



University Bulletin

Undergraduate Degree Programs

Meteorology

University Park, College of Earth and Mineral Sciences (METEO)

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Meteorology is a rigorous scientific discipline devoted to the attainment of an increased understanding of the atmosphere and the development of methods for applying that knowledge to practical problems. Although this field is usually associated with weather prediction, it also has significance in environmental, energy, agricultural, oceanic, and hydrological sciences. For students wishing to pursue many of these areas, the department offers several options within the major.

The major requires a solid foundation in mathematics and the physical sciences, and it provides a comprehensive survey of the fundamentals of atmospheric science. It has sufficient flexibility to permit intensive advanced study in such related areas as mathematics, earth sciences, or engineering. The department has particular strengths in weather analysis and prediction, including forecast uncertainty and severe weather; physical meteorology, including radar meteorology, instrumentation and atmospheric measurements; and applied areas, including atmospheric diffusion, air pollution chemistry, dynamic meteorology, tropical meteorology, climate, weather risk, and remote sensing.

Graduating meteorologists are prepared for professional employment with industry, private consulting firms, government, and the armed forces or for further study toward graduate degrees normally required for research, university, or management positions.

The freshman and sophomore years are largely devoted to preparatory work in science, mathematics, and the liberal arts. The junior and senior years involve a core of basic courses in applied and theoretical topics and a choice of courses offering specialized training. The courses unique to each option are normally taken in the junior and senior years.

AIR-QUALITY STUDIES OPTION: This option enables students to gain in-depth knowledge of important areas within the air-quality field. Air-quality meteorologists are employed in both the public and private sectors. Public-sector positions include those with local, state, and federal agencies charged with regulatory, enforcement, and research activities. Within the private sector, air-quality meteorologists are employed by consulting firms whose clients are concerned with meeting environmental regulations on emissions of pollutants into the atmosphere or with determining the effects of such emissions. Topics offered in the option include the physical and chemical nature of air pollutants; their sources in industrial processes and human activity; their control at the source; their transport and dispersion through the atmosphere; their interaction with other atmospheric constituents; their removal through cloud processes, fallout, and wet deposition; their effects on ecosystems, materials, and humans; and their economic and societal impacts.

ATMOSPHERIC SCIENCES OPTION: This option challenges students to strengthen and broaden their understanding of the physics and chemistry of the atmosphere and oceans. It helps prepare them for employment in the diverse field of the atmospheric sciences and

for graduate study in the atmospheric or related disciplines. Students are encouraged to participate in undergraduate research projects under the supervision of atmospheric and oceanic scientists in the department.

CLIMATOLOGY OPTION: This option allows students to learn about the earth's climate system, with emphasis on how the atmosphere and ocean interact. Students can choose among courses that focus on tropical regions, planetary atmospheres, remote sensing, long-term climate change, human dimensions, the biosphere, and statistical methods used in climate science, as well as on their own independent research.

ENVIRONMENTAL METEOROLOGY OPTION: Environmental Meteorology prepares the student for understanding the impact of the weather on the environment, which is to say the impacts of air and water on ecosystems at human scales. In order to do this, the option establishes links between atmospheric physics and a variety of environmental disciplines pertaining to land, water, soils, and plants. Depending on his/her interests, the student will select courses in the biological sciences, air or water quality, human dynamics, data analysis and surface microclimate. An important component of this program is an undergraduate research project, in which the student is encouraged to develop a topic that addresses problems related to the environment and society, if possible by interacting with public agencies or groups.

GENERAL OPTION: This option has sufficient flexibility to serve the needs of students who wish to pursue topics chosen broadly from subdisciplines of meteorology or from related areas in consultation with the academic adviser. The General option is appropriate both for students who intend to pursue postgraduate degrees and for students who want to emphasize a topic for which no option exists.

WEATHER FORECASTING AND COMMUNICATIONS OPTION: This option prepares students for careers in which their skills as weather forecasters are effectively used in a variety of ways, from science reporting and television broadcasting to web design and computer-based weather graphics production, and developing innovative applications of weather and climate data to industry.

WEATHER RISK MANAGEMENT OPTION: The option combines study of meteorology and atmospheric sciences with training in risk, finance, and decision-making. Weather affects a wide range of industries, including energy, agriculture, insurance, construction, retail, and transport, among others. Weather and climate variation play central roles in the availability of water resources, the spread of disease, and an array of other processes vital for human welfare. There are, consequently, many organizations that confront risks related to weather, and that have a demand for experts who can help them manage these risks. The option in Weather Risk Management is designed for students who wish to work professionally at this intersection of meteorology and risk management.

For a Meteorology course to serve as a prerequisite for any subsequent prescribed or supporting Meteorology course in the major, a grade of C or better must be earned in the prerequisite course.

For the B.S. degree in Meteorology, a minimum of 121 credits is required.

Scheduling Recommendation by Semester Standing given like (Sem: 1-2)

GENERAL EDUCATION: 45 credits
(23-26 of these 45 credits are included in the REQUIREMENTS FOR THE MAJOR)
(See description of General Education in front of *Bulletin*)

FIRST-YEAR SEMINAR:
(Included in REQUIREMENTS FOR THE MAJOR)

UNITED STATES CULTURES AND INTERNATIONAL CULTURES:

(Included in ELECTIVES or GENERAL EDUCATION course selection)

WRITING ACROSS THE CURRICULUM:

(Included in REQUIREMENTS FOR THE MAJOR)

ELECTIVES: 6-8 credits

REQUIREMENTS FOR THE MAJOR: 93-95 credits

(This includes 23-26 credits of General Education courses: 8 credits of GN courses; 6 credits of GQ courses; 0-3 credits of GS courses; 9 credits of GWS courses.)

COMMON REQUIREMENTS FOR THE MAJOR (ALL OPTIONS): 63 credits**PRESCRIBED COURSES** (44 credits)

CHEM 110 GN(3), EM SC 100S GWS(3) [\[71\]\(#mnote71\)](#), MATH 140 GQ(4), MATH 141 GQ(4) [\[1\]\(#mnote01\)](#), PHYS 211 GN(4) (Sem: 1-2)
MATH 251(4), PHYS 212 GN(4) (Sem: 3-4)
METEO 300(4) [\[1\]\(#mnote01\)](#), METEO 411(4) [\[1\]\(#mnote01\)](#), METEO 421(4) [\[1\]\(#mnote01\)](#), METEO 431(3) [\[1\]\(#mnote01\)](#), METEO 440W(3) [\[1\]\(#mnote01\)](#) (Sem: 5-6)

ADDITIONAL COURSES (19 credits)

ENGL 015 GWS(3) or ENGL 030 GWS(3) (Sem: 1-2)
CMPSC 101 GQ(3) or CMPSC 200 GQ(3) or CMPSC 201 GQ(3) or CMPSC 202 GQ(3) (Sem: 3-4)
MATH 230(4) [\[1\]\(#mnote01\)](#), or MATH 231(2) [\[1\]\(#mnote01\)](#) and MATH 232(2) [\[1\]\(#mnote01\)](#) (Sem: 3-4)
E B F 472(3) or STAT 301 GQ(3) or STAT 401(3) (Sem: 3-6)
CAS 100 GWS(3) or ENGL 202C GWS(3) (Sem: 3-8)
METEO 101 GN(3) [\[1\]\(#mnote01\)](#), or METEO 200A(1.5) [\[1\]\(#mnote01\)](#) and METEO 200B(1.5) [\[1\]\(#mnote01\)](#), or METEO 201(3) [\[1\]\(#mnote01\)](#) (Sem: 1-5)

REQUIREMENTS FOR THE OPTION: 30-32 credits**AIR-QUALITY STUDIES OPTION:** (30 credits)**PRESCRIBED COURSES** (12 credits)

M E 433(3), METEO 437(3) [\[1\]\(#mnote01\)](#), METEO 454(3) [\[1\]\(#mnote01\)](#), METEO 455(3) (Sem: 6-8)

ADDITIONAL COURSES (18 credits)

Select 3 credits from METEO 473(3) [\[1\]\(#mnote01\)](#) or METEO 474(3) [\[1\]\(#mnote01\)](#) (Sem: 5-8)

Select 15 credits from:

CHEM 112 GN(3) (Sem: 6-8)
ENNEC 484(3), E R M 430(3), F SC 401(3), F SC 422(3), EGEE 470(3), GEOG 363(3), GEOG 430(3), M E 405(3), METEO 422(3), METEO 436(3), STAT 462(3) (Sem: 7-8)

ATMOSPHERIC SCIENCES OPTION: (30-31 credits)**PRESCRIBED COURSES** (3 credits)

METEO 422(3) (Sem: 6-8)

ADDITIONAL COURSES (24-25 credits)

Select 3-6 credits from METEO 473(3) [\[1\]\(#mnote01\)](#) and METEO 474(3) [\[1\]\(#mnote01\)](#) (Sem: 5-8)

Select 6-9 credits from METEO 436(3) [\[1\]\(#mnote01\)](#), METEO 437(3) [\[1\]\(#mnote01\)](#), and METEO 454(3) [\[1\]\(#mnote01\)](#) (Sem: 5-8)

Select 9-16 credits from METEO 414(4), METEO 434(3), METEO 448(3), METEO 451(3), METEO 452(3), METEO 455(3), METEO 465(3), METEO 466(3), METEO 470(3), METEO 471W(3), METEO 472W(3), METEO 475W(3), METEO 477(3), METEO 480W(3) (Up to 9 of these credits in relevant courses in Acoustics, Chemistry, Engineering, Mathematics, and Physics may be substituted with the approval of the student's adviser.) (Sem: 7-8)

SUPPORTING COURSES AND RELATED AREAS (3 credits)

Select 3 credits of W courses or their equivalent in addition to METEO 440W. (Sem: 7-8)

CLIMATOLOGY OPTION: (30 credits)

PRESCRIBED COURSES (18 credits)

METEO 422(3), METEO 436(3) [\[1\]\(#mnote01\)](#), METEO 437(3) [\[1\]\(#mnote01\)](#), METEO 451(3), METEO 470(3), METEO 473(3) [\[1\]\(#mnote01\)](#) (Sem: 6-8)

ADDITIONAL COURSES (12 credits)

Select 12 credits from GEOG 310W(3), GEOG 412W(3), GEOG 417(3), GEOG 430(3)*, GEOG 438W(3)*, GEOSC 320(3), METEO 452(3), METEO 454(3), METEO 466(3), METEO 472W(3), METEO 474(3), METEO 475W(3) or GEOSC 475W(3), METEO 480W(3)*, METEO 486(3), METEO 496(3)* (Sem: 6-8)

**Research would be climate-related.*

ENVIRONMENTAL METEOROLOGY OPTION:(31 credits)

PRESCRIBED COURSES (16 credits) (May apply to General Education)

BIOL 110 GN(4), C E 370(3), GEOG 160 GS(3), METEO 454(3) [\[1\]\(#mnote01\)](#), METEO 480W(3) (Sem: 2-8)

ADDITIONAL COURSES (15 credits) (May apply to General Education)

Select 3 credits from METEO 473(3) [\[1\]\(#mnote01\)](#) or METEO 474(3) [\[1\]\(#mnote01\)](#) (Sem: 5-8)

Select 12 credits from B E 300(3), C E 475(3), E B F 200 GS(3), E R M 430(3), EGEE 470(3), GEOG 323(3), GEOG 362(3), GEOG 363(3), GEOG 313(3), M E 320(3), M E 405(3), M E 433(3), METEO 422(3), METEO 436(3), METEO 437(3), METEO 448(3), METEO 455(3), STAT 462(3), W F S 209 GN(3) (Sem: 2-8)

GENERAL OPTION: (30 credits)

ADDITIONAL COURSES (6 credits)

Select 3 credits from METEO 436(3) [\[1\]\(#mnote01\)](#) or METEO 437(3) [\[1\]\(#mnote01\)](#) or METEO 454(3) [\[1\]\(#mnote01\)](#) (Sem: 5-8)

Select 3 credits from METEO 473(3) [\[1\]\(#mnote01\)](#) or METEO 474(3) [\[1\]\(#mnote01\)](#) (Sem: 5-8)

SUPPORTING COURSES AND RELATED AREAS (24 credits)

Select 24 credits from 400-level METEO courses and/or 200-, 300-, or 400-level courses from the Colleges of Agricultural Sciences, Earth and Mineral Sciences, Engineering, and/or Science (Sem: 7-8)

WEATHER FORECASTING AND COMMUNICATIONS OPTION: (31-32 credits)

PRESCRIBED COURSES (13 credits)

METEO 481(3), METEO 482(3) (Sem: 5-6)

METEO 414(4), METEO 415(3) (Sem: 6-8)

ADDITIONAL COURSES (18-19 credits)

Select 3 credits from METEO 436(3) [\[1\]\(#mnote01\)](#) or METEO 437(3) [\[1\]\(#mnote01\)](#) (Sem: 5-8)

Select 3-6 credits from METEO 473(3) [\[1\]\(#mnote01\)](#) and METEO 474(3) [\[1\]\(#mnote01\)](#)

(Sem: 5-8)

Select 9-13 credits from CAS 211(3) (Sem: 5-8); E E 477(3) or METEO 477(3); ENGL 416(3), GEOSC 402Y IL(3), METEO 412(4), METEO 413(3), METEO 416(3), METEO 418W(3), METEO 422(3), METEO 454(3), METEO 471W(3), METEO 483(3), METEO 484(3), METEO 485(2-3), METEO 486(3), METEO 496(3)* (Sem: 7-8)

*If a weather-forecasting-and-communications related internship

WEATHER RISK MANAGEMENT OPTION: (30-31 credits)

PRESCRIBED COURSES (18 credits) (May apply to General Education)

E B F 200 GS(3) (Sem: 1-2)

EM SC 301(3), E B F 473(3) (Sem: 3-6)

METEO 460(3), METEO 473(3) [1](#mnote01), METEO 474(3) [1](#mnote01) (Sem: 5-8)

ADDITIONAL COURSES (12-13 credits)

Select 3 credits from METEO 436(3) [1](#mnote01), METEO 437(3) [1](#mnote01) or METEO 454(3) [1](#mnote01) ** (Sem: 5-8)

Select 3 credits from E B F 4013) or ENNEC 484(3) (Sem: 6-8)

Select 3 credits from ECON 490(3), STAT 318(3), STAT 319(3), STAT 414(3), STAT 415(3), STAT 460(3) or STAT 462(3) (Sem: 6-8)

Select 3-4 credits from METEO 414(4), METEO 415(3), METEO 416(3), METEO 417(3), METEO 448(3), METEO 452(3), METEO 454(3)*, METEO 455(3), METEO 456(3), METEO 470(3), METEO 476(3). (Sem: 6-8) Substitutions are possible subject to *prior* approval by the option director.

**Preferred choice

*If not used to fill above requirement

Integrated B.S./M.S. Program in Meteorology

The Department of Meteorology offers an integrated B.S./M.S. (IUG) Program that is designed to allow academically superior students to obtain both the B.S. and the M.S. degree in Meteorology in five years of study. In order to complete the program in five years, students interested in the Integrated B.S./M.S. Program in Meteorology must apply for admission to the Graduate School and the Integrated B.S./M.S. Program by the end of their junior year.

During the first three years, the student will follow the course scheduling of one of the options in the B.S. degree, normally the Atmospheric Sciences or the General option (see the Undergraduate *Bulletin*). Students who intend to enter the Integrated B.S./M.S. program are encouraged to take upper level classes during their first three years whenever appropriate. By the end of the junior year, students normally apply for admission to both the IUG program and to the Graduate School. Acceptance decisions will be made prior to the beginning of the senior year and M.S. advising committees appointed for successful applicants. During the senior year, IUG students follow the scheduling of the selected B.S. Meteorology option, with an emphasis on completing 500-level course work as appropriate. During the senior year, IUG students will start work on their theses or papers that are designed to meet the requirements of the M.S. degree in Meteorology. During the fifth year, IUG students take courses fulfilling the departmental M.S. degree requirements and complete their M.S. theses or papers. Typical scheduling plans for students pursuing the General or Atmospheric Sciences options are given on the departmental Web site <http://www.met.psu.edu>. Undergraduate tuition rates will apply as long as the student is an undergraduate, unless the student receives financial support, for example, via an assistantship requiring the payment of graduate tuition.

Admission Requirements

Students who wish to complete the Integrated B.S./M.S. Program in Meteorology should

apply for admission to both the Graduate School and the Integrated B.S./M.S. Program by no later than the end of their junior year. In this case, successful students will be admitted formally into the graduate program in Meteorology just prior to their senior year, if their progress has been satisfactory. Admission prior to the senior year is also possible in some unusual circumstances. In all cases, admission to the program will be at the discretion of the Graduate Admissions Officer for the Department of Meteorology, who will determine the necessary criteria for all applicants. These criteria include the setting of the minimum required scores on the GRE and the minimum cumulative GPA for consideration, the receipt of sufficiently strong recommendation letters from three faculty and a strong letter of support from the department head, and the writing of an excellent proposal for a workable research project with a specific adviser; normally, evidence of significant research progress must be provided in the application as well.

The details of the program requirements can be found in the Graduate Degree Programs *Bulletin*

[1] A student enrolled in this major must receive a grade of C or better, as specified in Senate Policy 82-44.

[71] The following substitutions are allowed for students attending campuses where the indicated courses is not offered: CAS 100 GWS or ENGL 202C GWS can be substituted for EM SC 100S GWS.

Last Revised by the Department: Spring Semester 2009

Blue Sheet Item #: 37-02-022

Review Date: 10/7/08

UCA Revision #1: 8/9/06

UCA Revision #2: 7/30/07

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The University reserves the right to change the requirements and regulations listed here and to determine whether a student has satisfactorily met its requirements for admission or graduation, and to reject any applicant for any reason the University determines to be material to the applicant's qualifications to pursue higher education. Nothing in this material should be considered a guarantee that completion of a program and graduation from the University will result in employment.

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