ATMOSPHERIC SCIENCE (ATM)

ATM 102. Introduction to Weather and Climate. 3 Credit Hours.
The structure, physics, dynamics and thermodynamics of the atmosphere. Weather, weather forecasting, climate and climate change.
Components: LEC.
Grading: GRD.
Typically Offered: Fall & Spring.

ATM 103. Survey of Modern Meteorology. 3 Credit Hours.
Dynamics and thermodynamics of the atmosphere as they relate to contemporary issues in meteorology. Overview of numerical weather prediction techniques and new technologies for monitoring weather and climate. Open to all Meteorology majors and minors as well as Oceanography majors.
Requisite: Major or Minor in Meteorology, or Major in Oceanography, and Pre/Corequisite: MTH 108 or higher (MTH 108. Or MTH 113. Or MTH 140. Or MTH 141. Or MTH 161. Or MTH 171).
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

ATM 243. Weather Forecasting. 3 Credit Hours.
Application of physical principals to weather forecasting. Use interpretation of computer-generated forecast guidance products of the U.S. Weather Service.
Prerequisite: ATM 103 or MSC 103 and MTH 108 or higher.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

ATM 244. Tropical Weather and Forecasting. 3 Credit Hours.
Introduction to tropical weather systems, with an emphasis on hurricanes, and syntheses of observational data and numerical model predictions to create forecasts
Prerequisite: ATM 103 and ATM 243.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

ATM 265. Atmospheric Chemistry. 3 Credit Hours.
ATM 265 is focused on those aspects of environmental chemistry of most relevance to meteorology students. The class fulfills the American Meteorological Society (AMS) chemistry expectations for a Bachelor's Degree in Meteorology, and in addition, addresses further recommendations from the AMS. AMS expects knowledge of atomic structure and chemical bonding, and, of the properties of gases. Recommended 'beyond the basics' goals include air quality and environmental science applications.
Prerequisite: ATM 103.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

ATM 303. Meteorological Instrumentation and Observation. 3 Credit Hours.
Techniques for measuring meteorological variables at the ground and in the free atmosphere.
Prerequisite: ATM 103, and PHY 101 or PHY 201 or PHY 221.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

ATM 305. Atmospheric Thermodynamics. 3 Credit Hours.
Equation of state; water vapor and moist air thermodynamics; phase changes and latent heat; buoyancy and atmospheric convection; thermodynamic diagrams.
Prerequisite: PHY 201 or PHY 221 And ATM 103.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

ATM 306. Advanced Principles in Broadcasting Meteorology. 3 Credit Hours.
Broadcast meteorology including the production of professional weather briefings and weather news for on camera delivery. Emphasis on accurately communicating complex meteorological concepts, use of computer graphics, and on-camera delivery.
Prerequisite: ATM 103 and ATM 243.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

ATM 307. Introduction to the Physics of Climate. 3 Credit Hours.
The Physical mechanisms which govern the earth's climate and climate variability.
Prerequisite: ATM 305.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

ATM 371. Readings in Atmospheric Science. 1-3 Credit Hours.
Library research and discussion on selected topics under faculty supervision. No more than 6 credits in total from ATM371, ATM411, and ATM412 can be counted towards any of the Rosenstiel School major or minor requirements with no more than 3 credits from each course.
Rosenstiel majors only.
Components: DIS.
Grading: GRD.
Typically Offered: Fall & Spring.

ATM 405. Atmospheric Dynamics I. 3 Credit Hours.
Derivation and scaling of the equations of atmospheric motion; hydrostatic and geostrophic balance; circulation and vorticity.
Prerequisite: ATM 305 And MTH 310 or MTH 211.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

ATM 406. Atmospheric Dynamics II. 3 Credit Hours.
Baroclinic and barotropic instability; boundary layer dynamics; mathematical principles of numerical weather prediction; maintenance of the general circulation.
Prerequisite: ATM 405.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

ATM 407. Weather Analysis. 4 Credit Hours.
Three-dimensional analysis of synoptic-scale weather systems; application of the fundamental laws of atmospheric dynamics to observed weather patterns; practical questions of worldwide data exchange and display.
Prerequisite: ATM 305 And ATM 405, And Corequisite: ATM 406.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

ATM 409. Cloud Physics, Radiation, and Remote Sensing. 3 Credit Hours.
Atmospheric radiation; absorption and scattering principles of remote sensing of the atmosphere; cloud microphysics; nucleation, coalescence, ice crystal growth, atmospheric electricity and lightning.
Prerequisite: ATM 305.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

ATM 411. Research in Atmospheric Science. 1-3 Credit Hours.
Individual, independent research projects in Atmospheric Science with faculty supervision. A formal written report is required after every semester. Each credit of research will correspond to a minimum of 3 hours of hands-on research experience per week. No more than 6 credits in total from ATM, GSC, MBE, or MSC 371, 411, and 412 can be counted towards the Rosenstiel School major or minor requirements with no more than 3 credits from each course.
Requisite: Junior or Senior Standing.
Components: THI.
Grading: CNC.
Typically Offered: Fall, Spring, & Summer.

ATM 412. Undergraduate Thesis in Atmospheric Science. 1 Credit Hour.
Students will write a formal thesis summarizing the results of independent research carried out under faculty supervision. The thesis must be reviewed and approved by a committee. An approved public presentation of research findings (oral or poster presentation) is required at the end of the term. No more than 6 credits in total from ATM, GSC, MBE or MSC 371, 411, and 412 can be counted towards any of the Rosenstiel School major or minor requirements with no more than 3 credits from each course.
Pre-Requisite: ATM 411 or GSC 411 or MBE 411 or MSC 411, And Requisite: Senior Standing.
Components: THI.
Grading: GRD.
Typically Offered: Fall, Spring, & Summer.

ATM 511. Geophysical Fluid Dynamics I. 3 Credit Hours.
The basic equations of state, continuity, and motion. Topics include wave motions, group velocity, theory of stratified fluids and internal waves turbulence.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

ATM 532. Broadcast Meteorology. 3 Credit Hours.
Students will learn the proper techniques involved in preparing and presenting a complete and professional weathercast with a heavy emphasis on communication skills, computer graphics, and on-camera delivery.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

ATM 533. Atmospheric Boundary Layer. 3 Credit Hours.
The boundary layer is the lowest 1-2 km of the atmosphere, where we live. It is necessary to understand boundary layer processes to pursue research in clouds and radiation, weather and climate, air/sea/land interaction, and chemistry of the lower atmosphere. In this course, students will learn the basic physical concepts, from observational, theoretical and modeling perspectives.
Enrollment Condition: Senior Standing.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

ATM 534. Introduction to Atmospheric Chemistry. 3 Credit Hours.
This course covers the basic principles of atmospheric chemistry. Concepts taught will include gas phase reactions, the production and destruction of ozone, aerosol size and composition.
Senior Standing.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

ATM 536. Hurricanes. 3 Credit Hours.
This course is intended to provide a broad overview of tropical cyclones, starting from the basic structure, dynamics and thermodynamics, then expanding through to observations, modeling, forecasting and impacts.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

ATM 537. Natural Hazards: Atmosphere and Ocean. 3 Credit Hours.
This course is designed to provide students with an understanding of natural hazards in both the atmosphere and ocean. In the atmosphere, we will explore both weather events such as storms and hurricanes and tornadoes as well as longer term phenomena such as monsoons and excess rainfall in the tropics. Oceanographically, the course will address hazards such as storm surge and flooding, rogue waves, rip currents, and tsunamis that occur on short time scales as well as the longer terms effects such as sea level rise and the impacts of El Niño and La Niña oceanographic conditions on weather conditions. Thus, the course focus is on hazards and their impacts around the globe.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

ATM 553. Climate Change. 3 Credit Hours.
Overview of the physical processes which regulate the earth's climate and response to forcing.
1 year of Calculus 1 year Physics.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

ATM 554. Climate Variability. 3 Credit Hours.
This class will cover the physical mechanisms that govern the earth's climate and climate variability. It is intended for beginning graduate students in marine and atmospheric science, and upper-level undergraduate physical science students.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

ATM 562. Advanced Weather Forecasting. 3 Credit Hours.
Students will learn the skills needed in researching and preparing a professional weather forecast. There is a plethora of forecast resources available online. Students will learn about using these forecast resources and share resources of their own. Specifically, we will cover topics such as the basics of atmospheric meteorology, large and small scale weather forecasting, operational weather forecasting, tropical weather, severe weather, nor'easters, lake effect snow, oscillations and various other weather phenomena. During the course of the semester a couple of Guest speakers in various parts of the field will visit to discuss relevant topics.
Prerequisite: ATM 243 and ATM 305 and ATM 405.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

ATM 563. Mesoscale Meteorology and Severe Storms. 3 Credit Hours.
Course topics include the structure and dynamics of clouds, thunderstorms, and mesoscale convective systems, radar and satellite observations of clouds and precipitation, severe storm forecasting, mesoscale disturbances, frontal and orographic clouds, and precipitation.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

ATM 581. Special Topics. 1-4 Credit Hours.
Lectures, research projects or directed readings in special topics related to Atmospheric Sciences.
Components: LEC.
Grading: GRD.
Typically Offered: Fall, Spring, & Summer.

ATM 582. Special Topics. 3 Credit Hours.
Lectures, research projects or directed readings in special topics related to Atmospheric Sciences.
Components: LEC.
Grading: GRD.
Typically Offered: Fall, Spring, & Summer.

ATM 583. Special Topics. 1-4 Credit Hours.
Lectures, research projects or directed readings in special topics related to Atmospheric Sciences.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

ATM 584. Special Topics. 1-4 Credit Hours.
Lectures, research projects or directed readings in special topics related to Atmospheric Sciences.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

ATM 585. Special Topics. 1-4 Credit Hours.
Lectures, research projects or directed readings in special topics related to Atmospheric Sciences.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

ATM 611. Geophysical Fluid Dynamics I. 3 Credit Hours.
The basic equations of state, continuity, and motion. Topics include wave motions, group velocity, theory of stratified fluids and internal waves turbulence.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

ATM 614. Introduction to Weather and Climate. 3 Credit Hours.
This course will cover the structure, physics, dynamics and thermodynamics of the atmosphere; including weather analysis, weather forecasting, climate and climate change. Contemporary topics covered in this class will include global warming, the ozone hole, hurricanes, thunderstorms and other severe weather phenomena.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

ATM 624. Applied Data Analysis. 3 Credit Hours.
The course is intended to jump-start students in strategies for fruitful computer interaction practices for careers in MPO areas of science. Academic topics include key concepts in probability & statistics, issues of graphical evidence and inference, linear models and regression, spectral analysis, and matrix decomposition. Practical topics include hands-on exercises in data analysis and the sharing of code+results and interpretation. Students do projects on data from their research or interests.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

ATM 632. Broadcast Meteorology. 3 Credit Hours.
Students will learn the proper techniques involved in preparing and presenting a complete and professional weathercast with a heavy emphasis on communication skills, computer graphics, and on-camera delivery.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

ATM 633. Atmospheric Boundary Layer. 3 Credit Hours.
The boundary layer is the lowest 1-2 km of the atmosphere, where we live. It is necessary to understand boundary layer processes to pursue research in clouds and radiation, weather and climate, air/sea/land interaction, and chemistry of the lower atmosphere. In this course, students will learn the basic physical concepts, from observational, theoretical and modeling perspectives.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

ATM 634. Introduction to Atmospheric Chemistry. 3 Credit Hours.
This course covers the basic principles of atmospheric chemistry. Concepts taught will include gas phase reactions, the production and destruction of ozone, aerosol size and composition.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

ATM 636. Hurricanes. 3 Credit Hours.
This course is intended to provide a broad overview of tropical cyclones, starting from the basic structure, dynamics and thermodynamics, then expanding through to observations, modeling, forecasting and impacts.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

ATM 637. Natural Hazards: Atmosphere and Ocean. 3 Credit Hours.
This course is designed to provide students with an understanding of natural hazards in both the atmosphere and ocean. In the atmosphere, we will explore both weather events such as storms and hurricanes and tornadoes as well as longer term phenomena such as monsoons and excess rainfall in the tropics. Oceanographically, the course will address hazards such as storm surge and flooding, rogue waves, rip currents, and tsunamis that occur on short time scales as well as the longer terms effects such as sea level rise and the impacts of El Niño and La Niña oceanographic conditions on weather conditions. Thus, the course focus is on hazards and their impacts around the globe.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

ATM 651. Introduction to Atmospheric Dynamics. 3 Credit Hours.
This course surveys the dynamics of atmospheric flow and the physically-grounded description and depiction of weather phenomena. It is intended to serve as core preparation for incoming PhD students whose research will be dynamical, while also serving as an accessible overview for students in other subdisciplines. For these reasons, it stresses phenomena and the essentials of our physical discourses about them (emphasizing useful approximations and lucid treatments), with enough exposure to the underlying full-complexity fundamentals to facilitate more advanced study in the future.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

ATM 652. Introduction to Atmospheric Physics. 3 Credit Hours.
The goal of this class is to develop an understanding of the fundamental physical processes governing cloud behavior and atmospheric radiative transfer, including atmospheric thermodynamics. The class will focus on processes with temporal scales of one day or less, and spatial scales of 1km or less, and will recognize the links to weather and climate, or through the student presentations. Students will learn about: cloud formation, lifetime, and dissipation, and how clouds interact with the aerosol, thermodynamic, and dynamic environments; about how clouds and clear skies interact with sunlight and infrared. This course is split into two sections: the first half will cover thermodynamics and cloud physics, and the second half will cover atmospheric radiation. Guest lectures by advanced graduate students and postdoctoral research associates will introduce students to current research areas.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

ATM 653. Climate Change. 3 Credit Hours.
Overview of the physical processes which regulate the earth's climate and response to forcing.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

ATM 654. Climate Variability. 3 Credit Hours.
This class will cover the physical mechanisms that govern the earth's climate and climate variability. It is intended for beginning graduate students in marine and atmospheric science, and upper-level undergraduate physical science students.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

ATM 660. Tropospheric Chemistry I. 3 Credit Hours.
Process-Oriented lower atmospheric chemistry. Topics include photochemical oxidant formation, nighttime chemistry, air-sea exchange, cloud droplet and aerosol reactions, physical properties of aerosols, and transport properties of the troposphere.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

ATM 662. Advanced Weather Forecasting. 3 Credit Hours.
Students will learn the skills needed in researching and preparing a professional weather forecast. There is a plethora of forecast resources available online. Students will learn about using these forecast resources and share resources of their own. Specifically, we will cover topics such as the basics of atmospheric meteorology, large and small scale weather forecasting, operational weather forecasting, tropical weather, severe weather, nor'easters, lake effect snow, oscillations and various other weather phenomena. During the course of the semester a couple of Guest speakers in various parts of the field will visit to discuss relevant topics.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

ATM 663. Mesoscale Meteorology and Severe Storms. 3 Credit Hours.
Course topics include the structure and dynamics of clouds, thunderstorms, and mesoscale convective systems, radar and satellite observations of clouds and precipitation, severe storm forecasting, mesoscale disturbances, frontal and orographic clouds, and precipitation.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

ATM 681. Special Topics. 1-4 Credit Hours.
Lectures, research projects or directed readings in special topics related to Atmospheric Sciences.
Components: LEC.
Grading: GRD.
Typically Offered: Fall, Spring, & Summer.

ATM 682. Special Topics. 3 Credit Hours.
Lectures, research projects or directed readings in special topics related to Atmospheric Sciences.
Components: LEC.
Grading: GRD.
Typically Offered: Fall, Spring, & Summer.

ATM 683. Special Topics. 1-4 Credit Hours.
Lectures, special projects or directed readings in special topics related to Atmospheric Sciences.
Components: LEC.
Grading: GRD.
Typically Offered: Fall, Spring, & Summer.

ATM 684. Special Topics. 1-4 Credit Hours.
Lectures, special projects or directed readings in special topics related to Atmospheric Sciences.
Components: LEC.
Grading: GRD.
Typically Offered: Fall, Spring, & Summer.

ATM 685. Special Topics. 1-4 Credit Hours.
Lectures, research projects or directed readings in special topics related to Atmospheric Sciences.
Components: LEC.
Grading: GRD.
Typically Offered: Fall, Spring, & Summer.

ATM 711. Geophysical Fluid Dynamics II. 3 Credit Hours.
The focus of this course is on the effects of stratification, on time variable phenomena, and on the interaction between large-scale circulation and mesoscale eddies. Course topics include quasi geostrophic scale analysis, Rossby waves, barotropic and baroclinic instability, wave-mean flow interaction and non-geos trophic waves.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

ATM 713. Predictability. 3 Credit Hours.
Introduction to concepts of predictability and error growth, beginning from the seminal papers of Ed Lorenz, and expanding into state estimation, data assimilation, forecast sensitivity and ensemble prediction.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

ATM 716. Lagrangian Fluid Dynamics and Predictability. 3 Credit Hours.
The ash cloud produced by the eruption of Eyjafjallajokull in Iceland, the oil spill produced by the explosion of the Deepwater Horizon drilling rig in the Gulf of Mexico, and release of debris and radioactive contamination into the Pacific Ocean after the Fukushima nuclear reactor was hit by the Tohoku tsunami, are examples of events that have caused considerable impact to the environment. They all represent problems in Lagrangian ocean or atmospheric dynamics in which predicting where the material released into the environment will be transported by the ocean currents or winds is critical. A common approach to predict the outcome of an event like the above is to run an ocean or atmosphere circulation model simulations and then integrate the resulting velocity fields from a given release location to predict pollutant trajectories. An important drawback of such an approach is that the predictions are highly sensitive to small changes in the release time and location. Attempts to cope with the sensitivity to initial conditions include running several different models for the same scenario, but this typically leads to even larger distributions of advected tracers, hiding the key organizing structures of the flow. Improved understanding and forecasting requires novel notions and techniques capable of casting light on why material is transported the way it is by a given flow. The goal of this course is acquaint the student with a series of recent developments originated at the interface of nonlinear dynamics and fluid dynamics that have led to a number of novel such notions and techniques.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

ATM 731. Air-Sea Interaction. 3 Credit Hours.
Oceanic and atmospheric mixed layers including fluxes of heat, momentum, moisture and salt between the ocean and atmosphere; vertical distribution of energy sources and sinks at the interface including the importance of surface currents; forced upper ocean dynamics, the role of surface waves on the air-sea exchange processes and ocean mixed layer processes.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

ATM 732. Climate Dynamics. 3 Credit Hours.
Basic understanding of the Earth's Climate System and its variability on time scales ranging from weeks to millennia. Topics include internal atmospheric variability, coupled ocean-atmosphere interactions, and the theory, observations and modeling of climate change.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

ATM 750. Reaction Kinetics and Molecular Dynamics. 3 Credit Hours.
Theories and experimental techniques for studying kinetics in the gas-phase, association, unimolecular and bimolecular reactions, chain reactions, flames, statistical theories, potential energy surfaces, collision dynamics, kinetics in solution and the solid-state, experimental methods, diffusion-controlled processes, transition state theory, thermal decomposition, and nucleation are discussed.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

ATM 761. Atmospheric Chemistry II. 3 Credit Hours.
Advanced atmospheric chemistry.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

ATM 762. Computer Models in Fluid Dynamics. 3 Credit Hours.
Course topics include numerical techniques of dealing with dynamic problems in meteorology and oceanography. Dynamic prediction models, initial data conditioning, computational stability, and error estimates are also included.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

ATM 764. Atmospheric and Oceanic Turbulence. 3 Credit Hours.
Structure and dynamics of planetary boundary layers, turbulent transport processes, Fickian and statistical theories of turbulence, influence of stratification, and rotation on turbulent motion are discussed.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

ATM 765. General Circulation of the Atmosphere. 3 Credit Hours.
Course topics include structure and behavior of planetary scale motions, energy, momentum, and moisture budgets of the general circulation, and models of the general circulation and climatic change.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

ATM 767. Spectral and Finite Element Methods in Computational Fluid Dynamics. 3 Credit Hours.
The simulation of fluid flows in geometrically complex domains (like ocean basins) and/or with high fidelity requires the adoption of new discretization techniques that can simultaneously handle the complicated geometry and permit high accuracy solution. The finite element method has traditionally been used to tackle the geometric complexity while spectral methods have been developed to handle high accuracy in simple geometries. Here we present an approach to handle both complexity within a single framework, namely the spectral element method. The course starts by describing the weak formulation common to all finite element methods which, by design, are geometrically flexible. The second part of the course describe how high order polynomial can be implemented within the finite element framework to achieve high accuracy rates.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

ATM 768. ENSO Dynamics, Prediction, and Predictability. 3 Credit Hours.
This course will provide students with a comprehensive observational and mechanistic understanding of the El Nino and the Southern Oscillation (ENSO) phenomena and how ENSO impacts the natural variability of the global climate system. Topics will include: Observations and theories of the seasonal and interannual changes in the ocean circulation and temperature, and interactions with the atmosphere; equations of motion and theories of tropical ocean and atmosphere circulation; tropical wave dynamics; large scale air-sea coupling; mechanisms for ENSO: delayed oscillator theory, recharge oscillator theory, slow SST modes; ENSO prediction and predictability; ENSO-monsoon-Indian Ocean interactions; Global climate response to ENSO; decadal ENSO variability; ENSO in a changing climate. This course has a phenomenological focus, which complements current MPO course offerings. In particular, students who have taken dynamic and physical meteorology, ocean general circulation or geophysical fluid dynamics will be exposed to how general theory (e.g., wave dynamics) relates to particular phenomena and current research foci. In addition, student will have the opportunity to design and implement numerical hypothesis testing experiments.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

ATM 770. Seminar in Atmospheric Science. 1 Credit Hour.
Oral presentation of research and special topics by students, faculty, and visiting scientists.
Components: SEM.
Grading: SUS.
Typically Offered: Fall & Spring.

ATM 772. Vortex Dynamics. 3 Credit Hours.
This course will cover fundamental to advanced topics in vortex dynamics. A review of fluid dynamics and vorticity in two dimensions will be followed by studies of vortex dynamics in three-dimensional, incompressible flow and in three-dimensional, stratified flow.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

ATM 774. Advanced Studies. 1-4 Credit Hours.
Supervised study of special interest to graduate students.
Components: LEC.
Grading: GRD.
Typically Offered: Offered by Announcement Only.

ATM 805. MPS Internship. 1-6 Credit Hours.
The MPS internship is an approved, supervised internship project with an organization engaged in activities associated with the student's degree track. The internship results in a collaborative project, written report, and oral presentation on a topic approved by the student's advisory committee. Up to 6 credits are necessary for graduation.
Components: PRA.
Grading: SUS.
Typically Offered: Fall, Spring, & Summer.

ATM 810. Master's Thesis. 1-6 Credit Hours.
The student working on their master's thesis enrolls for credit, in most departments not to exceed six, as determined by their advisor. Credit is not awarded until the thesis has been accepted.
Components: THI.
Grading: SUS.
Typically Offered: Fall, Spring, & Summer.

ATM 820. Research in Residence. 1 Credit Hour.
Used to establish research in residence for the master's degree, after the student has enrolled for the permissible cumulative total in appropriate thesis research. Credit not granted. May be regarded as full-time residence as determined by the Dean of the Graduate School.
Components: THI.
Grading: SUS.
Typically Offered: Fall, Spring, & Summer.

ATM 830. Doctoral Dissertation. 1-12 Credit Hours.
Required of all candidates for the Ph.D. The student will enroll for credit as determined by their advisor, but for not less than a total of 12 hours. Up to 12 hours may be taken in a regular semester, but not more than six in a summer session. Where a student has passed their (a) qualifying examinations, and (b) is engaged in an assistantship, they may still take the maximum allowable credit stated above.
Components: THI.
Grading: SUS.
Typically Offered: Fall, Spring, & Summer.

ATM 850. Research in Residence. 1 Credit Hour.
Used to establish research in residence for the Ph.D., after the student has been enrolled for the permissible cumulative total in appropriate doctoral research. Credit not granted. May be regarded as full-time residence as determined by the Dean of the Graduate School.
Components: THI.
Grading: SUS.
Typically Offered: Fall, Spring, & Summer.