DEPARTMENT OF EARTH AND ATMOSPHERIC SCIENCES

The Department of Earth and Atmospheric Sciences offers students four distinct undergraduate degrees within two programs: [1] a Bachelor of Science degree (B.S.) in Geological Sciences is offered within the Geological Sciences Program; [2] a Bachelor of Science (B.S.) in Atmospheric Science is offered within the Atmospheric Science Program; [3] a Bachelor of Science (B.S.) in Environmental Science; and [4] a Bachelor of Arts degree (B.A.) in Earth and Atmospheric Sciences. Both the B.A. in Earth and Atmospheric Sciences and the B.S. in Environmental Science are offered within the overall department, spanning both programs. All four degrees are recognized as particularly challenging and attract students of high caliber who are interested in studying the fundamental processes operating on-and-within the Earth and its atmosphere.

(A detailed description of the *Geological Sciences Program* follows below; descriptions of the *Atmospheric Science Program* and the *Broadcast Meteorology* and *Environmental Science Program* follow immediately.)

PROGRAM IN GEOLOGICAL SCIENCES

Faculty

Distinguished Teaching Professors
John W. Delano, Ph.D.
State University of New York at Stony Brook
Professors
William S. F. Kidd, Ph.D.
Cambridge University
Gregory D. Harper, Ph.D.
University of California, Berkeley
Associate Professors
Andrei Lapenis, Ph.D.
State Hydrological Institute, St. Petersburg
(joint appointment in Geography and Planning)
Braddock K. Linsley, Ph.D.
University of New Mexico
Visiting Assistant Professor
John G. Arnason, Ph.D.
Stanford University
Professor Emeritae/i
Winthrop D. Means, Ph.D.
University of California, Berkeley
Akiho Miyashiro, D.O.C.
Tokyo University
Associate Professor Emeritae/i
George W. Putman, Ph.D.
Pennsylvania State University
Adjuncts (estimated): 2
Teaching Assistants (estimated): 8

Careers

Graduates with a B.S. in geology or environmental science have found satisfying employment not only in jobs directly related to these disciplines but also in a wide variety of other activities. Students graduating with a B.S. in geology who pursue advanced degrees in geology, computer science, business administration, or geophysics have a competitive edge in the job market. Professional opportunities in jobs using geological expertise are much wider for graduates with master's degrees, in particular for employment with environmental service/consulting companies, oil and mineral resource companies, and with state or federal agencies having responsibilities involving geological matters (geological surveys, water supply, environmental conservation, transport, etc.). Developing shortages of fossil fuels and raw materials for industry, along with an increasing need for professionals trained to understand complex environmental problems should provide a sustained demand for professional geologists and environmental scientists.

Special Programs or Opportunities

The Geology Program sponsors two weekly seminar series that provide students with a sampling of important topics in current geological research: (1) informal talks given by faculty and graduate students; and (2) formal seminars presented by outside speakers. The Program also sponsors field trips in New York, New England, and the Appalachians.

Degree Requirements for the Major in Geology

General Program B.S.: A minimum of 66 credits for the combined major and minor including: (Required) A Geo 100N or A Geo 100F, 106, 210, 212, 222, 230, 231 (or 231Z), 330, 350, 400, , 470 ; A Mat 111 or 112 or 118, 113 or 119; A Phy 105N, 106, 108N; 109, A Chm 120N or 130, 121 or 131, 122A, 122B. Elective Classes (choose at least 9 credits of the following; A Geo 260, 331, 332, 420, 435, 450, 466, 497. Students are encouraged to take the following additional courses: A Mat 108, 214, 220, 311; A Csi 101N or 201N; A Atm 100N.

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 or 130; A Geo 100N or 100F, 106, 250 or 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, and 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 geology or atmospheric science 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.

Departmental Honors Program

Students who have achieved a GPA of 3.5 in the major, and an overall GPA of 3.25, may apply to the Department Chairperson not later than the end of their junior year to enter the

Department Honors Program. Interested students should enroll in Geo 499, Seminar in Geology, in the spring semester of their junior year. In order to graduate with Honors, accepted students must take A Geo 498, Independent Honors Research (3 credits), and complete it with a grade of *A* or *A-*, as well as maintaining superior academic performance overall and in the major during their senior year. Proposals for research to be done in A Geo 498 must be approved in writing by the supervising faculty member and the Department Chairperson before the end of the spring semester of the student's junior year. The other three required credits for Departmental Honors will consist of a total of three credits of A Geo 499 Seminar in Geology, one in each of the last three semesters of the degree program.

Combined B.S./M.S. Program

The combined B.S./M.S. program in geology provides an opportunity for students of recognized academic ability and educational maturity to fulfill integrated requirements of undergraduate and master's degree programs from the beginning of the junior year. A carefully designed program can permit a student to earn the B.S. and M.S. degrees within ten semesters.

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, general educational 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 12 graduate credits may be applied simultaneously to both the B.S. and M.S. programs.

The following graduate courses may be substituted for required undergraduate courses: A Geo 517 for A Geo 470, A Geo 535 for A Geo 435, A Geo 550 for A Geo 450, A Geo 566 for A Geo 466,. A reading knowledge of a foreign language useful in the study of geology (French, German, Russian, Spanish, Portuguese, Chinese) must be demonstrated before completion of the program, or satisfactory proficiency in a research skill such as computer programming may be substituted for the language requirement at the discretion of the department.

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 accepted into the combined B.S./M.S. program are automatically considered as graduate students.

Students may apply for admission to the combined degree program in geology at the beginning of their junior year or after the successful completion of 56 credits, but no later than the accumulation of 100 credits. A cumulative grade point average of 3.20 or higher and three supportive letters of recommendation from faculty are required for consideration.

Courses

A Geo 100N Planet Earth (3)
Introduction to the Geological Sciences, including evidence for the major processes and significant events in the origin, history and present condition of the solid Earth. Major topics include geological time, earthquakes, volcanism, plate tectonics and the origin and movement of continents and oceans, mountain building, evidence for past climate change, including glaciation, formation of the earth-moon system, earth resources and geological constraints and consequences of energy use. Emphasis is placed on understanding why we think we know things about the Earth, to enable the student to understand common features of rocks and minerals and the larger-scale solid Earth, and to provide a lifetime background for making informed judgments on increasing number of public issues requiring geological knowledge. Fall and spring semesters. [NS]

A Geo 100F Planet Earth (3)
A Geo 100F is the writing intensive version of A Geo 100N; only one may be taken for credit. Fall semester only. [NS WI]

A Geo 106 Physical Geology Laboratory (1)
Elementary classification of minerals and rocks, and their identification in hand specimen. Introduction to geological maps and sections, both as sources of geological information and as aids in the solution of practical problems. Guided and self-guided field trips to building stones of downtown Albany. This course is required for majors in Geology and Earth Science. One lab each week. Corequisite(s): A Geo 100N or 100F. Fall and spring semesters.

A Geo 201 (= A Gog 201) Environmental Analysis (3)
Uses laboratory work and local field excursions to give students "hands-on" experience in physical geography and environmental sciences. Focuses on human impacts on the environment and on problems of environmental contamination. Prerequisite or corequisite: A Gog 101N. [NS]

A Geo 210 Earth Materials (3)
Crystal structures and crystal chemistry, with emphasis on the major rock- and soil-forming mineral groups. Selected minerals of commercial importance. Examples of mineral-forming processes, and use of mineral properties as indicators of geological conditions. Three lectures each week. Prerequisite(s): A Geo 100N or 100F, 106; or permission of instructor. Fall semester only.

A Geo 211 Optical Mineralogy Laboratory (1)
Introduction to the petrographic microscope. Optical properties of minerals and their use for mineral identification. One lab each week. Corequisite(s): A Geo 210 or permission of instructor.

A Geo 212 Earth Materials Laboratory (1)
An introduction to the study of minerals. Major topics include the formation, physical properties, structure, symmetry, and classification of minerals with emphasis on rock-forming minerals. In laboratory, students will gain hands-on experience with mineral identification of hand samples and mineral properties. The course also introduces more advanced topics in mineral transformations, crystal chemistry, and crystallography.

A Geo 222 Igneous and Metamorphic Geology (4)
Description, classification, and occurrence of igneous and metamorphic rocks. Introduction to phase diagrams, metamorphic facies, and petrogenetic grids. Laboratory section will involve practical identification of mineralogy and textures in hand specimens and thin sections. Three lectures and one lab per week. Prerequisite(s): A Geo 100N or 100F, 106, 210, 211; or permission of instructor. Spring semester only.

A Geo 230 Stratigraphy, Sedimentology, and the Fossil Record (3)
Stratigraphic principles and correlation, identification and classification of sedimentary rocks, introduction to paleontology and historical geology. Three lectures and one lab each week. Geology BS and Earth Science BS majors must also register concurrently for either A Geo 231 or A Geo 231Z, Field Excursions in Stratigraphy. Prerequisite(s): AGeo 100N or 100F, 106; or permission of instructor. Fall semester only.

A Geo 231 Field Excursions for Stratigraphy (2)
One lab per week and five full-day weekend field trips to be taken by Geology BS and Earth Science BS majors concurrently with A Geo 230 Stratigraphy. Corequisite(s): A Geo 230 or permission of instructor. Offered fall semester only.

A Geo 231Z Field Excursions for Stratigraphy (2)
One lab per week and five full-day weekend field trips to be taken by Geology and Earth Science BS majors concurrently with A Geo 230 Stratigraphy. Extended written and illustrated reports must be submitted based on the observations made on each trip. AGeo 231Z is the writing intensive version of A Geo 231; only one may be taken for credit. Corequisite(s): A Geo 230 or permission of instructor. [WI]. Offered fall semester only.

A Geo 250 Energy and Resources (3)
Examination of energy production using non-renewable (coal, oil, natural gas, uranium) versus renewable resources (hydroelectric, solar, wind, geothermal) relative to present and future environmental and societal impacts. Fields trips to energy producing facilities (e.g., Blenheim-Gilboa Pumped Storage Power Plant). Prerequisites; A Geo 100 or A Atm 100; A Chm 120N or 130 or A Phy 105N; A Mat 111.

A Geo 260 Earth Surface Processes and Hazards (3)
An aspect of environmental science that includes natural geologic processes potentially harmful to people and human modifications of natural systems that can make them harmful. Includes rivers and flooding, groundwater, severe storms, landslides, soil erosion, acid rain, greenhouse effect, pollution and waste disposal, coastal problems, estuarine and wetland problems, and hazards associated with volcanoes and earthquakes. Prerequisites: A Geo 100N.

A Geo 317 (= A Gog 317) Geomorphology (3)
A systematic introduction to the study of landforms and the processes that shape them. Laboratory work and field trips are part of the course. Prerequisite(s): A Gog 101N; A Geo 100N or 100F; or permission of instructor. Fall semester only. May not be offered in 2004-2005.

A Geo 330 Structural Geology I (3)
Descriptive structural geology, with emphasis on features seen at outcrop and map scales. Selected examples of rock microstructures and their interpretation. Three lectures each week. Prerequisite(s): A Geo 100N or 100F, 106. Spring semester only.

A Geo 331 Field Excursions for Structural Geology I (1)
Five full-day weekend field trips to be taken by Geology and Earth Science BS majors concurrently with Structural Geology I. Several written and illustrated reports must be submitted based on the observations made. Prerequisite(s): permission of instructor; corequisite: A Geo 330. Offered spring semester only.

A Geo 332 Structural Geology Laboratory (1)
Structures on maps, on images, and in rock specimens; computer-based presentation of data. One lab each week. Corequisite(s): A Geo 330. Spring semester only.

A Geo 350 (formerly A Geo 415) Environmental Geochemistry (4)

Contemporary topics are used to develop concepts of geochemical processes operating in Earth's environmental system. These topics (a) PCBs in the Upper Hudson River, (b) biogeochemical cycles in the global climate system, and (c) geochemical constraints on long-term disposal of high-level, nuclear wastes. 3 hours per week in classroom setting + 2 hours per week of oral presentations by students. [OD]

A Geo 395Z Writing in the Geological Sciences (1)
May be taken with any Geo course at the 300 or 400 level to fulfill a writing intensive version of that course. Students will have an opportunity for assistance during writing and revision of written material with the help of editorial assignments from the instructor. Corequisite(s): any A Geo 300 or 400 level course. Fall and spring semesters. [WI]

A Geo 400 Field Mapping (4)
Supervised geological mapping. Three weeks of field work (off campus) followed by independent study and laboratory sessions for preparation of report (in Albany). Field work starts in early August; laboratory sessions once a week in first quarter of fall semester. Prerequisite(s): A Geo 230, 330; or permission of instructor.

A Geo 420 Instrumental Analysis in Environmental Science (3)
A hands-on introduction to instrumental analysis in earth science. Lecture topics include basic principles of spectroscopy, chromatography, mass spectrometry, sampling methods, and error estimation with specific applications to environmental science and geology. In laboratory, students will gain hands-on experience with ion chromatography, atomic absorption spectrometry, carbon analysis, and other methods. Provides a foundation for research projects in the senior year. Two hours lecture/2 hours laboratory each week. Prerequisite(s): A Mat 108 and A Geo 350 or permission of the instructor. *S/U* graded.

A Geo 435 Geohydrology (3)
Introduction to surface water hydrology and ground water hydrogeology. Topics to be covered include, stream hydrograph analysis, flood plain determination, drainage basin analysis, aquifer characterization, pump test analysis, groundwater chemistry and tracers, contaminant hydrogeology, regulatory policy, and introduction to groundwater modeling. . Prerequisite(s): A Mat 112, A Chm 120N or 130 or permission of instructor. Spring semester only.

A Geo 450 Climate Change (4)
Introduction to the field of Paleoclimatology. Focus will be on the use of sediments and other biological and geological archives to reconstruct environmental, climatic, and oceanographic change over a range of time scales. Lecture will also provide an introduction to the fields of climatology, age dating techniques, climatic/environmental proxies (tracers), micro-paleontology, and time-series analysis. In addition to lectures, the class will involve review of current scientific studies, class presentations by each student, and a review paper on a relevant topic of choice. 3 lectures each week and 2 hours each week of oral presentations by students; Prerequisites: A Chm 120N or 130, A Mat 108, or permission of the instructor. This course satisfies the General Education requirement in Oral Discourse. Fall semester only.

A Geo 455 Special Topics (2-3)
A structured program of reading and seminars leading to an in-depth understanding of a chosen topic in geology. Prerequisite(s) A Geo 210, 230, or 230Z; and permission of instructor. Students may repeat course once for an additional two or three credits. Fall or Spring semester.

A Geo 466 Marine/Estuary Systems (3)
Interdisciplinary study of marine and estuary systems with a focus on marine/estuary sedimentology and biogeochemistry. Additional study of lacustrine systems will be integrated into the class. In addition to lectures, the class will involve review of current scientific studies, a class presentation by each student, and a review paper on a relevant topic of choice. 3 lectures each week. Prerequisites: A Geo 100N, A Chm 120N or 130, A Geo210, or permission of the instructor.

A Geo 470 Tectonics (4)
Seismologic basis for plate tectonics, kinematics of plate motions, paleomagnetism. Study of modern mid-ocean ridges, magmatic arcs, transforms, and collisional belts. Three lectures and one lab per week. Prerequisite(s): A Geo 230, 330; or permission of instructor. Fall semester only.

A Geo 497 Independent Study (1-3)
Field or laboratory investigation of a chosen geologic problem, including the writing of a research report to be undertaken during the senior year. Prerequisite(s): permission of instructor. Students may repeat this course once for additional credits. Fall or spring semesters.

A Geo 498 Undergraduate Honors Research (3)
Supervised research for undergraduates admitted to the Department Honors Program. To be taken summer and/or fall semester at beginning of senior year. Written proposal for research must be approved no later than end of spring semester of junior year. Prerequisite(s): Permission of instructor and chair. Fall and spring semesters.

A Geo 499 Seminar in Geology (1)
Oral presentation by students of a research topic: attendance at weekly seminar given by other students in this course, and AGeo 500, and regular attendance at geological science seminars given by outside speakers [approximately once weekly in semester]. Students admitted to the Departmental Honors Program must take this course in the last three semesters of their degree program. Fall and spring semesters.

PROGRAM IN ATMOSPHERIC SCIENCE

Faculty

Professors
- Lance F. Bosart, Ph.D.
  Massachusetts Institute of Technology
- Kenneth L. Demerjian, Ph.D.
  Ohio State University
- Daniel Keyser, Ph.D.
  Pennsylvan ia 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
- David R. Fitzjarrald, Ph.D.*
  University of Virginia
- Lee C. Harrison, Ph.D.*
  University of Washington, Seattle
- David Knight, Ph.D.
  Univ ersity 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

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

**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 or 141, 145, 150 or 151, 240 or 241; A Mat 111 or 112 or 118, 113 or 119, 214, 311; A Chm 120N or 130, 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 or 141, 145, 150 or 151, 240 or 241), 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 or 130; 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 2004-2005. [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 2004-2005.

A Atm 210 Atmospheric Structure, Thermodynamics, 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, or 151. Fall semester only.

A Atm 210Z Atmospheric Structure, Thermodynamics, 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: AAtm 210 (or Atm 210Z) or permission of instructor. May not be taken *S/U* graded. 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; APhy 108N, or 150, or 151; junior or senior class standing. .May not be offered in 2004-2005. [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): AMat 111 or 112 or 118; A Phy 108 or 150 or 151. Offered alternate Spring semester. Next offered in Spring 2006.

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 2006. [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): AAtm 210 (or 210Z). Offered alternate Fall semesters; will next be offered in fall 2005.

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 or 151; 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 or 130. 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): AAtm 210 (or 210Z); A Mat 214; APhy 150 or 151; 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 or 241. 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 or 151; 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. Spring semester only.

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. Offered alternate spring semesters; will next be offered in spring 2005. Prerequisite(s): A Atm 311 and permission of instructor.

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. Will next be offered in Fall 2005.

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 2005.

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 Spring 2006.

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 or 241. May not be offered in 2004-2005.

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 or 241. Spring semester only. May not be offered in 2004-2005.

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 or 151. May not be offered in 2004-2005

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 2004-2005.

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.

PROGRAM IN BROADCAST METEOROLOGY

Careers

The B.A. in Broadcast Meteorology is offered as an interdisciplinary study of significant breadth combining science and the arts. It is intended for students focused on a career in the media. Students electing this major will have the opportunity to combine their passion for meteorology with full development of their personal communication skills, both written and oral, appropriate to the intended career path. However, those students desiring an advanced, research-oriented degree in Atmospheric Science should pursue the B.S. degree instead. All students contemplating any of the curricula described herein should thoroughly discuss their options with the personnel of the Advisement Services Center (ASC) and an Atmospheric Science undergraduate adviser in the DEAS, before formal declaration of a specific major.

The Bachelor of Arts degree in Broadcast Meteorology is a **restricted major**. For advisement purposes, students should initially declare the Earth and Atmospheric Sciences B.A. as their major; they can subsequently apply for the Broadcast Meteorology B.A. by December 1st of a fall semester, while enrolled in A Atm 210, or by May 1st of a spring semester, while enrolled in A Atm 211. A minimum grade of B- is required in **both** A Atm 211 and A Thr 240 for acceptance into this major.

Degree Requirements for the Major in Broadcast Meteorology

Bachelor of Arts (B.A.): A minimum of 60 credits for the combined major and minor including: A Atm 107N, 210/Z, 211, 305 or A Gog 304, A Atm 311, 335, 390, 408/B, 490, A Com 203, A Gog 290, 496, A Jrl 300/Z, either A Mat 101 and 111 or A Mat 112, A Phy 105N, 108N, A Thr 240, 242.

Non-required but Recommended Courses

A Atm 304, A Csi 101, 201N, A Gog 210, 385, 414, 485, A Jrl 364/Z, A Mat 108, B Mgt 341, B Mkt 310, B Msi 215.

Class Key to the Broadcast Meteorology Major

Broadcast Meteorology B.A. core curriculum:

A Atm 107N; The Oceans (3)
A Atm 210/Z; Atmospheric Structure (4)
A Atm 211; Weather Analysis and Forecasting (4)
A Atm 305; Global Phys. Climatology (3) (or A Gog 304)
A Atm 311; Severe & Unusual Weather Forecasting (4)
A Atm 335; Meteorological Remote Sensing (3)
A Atm 390; Commercial Meteorology (2)
A Atm 408/B; Hydrometeorology (3)
A Atm 490; Internship in Atmospheric Science (2)
A Com 203; Speech Composition and Presentation (3)
A Gog 290; Introduction to Cartography (4)
A Gog 304; Climatology (3) (or A Atm 305)
A Gog 496; Geographic Information Systems (3)
A Jrl 300/Z; Introduction to Journalism (3)
A Mat 101; Algebra and Calculus I (3) plus
A Mat 111; Algebra and Calculus II (4) or A Mat 112, Calculus I (4)
A Phy 105N; General Physics I (3)
A Phy 108N; General Physics II (3)
A Thr 240, Acting I (3)
A Thr 242; Voice I (3)

Non-required but recommended courses:

A Atm 304; Air Quality (3)
A Csi 101; Elements of Computing (3)
A Csi 201N; Introduction to Computer Science (4)
A Gog 201; Environmental Analysis (3)
A Gog 385; Introduction to Remote Sensing Environ. (4)
A Gog 414; Computer Mapping (3)
A Gog 485; Advanced Remote Sensing of Environ. (3)
A Jrl 364Z; Science Journalism (3)
A Mat 108; Elementary Statistics (3)
A Mgt 341; Behavioral Foundations of Management (3)
A Mkt 310; Marketing Principles (3)
A Msi 215; Computer Applications in Business (3)

PROGRAM IN ENVIRONMENTAL SCIENCE

Careers

Graduates with a B.S. in Environmental Science will be well qualified for a broad range of positions within the highly inter-disciplinary field of environmental science. Consulting firms, industry, federal and state government agencies all require employees with this type of training. The demand for individuals with such a degree is anticipated to remain strong as our society attempts to cope with and address myriad environmental impacts that are occurring on local, regional, national and global scales. Additionally, graduates with this degree are well prepared to consider advanced degrees in the sciences, or other fields such as business administration (M.B.A.) or law (J.D.).

Degree Requirements for the Major in Environmental Science

Bachelor of Science (B.S.): A minimum of 64 credits for the combined major and minor including: A Atm 100N, A Geo 100N, A Geo/Gog 201, 210, 250, 350, A Gog/Pln 330, A Mat 108, 111 or 112, 113, and 108, A Bio 110N/F, A Chm 120N or 130, A Phy 105N, 108N.

Additionally each student must select a concentration in either Earth Science, Atmospheric Science, Biology, or Geography at the time of major declaration (see below). Each concentration represents an emphasis within the overall program that best matches a student's interest and desired career path. For example, those most interested in land surface or hydrological processes would opt for the Earth Science concentration, while those seeking careers in land use planning and geographic information systems might opt for the Geography concentration. Correspondingly, students more interested in air pollution and climate would select the Atmospheric Science track, while those keen on aspects of biological processes and ecology would select the Biology concentration.

Earth Science Concentration (19-21 credits)

A Geo 260; 420: *Electives (any combination of the following):* A Bio 111N, 316, A Geo 330, 435, 450, 466, 497, 498, A Phy 202N.

Atmospheric Science Concentration (19-21 credits)

A Atm 210/Z, A Geo 260; *Electives (any combination of the following);* A Atm 211, 304/Z, 305, 307/Z , 311, 335, 422, 408B: *Additional electives (maximum of two):* A Geo 420, 450, A Bio 316, A Phy 202N.

Biology Concentration (19-21 credits)

A Bio 111N, 320: *Electives (any combination of the following);* A Bio 212, 306, 314, 316, 319/Z, 325, 365, 366, 402, 422, 432, 436, 442/443, 444, 445, 455, 468, A Chm 440A+B, R Pad/R Pub 465.

Geography Concentration (19-21 credits)

A Geo 260: *Electives(any combination of the following);* A Gog 290, 293, 304, 385, 390, 404, 414, 431, 479, 485, A Gog/Pln 496, A Geo 420, 435.

Class Key to Environmental Science Major

Environmental Science B.S. core curriculum:

A Atm 100N; The Atmosphere (3)
A Geo 100N; Planet Earth (3)
A Geo/Gog 201; Environmental Analysis (3)
A Geo 210; Earth Materials (3)
A Geo 250; Energy and Resources (3)
A Geo 350; Environmental Geochemistry (3)
A Gog 330; Principles of Environ. Manag. (3)
A Mat 111 or 112;Algebra and Calculus II or Calculus I (4)
A Mat 113; Calculus II (4)
A Mat 108; Statistics (3)
A Bio 110N/F; General Biology I (4)
A Chm 120N;General Chemistry I (3) or A Chm 130, Chemical Principles I: Advanced General Chemistry I
A Phy 105N+108N; General Physics I and II (6)

Earth Science Concentration (19-20 credits)

Required:
A Geo 260N; Earth Surface Proc. & Hazards (3)
A Geo 420; Instrum. Anal. in Environ. Sci. (3)

Electives (any combination):
A Bio 111N; General Biology II (4)
A Geo 230; Stratigraphy, Sedimentology, and the Fossil Record (3)
A Geo 231; Field Excursions for Stratigraphy (2)
A Bio 316; Biogeography (3)
A Geo 435; Geohydrology (3)
A Geo 450; Climate Change (4)
A Geo 466; Marine/Estuary Systems (3)
A Geo 497; Independent Study (at USGS or other local organization) (1-3)
A Geo 498; Honors Research (3)
A Phy 202N; Environmental Physics (3)

Atmospheric Science Concentration (19-20 credits)

Required:
A Atm 210/Z; Atmospheric Structure (3)
A Geo 260N; Earth Surface Proc. & Hazards (3)

Electives (any combination):
A Atm 211; Weather Analysis and Forecasting (4)
A Atm 304/Z; Air Quality (3)
A Atm 305;Global Physical Climatology (3)
A Atm 307/Z; Atmospheric Chemistry (3)
A Atm 311; Severe and Unusual Weather and Forecasting (3)
A Atm 335; Meteorological Remote Sensing (3)
A Atm 422; Meteorological Instrumentation & Measurement (2)
A Atm 408B; Hydrometeorology (3)

Additional electives (maximum of two):
A Geo 420; Instrum. Anal. in Environ. Sci.(3)
A Geo 450; Climate Change (4)
A Gog 304 Climatology (3)
A Bio 316; Biogeography (3)
A Phy 202N; Environmental Physics (3)

Biology Concentration (19-20 credits)

Required:
A Bio 111N; General Biology II (4)
A Bio 320; Ecology (3)

Electives (any combination):
A Bio 199; Cont. Issues in Bio Sciences (1-3)
A Bio 212; Introductory Genetics (4)
A Bio 306; Marine Biology (3)
A Bio 314; General Bacteriology (3)
A Bio 316; Biogeography (3)
A Bio 365; Biological Chemistry (3)
A Bio 366; Biological Chemistry II (3)
A Bio 399; Supervised Research (1-3)
A Bio 402; Evolution (3)
A Bio 422; Biological Architecture (3)
A Bio 442/443; Restoration Ecology (3+1)
A Bio 444; Biology of Birds (3)
A Bio 445; Experimental Ecology (3)
A Bio 455; Plant Ecology (4)
A Bio 499; Supervised Research (1-3)
A Chm 440 A; Comprehensive Biochemistry A (3)
A Chm 440 B; Comprehensive Biochemistry B (3)
R Pad/ R Pub 465/565; Hudson River Watershed: Environment, Society and Policy (3)

Geography Concentration (19-20 Credits)

Required:
A Geo 260N; Earth Surface Proc. & Hazards (3)

Electives(any combination):
A Gog 290; Introduction to Cartography (4)
A Gog 293; Use and Interpretation of Aerial Photographs (3)
A Gog 304; Climatology (3)
A Gog 385; Introduction to Remote Sensing of the Environment (4)
A Gog 390; Intermediate Cartography (3)
A Gog 404; Topics in Physical Geography (1-4)
A Gog 414; Computer Mapping (3)
A Gog 431; Climatic Change (3)
A Gog 479; Fundamentals of Applied GIS (3)
A Gog 485; Advanced Remote Sensing of the Environment (3)
A Gog/Pln 496; Geographic Information Systems (3)
A Geo 420; Instrum. Anal. in Environ. Sci. (3)
A Geo 435; Geohydrology (3)