DEPARTMENT OF ATMOSPHERIC SCIENCES

http://atmo.tamu.edu

Head: P. Yang

Graduate Advisor: B. Dennis

Thesis and non-thesis Master of Science as well as Doctor of Philosophy degrees are offered in atmospheric sciences. Students from disciplines other than meteorology are encouraged to enroll in our graduate program. Normal prerequisites are 12 hours of calculus and differential equations and 8 hours of physics. The department offers a basic sequence of courses each year that covers key topics of atmospheric relevance in the areas of fluid dynamics, thermodynamics, cloud physics, radiation, and chemistry. These courses form a base for a large number of the other graduate courses. By the end of their first year, students typically have made arrangements to begin a research project directed by a faculty member. Faculty interests span a wide range extending from field and laboratory work through data analysis, numerical modeling, and theory. Please see the department's website at http://atmo.tamu.edu for more information. The Department of Atmospheric Sciences can also serve as the "home" department for the Master of Geoscience Degree. The MGsc is a non-thesis degree that provides a multidisciplinary background in the geosciences that is appropriate for science teachers in public schools or for individuals interested in environmental issues.

Persons with an MS degree in atmospheric sciences typically obtain employment with government agencies, industrial organizations, and consulting firms, or they may enter the meteorological branch of one of the military services. The PhD degree is normally required for a college level teaching or research career.

The Department of Atmospheric Sciences occupies the upper floors in the 15-story David G. Eller Building for Oceanography and Meteorology. The 10-cm Doppler weather radar on top of the building is a campus landmark, and the department jointly operates two mobile radars. In-house laboratory facilities and fixed and mobile observing suites offer many opportunities for physical and chemical studies of the atmosphere. The department is well-equipped for data analysis and modeling, with a high-speed network, numerous personal computers, teaching laboratories, and high-performance computing systems. Additional computing resources are available at the University's Supercomputing Facility.

The Cooperative Institute for Applied Meteorological Studies (CIAMS) is affiliated with the Fort Worth-based headquarters office of the Southern Region of the National Weather Service. The Institute employs research scientists and graduate students in a broad program of applied research and service to Texas and surrounding states in agricultural meteorology, marine meteorology and air-sea interactions over the Gulf of Mexico, lightning and severe weather, and Doppler radar studies from the installments in the Department and at the Houston Forecast Office.

Faculty

Bowman, Kenneth P, Professor
Atmospheric Sciences
PHD, Princeton University, 1984

Brooks, Sarah D, Professor
Atmospheric Sciences
PHD, University of Colorado, 2002

Collins, Donald R, Professor
Atmospheric Sciences
PHD, California Institute of Technology, 2000

Conlee, Don T, Instructional Professor
Atmospheric Sciences
PHD, Texas A&M University, 1994

Dessler, Andrew E, Professor
Atmospheric Sciences
PHD, Harvard University, 1994

Epifanio, Craig C, Associate Professor
Atmospheric Sciences
PHD, University of Washington, 1999

Korty, Robert L, Associate Professor
Atmospheric Sciences
PHD, Massachusetts Institute of Technology, 2005

Lemmon, Mark T, Associate Professor
Atmospheric Sciences
PHD, University of Arizona, 1994

Logan, Timothy S, Professor
Atmospheric Sciences
PHD, University of North Dakota, 2014

Nielsen-Gammon, John W, Professor
Atmospheric Sciences
PHD, Massachusetts Institute of Technology, 1990

North, Jerry R, Research Professor
Atmospheric Sciences
PHD, University of Wisconsin - Madison, 1966

Nowotarski, Christopher J, Assistant Professor
Atmospheric Sciences
PHD, The Pennsylvania State University, 2013

Orville, Richard E, Research Professor
Atmospheric Sciences
PHD, University of Arizona, 1966

Panetta, Richard L, Professor
Atmospheric Sciences
PHD, University of Wisconsin - Madison, 1978

Rapp, Anita D, Assistant Professor
Atmospheric Sciences
PHD, Colorado State University, 2008

Saravanan, Ramalingam, Professor
Atmospheric Sciences
PHD, Princeton University, 1999

Schade, Gunnar W, Associate Professor
Atmospheric Sciences
PHD, Johannes Gutenberg Universitat, Germany, 1997
Schumacher, Courtney, Professor  
Atmospheric Sciences  
PHD, University of Washington, 2003

Szunyogh, Istvan, Professor  
Atmospheric Sciences  
PHD, Hungarian Academy of Sciences, 1994

Xu, Yangyang, Associate Professor  
Atmospheric Sciences  
PHD, University of California, San Diego, 2014

Yang, Ping, Professor  
Atmospheric Sciences  
PHD, University of Utah, 1995

Zhang, Renyi, Professor  
Atmospheric Sciences  
PHD, Massachusetts Institute of Technology, 1994

**Masters**

- Master of Science in Atmospheric Sciences ([http://catalog.tamu.edu/graduate/colleges-schools-interdisciplinary/geosciences/atmospheric-sciences/ms](http://catalog.tamu.edu/graduate/colleges-schools-interdisciplinary/geosciences/atmospheric-sciences/ms))

**Doctoral**

- Doctor of Philosophy in Atmospheric Sciences ([http://catalog.tamu.edu/graduate/colleges-schools-interdisciplinary/geosciences/atmospheric-sciences/phd](http://catalog.tamu.edu/graduate/colleges-schools-interdisciplinary/geosciences/atmospheric-sciences/phd))

**Courses**

**ATMO 601 Fundamentals of Atmospheric Dynamics**  
Credits 3. 3 Lecture Hours.  
Basic concepts of fluid dynamics; meteorological approximations and coordinate systems; simple models and wave motion; barotropic models.  
**Prerequisite:** Approval of instructor.

**ATMO 602 Atmospheric Physics I**  
Credits 3. 3 Lecture Hours.  
Integrated treatment of the dry and moist thermodynamics of the atmosphere, and cloud and precipitation microphysics.

**ATMO 603 Quantitative Methods for the Atmospheric Sciences**  
Credits 3. 3 Lecture Hours.  
Mathematical and numerical methods applied to ODE’s, PDE’s and statistical methods; methods of analysis and modeling of atmospheric phenomena.  
**Prerequisites:** Concurrent registration in ATMO 601 and CSCE 203 or equivalents.

**ATMO 604 General Circulation and Climate**  
Credits 3. 3 Lecture Hours.  
Observed large scale circulation and climate of the earth; physical processes which maintain relevant budgets; models and theories explaining mean observations.  
**Prerequisite:** ATMO 601.

**ATMO 606 Atmospheric Chemistry I**  
Credits 3. 3 Lecture Hours.  
Fundamentals of atmospheric chemistry; tropospheric ozone, NOx and HOx cycling, sulfur chemistry, stratospheric chemistry, and aerosol composition; analytical measurement methods; review of chemical basics as needed.

**ATMO 611 Atmospheric Dynamics II**  
Credits 3. 3 Lecture Hours.  
Continuation of ATMO 601; flow in planetary boundary layer; balanced flows; atmospheric instabilities; tropical dynamics.  
**Prerequisite:** ATMO 601 or approval of instructor.

**ATMO 612 Atmospheric Physics II**  
Credits 3. 3 Lecture Hours.  
Continuation of ATMO 602. Radiative transfer into the atmosphere.  
**Prerequisite:** ATMO 602.

**ATMO 613 Advanced Atmospheric Chemistry**  
Credits 3. 3 Lecture Hours.  
An advanced survey of fundamental atmospheric processes involving biogeochemical cycles, air pollution, tropospheric chemistry, atmospheric aerosols and stratospheric chemistry.  
**Prerequisite:** ATMO 606.

**ATMO 618 Numerical Methods for the Geosciences**  
Credits 3. 3 Lecture Hours.  
Mathematical theory and numerical techniques for modeling physical systems and processes in the Geosciences; discretization of continuum equations for solids and fluids; finite difference methods convergence, consistency, and stability; finite element and spectral methods in fluid dynamics and geosimulation; iterative solvers; implicit and explicit methods for diffusion and advection.  
**Prerequisite:** Graduate classification or approval of instructor.  
**Cross Listing:** GEOP 618 and OCNG 618.

**ATMO 629 Climate Change**  
Credits 3. 3 Lecture Hours.  
Climate of the geological and recent past; methods of assessing climate and climatic change; mechanisms, models, theories, impact and prediction of climatic change.  
**Prerequisites:** ATMO 324 or equivalent; approval of instructor.

**ATMO 631 Climate Modeling**  
Credits 3. 3 Lecture Hours.  
A study of mathematical models used in the simulation of climate. Development and structure of selected members of the hierarchy of models ranging from energy balance models to general circulation models. Applications to paleoclimate and future climate scenarios.  
**Prerequisite:** Approval of instructor.

**ATMO 632 Statistical Methods in Climate Research**  
Credits 3. 3 Lecture Hours.  
Advanced techniques especially applicable to climatology; space-time random field analysis applied to stochastic models, parameter estimation, statistical forecasting, data interpolation and signal detection; applications to real data and climate model output.  
**Prerequisites:** STAT 601 or equivalent; approval of instructor.

**ATMO 636 Dynamic Meteorology**  
Credits 3. 3 Lecture Hours.  
General circulation; stratospheric dynamics; tropical systems.  
**Prerequisite:** ATMO 611.

**ATMO 638 Dynamics of Convective Clouds**  
Credits 3. 3 Lecture Hours.  
Parcel, slice and entrainment concepts; bubble and plume theories; spherical vortex; the starting plume; one-dimensional models; selected topics of current interest.  
**Prerequisite:** ATMO 611.
ATMO 645 Cloud and Precipitation Physics  
Credits 3. 3 Lecture Hours.  
Physics of atmospheric condensation nuclei, ice in the atmosphere; precipitation processes; artificial modification of clouds; precipitation.  
Prerequisite: ATMO 612 or approval of instructor.

ATMO 655 Satellite Data in Meteorology  
Credits 3. 3 Lecture Hours.  
Meteorological satellite programs of the United States and other countries; theory of meteorological measurements from artificial satellites; applications of satellite data in determinations of atmospheric structure and in forecasting; recent and current research studies; future programs.  
Prerequisite: ATMO 251 or approval of instructor.

ATMO 656 Tropical Meteorology  
Credits 3. 3 Lecture Hours.  
Role of the tropics in global circulation; structure and dynamics of the tropical zone; local and diurnal phenomena; synoptic components; tropical cyclones; role of cumulus-scale convection; current topics.  
Prerequisite: ATMO 251 or approval of instructor.

ATMO 657 Mesometeorology  
Credits 3. 3 Lecture Hours.  
Theory and structure of mesoscale weather systems and their relation to larger and smaller scale systems.  
Prerequisite: ATMO 251 or approval of instructor.

ATMO 658 Synoptic Meteorology  
Credits 3. 3 Lecture Hours.  
Mechanism and energetics of general circulation. Structure of large-scale systems. Persons desiring practice in analysis techniques should enroll for 1 hour or more of ATMO 685.  
Prerequisite: ATMO 251 or approval of instructor.

ATMO 659 Tropical Cyclones  
Credits 3. 3 Lecture Hours.  
Tropical climatology; structure evolution and motion of tropical cyclones; tropical cyclone hazards; large scale tropical phenomena.  
Prerequisite: ATMO 251.

ATMO 661 Atmospheric Turbulence  
Credits 3. 3 Lecture Hours.  
Classical turbulence theories and statistical approaches; closure models; effects of rotation and stratification; interpretations of atmospheric observations.  
Prerequisite: ATMO 611 or suitable background in fluid dynamics.

ATMO 664 Laboratory Methods in Atmospheric and Environmental Sciences  
Credits 3. 2 Lecture Hours. 4 Lab Hours.  
Classroom and laboratory course; introduction to chemical techniques used to monitor the atmosphere and environment; instrumentation, sampling strategies; survey of current literature focusing on development of new techniques.  
Prerequisite: Graduate classification.

ATMO 677/OCNG 677 Geophysical Data Assimilation  
Credits 4. 3 Lecture Hours. 2 Lab Hours.  
Modern data assimilation methods applied to oceanic and atmospheric circulation models, as well as in other simple models; methods to interpolate one-, two-, and three-dimensional randomly spaced data to regular grids for use in numerical models of atmospheric and oceanic circulation.  
Prerequisites: OCNG 657, ATMO 632, STAT 601.  
Cross Listing: OCNG 677/ATMO 677.

ATMO 681 Seminar  
Credit 1. 1 Other Hour.  
Presented by students and faculty based upon their research work and upon surveys of the literature.

ATMO 685 Directed Studies  
Credits 1 to 16. 1 to 16 Other Hours.  
Offered to enable majors in meteorology to undertake and complete, with credit, in their particular fields of specialization, limited investigations not covered by any other courses in established curriculum.

ATMO 689 Special Topics in...  
Credits 1 to 4. 1 to 4 Lecture Hours. 0 to 4 Lab Hours.  
Special topics in an identified area of meteorology. May be repeated for credit.

ATMO 691 Research  
Credits 1 to 23. 1 to 23 Other Hours.  
For thesis or dissertation. Topic subject to approval of department head.