ATMOSPHERIC SCIENCES (ATMS)

ATMS Class Schedule (https://courses.illinois.edu/schedule/DEFAULT/DEFAULT/ATMS)

Courses

ATMS 100 Introduction to Meteorology  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/100)
Introduces the student to the basic concepts and principles of meteorology via the interpretation of weather maps and charts; uses current weather information to illustrate key concepts, emphasizes the physical atmospheric processes responsible for weather. By the end of the class students will be able to interpret and make basic weather forecasts as well as be able to explain basic atmospheric phenomena. Same as GEOG 100.

This course satisfies the General Education Criteria for:
Nat Sci Tech · Phys Sciences

ATMS 120 Severe and Hazardous Weather  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/120)
Most extreme manifestations of weather and climate are analyzed in terms of their physical basis and their historical, economic and human consequences. Emphasis is placed on the interplay between technological advances, the evolution of meteorology as a science, and the impacts of extreme weather (winter storms, floods, severe thunderstorms, hurricanes, El Nino). Technological advances include satellites, weather radars and profilers, and computer models used for weather prediction. Same as ESE 120.

This course satisfies the General Education Criteria for:
Nat Sci Tech · Phys Sciences

Quantitative Reasoning II

ATMS 140 Climate and Global Change  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/140)
Introduces climate change and its interactions with the global environment; surveys the physical, chemical, biological and social factors contributing to global change; includes topics such as greenhouse warming, acid rain, ozone depletion, distinguishes anthropogenic influences and natural variability of the earth system; addresses societal impacts, mitigation strategies, policy options and other human responses to global change. Same as ESE 140.

This course satisfies the General Education Criteria for:
Nat Sci Tech · Phys Sciences

ATMS 199 Undergraduate Open Seminar  credit: 1 to 5 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/199)
Special topics each term. May be repeated.

ATMS 201 General Physical Meteorology  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/201)
Introduction to physical processes in the atmosphere, focusing on those relevant to weather and storms. Emphasizes quantitative problem solving. Topics include atmospheric structure, atmospheric thermodynamics, clouds, synoptic meteorology, weather forecasting, and storms. For students in atmospheric sciences, physics, mathematics, engineering, and other physical and natural sciences. Prerequisite: MATH 220 or MATH 221; credit or concurrent registration in MATH 231 and PHYS 211.

ATMS 207 Weather and Climate Data Science  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/207)
Introduces python programming fundamentals as applied to real-world problems in the atmospheric sciences. Students will develop an understanding of the structure and use of weather and climate datasets; use computers for data representation, presentation, and visualization; and implement introductory methods for weather and climate data reduction and statistical analysis. Prerequisite: Prior enrollment in STAT 107 is recommended but not required.

ATMS 301 Atmospheric Thermodynamics  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/301)
Introduction to fundamental thermodynamic processes that occur in Earth's atmosphere. Defines, describes, and derives various thermodynamic concepts including (1) the conservation of energy, (2) laws of thermodynamics, (3) kinetic theory, (4) phase transitions of water, and (5) thermodynamic processes of the atmosphere. Applies thermodynamic concepts to atmospheric structure and stability, water phase transformations, and energy and mass transport within the atmosphere. Prerequisite: ATMS 201, MATH 241, and PHYS 211.

ATMS 302 Atmospheric Dynamics I  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/302)
Introduction to fundamental dynamical processes in the atmosphere through a descriptive and quantitative analysis of dynamical meteorology at the synoptic and global scale. Covers basic laws of fluid mechanics as applied to the atmospheric sciences, vorticity and circulation in 2-D and 3-D flows, boundary layer dynamics and friction, basic concepts of geophysical waves, and baroclinic instability. These topics will be covered both descriptively and mathematically with emphasis on computer representation of the fundamental processes governing atmospheric motion and application of theory to real-world examples. Same as PHYS 329. Prerequisite: ATMS 201, MATH 241 and PHYS 211.

ATMS 303 Synoptic-Dynamic Wea Analysis  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/303)
Conceptualizes the structure and dynamics of the atmosphere through interpretation and analysis of weather charts, time and cross sections, soundings, and forecast products. Students develop case studies of weather system structure, and participate in discussions of weather processes as depicted by weather maps. Depiction of atmospheric kinematic and dynamic processes on weather charts is emphasized. Students learn conceptual models of the structure of mid-latitude cyclones and convective weather systems, including cyclogenesis, frontogenesis, the process of storm intensification, occlusion and frontalysis. Prerequisite: ATMS 201 and credit or concurrent registration in MATH 241.

ATMS 304 Radiative Transfer-Remote Sens  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/304)
Introduction to the laws governing the propagation of electromagnetic radiation in the Earth's atmosphere. Topics include absorption, emission, and scattering of radiation, absorption and scattering properties of atmospheric constituents, the Sun as a source of radiation, the radiative transfer equation, and simple radiative balance models. Emphasis will be placed on the role of radiation in weather and climate, the description of atmospheric optical phenomena, and the application to remote sensing. Prerequisite: MATH 241 and PHYS 212.
ATMS 305 Computing and Data Analysis  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/305)
Introduction to the statistical treatment and graphical representation of atmospheric sciences data, both in the space and time domain. Emphasis is placed on applications and real-world examples. Discusses relevant statistics, methods of interpolation and least squares, and linear and nonlinear correlations. Students gain experience using Python for data analysis, develop theoretical skills for analyzing and modeling data, and perform virtual experiments and analyze real-world publicly available data sets. Prerequisite: MATH 241 or consent of instructor.

ATMS 306 Cloud Physics  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/306)
Develops an understanding of microphysical processes occurring within clouds through use of in-situ observations, modeling, and theoretical studies; topics covered include nucleation, diffusional growth of water and ice particles, the warm rain process, the cold rain process (including riming, aggregation, graupel, and hail), weather modification, and an introduction to radar meteorology. Prerequisite: ATMS 301.

ATMS 307 Climate Processes  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/307)
Introduces students to Earth’s climates and the processes that determine them. Examines factors that control natural climate change over long and short time scales, processes by which humans impact climate and climate change, methods to predict climate change, and climate change response by policymakers. Prerequisite: ATMS 201.

ATMS 311 Environmental Issues Today  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/311)
Same as ESE 311. See ESE 311.

ATMS 312 Atmospheric Dynamics II  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/312)
Rigorous examination of the dynamical nature of various manifestations of the atmospheric circulation. Topics include the intrinsic effects of earth’s rotation and stratification, vorticity and potential vorticity dynamics, various forms of boundary layer, wave dynamics (gravity waves and Rossby waves), geostrophic adjustment, cyclogenesis, frontogenesis and a potpourri of instability theories. Same as PHYS 330. Prerequisite: ATMS 301, ATMS 302.

ATMS 313 Synoptic Weather Forecasting  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/313)
Examines the tools and techniques of weather forecasting, with heavy emphasis on actual forecasting. Numerical models used to forecast weather are reviewed and compared. Forecasting using numerical, statistical and probabilistic forecasting techniques is studied. Forecasts of significant winter weather, convection, floods and other weather hazards are emphasized. Students learn the process behind Severe Weather Watches and Warnings, Quantitative Precipitation Forecasts, precipitation type forecasts, flood forecasts and forecasts of other significant weather. Prerequisite: ATMS 302, ATMS 303 or consent of instructor.

ATMS 314 Mesoscale Dynamics  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/314)
Examination of the structure and dynamics of weather systems that occur on the mesoscale. The course first reviews what is meant by "mesoscale". Examines the structure and dynamics of both free and forced mesoscale circulations. Free circulations are those internal to the atmosphere, such as thunderstorms, mesoscale convective systems, squall lines, hurricanes, jet streaks, and fronts. Forced circulations are those tied to features external to the atmosphere, such as shorelines (the sea breeze), lakes (lake effect storms), and mountains. Prerequisite: ATMS 301, ATMS 302, ATMS 303, or consent of instructor.

ATMS 315 Meteorological Instrumentation  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/315)
A survey of the meteorological instrumentation used to document and investigate weather and climate. Students will gain hands-on experience with a variety of instrumentation integrated with the data analysis techniques and scientific communication formats used professionally within the field of atmospheric sciences. The focus is to explore modern methods of weather observation used in research, governmental, and industrial settings while training each student to gather, assess, interpret and communicate weather data. Students will gain hands-on experience with a variety of instrumentation integrated with data analysis techniques and intensive scientific writing exercises. Each writing exercise has been designed to teach the variety of writing techniques employed in Atmospheric Sciences. Prerequisite: ATMS 201. Concurrent enrollment in ATMS 305 is encouraged. Restricted to Atmospheric Sciences Majors. Additional seats may be available for Atmospheric Sciences Minors. This course satisfies the General Education Criteria for: Advanced Composition.

ATMS 322 Soc Impacts Weather & Climate  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/322)
Examines the interconnectedness of weather, climate and society. Focus is on the complex relationship between weather, climate and society from both a physical and social perspective with an examination of the role of sustainability in both impacts and future mitigation. Discussions focused on the physical principles driving the weather and climate and how they interact with all aspects of society. Same as ENSU 301. This course satisfies the General Education Criteria for: Social Beh Sci - Soc Sci.

ATMS 323 Air Pollution to Global Change  credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/323)
Develops the science of air pollution across spatial scales with an Earth-systems approach. Considers how fossil fuel combustion, agriculture development, waste generation, synthetic chemicals production, biomass burning, and changes in land use are significantly altering levels of radiatively and chemically active gases and aerosols in the atmosphere, and how these pollutants interact at local, regional, and global scales. The systems nature of the processes through which air pollution is linked to global change will be examined via integrated science assessment modeling that includes feedbacks from societal policies, industrial practices, and human populations. Same as ENSU 302.
ATMS 324  Field Studies of Convection  credit: 2 Hours.  (https://courses.illinois.edu/schedule/terms/ATMS/324)
Students learn to recognize the structural features characteristic of supercellular convection, organized mesoscale convective systems, frontal squall lines, and ordinary thunderstorms, and to relate these structures to theory and conceptual models. Students forecast atmospheric convection, providing daily meteorological forecast discussions and analysis of current and future weather conditions. This course includes a mandatory 12-14 day field trip. Additional fees may apply. See Class Schedule. Approved for S/U grading only. May be repeated in separate terms to a maximum of 6 hours. Prerequisite: ATMS 201. ATMS Majors or Minors only with consent of instructor. Instructor Approval Required.

ATMS 391  Topics in Atmospheric Sciences  credit: 1 to 3 Hours.  (https://courses.illinois.edu/schedule/terms/ATMS/391)
Special topics in atmospheric sciences at the undergraduate level. See Class Schedule for topics and prerequisites. Additional fees may apply. See Class Schedule. Approved for Letter and S/U grading. May be repeated in the same or separate terms to a maximum of 12 hours if topics vary. Prerequisite: ATMS 201. Consent of Instructor.

ATMS 401  Applied Meteorology  credit: 3 Hours.  (https://courses.illinois.edu/schedule/terms/ATMS/401)
Examines how providers of meteorological information work with stakeholders who value that information to develop decision support systems in fields such as aviation, hydrometeorology, energy, health, national security, transportation, agriculture, emergency management, air quality, and climate sustainability. 3 undergraduate hours. 3 graduate hours.

ATMS 404  Risk Analysis in Earth Science  credit: 3 or 4 Hours.  (https://courses.illinois.edu/schedule/terms/ATMS/404)
Introduction to concepts and methods of quantitative risk analysis in the Earth system. Key concepts will include probability, impacts, risk, uncertainty, statistical estimation, and decision making. Students will use simple risk analysis methods to apply these concepts to example problems related to drought, flooding, weather extremes, and anthropogenic climate change. The students will learn the R programming language for statistical computing, which will be used to integrate concepts and methods using observational data sets and model output. Same as GEOL 485. 3 undergraduate hours. 4 graduate hours. Prerequisite: MATH 241 or consent of instructor.

ATMS 405  Boundary Layer Processes  credit: 4 Hours.  (https://courses.illinois.edu/schedule/terms/ATMS/405)
Course will qualitatively and quantitatively describe atmospheric boundary layer characteristics and processes. The course will focus on the turbulent structure of the boundary layer and the factors that influence this structure over a variety of surfaces (e.g., soil, vegetation, marine) and under a variety of atmospheric conditions (e.g., stability, diurnal/nocturnal). This atmospheric layer is important to our daily lives because it is where humans live and it connects the small-scale fluxes of energy and mass to the large-scale atmospheric circulation. 4 undergraduate hours. 4 graduate hours. Prerequisite: ATMS 301, ATMS 302, and ATMS 304; MATH 285; or consent of instructor.

ATMS 406  Tropical Meteorology  credit: 4 Hours.  (https://courses.illinois.edu/schedule/terms/ATMS/406)
Covers the mesoscale, synoptic scale and planetary scale motions in the tropical circulation. Emphasis will be on delineating the unique characteristics of tropical dynamics. Topics include Hadley circulation, Walker circulation, Madden-Julian oscillation, monsoons, easterly waves, equatorial waves, hurricanes, the quasi-biennial oscillation, El Nino and the Southern Oscillation. 4 undergraduate hours. 4 graduate hours. Prerequisite: ATMS 301 and ATMS 302 and MATH 285; or consent of instructor.

ATMS 410  Radar Remote Sensing  credit: 4 Hours.  (https://courses.illinois.edu/schedule/terms/ATMS/410)
Basic principles of radar and references to other ground based remote sensing systems, with emphasis on radar. Discusses principles of conventional and Doppler radar, data processing, and use of Doppler radar in meteorology. Emphasizes radar observations of meteorological phenomena, such as severe thunderstorms and wind shear. Students analyze data from national radar facilities. 4 undergraduate hours. 4 graduate hours. Prerequisite: ATMS 201 and MATH 231 and credit or concurrent registration in MATH 241; or consent of instructor.

ATMS 411  Satellite Remote Sensing  credit: 4 Hours.  (https://courses.illinois.edu/schedule/terms/ATMS/411)
Review of the basic techniques used in satellite remote sensing of the Earth’s surface and atmosphere, as well as other planets in our solar system. Topics include radiative transfer, scattering and absorption processes, the Sun, mathematics of inversion, atmospheric properties and constituents, surface properties, precipitation, radiation budgets, image classification, satellite technology and orbital configurations. Laboratory work on radiative transfer modeling and satellite data analysis emphasized. All students participate in a team project that has novel and practical applications. 4 undergraduate hours. 4 graduate hours. Prerequisite: MATH 285 and PHYS 212.

ATMS 420  Atmospheric Chemistry  credit: 4 Hours.  (https://courses.illinois.edu/schedule/terms/ATMS/420)
Biochemical cycles of atmospheric trace gases, their interactions on global and regional scales, and their significance for the chemistry in the atmosphere. Important fundamental concepts central to understanding air pollutants, e.g., the formation of aerosols and the transformation and removal of species in the atmosphere. Same as CEE 447. 4 undergraduate hours. 4 graduate hours. Prerequisite: CHEM 102, PHYS 211, and MATH 241.

ATMS 421  Earth Systems Modeling  credit: 4 Hours.  (https://courses.illinois.edu/schedule/terms/ATMS/421)
Introduces the fundamentals of python programming as applied to numerical modeling within the earth and environmental sciences. Students will identify key processes and relationships in systems, represent these elements numerically, use models to predict system behavior, and assess the validity of the model predictions. Previous models developed include Eulerian representations of global energy balance, glaciation, population, and a Lagrangian volcanic plume model. No computing background is required, but a prior course on integral calculus is strongly recommended. Same as ESE 421, GEOG 421, GEOL 481, and NRES 422. 4 undergraduate hours. 4 graduate hours. Prerequisite: Junior, senior, or graduate standing in a natural science, geography, natural resources and environmental studies, or engineering. No Computing background is required, but prior course on integral calculus is strongly recommended.

ATMS 425  Air Quality Modeling  credit: 4 Hours.  (https://courses.illinois.edu/schedule/terms/ATMS/425)
Same as CEE 445. See CEE 445.
ATMS 446 Climate & Social Vulnerability credit: 3 or 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/446)
Same as GEOG 496 and SOC 451. See GEOG 496.

ATMS 447 Climate Change Assessment credit: 3 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/447)
Provides students with first-hand experience with computer models used to study climate change and permits them to test hypotheses, develop scenarios, learn about the implications of various structures of the modeled system, and evaluate the climatic impacts of anthropogenic emissions. Students perform calculations and produce model scenarios using a web interface to our Integrated Science Assessment Model (ISAM). 3 undergraduate hours. 3 graduate hours.

ATMS 449 Biogeochemical Cycles credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/449)
Prepares students with first-hand experience with computer models used to study climate change and permits them to test hypotheses, develop scenarios, learn about the implications of various structures of the modeled system, and evaluate the climatic impacts of anthropogenic emissions. Students perform calculations and produce model scenarios using a web interface to our Integrated Science Assessment Model (ISAM). 4 undergraduate hours. 4 graduate hours. Prerequisite: Consent of instructor.

ATMS 490 Individual Study credit: 1 to 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/490)
Individual study or reading at an advanced undergraduate level in a subject not covered in normal course offerings. 1 to 4 undergraduate hours. May be repeated to a maximum of 8 hours. May not be used to satisfy requirements for an M.S. or Ph.D. degree in Atmospheric Sciences. Prerequisite: Consent of advisor and of staff member supervising work.

ATMS 491 Adv Topics in Atmospheric Sci credit: 2 to 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/491)
Special topics in atmospheric sciences. See Class Schedule for topics and prerequisites. 2 to 4 undergraduate hours. 2 to 4 graduate hours. May be repeated in the same or separate terms as topic varies to a maximum of 12 hours.

ATMS 492 Capstone Undergraduate Research credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/492)
All senior Atmospheric Sciences undergraduate majors have the opportunity to take a Capstone Undergraduate Research experience. Students will be engaged in an atmospheric science research project with an ATMS faculty supervisor. 4 undergraduate hours. No graduate credit. May be repeated to a maximum of 8 undergraduate hours. Prerequisite: Senior standing in Atmospheric Sciences, or permission of ATMS faculty supervisor.

ATMS 500 Dynamic Meteorology credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/500)
Examines the observed behavior of the atmosphere through the application of physical and hydrodynamical principles to analyses of real meteorological data; develops concepts for studying atmospheric circulations, particularly extratropical cyclones and anticyclones. Laboratory work includes the development of diagnostic techniques suitable for a better understanding of the current weather.

ATMS 502 Numerical Fluid Dynamics credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/502)
Addresses numerical techniques for solving linear and nonlinear differential equations in initial value fluid flow problems. Students receive a thorough background in the principles used to evaluate numerical methods, the ability to critically interpret these methods as presented in the literature, and in particular, the practical application of these techniques in modeling multi-dimensional flow on high-performance computers. Temporal and directional splitting, finite differencing/volume methods, and adaptive nesting will be discussed. Same as CSE 566. 4 graduate hours. No professional credit. Prerequisite: MATH 285 or equivalent. Graduate Standing or Consent of Instructor.

ATMS 504 Physical Meteorology credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/504)
Examines the physical processes that occur in the atmosphere. Topics include atmospheric thermodynamics, cloud physics, and atmospheric radiation. 4 graduate hours. No professional credit. Prerequisite: Graduate standing or consent of instructor.

ATMS 505 Weather Systems credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/505)
Examines the structure and dynamics of mid-latitude weather systems, integrating weather observations, with the current state of dynamic theory, numerical weather prediction models, and the physical principles of atmospheric thermodynamics, cloud and precipitation physics, and radiation to the problems of weather analysis and forecasting. Students will be required to give weather forecast briefings to develop an understanding of the weather forecasting process, and gain experience in communicating weather forecasts. 4 graduate hours. No professional credit. Prerequisite: Graduate standing or consent of instructor.

ATMS 507 Climate Dynamics credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/507)
Investigates the dynamical and physical processes that govern Earth's paleo, current, and future climates. Emphasizes principles of climate change, natural and anthropogenic, and regional, national, and global. Global climate models and their predictions are examined in the context of scenarios for future population growth and energy consumption. 4 graduate hours. No professional credit. Prerequisite: Graduate standing or consent of instructor.

ATMS 510 Precipitation Physics credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/510)
Develops an understanding of precipitation processes through cloud observations, microphysics, dynamics, and comprehensive theoretical models; includes growth by condensation, coalescence, and riming; and studies ice crystals, hail, and weather modification. Prerequisite: ATMS 504 or consent of the instructor.

ATMS 511 Atmospheric Radiation credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/511)
Physical concepts and various methods of analysis of radiation scattering by atmospheric molecules, particulates, and clouds; infrared radiative transfer in a stratified inhomogeneous atmosphere; radiation and ozone photochemistry in the stratosphere; and remote temperature and composition sensing techniques using satellite radiation data. Prerequisite: ATMS 504 or consent of the instructor.

Information listed in this catalog is current as of 04/2020
ATMS 512 Clouds and Climate  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/512)
The following topics are addressed to examine the role of clouds in the climate system: aerosols and aerosol cloud interactions, direct, semi-direct and indirect aerosol effects, in-situ measurements of clouds, properties of liquid and ice clouds, precipitation mechanisms and representation in models, scattering by cloud particles and model representations, remote sensing of cloud properties, and representation of clouds in climate models. Prerequisite: ATMS 504 or consent of instructor.

ATMS 514 Dynamics of Convective Clouds and Storms  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/514)
Describes the initiation, subsequent organization, and then morphology of deep convective clouds and storms. Includes the dynamics of cumulus updrafts, downdrafts, and cold pools; long-lived rotating thunderstorms and attendant tornadogenesis; and mesoscale convective systems and their hazards. Also provides material on how convective processes are observed, numerically modeled, and theoretically treated. Concludes with how convective clouds/systems interact with the larger-scale atmosphere, especially in the context of climate variability and change. 4 graduate hours. No professional credit. Prerequisite: ATMS 500 or equivalent; MATH 241 or equivalent; PHYS 211 or equivalent.

ATMS 517 Data Science for the Geosciences  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/517)
Many petabytes of geosciences data have been observed and curated by NASA and NOAA in anticipation of new data science tools designed to yield insights and improve forecasts of Earth processes. Students will learn the fundamentals of data science using publicly available datasets toward the end of conducting novel research in the geosciences. Topics include data ethics, uncertainty, data curation and management, version control, cluster and cloud computing, introductory Unix and Python, and visualization. 4 graduate hours. No professional credit.

ATMS 520 Physical and Dynamical Meteorology  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/520)
Course introduces atmospheric properties, their measurement, atmospheric composition, and structure, and introduces and applies principles of atmospheric thermodynamics to understand physical processes such as heat transfer, cloud formation, cloud physics and radiative transfer. The course also examines the observed behavior of the atmosphere flows and storms through the application of physical and hydrodynamical principles to analyses of meteorological data, and investigates atmospheric circulations in Earth's middle latitudes and tropics, including thunderstorms, extratropical cyclones, and hurricanes. 4 graduate hours. No professional credit. Cannot be used to satisfy course requirements for DAS on-campus MS and PhD programs. On-campus students must take ATMS 500 and 504.

ATMS 521 Climate Analysis, Variability, and Prediction  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/521)
This course provides a graduate-level treatment of the analysis and prediction of the Earth’s climate over subseasonal, seasonal, and decadal time scales. Following the preliminaries on how these scales are realized in climate observations, we will describe the drivers of the climate system across these scales. Modes of natural climate variability, which include El Nino/Southern Oscillation (ENSO), the North Atlantic Oscillation (NAO), and the Madden-Julian Oscillation (MJO), will then be described, as will the statistical techniques used to reveal them. Statistical prediction models based on multivariate regressions often incorporate index-representations of ENSO and other relevant variables. Accordingly, we will devote some time and exercises on methods in which these models are developed as well as tested. Dynamical models are also used for climate prediction, but require computational capability and relatively more thought in design and application. Thus, we will complete the course with a significant treatment of global models as well as regional models. Both models are based on the same basic set of equations, but typically have different applications. Model setup and implementation will be illustrated through practical exercises with open-source community global and regional models. 4 graduate hours. No professional credit. Prerequisite: Graduate standing and ATMS 520; or equivalent, by permission of the instructors.

ATMS 523 Weather and Climate Data Analytics  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/523)
In this course, students will get real-world hands on experience with a broad range of data analysis tools that are currently being used in academic, national laboratory, consulting, and private industry. Data sources in the atmospheric sciences are diverse and require specialized tools to open and reduce those datasets in an efficient manner. The intention of this course is to prepare the student to become a developer of data analysis tools in collaborative research environments in a variety of professional settings. Students will learn how to discover and cite earth science datasets, and curate those sources and code developed, and enable reproducibility of the workflow to allow for transparency, open peer-review, and extension of the work by the student or others. 4 graduate hours. No professional credit.

ATMS 526 Risk Analysis in the Geosciences  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/526)
This course will introduce concepts and methods in quantitative risk analysis in the Earth, atmospheric, and environmental sciences. Key concepts will include probability, impacts, risk, uncertainty, statistical estimation, and decision making. Students will use simple risk analysis methods to apply these concepts to example problems related to drought, flooding, weather extremes, and anthropogenic climate change. The students will learn the R programming language for statistical computing, which will be used to integrate concepts and methods using observational data and model output, and we will focus on real-world multi-disciplinary applications. 4 graduate hours. No professional credit. Cannot be used to satisfy course requirements for DAS on-campus MS and PhD programs. On-campus students must take ATMS 406. Prerequisite: Restricted to graduate students or consent of instructor.

ATMS 535 Aerosol Sampling and Analysis  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/535)
Same as CEE 545. See CEE 545.
ATMS 571  Professional Development  credit: 1 Hour. (https://courses.illinois.edu/schedule/terms/ATMS/571)
Aimed at professional development in the atmospheric sciences so that students recognize the importance of breadth of knowledge, effective oral and written scientific communication, and other skills they will need as professionals. 1 graduate hour. No professional credit. Approved for S/U grading only. Prerequisite: Graduate student in Atmospheric Sciences or consent of instructor.

ATMS 590  Individual Study  credit: 1 to 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/590)
Individual study or reading in a subject not covered in normal course offerings. 1 to 4 graduate hours. No professional credit. May be repeated to a maximum of 8 hours. Prerequisite: Consent of instructor.

ATMS 591  Atmospheric Sciences Seminar  credit: 0 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/591)
Seminar on topics of current interest. Approved for S/U grading only. Prerequisite: Consent of instructor.

ATMS 596  Non-Thesis Research  credit: 0 to 12 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/596)
Non-thesis research in the Atmospheric Sciences. Approved for S/U grading only. May be repeated. No more than 4 hours may be counted toward a master’s degree in ATMS. Prerequisite: Restricted to students in the non-thesis option.

ATMS 597  Special Topics in Atmospheric Sciences  credit: 0 to 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/597)
Lecture course in topics of current interest; subjects such as tropical meteorology, aerosol physics, and geophysical fluid dynamics will be covered in term offerings on a regular basis. 0 to 4 graduate hours. No professional credit. Approved for Letter and S/U grading. Prerequisite: Graduate standing or consent of instructor.

ATMS 599  Thesis Research  credit: 0 to 16 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/599)
Check with the department to identify which CRN is needed for your advisor and any related registration questions. Approved for S/U grading only. Prerequisite: Consent of instructor.