option:** Grade Pass/No Pass Option

**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

**Grading Option:** Grade Pass/No Pass Option

**Course and Laboratory Fee:** \$40

**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

**Grading Option:** Grade Pass/No Pass Option

**Prerequisite for:** METR 944

**Course and Laboratory Fee:** \$40

**Experiential Learning:** Research

**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

**Grading Option:** Grade Pass/No Pass Option

**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

**Grading Option:** Grade Pass/No Pass Option

**METR 850 Climate and Society**

**Crosslisted with:** PLAS 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

**Grading Option:** Grade Pass/No Pass Option

**Offered:** SPRING

**METR 853 GIS in Earth and Atmospheric Sciences**

**Crosslisted with:** GEOL 453, GEOL 853, METR 453

**Prerequisites:** Junior or above standing; and one of the following: GEOL 100 or 101, or METR 100

**Description:** Basic concepts of GIS, hands-on experience with various case studies from geology, meteorology, climatology and environmental applications.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded

**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

**Grading Option:** Grade Pass/No Pass Option

**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

**Grading Option:** Grade Pass/No Pass Option

**Offered:** SPRING

**Course and Laboratory Fee:** \$150

**Experiential Learning:** Research

**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

**Grading Option:** Grade Pass/No Pass Option

**Course and Laboratory Fee:** \$20

**METR 869 Bio-Atmospheric Instrumentation**

**Crosslisted with:** GEOG 469, PLAS 407, METR 469, AGST 469, NRES 469, AGRO 869, GEOG 869, HORT 807, AGST 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

**Grading Option:** Grade Pass/No Pass Option

**METR 870 The Climate System: Analysis and Prediction**

**Crosslisted with:** METR 470

**Prerequisites:** Senior standing; major or minor in meteorology.

**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

**Grading Option:** Grade Pass/No Pass Option

**Experiential Learning:** Research

**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

**Grading Option:** Grade Pass/No Pass Option

**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

**Grading Option:** Grade Pass/No Pass Option

**Prerequisite for:** METR 415, METR 815; METR 483, METR 883, NRES 467, NRES 867

**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

**Grading Option:** Grade Pass/No Pass Option

**METR 879 Hydroclimatology**

**Crosslisted with:** NRES 479, METR 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.

**Description:** Interaction between earth's climate and the hydrologic cycle. Energy and water fluxes at the land-atmosphere interface. Atmospheric moisture transport, precipitation, evaporation, snowmelt, and runoff. Impacts of climate variability and change on the hydrologic cycle.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Grade Pass/No Pass Option

**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

**Grading Option:** Grade Pass/No Pass Option

**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

**Grading Option:** Grade Pass/No Pass Option

**METR 887 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

**Grading Option:** Grade Pass/No Pass Option

**METR 891 Special Topics in Meteorology-Climatology**

**Crosslisted with:** METR 491

**Description:** Topics vary.

**Credit Hours:** 1-6

**Min credits per semester:** 1

**Max credits per semester:** 6

**Max credits per degree:** 8

**Grading Option:** Grade Pass/No Pass Option

**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

**Grading Option:** Pass No-Pass

**Experiential Learning:** Internship/Co-op

**METR 903 Seminar in Meteorology and Climatology**

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Grade Pass/No Pass Option

**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

**Grading Option:** Grade Pass/No Pass Option

**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

**Grading Option:** Grade Pass/No Pass Option

**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

**Grading Option:** Grade Pass/No Pass Option

**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

**Grading Option:** Grade Pass/No Pass Option

**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

**Grading Option:** Grade Pass/No Pass Option

**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

**Grading Option:** Grade Pass/No Pass Option