

# ATMOSPHERIC SCIENCE - METEOROLOGY

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Dept. Code: ATM

## Meteorology

Meteorology is the study of the atmosphere, including climate and climate variability, weather forecasting, cloud and precipitation physics, tropical dynamics, severe weather and hurricanes. Atmospheric scientists use computer models and sophisticated observing systems to describe and understand the atmosphere. The curriculum emphasizes math and physics basics, providing a strong foundation for an intensive study of meteorology. The curriculum, conforming to the recommendations of the American Meteorological Society, prepares students for graduate school and for jobs in industry and government.

The Rosenstiel School offers a Bachelor of Science in Marine and Atmospheric Science with a major in Meteorology. The major includes a minor in Mathematics with an adequate MTH GPA.

Although Meteorology is a single major program, students often combine Meteorology with a second major in such diverse fields as Mathematics, Marine Science, or Broadcast Journalism. Interested students should read the information below and contact the Rosenstiel School Undergraduate office (Ungar 210A or 305-284-2180) for details.

## Double Major Options

### Mathematics

The double major in Meteorology and Mathematics is intended for students who anticipate graduate study in Atmospheric Science and require a strong background in Mathematics. Interested students may find more information on the B.S.M.A.S. in Meteorology and Mathematics here (<http://bulletin.miami.edu/undergraduate-academic-programs/marine-atmospheric-science/atmospheric-science-meteorology/double-major-meteorology-mathematics-bs/>).

### Marine Science

The double major in Meteorology and Marine Science is intended for those students who wish to have a truly interdisciplinary career in atmospheric and marine science. Interested students may find more information on the B.S.M.A.S. in Meteorology and Marine Science here (<http://bulletin.miami.edu/undergraduate-academic-programs/marine-atmospheric-science/marine-science/marine-science-meteorology-bs/>).

### Broadcast Journalism

The double major in Meteorology and Broadcast Journalism is designed for Meteorology majors interested in Broadcast Meteorology. Students interested in adding Broadcast Journalism as a second major should review the School of Communication (<http://bulletin.miami.edu/undergraduate-academic-programs/communication/journalism-media-management/broadcast-journalism-bs/>) page for additional requirements.

#### **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:** GRD.

**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 term 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.