

ATMOSPHERIC SCIENCE PROGRAM



IN THE
DEPARTMENT
OF

ATMOSPHERIC

AND

ENVIRONMENTAL
SCIENCES



UNIVERSITY AT ALBANY
STATE UNIVERSITY OF NEW YORK

Bachelor of Science Degree (B.S.) in Atmospheric Science (Meteorology)

Department of Atmospheric and Environmental Sciences

University at Albany, State University of New York

Introduction

Interest in the atmosphere reaches back to antiquity when human survival itself depended directly upon the weather. Even today, we remain subject to the natural variability of the weather while also having to contend with new and frightening problems originating from the effects of modern industrial society. For example, acid rain from sulfur and nitrogen oxide emissions is literally killing lakes and forests in America and Europe. Gaps in the stratospheric ozone layer portend significant increases in the ultraviolet irradiation of the Earth with consequent increased skin cancer rates and reduced crop yields worldwide. Increased levels of carbon dioxide from the use of fossil fuels may result in significant global warming and altered climates, not in the distant future, but within the next few decades. Naturally occurring storms, droughts and frosts already disrupt our economy and day-to-day lives all too frequently.

These are but a few of the problems that concern teachers and researchers in the Department of Earth and Atmospheric Sciences and the Atmospheric Sciences Research Center (ASRC; <http://www.asrc.albany.edu/>) at the University at Albany. This combination of two distinct but related institutions gives the University at Albany the largest program of education and research in the atmospheric sciences in New York State. In addition, ASRC and the regional office of the National Weather Service (NWS) are collocated in the Center for Environmental Sciences and Technology Management (CESTM), which is located across the street from (and within easy walking distance of) the main campus.

The University at Albany's group of atmospheric scientists was established in the early 1960's by Vincent Schaefer, the protégé of Nobel Laureate chemist Dr. Irving Langmuir. Inspired by Langmuir, Schaefer, a world renowned cloud physicist himself, discovered the method of cloud seeding that ushered in the science of weather modification. The current group of scientists covers a broad range of interests in the atmospheric and environmental sciences. Topics of research and study include synoptic-dynamic meteorology, mesometeorology, severe weather, climate, hydrometeorology, theoretical meteorology (spanning planetary through convective scales), solar and wind energy development, solar radiation meteorology, hurricanes and tropical meteorology, energy conservation, atmospheric electricity and lightning, cloud and precipitation physics, atmospheric chemistry, acid precipitation, air pollution, and bioclimatology.

Research and teaching facilities are among the most advanced in the nation. The synoptic-dynamic research and teaching program is supported by a fully equipped and recently renovated "paperless" map room, a synoptic laboratory, and various available interactive computer systems. The department's own computing facilities consist of several powerful UNIX servers, as well as numerous UNIX workstations and Windows and Mac OS X PCs. These workstations ingest (in real time) conventional atmospheric observations from around the world, including satellite, radar, surface, upper-air, model forecast and lightning detection data. The university's computer network and numerous PCs are available to students across the campus, with all dormitory rooms configured for high-speed access to the Internet. WiFi is also available in most campus buildings and their surroundings. The department also has access to the supercomputing facilities of the National Center for Atmospheric Research (NCAR) in Boulder, Colorado, for use in research projects of a truly intense computational nature. Two computer experts are resident in the department, both having advanced meteorological degrees as well.

Undergraduate Degree Program in Atmospheric Science

Available Undergraduate Courses and Awarded Credits

Courses offered on a regular basis include (Z indicates a writing intensive option):

ATM 100:	The Atmosphere (3)
ATM 101:	The Upper Atmosphere (3)
ATM 102:	Science and Major Environmental Issues (3)
ATM 107:	The Oceans (3)
ATM 199:	Contemporary Issues in Atmospheric Science (1)
ATM 200:	Natural Disasters (3)
ATM 209:	Weather Workshop (1)
ATM 210/Z:	Atmospheric Structure, Thermodynamics and Circulation (3)
ATM 211:	Weather Analysis and Forecasting (4)
ATM 297:	Independent Study I (2-3)
ATM300/Z:	Solar Energy (3)
ATM 301:	Surface Hydrology and Hydrometeorology (3)
ATM 304/Z:	Air Quality (3)
ATM 305:	Global Physical Climatology (3)
ATM 306:	Climate Variability and Change (3)
ATM 307/Z:	Atmospheric Chemistry (3)
ATM 311:	Severe and Hazardous Weather Analysis and Forecasting (4)
ATM 315:	Quantitative Methods in Geophysics (3)
ATM 320:	Atmospheric Thermodynamics (3)
ATM 321:	Physical Meteorology (4) (also satisfies the Oral Discourse GenEd requirement)
ATM 327:	Meteorological and Environmental Measurement (3); (also carries an ENV designation)
ATM 335:	Meteorological Remote Sensing (3)
ATM 350:	Meteorological Datasets and Numerical Computation (1)
ATM 400:	Synoptic Meteorology I (3)
ATM 401:	Synoptic Meteorology II (3)
ATM 408:	Hydrometeorology (3); (for BS candidates only)
ATM 409:	Atmospheric Precipitation Processes (3)
ATM 410:	Dynamic Meteorology I (3)
ATM 411:	Dynamic Meteorology II (3)
ATM 414:	Air Pollution (3)
ATM 421:	Tropical Meteorology (3)
ATM 424:	Fundamentals of Atmospheric Electricity (3)
ATM 430:	Solar Radiation and Applications (3)
ATM 450:	Computer Applications in Atmospheric Science (3)
ATM 490:	Internship in Atmospheric Science (1-3)
ATM 497:	Independent Study II (1-3)
ATM 498:	Computer Applications in Meteorological Research (3)
ATM 499:	Undergraduate Research (3)

Requirements for the B.S. Degree in Atmospheric Science

Students planning to study atmospheric science (meteorology) should have a good academic preparation in physics and mathematics. Core courses related to the atmosphere begin in the sophomore year, though students are encouraged to take ATM 100N during their first year for an initial exposure to the basic principles and techniques used in atmospheric science.

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The B.S. program course requirements are: a minimum of 65 credits for the combined major/minor in Atmospheric Science including ATM 209, 210/Z, 211, 315, 320, 321, 350, 410, and 411 plus twelve credits from 307/Z or higher level ATM courses; PHY 140 or 141, 145 (lab), 150 or 151, and 240; MAT 111 or 112 or 118, 113 or 119, 214 and 311; CHM 120 or 130. No more than six credits from ATM 490, 497, 498 and 499 can apply toward the major; a maximum of 3 credits can be applied from ATM 490. A typical sequence of courses in the major appears below with **required courses** indicated in **bold**; additional courses to those listed are selected as determined by individual student interest and general university requirements (e.g., General Education courses). It also should be noted that a minor in Broadcast Meteorology is available to students pursuing the B.S. in Atmospheric Science.

Students with a cumulative Grade Point Average (GPA) of at least 3.25 overall and 3.5 in the major at the end of the fourth semester may apply for a B.S. with honors in atmospheric science. To be eligible for a degree with honors, students must also complete a total of 74 credits including two semesters of Undergraduate Research (ATM 499) leading to a significant undergraduate thesis. Further, the above GPAs must be maintained. The honors degree represents one of the most challenging programs on this campus; it is designed and intended for only the most exemplary students.

Other Atmospheric Science Degrees

A Bachelor of Arts (B.A.) degree in Atmospheric and Environmental Sciences is also offered. This degree provides more of an interdisciplinary education designed to span both classical disciplines of the Geological and Atmospheric Sciences with a breadth appropriate for individuals who desire a non-research focused career, related to, for example, business, law or environmental planning. In addition, it is possible to minor in Atmospheric Science. For qualified students, double majors such as Atmospheric Science-Computer Science, Atmospheric Science-Physics, and Atmospheric Science-Mathematics are possible and encouraged. Adding one or more minors in these areas or others also is encouraged.

Typical B.S. Program in Atmospheric Science (Required courses in **bold**)

<i>Semester 1</i>		<i>Semester 2</i>	
MAT 112 Calculus I	4	MAT 113 Calculus II	4
PHY 140, 145 Physics I and Lab I	4	PHY 150 Physics II (no lab required)	3
CHM 120 Chemistry I	4	Two electives	6
Elective	3		
<i>Semester 3</i>		<i>Semester 4</i>	
MAT 214 Calculus III	4	MAT 311 Differential Equations	3
PHY 240 Physics III (no lab required)	4	ATM 211 Weather Forecasting and Analysis	4
ATM 209 Weather Workshop	1	Three electives	9
ATM 210/210Z Atmospheric Structure, Thermodynamics, and Circulation	3		
Elective	3		
<i>Semester 5</i>		<i>Semester 6</i>	
ATM 315 Quantitative Methods in Geophysics	3	ATM 321 Physical Meteorology	4
ATM 311 Severe and Hazardous Forecasting Weather Analysis and Forecasting	4	ATM 320 Atmospheric Thermodynamics	3
Electives	9	ATM 350 Meteorological Datasets...	1
		Electives	6
<i>Semester 7</i>		<i>Semester 8</i>	
ATM 410 Atmospheric Dynamics I	3	ATM 411 Atmospheric Dynamics II	3
ATM 400 Synoptic Meteorology I	3	ATM 401 Synoptic Meteorology II	3
Three electives	9	Three electives	9

Undergraduate Degree Program in Atmospheric Science

Undergraduate Research and Internship Opportunities

Research. Undergraduates have participated in past research programs such as the Genesis of Atlantic Lows Experiment (GALE), the Experiment on Rapidly Intensifying Cyclones over the Atlantic (ERICA) and the Storm Scale Operational Meteorology-Fronts experiment (STORM-FEST). To date, six of our undergraduates have placed seven times (three students took first place and three others took second place, one individual twice) in the prestigious *Father James B. Macelwane Award in Meteorology* sponsored by the American Meteorological Society (AMS). This award recognizes the best research projects submitted by undergraduates in a given year for all entrants nationwide.

Internships. All undergraduates are encouraged to participate in our local year-round forecasting contests as well as the national weather forecasting contest based at the University at Oklahoma, *WxChallenge*, to provide a practical application of their coursework. Some of the more advanced students forecast for local radio and television stations as part of a formal internship. This involves spending a few hours each week working with any of several local professional meteorologists over the course of a semester. In another type of internship, students work several hours each week in the regional office of the National Weather Service (NWS), which is located just across the street from the main campus in the CESTM building. Both types of internships award credit in the major. An excellent degree of interaction between researchers and resident NWS forecasters is the norm, with corresponding opportunities for undergraduate and graduate students pursuing degrees at all levels. The *Cooperative Institute for the Prediction of Hydrometeorological Hazards in the Northeastern United States* (a joint effort between the NWS, NOAA, and the University at Albany) has existed for more than a decade now and will ensure that such opportunities for students continue.

Careers

Many of our degree recipients go on to graduate study. Others obtain employment in federal, state and local government agencies, university departments, research laboratories, and private industry. Some of the more common types of employment span the areas of research, teaching, governmental regulation, air quality monitoring, weather forecasting (private and NWS), radio and TV broadcasting, scientific and engineering consultation, solar and wind energy development, meteorological instrumentation (development and manufacturing), environmental legislation and weather modification programs. An increasing number of graduates are being employed in the private sector via the unique combination of an undergraduate degree in atmospheric science with graduate education in areas as diverse as business, management and public health.

Faculty Research Interests

Members of the Department of Earth and Atmospheric Sciences are funded externally by agencies such as the National Science Foundation (NSF), the National Aeronautics and Space Administration (NASA), the Office for Naval Research (ONR), the National Oceanic and Atmospheric Administration (NOAA), the Air Force Office for Scientific Research (AFOSR) and others. Several faculty members have recently served as either an editor or associate editor for some of the premier scientific journals in the field, such as *Monthly Weather Review*, the *Journal of the Atmospheric Sciences*, and the *Journal of Geophysical Research-Atmospheres*. Special recognition has come to several faculty members as winners of prestigious awards from the American Meteorological Society (AMS) in recognition of outstanding achievement in the field: Dr. Keyser received the *Meisinger Award (1989)*, Dr. Bosart garnered the *Jule G. Charney Award (1992)* and was the inaugural recipient of the *Teaching Excellence Award (2001)*, while Dr. Molinari received the *Banner I. Miller Award (1999)*. Dr. Bosart, a Distinguished Professor, also is an Affiliate Scientist with the National Center for Atmospheric Research (NCAR) in Boulder, Colorado.

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Faculty research specializations include atmospheric chemistry (Dr. K. Demerjian and Dr. R. Keese), synoptic-dynamic meteorology (Dr. L. Bosart, Dr. D. Keyser, Dr. J. Molinari, Dr. C. Thorncroft, and Dr. R. Torn), mesoscale meteorology (Dr. L. Bosart, Dr. D. Keyser and Dr. D. Knight), tropical meteorology and hurricanes (Dr. L. Bosart, Dr. C. Thorncroft, and Dr. J. Molinari), tropical climate variability (Dr. P. E. Roundy and Dr. C. Thorncroft), severe storms (Dr. L. Bosart), atmospheric electricity/lightning (Dr. V. Idone), and hydrometeorology/climatology (Dr. C. Thorncroft, and Dr. M. Vuille).

The staff of the Atmospheric Sciences Research Center (ASRC; <http://www.asrc.albany.edu/>) includes one of the premier atmospheric chemistry groups in the country. This group carries out field, theoretical and numerical modeling work. The study of climate change, aerosol physics, boundary-layer meteorology and atmospheric radiation are also prime research areas within ASRC. Occasional opportunities exist for undergraduates to become involved in the research programs of ASRC members.

In addition to excellent on-campus research laboratories, computer facilities and a state-of-the-art “paperless” map room, we operate several field stations. One such station, operated by ASRC, is atop Whiteface Mountain just north of Lake Placid, NY. This facility provides long-term observation of atmospheric chemical species, cloud properties, acid precipitation, aerosol content and other environmental parameters used in various ongoing investigations. An atmospheric observatory (Mohawk Tower) is available on campus for use in research projects undertaken by ASRC scientists, DAES faculty and students. This observatory, on the 23rd floor of Indian Quad dormitory, commands a 360° view of the surrounding area.

For more information, please contact any of the following sources:

University at Albany Undergraduate Admissions Office: 1-800-293-SUNY (7869)

Department of Atmospheric and Environmental Sciences <http://www.atmos.albany.edu>

University at Albany, ES 351

State University of New York, Albany, NY 12222

Phone: (518) 442-4556; Fax: (518) 442-5825

E-mail: chair@atmos.albany.edu

ASRC Web Site: <http://www.asrc.cestm.albany.edu>

Mr. Eugene P. Auciello, Meteorologist-in-Charge

National Weather Service Office

Center for Environmental Sciences and Technology Management (CESTM)

251 Fuller Road - Suite B300, Albany, NY 12203

Phone: (518) 435-9566; E-mail: gene.auciello@noaa.gov

American Meteorological Society <http://www.ametsoc.org/AMS>

45 Beacon Street

Boston, MA 02108-3693

Phone: (617) 227-2425

American Geophysical Union <http://www.agu.org/>

2000 Florida Avenue, NW

Washington, D.C. 20009

Phone: 1-800-966-2481

Undergraduate Degree Program in Atmospheric Science

Faculty: 2009-2010

Lance F. Bosart, Distinguished Professor (Ph.D., MIT);
(518) 442-4564; e-mail:
bosart@REMOVE_THISatmos.albany.edu.

Kenneth L. Demerjian, Ray Falconer Endowed Professor and
Director of ASRC (Ph.D., Ohio State Univ.); (518) 442-4557; e-
mail: kld@REMOVE_THISatmos.albany.edu.

*David R. Fitzjarrald, Research Professor (Ph.D., Univ. of
Virginia); (518) 437-8735; e-mail:
fitz@REMOVE_THISasrc.cestm.albany.edu.

*Lee C. Harrison, Research Professor (Ph.D., Univ. of
Washington); (518) 437-8741; e-mail:
lee@REMOVE_THISasrc.cestm.albany.edu.

Vincent P. Idone, Associate Professor, (Ph.D., Univ. at Albany,
SUNY); (518) 442-4577; e-mail:
vpi@REMOVE_THISatmos.albany.edu.

Robert G. Keesee, Associate Professor (Ph.D., Univ. of Colorado);
(518) 442-4566; e-mail: rgk@REMOVE_THISatmos.albany.edu.

Daniel Keyser, Professor (Ph.D., Pennsylvania State Univ.);
(518) 442-4559; e-mail: keyser@REMOVE_THIatmos.albany.edu.

David Knight, Research Professor (Ph.D., Univ. of Washington);
(518) 442-4204; e-mail: knight@atmos.albany.edu.

*G. Garland Lala, Research Professor (Ph.D., Univ. at Albany,
SUNY); (518) 437-8703; e-mail:
lala@REMOVE_THIScestm.albany.edu.

Michael Landin (*retired*), Instructional Support Specialist (M.S.,
Univ. at Albany, SUNY); (518) 442-4572; e-mail:
landin@REMOVE_THISatmos.albany.edu.

Ross Lazear, Instructional Support Specialist, (M.S., Univ. of
Wisconsin); (518) 437-3601; e-mail:
ralazear@REMOVE_THISatmos.albany.edu.

*Scott D. Miller, Research Associate (Ph.D., Univ. of California,
Irvine); (518) 437-8799; e-mail:
smiller@REMOVE_THISalbany.edu.

*Qilong Min, Research Professor (Ph.D., Univ. of Alaska); (518)
437-8742; e-mail: min@REMOVE_THISasrc.cestm.albany.edu.

John E. Molinari, Research Professor (Ph.D., Florida State Univ.);
(518) 442-4562; e-mail: molinari@REMOVE_THISatmos.albany.edu.

*Richard R. Perez, Research Professor, (Ph.D., Univ. at Albany,
SUNY); (518) 437-8751; e-mail:
perez@REMOVE_THISasrc.cestm.albany.edu.

Michael Reeder, Visiting Professor, Monash Univ., (613) 9905
4464; michel.reeder@REMOVE_THISsci.monash.edu.au.

Paul E. Roundy, Assistant Professor, (Ph.D., Pennsylvania State
Univ.); (518) 442-4476, e-mail:
roundy@REMOVE_THISatmos.albany.edu.

James J. Schwab, Research Professor (Ph.D., Harvard Univ.)
(518) 437-8754; e-mail:
schwab@REMOVE_THISasrc.cestm.albany.edu.

Jim Steenburgh, Visiting Professor, Univ. of Utah, (801) 581-
7827; e-mail: jmsteen@REMOVE_THISmet.utah.edu.

Christopher D. Thorncroft, Associate Professor and Chair, (Ph.D.,
Univ. of Reading); (518) 442-4555; e-mail:
chris@REMOVE_THISatmos.albany.edu.

Ryan Torn, Assistant Professor, (Ph.D. Univ. of Washington);
(518) 442-4560; e-mail: torn@REMOVE_THISatmos.albany.edu.

Kevin R. Tyle, Computer Support Specialist, (M.S., Univ. at
Albany, SUNY); (518) 442-4571; e-mail:
ktyle@REMOVE_THISatmos.albany.edu.

Mathias Vuille, Assistant Professor (Ph.D. Univ. of Bern); (518)
442-4472; e-mail: mathias@REMOVE_THISatmos.albany.edu.

*Christopher J. Walcek, Research Professor (Ph.D., UCLA);
(518) 437-8720; e-mail:
walcek@REMOVE_THISasrc.cestm.albany.edu.

*Wei-Chyung Wang, Research Professor (Ph.D., Columbia Univ.);
(518) 437-8708; e-mail:
wang@REMOVE_THISclimate.cestm.albany.edu.

Morris Weisman, Visiting Professor, National Center for
Atmospheric Research (NCAR); (303) 497-8901; e-mail:
weisman@REMOVE_THISucar.edu.

*Fangqun Yu, Research Professor (Ph.D., UCLA);
(518) 437-8767; e-mail:
yfq@REMOVE_THISasrc.cestm.albany.edu.

* primary appointment with the *Atmospheric Sciences Research Center (ASRC)*