PROGRAM IN ATMOSPHERIC SCIENCE

Faculty

Professor Emeritae/i

Duncan C. Blanchard, Ph.D.*
Massachusetts Institute of Technology

Ulrich Czapski, Ph.D.
Hamburg University

Jai S. Kim, Ph.D.
University of Saskatchewan

Volker A. Mohnen, Ph.D.
University of Munich

Jon T. Scott, Ph.D.
University of Wisconsin

Professors

Lance F. Bosart, Ph.D.
Massachusetts Institute of Technology

Kenneth L. Demerjian, Ph.D.
Ohio State University

Daniel Keyser, Ph.D.
Pennsylvania State University

Arthur Z. Loesch, Ph.D.
University of Chicago

John E. Molinari, Ph.D.
Florida State University

Associate Professors

Vincent P. Idone, Ph.D. (Chairperson)
University at Albany

Robert G. Keesee, Ph.D.
University of Colorado

Christopher Thorncroft, Ph.D.
University of Reading

Assistant Professor

Karen Mohr, Ph.D.
University of Texas, Austin

Associated Faculty

Julius Chang, Ph.D.*
State University of New York at Stony Brook

David R. Fitzjarrald, Ph.D.*
University of Virginia

Lee C. Harrison, Ph.D.*
University of Washington, Seattle

David Knight, Ph.D.
University of Washington, Seattle

G. Garland Lala, Ph.D.*
University at Albany

Michael Landin, M.S.
University at Albany

Joseph J. Michalsky, Ph.D.*
University of Kentucky

Qilong Min, Ph.D.*
University of Alaska, Fairbanks

Richard R. Perez, Ph.D.*
University at Albany

James J. Schwab, Ph.D.*
Harvard University
Christopher J. Walcek, Ph.D.*
University of California, Los Angles
Wei-Chyung Wang, D.E.S.*
Columbia University
Kevin Tyle, M.S.
University at Albany
Fangqun Yu, Ph.D.*
University of California, Los Angeles

Visiting Professors

Michael J. Reeder
Monash University
Morris Weisman
National Center for Atmospheric Research
W. James Steenburgh
University of Utah

** Primary appointment with the Atmospheric Sciences Research Center as Research Professors.*

Adjuncts (estimated): 1
Teaching Assistants (estimated): 10

The Department of Earth and Atmospheric Sciences and the Atmospheric Sciences Research Center (ASRC) provide the University with the state's largest program in atmospheric science and meteorology.

The undergraduate program provides a broad background in three fundamental areas of atmospheric science: synoptic (observations and weather forecasting), dynamic (theory and computer modeling), and physical (lightning, acid rain, cloud physics, atmospheric chemistry). Because the department has a highly active research program in these areas, many opportunities exist for undergraduate research projects and part-time jobs.

The first two years of the program provide basic training in mathematics, physics, chemistry, and introductory atmospheric science. All students are encouraged to take one or two 100-level courses for enjoyment and experience (these count as electives but not as courses for the major). In the junior and senior years, requirements in the fundamental areas of atmospheric science are combined with electives, including advanced courses on atmospheric physics, atmospheric dynamics, weather forecasting, tropical meteorology and hurricanes, solar energy, air pollution, climatology, and computer applications. Highly qualified students are eligible to enter an accelerated degree program in their junior year that leads to a combined B.S./M.S. degree

Many opportunities exist for students to become involved in department activities. Each semester, several students take part in an internship program with the on-campus office of the National Weather Service (NWS), gaining experience with weather forecasting and familiarity with the responsibilities of a NWS meteorologist.

In addition, a weather forecasting competition is held in the department each semester while classes are in session. The forecasting, along with concurrent weather discussions led by a faculty member, are open to all undergraduate majors. Undergraduates hired part-time and during the summer through research grants have the chance to work closely with a faculty member while contributing to current meteorological research. The Eastern New York Chapter of the American Meteorological Society (AMS) meets regularly and provides speakers of general interest on a variety of meteorological topics. Through these and other activities, the department offers exciting and varied opportunities to any student curious about the science of the atmosphere around us.

Careers

Graduates obtain employment in weather forecasting, environmental engineering, radio and TV broadcasting, scientific consulting, and other private firms; in university departments and research laboratories; and in federal and state agencies such as the National Weather Service, U.S. Air Force, and State Department of Energy Conservation. About half our graduates choose to go on to graduate school for an advanced degree. (The department offers full financial support and a complete tuition waiver to most students accepted into our graduate program.)

Degree Requirements for the Major in Atmospheric Science

General Program B.S.: A combined major and minor sequence including A Atm 210 (or 210Z), 211, 320, 321, 333, 410, 411; at least 12 additional credits from A Atm 307 (or 307Z) and higher level courses as advised; A Phy 140, 145, 150, 240; A Mat 111 or 112 or 118, 113 or 119, 214, 311; A Chm 120N, 122A. No more than 6 credits from A Atm 490, 497, 498 or 499 may be applied toward the major requirements; further, a maximum of 3 credits from A Atm 490 will apply.

A solid foundation in physics and mathematics is recommended for all students planning to major in atmospheric science. It is recommended that all students considering this major meet with a representative of the department before each of the freshman and sophomore registration sessions.

Departmental Honors Program

Students who have by the end of their fourth semester attained a cumulative grade point average of at least 3.25 and a grade point average of at least 3.5 in courses required of the major in atmospheric science may apply to the department chair for the program leading to a B.S. degree with honors in atmospheric science. Applications must be submitted before the end of the first semester of the student's junior year and must be accompanied by letters of recommendation from at least two faculty members.

To be admitted to the program, a student must have completed three semesters of physics (A Phy 140, 145, 150, 240, three semesters of mathematics (A Mat 111 or 112 or 118, 113 or 119, 214), and must be enrolled in or have completed A Atm 333. These requirements may be altered, upon request, for qualified transfer students. At the end of the junior year, the student's program will be reviewed by the Honors Committee to see if satisfactory progress is being made.

To be eligible for a degree with honors, students must complete a minimum of 74 credits specified as follows: (1) the physics, mathematics, and chemistry requirements of the major; (2) the core sequence in atmospheric science (A Atm 210 or 210Z, 211, 320, 321, 333, 410 and 411) plus any three A Atm courses at the 400 or 500 level; (3) a coherent core of three upper-division courses in any discipline besides atmospheric science; and (4) 6 credits of A Atm 499 taken over at least two semesters culminating in a significant undergraduate thesis and an honors seminar in the student's final semester. Students in the program must maintain both a minimum grade point average of 3.25 overall and 3.5 in atmospheric science courses taken to satisfy major requirements during the junior and senior years.

Upon completion of the requirements, the honors committee will make its recommendation to the faculty to grant the degree with honors in atmospheric science based upon the candidate's (1) academic record, (2) research project report, (3) honors seminar, and (4) faculty recommendations.

Degree Requirements for the Major in Earth and Atmospheric Sciences

Bachelor of Arts (B.A.): A minimum of 56-60 credits for the combined major and minor including: A Phy 105, 106, 108, 109; A Mat 101, 108, 111; A Chm 120N; A Geo 100N or 100F, 106, 250 A Gog 101N; A Atm 100N or 102N, 210 or 210Z, 211; two courses from A Gog 304, 385, 431, 496; a total of at least 12 credits from the following, including at least one course from each discipline: A Geo 330, 350, 435; A Atm 304 or 304Z, 305, 307 or 307Z, 311, 335, 390, 408B.

The B.A. in Earth and Atmospheric Sciences is offered as an interdisciplinary study of significant breadth spanning two classical disciplines. Students electing this major have the potential to realize new opportunities for personal enrichment and career development. However, those students committed to seeking advanced degrees in the geological or atmospheric sciences should pursue the corresponding B.S. degree instead. All students contemplating any of the curricula described here should thoroughly discuss their options with personnel of the Advisement Services Center (ASC) and a department undergraduate adviser before formal declaration of a specific major.

Combined B.S./M.S. Program

The combined B.S./M.S. program in atmospheric science provides an opportunity for students of recognized academic ability and educational maturity to fulfill simultaneously undergraduate and graduate course requirements in their senior year, thereby accelerating progress toward the M.S. degree. A carefully designed program can permit a student to complete the B.S. and M.S. degrees one year sooner than is otherwise possible.

The combined program requires a minimum of 138 credits, of which at least 30 must be graduate credits. In qualifying for the B.S., students must meet all University and college requirements, including the requirements of the undergraduate major described previously, the minimum 60-credit liberal arts and sciences requirement, the general education requirements, and residency requirements. In qualifying for the M.S., students must meet all University and college requirements as outlined in the

Graduate Bulletin, including completion of a minimum of 30 graduate credits and any other conditions such as a research seminar, thesis, comprehensive examination, professional experience, and residency requirements. Up to 9 graduate credits may be applied simultaneously to both the B.S. and M.S. programs.

In the summer following the senior year, the student will begin work on his or her graduate research. In preparation for this accelerated research program, the student will be required to take two semesters (6 credits) of A Atm 499, Undergraduate Research, during the junior or senior year. These 6 credits may be counted toward the undergraduate elective requirement from either of the following requirements: (1) from any four additional

A Atm courses at the 400 or 500 level as advised or (2) from 6 additional credits in mathematics or sciences as advised.

Students are considered as undergraduates until completion of 120 graduation credits and satisfactory completion of all B.S. requirements. Upon meeting B.S. requirements, students are automatically considered as graduate students.

Students may apply for admission to the combined degree program in atmospheric science at the beginning of their junior year or after the successful completion of 56 credits, but not later than the accumulation of 100 credits. A cumulative grade point average of 3.2 or higher and three supportive letters of recommendation from faculty are required for consideration.

Courses

A Atm 100N The Atmosphere (3)
Non-technical survey of the atmosphere; the physical environment of society and its historical development; intentional and unintentional modifications of the environment; cloud types and structure; severe storms; weather forecasting; air pollution; major wind and weather systems. Does not yield credit toward the major in atmospheric science. Two lectures, one-two-hour discussion each week. May not be taken for credit by students with credit for A Atm 210 or 210Z or 320. Fall semester only. [NS]

A Atm 101N The Upper Atmosphere (3)
Elementary survey of the properties and geophysical phenomena of the upper atmosphere; ionosphere, magnetosphere, and interplanetary space, ionospheric and magnetic storms; aurora and airglow; observational techniques including rockets and satellites. Does not yield credit toward the B.S. in atmospheric science. Two lectures, one two-hour discussion each week. May not be offered in 2003-2004. [NS]

A Atm 102N Science and Major Environmental Issues (3)
Study of the role of science in creating, defining, evaluating, and resolving major issues relating to energy production and its use and impact on the physical environments; case studies of such issues as change in climate, air pollution, the fluorocarbon/ozone link, etc. Three lectures each week. Does not yield credit toward the B.S. in atmospheric science. Spring semester only. [NS]

A Atm 107N The Oceans (3)
Introductory survey of the physical, chemical, geological, and biological processes in the marine environment; promise and problems of the oceans as a natural resource. Does not yield credit toward the B.S. in atmospheric science. Three lectures each week. Spring semester only. [NS]

A Atm 199 Contemporary Issues in Atmospheric Science (1)
Issues from the current literature in selected areas of atmospheric science. Particular areas of study to be announced each term. Intended for students interested in exploring in depth themes covered in large lecture courses. Prerequisite(s): permission of instructor. *S/U* graded. .May not be offered in 2003-2004.

A Atm 210 Atmospheric Structure and Circulation (4)
Technical survey of the atmosphere with application of elementary physical and mathematical concepts to the horizontal and vertical structure of the atmosphere; planetary, regional and local circulations; atmospheric radiation; precipitation physics and thermodynamics. Three lectures and one discussion/lab period per week. Prerequisites: A Mat 111 or 112 or 118; A Phy 108 or 150. Fall semester only.

A Atm 210Z Atmospheric Structure and Circulation (4)
A Atm 210Z is writing intensive version of A Atm 210; only one may be taken for credit. Fall semester only. Three lectures and one discussion/lab period per week. [WI]

A Atm 211 Weather Analysis and Forecasting (4)
Physical principles and empirical methods of weather analysis and forecasting, with emphasis on synoptic, regional and local weather systems; introduction to use and interpretation of observed weather data, satellite imagery, temperature and precipitation processes, soundings and stability; use of computer forecast guidance models and products of the National Centers for Environmental Prediction. Prerequisite: A Atm 210 (or Atm 210Z) or permission of instructor. Spring semester only.

A Atm 297 Independent Study I (1-3)
By advisement only and may be repeated once for credit. *S/U* graded. Fall and Spring semesters.

A Atm 300Z Solar Energy (3)
Discussion of solar energy technology, including solar energy measurement and distribution; direct use of the sun's energy; solar architecture; energy from wind, tides, waves, currents, and salinity gradients; biomass and geothermal energy; energy use, conservation, and other major environmental issues. Prerequisite(s): 6 credits in mathematics including one course in calculus; A Phy 108N or 150; junior or senior class standing. .May not be offered in 2003-2004. [WI]

A Atm 304 Air Quality (3)
Designed for undergraduate students not pursuing the B.S. in Atmospheric Science. Topics include air pollution criteria standards and regulations, basic air pollution monitoring (including quality assurance), simple statistical analysis of data, and pollutant transport, transformation and deposition. Prerequisite(s): A Mat 111 or 112 or 118; A Phy 108 or 150.Offered alternate Spring semester. Next offered in Spring 2004.

A Atm 304Z Air Quality (3)
A Atm 304Z is writing intensive version of A Atm 304.; only one may be taken for credit. Offered alternate spring semesters; will next be offered in spring 2004. [WI]

A Atm 305 Global Physical Climatology (3)
The physical basis of climate and climate variability from a coupled atmosphere-ocean perspective. Emphasis will be placed on understanding the causes of regional climate differences and regional climate variability and the role that the

global atmosphere and oceans play in the process Prerequisite(s): A Atm 210 (or 210Z). Offered alternate fall semesters; will next be offered in fall 2003.

A Atm 307 (= A Chm 307) Introduction to Atmospheric Chemistry (3)
Chemical principles and concepts leading to understanding the composition and change in the chemical/atmospheric environment; sources and links of chemical constituents; chemistry of the troposphere and stratosphere; measurement and theory of greenhouse gases; global pollution and ozone depletion. Prerequisite(s): A Mat 111 or 112 or 118; A Phy 108 or 150; A Chm 121N. Offered alternate Spring semesters. Will next be offered Spring 2005.

A Atm 307Z (= A Chm 307) Introduction to Atmospheric Chemistry (3)
A Atm 307Z is the writing intensive version of A Atm 307; only one may be taken for credit. Prerequisite(s): A Mat 111 or 112 or 118; A Phy 108 or150N A Chm 120N. . Offered alternate Spring semester. Will next be offered Spring 2005. [WI]

A Atm 311 Severe and Unusual Weather Analysis and Forecasting (4)
Continuation of Atm 211, with emphasis on severe and unusual weather analysis and forecasting, including thunderstorms, tornadoes, downbursts, derechoes, hail, flash floods, hurricanes, winter storms, blizzards, blocking weather patterns, floods and drought; introduction to weather analysis software and weather display systems; commercial meteorology. Prerequisite(s): A Atm 211. Fall semester only.

A Atm 320 Atmospheric Thermodynamics (3)
Equation of state; principles of thermodynamics; water vapor and moist air thermodynamics; changes of phase and latent heat; hydrostatic equilibrium; atmospheric convection; thermodynamic diagrams; atmospheric stability and severe weather events. Prerequisite(s): A Atm 210 (or 210Z); A Mat 214; A Phy 150; co-requisite: ATM 333. Fall semester only.

A Atm 321 Physical Meteorology (4)
Atmospheric physics, including radiation, optics, and visibility; atmospheric electricity; cloud and aerosol physics; acoustics; upper atmospheric processes; radar meteorology. Three lectures and one lab discussion per week. Prerequisite(s): A Atm 320, 333; A Phy 240. Spring semester only. [OD]

A Atm 333 Quantitative Methods in Geophysics (3)
Important topics in atmospheric and geophysical science studied using various analytical and numerical techniques. Description and analysis of specific but disparate geophysical phenomena will expose the student of the commonality of application of certain classical and modern mathematical approaches used to expound the underlying physical principles. Prerequisite(s): A 210 (or 210Z); Mat 214; Phy 150; Mat 311 (recommended as a pre-requisite, acceptable as a co-requisite). Fall semester only.

A Atm 335 Meteorological Remote Sensing (3)
Satellite remote sensing from UV to microwave including the principles of atmospheric radiative transfer, descriptions of important satellite orbits and sensors, the retrieval of atmospheric variables from active and passive systems, and basic principles of interpretation. Prerequisite(s): A Mat 111 or 112 or 118 and A Atm 211. Offered alternate spring semesters; will next be offered in spring 2004.

A Atm 390 Commercial Meteorology (2)
Examination of the impact of weather and climate forecasting on social and economic factors in our society. Emphasis on severe weather prediction, warnings, and disaster preparedness. Guest lectures by private-sector professional meteorologists. Each student will participate as a member of a mock "company" providing weather services to a real client in the community. One lecture each week. Prerequisite(s): A Atm 311. Offered alternate spring semesters; will next be offered in spring 2005.

A Atm 400 Synoptic Meteorology I (3)
Electronic meteorological database description and analysis procedures; use of meteorological software packages and remote sensing technologies in weather analysis and forecasting; operational numerical weather prediction model procedures; application of fundamental thermodynamic and dynamic principles to multiscale weather events; scientific issues in weather forecasting. Two joint lecture-laboratory periods each week. Corequisites: A Atm 311; 410. Fall semester only.

A Atm 401 Synoptic Meteorology II (3)
Application of more advanced thermodynamic and dynamic concepts, laws and remote sensing technologies to multiscale weather analysis and prediction; structure of global scale temperature, wind and precipitation regimes and their causes; use of operational weather prediction models and products for research and weather forecasting; severe weather and heavy precipitation analysis and forecasting. Two joint class/laboratory periods each week. Prerequisite: A Atm 400; corequisite(s): A Atm 411. Spring semester only.

A Atm 408 Hydrometeorology (3)
The physical processes governing the continental hydrologic cycle such as water vapor transport, runoff, evapotranspiration, streamflow, sub-surface recharge; land/atmosphere interaction; spatial/ temporal variability of hydrologic parameters. Prerequisite(s): A Atm 320 and A Mat 311.

A Atm 408B Hydrometeorology (3)
The physical processes governing the continental hydrologic cycle such as water vapor transport, runoff, evapotranspiration, streamflow, sub-surface recharge; land/atmosphere interaction; spatial/ temporal variability of hydrologic parameters. Prerequisite(s): A Atm 211 or A Geo 260; will not yield upper level credit for the atmospheric science B.S. degree.

A Atm 409 Atmospheric Precipitation Processes (3)
Fundamentals of atmospheric precipitation processes; atmospheric moisture budget; convective and stratiform precipitation; application of satellite and radar imagery to precipitation analysis and forecasting; mesoscale convective systems; mesoscale precipitation structure in cyclones; flash flood forecasting; quantitative precipitation forecasting exercise. Prerequisite(s): A Atm 320; A Mat 311. Corequisite: A Atm 410. Offered every other year; will next be offered in fall 2003.

A Atm 410 Dynamic Meteorology I (3)
Forces and force balances in the atmosphere; thermal wind, vorticity and circulation; structure and dynamics of the middle latitudes and tropical cyclones. Prerequisite(s): A Atm 320, 321, 333. Fall semester only.

A Atm 411 Dynamic Meteorology II (3)
Derivation and scaling of the equations of atmospheric motion; major forces in the atmosphere; dynamics of frontal cyclones; mathematics of weather prediction. Prerequisite(s): A Atm 410. Spring semester only.

A Atm 414 Air Pollution (3)
Physical and chemical processes affecting air suspensoids; pollutant dispersion; effects of pollutants on materials, vegetation, and animal life; environmental gas cycles; applications to instruments and industrial removal processes. Corequisite(s): A Atm 410 or permission of instructor. Fall semester only.

A Atm 421 Tropical Meteorology (3)
Tropical cyclone dynamics and thermodynamics; tropical cyclone formation; monsoons; tropical waves; El Niño. Prerequisite(s): A Atm 410 or equivalent. Spring semester only. May not be offered in 2003-2004.

A Atm 422 Meteorological Instrumentation and Measurement (2)
Principles of meteorological measurement; error and propagation of error; measurement of temperature, pressure, windfield, water vapor and solar radiation; basic photogrammetry; survey of measurement systems: Doppler radar, lidar, profilers and ASOS. One lecture and one demonstration/laboratory session per week. Prerequisite(s): A Atm 321; A Phy 240. May not be offered in 2003-2004.

A Atm 424 Fundamentals of Atmospheric Electricity (3)
An introduction to the basic electrical processes operating in the atmosphere; fair weather electricity and the global circuit; electrical properties of clouds and thunderstorms; thunderstorm electrification; the lightning flash; observation and measurement techniques. Prerequisite(s): A Atm 321; A Mat 214; A Phy 240. Spring semester only. May not be offered in 2003-2004.

A Atm 430 Solar Radiation and Applications (3)
Definition of solar and terrestrial radiation components; basic celestial geometry; introduction to the measurement of solar radiation; principles of solar radiation transfer through the Earth's atmosphere; study of the interrelationship between solar radiation components; applied solar radiation examples. Prerequisite(s): A Mat 113 or 119; A Phy 150. May not be offered in 2003-2004

A Atm 433 Software-based Computational Geophysics (3)
Computation of solutions of geophysical problems using contemporary symbolic and numerical mathematical software for PCs. Problems will be drawn from a variety of topics in atmospheric and geological sciences. Emphasis will be placed on the use of appropriate software to obtain, graphically display and physically interpret the solutions. Prerequisite(s): A Atm 333 or permission of instructor. May not be offered in 2003-2004.

A Atm 450 Computer Applications in Atmospheric Science (3)
Computer programming and numerical methods for solving atmospheric science problems; data handling and storage; examination of currently used programs in atmospheric science research; iterative methods; numerical weather prediction. Prerequisite(s): A Atm 333; A Csi 204 or 205 or permission of instructor. May not be offered in 2003-2004.

A Atm 490 Internship in Atmospheric Science (1-3)
Research or operational experience in atmospheric-related activities with local governmental agencies or private industry. No more than 3 credits for A Atm 490 may be applied toward major requirements in atmospheric science. **Internships are open only to qualified juniors and seniors who have an overall grade point average of 2.50 or higher.** Prerequisite(s): junior or senior standing in atmospheric science. *S/U* graded, may be repeated for credit.

A Atm 497 Independent Study II (1-3)
May be repeated once for credit. No more than 6 credits from A Atm 490, 497, 498, and 499 may be applied toward major requirements in atmospheric science. Prerequisite(s): junior senior class standing, and by advisement only. Fall and spring semesters.

A Atm 498 Computer Applications in Meteorological Research (3)
Directed individual study of a particular problem in atmospheric science that requires use of the University Computing Center and/or departmental computers. May be repeated once for credit. No more than 6 credits from A Atm 490, 497, 498, and 499 may be applied toward major requirements in atmospheric science. Prerequisite(s): A Csi 201N or permission of instructor. *S/U* graded.

A Atm 499 Undergraduate Research (3)
Guided research leading to a senior thesis. Oral presentation of results required. May be repeated for credit. No more than 6 credits from A Atm 490, 497, 498, and 499 may be applied toward major requirements in atmospheric science. Prerequisite(s): junior or senior class standing, and permission of department chair. *S/U* graded.