Policies for Graduate Study in Atmospheric Science

This publication is for informational purposes and does not constitute a contract.
INTRODUCTION

Policies for Graduate Study in Atmospheric Science focuses on graduate guidelines specific to the Department of Geography and is not intended to summarize or cover all policies for graduate study at the University of Kansas. For guidelines published by the University and the College Office of Graduate Affairs (COGA), see the following links:

Online Graduate Catalog:  http://www2.ku.edu/~distinction/cgi-bin/overview302

COGA Graduate Policies:  http://www.clas.ku.edu/coga/department/policies

University Policy Library:  http://www.policy.ku.edu/office.shtml

Graduate policies are continually being reviewed, updated, and published. As a general principle, specific graduate policies apply to those students who enter the program after the effective date of the policy. Students who entered the program prior to the effective date of a policy generally have the option of following either the policy in force when they entered the program (sometimes referred to as “grandfathering”) or the new policy. Decisions about which policy to follow should be made in conjunction with the advisor and any questions should be directed to the Chair of the Graduate Studies Committee.

Every effort is made to ensure that the policies spelled out in Policies for Graduate Study in Atmospheric Science are free of error and conform to policies published by the University and the College Office of Graduate Affairs (COGA). In any case of disagreement between policies in this book and University or COGA policies, the University or COGA policies take precedence.

GENERAL PROCEDURES

Annual Progress Reports. All graduate students will be evaluated on an annual basis to achieve the following goals:

1) To fairly and transparently allocate funding beyond our normal 3 years for Ph.D. and 2 years for MS students based on student progress and achievements.
2) To identify students who are under performing and in need of assistance.
3) To keep track of graduate student performance and achievements.

The evaluation procedure consists of the student filling out a form and sending it to their advisor for additional (optional) comments.

Annual Meeting with Thesis or Dissertation Committee. Once an MS thesis or Ph.D. committee has been established for a student (normally by the end of the first year of academic residence), the student will be required to meet with committee members on a yearly basis (before April 1 of the spring semester) to review the student’s program in all of its facets.
**GTA Evaluations.** The department is required to evaluate all Graduate Teaching Assistants at least once every academic year during the GTA’s appointment. The performance evaluations must include classroom observations documented in writing and a written performance evaluation from the evaluator. Faculty evaluators are assigned each year. Evaluations must be completed by May 31 of each year. Beyond the obvious advantage of improving teaching, this process will enable faculty members to comment directly on teaching skills when writing letters of recommendation for on-campus awards or postgraduate positions.

**Directed Readings and Independent Research Hours.** Although the Graduate School sets minimal hours requirements for the M.S., and Ph.D. degrees, most students take coursework beyond this basic core. Formal classes and seminars constitute the heart of degree programs, but independent study through readings-research-problem courses is often a useful adjunct. M.S. students wanting to take more than 6 hours of independent study courses and Ph.D. students wanting to take more than 12 hours of independent study, however, must first obtain permission from the Graduate Studies Committee (GSC). In addition, a one-page statement of the nature of each independent study course shall be prepared by the student, signed by the professor involved, and placed in the student's file. If these statements are not so filed, the student will not be permitted to take the M.S. proposal defense or Ph.D. comprehensive exam.

**Incompletes.** Students are strongly discouraged from requesting "incompletes" in lieu of regular letter grades. Students with six or more hours of "incomplete" grades will be denied permission to enroll until these hours are reduced to the allowable limit (i.e., five hours). "Incomplete" grades automatically revert to an “F” after one year.

**Colloquium Attendance.** All graduate students are strongly encouraged to attend the various departmental colloquia offered throughout the year. Enrollment in Geography 980 (Seminar in Geography: Colloquium) for 1 credit hour is required during each of the first two semesters of residence at KU.

**THESES AND DISSERTATIONS**

**Guidelines for Proposals.** Although a dissertation proposal is necessarily more elaborate than that for a M.S. thesis, all proposals are expected to contain three basic elements:

1. A statement of the research problem or questions to be investigated.
2. A survey of relevant literature and how it relates to the student’s research problem
3. An outline of the general methodology, if not specific techniques, to be utilized in addressing the research problem or answering the basic research questions.

While these are the minimum content requirements for all proposals, students should consult with their advisor early in the proposal writing process with regard to specific format, length, or content requirements. It is expected that the student will consult closely with the advisor during the development and drafting of the proposal and that the student will receive the advisor’s approval of the proposal before submitting it to committee members and scheduling the M.S. thesis proposal defense or the Ph.D. oral exam.
Submission of Thesis/Dissertation for Committee Examination. Students should submit theses and dissertations directly to their advisors, and this advisor's approval must be received before a "clean and complete" version of this document is passed on to other committee members and the final oral defense is scheduled. A "clean" manuscript is typed in legible fashion with a minimum of handwritten corrections and is "complete" in the sense that the entire text is provided, together with table of contents, notes, bibliography, appendices, and supporting materials such as tables, graphs, maps, and illustrations. Graphics and maps should be carefully laid out with complete information in a format (size and shape) that is appropriate for inclusion in the final document. The thesis/dissertation need not, and in fact should not, be in final form for on-line submission. The presumption is that some changes will be necessary and these are easier to recommend and implement if the copy is "clean and complete" but not "final." Five weeks before the intended date of a student's final oral examination, the student (with approval of the committee chair), will submit a complete draft of the thesis or dissertation to all committee members. The advisor and committee members have a responsibility to provide timely evaluations. Within two weeks of this submission, committee members must indicate whether or not the thesis or dissertation is defendable by signing a "Permission to Schedule Defense" form.

Public Presentation. All M.S. and Ph.D. defenses must have a public component, which typically will involve an oral presentation by the student. These defenses must be announced via departmental email, the departmental Web page, and flyers posted in Lindley Hall. Once the presentation has been given and the public has been given a chance to ask questions, the public will be required to leave, and committee members will be able to ask questions in a private session.

Publication of Thesis and Dissertation Research. It is an expectation of the Department of Geography that all thesis and dissertation research be of publishable quality. All graduate students, under the guidance of their advisors and graduate committees, are strongly encouraged to develop a plan to publish their research in peer-reviewed journals, edited books, or other appropriate venues. Elements of that plan may include publishing abstracts and making presentations at scholarly conferences, submitting conference proceedings papers, and structuring the thesis or dissertation so as to facilitate publications.

M.S. IN ATMOSPHERIC SCIENCE

The purpose of the program is to expand the student's knowledge of fundamental atmospheric processes and how the atmosphere interacts with other parts of the environment. Students become familiar with quantitative research methods and how these various approaches can be used to address different problems in atmospheric science. Students gain an in depth ability to learn specific skills and apply them toward his/her thesis work. These skills consist of, for example, statistical analysis techniques, numerical modeling, or work with atmospheric instrumentation. The breadth of the program and the diverse research topics explored by the faculty are able to accommodate students with a variety of interests.
M.S. program requirements

Coursework
The program requires only a few specific courses and allows a wide variety of courses to count toward meeting the degree requirements.

Required credit hours:
30 credits 500 level or above.

Required Courses:
ATMO 710 Atmospheric Dynamics
ATMO 720 Atmospheric Modeling
GEOG 716 Advanced Geostatistics
Two-day (non-credit) orientation before classes begin in the fall semester
GEOG 980 (Seminar in Geography: Colloquium) for 1 credit hour during each of the first two semesters of residence at KU.

Electives:
3 additional credits of atmospheric science courses 700 level or above
6 credit hours of courses 500 level or above outside of the Geography department

Course Credit Limitations:
A maximum of 6 credits of 500 and 600 level Atmospheric Science courses may be included in the program (excluding ATMO 505)

Recommended:
Non-credit 8-hour Responsible Scholarship session held just before classes start in the spring semester

A maximum of 6 credit hours of ATMO 899.

M.S. Procedures

Admission and Prior Work
Entering students are ideally expected to have completed an undergraduate degree in a physical science (e.g., physics, chemistry, atmospheric science, oceanography), mathematics, or engineering. Entering students will be expected to have studied mathematics, including vector calculus and ordinary differential equations. Applicants holding an undergraduate degree in another subject, yet having a sufficient mathematical background, will be considered for admission. Prospective students should also have taken the equivalent of at least 2 semesters of calculus-based physics and one of chemistry. A minimum Grade Point Average (GPA) of 3.0 on a 4.0 scale is required. Applicants with a GPA of less than 3.0 may be considered for admission on a probationary or provisional status. Graduate Record Examination scores (verbal, quantitative and analytical) are required of all applicants.
Program and Coursework
The program at the M.S. level continues the general training of the bachelor's degree but also provides for the development of concentration in preparation for thesis research, employment, or advanced study. Upon a student's admission to the department, the Graduate Studies Committee will appoint an advisor. Early in the first semester (preferably in the first week of classes), the student should meet with this advisor to outline a tentative program of coursework for the degree. Such programs should be solidified by the time of enrollment for the second semester and submitted to the GSC for approval. The student and advisor then continue to discuss and update programs each semester, bearing in mind that any substantive changes must be approved by the GSC. Program sheets are available in the department office and must be filed before the thesis defense can be scheduled. The student will have a thesis committee consisting of at least three faculty members. At least two of these faculty members must regularly teach in the atmospheric sciences program.

The Master's Thesis
Ideally, work on the M.S. thesis research should begin during the second full-time semester. During this second semester, the student should decide on the general area of thesis research and select a member of the faculty who is competent in that area and willing to supervise the thesis and serve as the student's general advisor. The student's advisor must have at least a partial FTE appointment (i.e. tenured or tenure-track) within the Department of Geography. Should the student desire an advisor outside of the department, a departmental co-advisor is required. Two additional faculty members must also read and approve the thesis and sign it after a successful defense. One of these two readers may be from outside the program. All committee members must be approved by the GSC (Graduate Studies Committee) and recommended to the graduate school. Submission procedures for the thesis are discussed below.

Other Procedures
All master's students who have completed required coursework for their degrees are required to be continuously enrolled until all requirements for the degree are completed. No enrollment is necessary for the summer term. The Graduate School has established a maximum time limit of seven years between initial graduate enrollment and completion of all degree requirements.

Submission of the Approved Thesis
When the thesis has been completed and successfully defended, both electronic and hardbound copies need to be prepared. Both should include an abstract of no more than 150 words. A hardbound copy is required for the department. The KU Libraries recommend the following binders that can bind paper copies of your thesis and additionally offer print-from-electronic file services: 1) Heckman Bindery (http://www.thesisondemand.com/) or 2) Acme Bookbinding (http://www.acmebook.com/bindery/thesis). The student must turn in a receipt showing that arrangements have been made for such work prior to the deadline for graduation set by the Graduate School. It is also customary for the student to provide a bound copy for the advisor.

The thesis must be submitted to the Graduate School and UMI Dissertation Publishing electronically using Portable Document Format (PDF). Instructions for this process are available at the KU graduate school website. See also UMI's website at http://dissertations.umi.com/ku/. In addition to this electronic submittal, a student must submit a paper copy of the title page and
an “acceptance page” with original signatures to the College Office of Graduate Affairs office in 102 Strong Hall. Formats for both of these are at the graduate studies website. A copy of the title page should also be turned in to the Geography Office.

**KU M.S. Students Continuing for the Ph.D.** Departmental M.S. students desiring to continue at KU for their Ph.D. studies must apply to the Graduate Studies Committee. The application consists of a letter requesting admission accompanied by letters of evaluation from at least two KU faculty members in a position to judge the student's performance at the graduate level; one of these letters must be from the chair of the student's M.S. committee. A student is eligible to apply any time after successfully passing his or her M.S. examination. No more than nine hours of coursework completed within the M.S. program and in excess of the thirty-hour minimal requirement therein will be allowed to count toward Ph.D. requirements.

**PH.D. IN ATMOSPHERIC SCIENCE**

**Programs and Coursework.** The doctoral program requires a minimum of sixty hours: thirty hours of course work and thirty hours of dissertation research.

Programs are planned with the advisor and then approved by the GSC. Such approval must be secured at latest by the second month of the second semester of study. Changes in the approved program can be initiated by the student at any time but must be approved by the advisor and the GSC. Program sheets are available in the department office and must be filed before the comprehensive examination can be scheduled.

**Required Courses (or equivalent course work at another university).**

- ATMO 710, Atmospheric Dynamics
- ATMO 720, Atmospheric Modeling
- GEOG 716, Advanced Geostatistics
- Two-day (non-credit) orientation before classes begin in the fall semester
- GEOG 980 (Seminar in Geography: Colloquium) for 1 credit hour during each of the first two semesters of residence at KU.

Up to 12 hours of independent study may be used towards course work.

**Research Skills Requirement.**

The faculty consider it to be very important that students acquire a research skill in Mathematics or Engineering or a Related Discipline. Six hours are required in courses at the 500 level or above.

**Responsible Scholarship Requirement:** As part of the University requirement that all Ph.D. students receive “training in responsible scholarship relative to the field of study,” the Department of Geography will conduct a non-credit training seminar in responsible scholarship to be held at the beginning of spring semester each year. This requirement must be completed
prior to taking the comprehensive exam. The seminar consists of eight (8) contact hours between seminar leaders and Ph.D. students.

**Residency Requirement.** In order to fulfill the university’s residency requirement, a student must be involved full-time in academics for two semesters. One of these semesters can be a summer session. Full-time is defined as any of the following combinations:

1) 9 credit hours per semester; or 6 credit hours per summer session;
2) 8 credit hours per semester with a 30% TA or RA;
3) 7 credit hours per semester with a 40% TA or RA;
4) 6 credit hours per semester with a 50% TA or RA;
5) 5 credit hours per summer session with a 25% TA or RA;
6) 3 credit hours per summer session with a 50% TA or RA.

**Comprehensive Examination.** The comprehensive examination is scheduled when the student and the advisor believe that competence in the specialty or specialties has been achieved. Normally the process occurs after the student has completed nearly all of his/her coursework, although Graduate School regulations stipulate that the testing can take place as soon as five months after enrollment in the Ph.D. program. Admittance to the examination is by approval of the GSC. In petitioning for admittance, the student must submit the following materials at least three weeks prior to the scheduled examination (forms are available for 1 and 2 in the departmental office).

1. a program sheet listing courses taken, grades received, etc.
2. demonstration that the Research Skills and Responsible Scholarship requirements have been satisfied (see description above).
3. demonstration that the Residency Requirement has been satisfied (see description above).
4. a written dissertation proposal approved by the advisor (see guidelines on previous pages of this document).
5. a list of examination committee members. The Graduate School requires that the committee consist of at least five members of the graduate faculty. This consists of the student’s advisor and four additional members. The student’s advisor must have at least a partial FTE appointment (i.e., tenured or tenure-track) within the Department of Geography. Should the student desire an advisor outside of the department, a departmental co-advisor is required. At least one member must be from a KU department outside of geography and at least three members must represent the department. Members are chosen by the student in consultation with the advisor on the basis of expertise in the areas of specialization. They must also be approved by the GSC and recommended by the department to the Graduate School.
6. The date and time proposed for the oral portion of the examination.

The comprehensive examination normally focuses on the student's areas of specialization, including proposed dissertation research. It consists of two parts: written questions submitted
by the committee members and then an oral examination. At least four members of the committee must submit written questions. The procedure is for each examiner to give his/her questions to the chair of the student's committee at least one week before the written examinations begin. The committee chair has the responsibility of screening these questions for overlap and clarity, and then administering them, one set per day. The questions may be open-book or closed at the discretion of the individual submitting the questions, and the student normally will have up to eight hours to complete each set of questions. At the conclusion of the written portion of the examination, the committee chair will poll the committee. A majority of the members must approve their individual written portions of the examination in order for the second (oral) portion to take place. In the oral section, students often are asked to elaborate and comment on their written answers. The focus is on the proposal, however, with probes into its scope, justification, and methodology being common. Significant revisions to the research subject and approach sometimes emerge from this process. Three grades are possible for the overall examination: "honors," "satisfactory," and "unsatisfactory." In the unsatisfactory case, the student may be allowed to repeat the process upon recommendation of the committee. Such repetition can be undertaken no sooner than ninety days after the last testing. The comprehensive examination may be taken no more than three times. Approval of the Graduate School must be secured for the scheduling of this procedure and the request must be submitted three weeks prior to the proposed date for the examination.

**Ph.D. Comprehensive Exam Procedures.** In order to give committee members sufficient time to read and discuss responses to the written comprehensive examination questions, at least seven (7) calendar days must elapse between the date of the last written exam question and the meeting for the oral examination. The gap between the last written exam question and the oral exam may be up to 30 calendar days. Any exceptions to these policies must be unanimously agreed upon by all examination committee members and the chair of the Graduate Studies Committee.

**The Doctoral Dissertation.** Serious work on the dissertation should begin no later than the third full-time semester of study for the Ph.D. and well before the scheduling of the comprehensive examination. When selecting a topic, the student first should make sure that an advisor exists who is able and willing to supervise on that subject. Then, usually in close consultation with this advisor, a proposal is developed to articulate the research idea for the rest of the examination committee. The advisor also serves as chair of this committee.

The dissertation committee, consisting of the advisor and at least four others, is designated immediately following the passing of the comprehensive examination and is usually comprised of members of the examination committee. This committee must include at least one member from a KU department outside of geography and must have at least two members from Geography. Committee members must be approved by the GSC and recommended to the Graduate School.

After successful completion of the comprehensive examination, the student is officially admitted to candidacy for the Ph.D. degree (prior to this stage, the student is a Ph.D. aspirant). By passing to the candidacy stage, the examination committee records its view that this person has a satisfactory dissertation proposal as well as the capability to complete the proposed task of research and writing. Although formal coursework is finished at this point, continued scholarly
and professional development obligates the candidate to continue attendance at special-interest seminars and colloquia while still in residence.

After passing the comprehensive oral examination, every student must be continuously enrolled, including summer sessions, from the time of candidacy until the dissertation is deposited at the Graduate School office. The Graduate School further stipulates that a minimum enrollment of six hours is required each semester (plus three in summer) until a total of eighteen is achieved. Thereafter the enrollment may be dropped to one hour per semester, assuming that the dissertation is deposited in the Graduate School office within six months after the defense. Students who exceed this six-month limit must enroll in three hours per semester until the dissertation is so deposited.

When the dissertation committee has tentatively approved the dissertation, approval is sought from the Graduate Studies Committee to schedule the final oral defense. At least five months must elapse between the successful completion of the comprehensive examination and the date of this oral defense. The final oral defense committee has the same composition requirements as does the dissertation committee. Approval of the Graduate School must be secured for the scheduling of this exam and the request must be submitted to the GSC three weeks prior to the proposed date for the examination. Submission procedures for the dissertation are described elsewhere in this booklet.

When the final oral defense has been passed and the dissertation completed, both electronic and hardbound copies need to be prepared. Both should include an abstract of no more than 150 words. A hardbound copy (8 ½” x 11”) is required for the department. The KU Libraries recommend the following binders that can bind paper copies of your thesis and additionally offer print-from-electronic file services: 1) Heckman Bindery (http://www.thesisondemand.com/) or 2) Acme Bookbinding (http://www.acmebook.com/bindery/thesis). Bound copies can also be obtained through UMI Dissertation Publishing. The student must turn in a receipt showing that arrangements have been made for such work prior to the deadline for graduation set by the Graduate School. It is also customary for the student to provide a bound copy for the advisor.

The dissertation must be submitted to the Graduate School and UMI Dissertation Publishing electronically using Portable Document Format (PDF). Instructions for this process are available at the KU graduate school website. See also UMI's website at http://dissertations.umi.com/ku/.
In addition to this electronic submittal, a student must submit a paper copy of the title page and an “acceptance page” with original signatures to the College Graduate Studies Office in 102 Strong Hall. Formats for both of these are at the graduate school website. A copy of the title page should also be turned in to the Geography office.

The Graduate School has established a maximum time limit of eight years between initial enrollment in the doctoral program and completion of all degree requirements. For people earning both M.A. and Ph.D. degrees from KU, the combined time limit is ten years.
MISCELLANEOUS INFORMATION

Use of Departmental Resources
Only graduate students who hold teaching and research assistantships have access to photocopy and secretarial support. All graduate students have access to computers in the various laboratories so long as they follow posted guidelines. The department endeavors to provide desk space for every graduate student but people holding teaching assistantships and research assistantships have priority. All graduate students are provided with e-mail addresses.

Departmental Grievance Procedures
The Geography Department's grievance procedures are on file in the departmental office and are available upon request.

Student Rights and Responsibilities
All graduate students are responsible for informing themselves of requirements of the Graduate School as stated in the most recent issue of the Graduate School Catalog, both the general requirements and those specific to geography. Members of the faculty and the staff of the graduate school are ready to answer questions and offer counsel.

The university's Code of Student Rights and Responsibilities describes protected rights and expectations for conduct. Included are rights to free speech, expression, assembly, pursuit of educational goals, privacy, and due process. It also outlines how student and campus organizations may operate, and describes nonacademic misconduct such as threats and violence against disrupting classes and events. The complete text of the Code of Student Rights and Responsibilities is available online at www.ku.edu/~vcstuaff/rights.html or at the offices of the Vice Provost for Student Success and the Dean of Students.
Atmospheric Science Courses

ATMO 105 Introductory Meteorology. (5)
A lecture and laboratory course introducing students to the atmosphere, weather and climate phenomena, and their controlling physical processes. Topics covered include: the structure of the atmosphere, energy and energy budgets, climate and climate change, air pollution, clouds and precipitation, pressure and wind systems, severe weather, and weather forecasting.

ATMO 106 Introductory Meteorology, Honors (5)
Honors version of ATMO 105. A lecture and laboratory course introducing students to the atmosphere, weather and climate phenomena, and their controlling physical processes. Topics covered include: the structure of the atmosphere, energy and energy budgets, climate and climate change, air pollution, clouds and precipitation, pressure and wind systems, severe weather, and weather forecasting.
Prerequisite: membership in University Honors Program or by permission of instructor.

ATMO 220 Unusual Weather. (3)
An introductory lecture course which surveys the general principles and techniques of atmospheric science and illustrates their application through discussions of natural but unusual weather phenomena such as blizzards, hurricanes, tornados, and chinooks, of the effects of air pollution on weather, and of intentional human alteration of the atmosphere.

ATMO 310 Aviation Meteorology. (3)
This course introduces students to meteorological events that affect aircraft operations. Aviation applications of meteorological observations including satellite and radar observations are discussed. Students will learn about graphical displays of meteorological information. Numerical forecasting models and how their output is applied for aviation will be considered. Forecasting of weather events of particular interest to aviation such as ceiling, visibility, icing and turbulence is emphasized.
Prerequisite: ATMO 105 or AE 245 or equivalent.

ATMO 321 Climate and Climate Change. (3)
Same as GEOG 321
This course is designed to introduce students to the nature of the Earth’s physical climate. It introduces the basic scientific concepts underlying our understanding of our climate system. Particular emphasis is placed on energy and water balances and their roles in evaluating climate change. The course also evaluates the impact of climate on living organisms and the human environment. Finally, past climates are discussed and potential future climate change and its impact on humans is evaluated.
Prerequisite: GEOG 104 or ATMO 105.

ATMO 499 Honors Course in Atmospheric Science. (2-3)
Open to students with nine hours of upper level credit in Atmospheric Science, an average of at least 3.5 in all Atmospheric Science courses, and an overall average of at least 3.25. Includes the preparation of an honors paper and its defense before a committee of at least two regular
faculty members.

ATMO 505  Weather Forecasting. (3)
A first course in synoptic meteorology designed to introduce students to weather analysis and forecasting through the application of hydrodynamic and thermodynamic principles to operational analysis and forecasting. Topics include: analysis and interpretation of surface and upper-air observations and data from satellites, radars, and wind profilers; chart and sounding analysis; and three-dimensional, conceptual models of weather systems. The course includes student-led weather briefings and analysis exercises.

Prerequisite: ATMO 105 and MATH 125 or MATH 115.

ATMO 506  Forecasting Models and Methods (3)
Introduction to basic numerical weather prediction methods. Computer programs are used to apply numerical methods to weather data and to evaluate dynamical processes on numerical grids. Meteorological graphics packages are used to analyze current weather data and numerical model output. Current operational numerical models and output products are discussed.

Prerequisite: ATMO 505, Math 126, and EECS 138 or EECS 168.

ATMO 515  Energy and Water Balance (3)
A study of the distribution and circulation of water in the air-earth system as influenced by atmospheric processes and surface conditions. The solar and terrestrial radiation budget and the water balance at the earth’s surface will be applied to agricultural and urban energy and water problems.

Prerequisite: ATMO 105 or EECS 138.

ATMO 521  Microclimatology. (3)
Same as GEOG 521
A study of climatic environments near the earth-atmosphere interface. Consideration of rural climates in relationship to agriculture and urban climates as influenced by air pollution and other factors. Emphasis is on physical processes in the lower atmosphere, distribution of atmospheric variables, the surface energy budget and water balance.

Prerequisite: ATMO 105 and Math 106 or Math 125.

ATMO 525  Air Pollution Meteorology (3)
A study of background levels and concentrated sources of atmospheric pollution together with considerations of pollution buildup in urban areas as related to particular weather conditions. Inadvertent weather modifications and effects of atmospheric pollution on particular weather events and general climate will be discussed.

Prerequisite: ATMO 105, MATH 125, EECS138 and CHEM 130 or equivalent.

ATMO 531  Topics in Atmospheric Science: (1-3)
An investigation of special topics in atmospheric science. May include topics in dynamic, physical or synoptic meteorology or climatology as well as related topics in earth and physical sciences. May be repeated if topic differs.
ATMO 605  Operational Forecasting (2)
Students enhance their forecasting expertise by preparing forecasts for presentation to the public through a variety of media. Classroom activities include weekly map discussions and analysis of current weather situations. Forecasting topics such as forecast verification, aviation forecast products, severe weather, flash floods and watches and warnings are examined. Credit for ATMO 605, ATMO 606, and ATMO 607 is limited to a total of eight hours, six of which may be counted toward a degree in atmospheric science.
Prerequisites: ATMO 505.

ATMO 606  Forecasting Practicum – Private Industry (2)
Practical experience in private industry working with current and/or archived meteorological data. Possibilities include the preparation of forecasts for TV stations and meteorological consulting firms, and working with environmental consulting firms to assess air pollution hazards. May be repeated two times for credit. Credit for ATMO 605, 606, and 607 is limited to a total of eight hours, six of which may be counted toward a degree in Atmospheric Science.
Prerequisite: ATMO 605.

ATMO 607  Forecasting Intern – National Weather Service (2)
Practical experience working in a National Weather Service forecasting center in analyzing weather data and preparing weather forecasts. May be repeated two times for credit. Credit for ATMO 605, 606, and 607 is limited to a total of eight hours, six of which may be counted toward a degree in Atmospheric Science.
Prerequisite: ATMO 605.

ATMO 630  Synoptic Meteorology (3)
Interpretation, development, and analysis of synoptic charts.
Prerequisite: ATMO 505 and ATMO 640.

ATMO 634  Physical Climatology (3)
Atmospheric processes are described and discussed in relation to the climate of the earth’s surface. Such topics as the greenhouse effect, ozone depletion, and the effect of solar irradiance on climatic change will be included. The physical processes and relationships between various climatic features will be studied.
Prerequisites: ATMO 505 and DSCI 301 or MATH 526.

ATMO 640  Dynamic Meteorology (3)
This course introduces the student to the fundamentals of fluid dynamics necessary for understanding large scale atmospheric motions. Fundamental physical laws of conservation of mass, momentum and energy are examined and applied to atmospheric flows. Rotation in the atmosphere is examined quantitatively in terms of both circulation and vorticity.
Prerequisite: MATH 223 and PHSX 214 or PHSX 212 and 236.

ATMO 642  Remote Sensing (3)
This course is designed to prepare students to effectively use remotely sensed data in operational or research settings for further work in this field. Topics include radiation and radiation transfer applied to active and remote sensing; radiative properties of space, sun, earth
and atmosphere; instrument design considerations and operational characteristics; inversion methods for temperature or concentration profiling; surface temperature measurement; cloud top height determination; rain rate and wind velocity measurement; severe weather detection; satellite photograph interpretation.

**Prerequisite:** ATMO 680, MATH 581.

**ATMO 650  Advanced Synoptic Meteorology (3)**
Analysis and interpretation of synoptic weather charts including treatment of numerical weather forecasting.

**Prerequisite:** ATMO 630 and ATMO 660.

**ATMO 660  Advanced Dynamic Meteorology (3)**
Advanced study of the atmosphere including treatment of the vorticity equation.

**Prerequisite:** ATMO 640 and MATH 220 or MATH 320.

**ATMO 680  Physical Meteorology (3)**
This course is designed to enhance the student's understanding of atmospheric processes through the study of these processes at molecular through micro scales. Topics include the properties and behavior of gases; transfer processes; phase change; solar and earth radiation; cloud drop, ice crystal and precipitation formation; atmospheric electricity; stratospheric chemistry.

**Prerequisite:** MATH 223, PHSX 214 or PHSX 212 and 236.

**ATMO 690  Special Problems (1-3)**
This course provides the student with an opportunity for independent work in meteorology beyond the content of the regularly-scheduled courses. Done under the guidance of a faculty member, the problem should be of mutual interest to the student and the faculty member; the nature of the work should be carefully discussed by both before enrollment.

**Prerequisite:** Nine credit hours in meteorology.

**ATMO 697  Seminar for Seniors (1)**
Current research in atmospheric science will be discussed. May be repeated for a total of two credit hours.

**Prerequisite:** Senior level in Atmospheric Science.

**ATMO 699  Undergraduate Research (2)**
Work on a research project under the supervision of a faculty member. May be taken up to three times for credit.

**Prerequisite:** Nine credit hours in meteorology.

**ATMO 710  Atmospheric Dynamics (3)**
Presentation of contemporary approaches to the study of atmospheric dynamics. May include methodologies that provide insight into global, synoptic, mesoscale or microscale motions.

**Prerequisite:** ATMO 660 or equivalent.
ATMO 720 *Atmospheric Modeling* (3)
Illustration and application of contemporary approaches to mathematical and statistical description of atmospheric phenomena.
*Prerequisite:* Consent of instructor.

ATMO 727 *Atmospheric Storms* (3)
The physical processes and operating principles involved in the development and life cycles of extreme or unusual weather events including tornadoes, blizzards, lightning displays, and tropical storms.
*Prerequisite:* Consent of instructor.

ATMO 731 *Advanced Topics in Atmospheric Science:* (1-3)
Advanced investigation of special topics in atmospheric science. May include topics in dynamic, physical or synoptic meteorology or climatology as well as related topics in earth and physical sciences. May be repeated if topic differs.

ATMO 750 *Numerical Weather Prediction* (3)
An exploration of the mathematical methods used to describe the current state of the atmosphere and to predict future states. Current operational numerical weather prediction techniques will be included.
*Prerequisite:* ATMO 660.

ATMO 825 *Seminar in Climatology* (2-3)

ATMO 827 *Seminar in Atmospheric Science* (1-3)

ATMO 898 *Readings in Atmospheric Science* (1-4)

ATMO 899 *Master’s Thesis* (1-10)

ATMO 998 *Research in Atmospheric Science* (1-5)

ATMO 999 *Doctoral Dissertation* (1-10)

March 2016