

Meteorology

Saint Louis University



GRADUATE METEOROLOGY PROGRAM

Questions and Answers

DEPARTMENT OF EARTH AND ATMOSPHERIC SCIENCES
SAINT LOUIS UNIVERSITY

GRADUATE PROGRAMS IN METEOROLOGY

Some Commonly Asked Questions

Pursuing a graduate degree is quite different than a bachelors degree. In the opinion of recent graduate students this transition from an undergraduate to graduate status represents a greater shock than that from a high school student to a college student. Typically, one takes fewer courses each term (2-3) in which more is expected of you. Students are expected to be more independent and to seek in-depth answers to questions, not merely a cursory knowledge of a subject deemed sufficient *"to get by"*. Also, many students work as a teaching or research assistant, in which capacity they are expected to perform certain tasks, such as grading exams and homework, copying material for classes and labs, helping professors with audio-visual aids, etc. Research assistants are paid by individual professors through grants. They are expected to work directly with the professor on specific research projects. Thus, a graduate program is very focused and concentrated.

In these pages we have compiled some of the more typically asked questions that have been asked by graduate students in meteorology over the years. It is our hope that answering these questions in this way may make your life in the meteorology graduate program smoother and more organized. Should you still have more questions, however, please feel free to ask any of the meteorology professors—after all, you are the reason that we are here! Good luck!

Q. What is the difference between a MS (Research) and a MS (Professional) degree?

A. The Masters of Science in Research requires 24 hours of course work and 6 hours of thesis research. Most of our students take this option. It culminates in a masters thesis which must be approved by the student's committee and the graduate school. An oral defense of the thesis is also required, given before the committee. This program is geared to those students anticipating to enter a doctoral program later on or working in a research capacity (e.g., NASA or NOAA contractor).

The Masters of Science in Professional Meteorology requires 30 hours of course work and 3 hours in EAS-A 589, Research Seminar. In the latter course, the student works on a research topic that is more limited in scope than for the research degree. The student does prepare a report for his or her committee, but it is not of thesis quality. An oral defense is required before the committee. The professional degree is often sought by those students with a time limitation to their program, as it is very focused and can usually be completed within 2 years. Students anticipating that this will be their terminal degree take the professional route. It is **not** intended to be a program for marginal students. It is every bit as rigorous as the research degree, but different in scope.

If you choose one program initially and then change your mind later, you merely petition the Graduate School to change programs.

Q. How long does it take to finish an MS and a doctoral program?

A. The MS (Research) usually takes about 2 – 2 1/2 years to complete. The MS (Professional) typically take 1 1/2 - 2 years to complete. Doctoral programs vary according to the exact nature of the research involved, but typically take 3 - 4 years to complete.

Q. What is a teaching assistant and a research assistant?

A. A teaching assistant (TA) position is chosen competitively among those students applying to our program. TAs help out in the synoptic laboratory, work in the department on computers, grade homework exercises and tests, copy class material, and teach classes as needed. TAs are paid in 9 month (August to May) or 11 month (July to May) contracts and are waived tuition costs for 9 credits each term and 3 credits in the summer. We have four TA assignments in meteorology. All TA duties are specified at the beginning of the school semester. A TA typically works about 15 - 20 hours per week.

A research assistant (RA) works for a particular professor and is paid directly from his or her grant. The RA works on topics directly related to the grant topic. The RA will plot maps and charts, write computer algorithms, and analyze data as prescribed by the professor. Tuition is also waived for the RA (i.e., 9 credits each term and 3 credits in the summer). He or she may or may not be paid more money depending on the research resources.

Q. What courses do I need to take?

A. As noted above, a MS (Research) degree requires a total of 30 hours, which includes 6 hours of research. A MS (Professional) degree requires 33 hours including 3 hours of EAS-A 589, Research Seminar. A doctoral program requires 60 hours with an additional 12 hours of dissertation research. No more than 10 credit hours of 400 level courses may be applied to a graduate degree. Specific permitted courses are listed in the General Bulletin.

The Master's student must take at least two courses each in the general, dynamic, and physical meteorology courses as noted below:

GENERAL	DYNAMIC	PHYSICAL
EAS-A 527	EAS-A 523	EAS-A 536
EAS-A 528	EAS-A 524	EAS-A 547
EAS-A 529	EAS-A 570	EAS-A 565
EAS-A 550	EAS-A 648	EAS-A 636
EAS-A 561	EAS-A 659	
	EAS-A 680	

Note that EAS-A 588, EAS-A 593, and EAS-A 598 can be counted as general, dynamic or physical depending upon their content. This is a departmental rule not a Graduate School requirement.

There are no **required** courses for the MS programs, but most students take the following courses **in preparation for the comprehensive exam**:

COURSE NUMBER	COURSE NAME
EAS-A 534	Physical Meteorology (Cloud Physics)
EAS-A 527	Meteorology of Severe Storms
EAS-A 536	Principles of Radiation Transfer
EAS-A 520	Numerical Methods of Prediction
EAS-A 565	Radar Meteorology

Other courses are taken according to the students' interests and background.

Q. How many courses are offered each Spring, Fall, and Summer Semesters?

A. During the regular school year (Spring and Fall Semesters) typically 3 - 4 graduate courses are offered. This does not include graduate reading and independent study courses or thesis and dissertation research which are offered every semester. During the summer, typically 1-2 graduate courses are offered. If one professor is on a sabbatical, graduate course offerings are fewer.

Q. What is the Masters of Science Comprehensive Exam?

A. Typically, after one semester of study, a Master's student is expected to take the Comprehensive Exam. He or she signs up for EAS-A 550 (alias Advanced Meteorology Laboratory) for 3 credits which count toward the total 30 to 33 hours of study. During the semester, students in EAS-A 550 will meet 2 – 3 hours a week with each professor (rotating schedule) for about 10 weeks. During the meeting you will discuss a list of about 60 questions which will be given to you to study. The questions cover both Bachelor's level and Master's level material which you will be expected to know at the end of the semester.

The student will take a 3-hour written exam based on the 60 questions. There will be a total of 12 questions chosen from the list of which the student must answer 6. A week or so later, the student takes a one-half-hour oral exam given by all the professors also based on the material in the 60 questions. To be advanced to candidacy a student must pass both portions of the exam. If a student does poorly he or she will be asked to take a reading course to cover the weakest part of his or her knowledge with a professor's guidance. In rare instances the student will be asked to retake the oral exam.

Q. What is the qualifying exam for a doctoral program?

- A. When the doctoral candidate is within about 12 credits of the 60 hours required he or she should work with the advisor to "fine-tune" and organize the dissertation topic. The doctoral student should prepare a "prospectus" of around 20 pages or so detailing how the research topic will be approached. It should include an introduction to the dissertation problem, literature background, methods and procedures (including data sets to be used) and even some preliminary results (if available). The prospectus is then presented to all the faculty for their inspection. The student will discuss the prospectus with each faculty member, individually.

The doctoral student and his or her advisor will then schedule a date and time for a three and one-half-hour written exam. The written exam consists of two questions from each faculty member. The student will choose one of the two questions from each faculty member. A second date is then chosen for a two hour oral exam which all faculty attend to ask questions of the proposed candidate concerning the dissertation topic. The results of the oral examination will be tabulated by the Graduate School Dean.

Q. How do I get advanced to candidacy?

- A. After successfully completing the MS Comprehensive Exam or Doctoral Qualifying Exam the student must go to the Graduate School and ask to be advanced to candidacy. The Graduate School will check your courses and grades and report any deficiencies to Dr. Moore who will then sign the form advancing the student to candidacy. After this step, the student is ready to do research.

Q. What are the research interests of the faculty?

- A. It is in the student's interest to make an appointment with each member to chat about their recent research endeavors. In this way, the student can best match his or her interests with those of one of the professors. Naturally, an RA would most likely do research with the professor supporting his or her study.

General research interests of the faculty at the present include:

Prof. Abell: Operational weather forecasting and forensic meteorology.

Dr. Graves: Precipitation climatology, regional climatology, mesoscale modeling, and statistical analysis.

Dr. Lin: Doppler analysis of TAMEX storms, WSR-88D analyses of midwestern storms and squall lines, and numerical simulation of mesoscale convective systems.

Dr. Moore: Short-term forecasting of severe local storms - heavy precipitation analysis and forecasting, isentropic analysis of winter storms and mesoscale bands in cyclones, jet streak studies.

Dr. Pasken: WSR-88D data analysis and interpretation.

Dr. Rao: Monsoon convection, surface exchange processes, and tornadoes associated with landfalling hurricanes/tropical cyclones.

Q. How do I get an advisor assigned to me?

- A. When you first enter the graduate program. The Graduate Director of Meteorology, Dr. Moore, will be your advisor. However, once you choose a thesis advisor, that professor becomes your advisor. You may choose an advisor **prior to** being admitted to candidacy. Your advisor will not only direct your research, but also work with you on choosing courses each semester so that you finish according to schedule.

Q. When do I begin research?

- A. After passing the MS comprehensive exam and being advanced to candidacy, it is a good idea to take a 3 hour graduate reading course under the direction of the professor with whom you wish to do your thesis research. In this course you will be assigned journal articles, textbook reading, reports, etc., dealing with the background material you need to know to understand your research area. You will meet with your advisor for 2-3 hours per week to discuss the papers and how they relate to your proposed research. Typically, the student will be asked to write a 10-15 page paper as part of the reading course summarizing the pertinent literature and proposing an actual thesis topic. The paper will also present a preliminary "plan of attack" as to method and procedures and what data sets will be used. This document can later be useful in filling out the Graduate School's thesis form which is required early in the semester indicating your plan to graduate.

Q. How do you form a research committee?

- A. The semester before you plan to graduate, you and your advisor should discuss which two professors you want to ask to be on your MS committee. The professors you ask to be on your committee should have expertise in your area of research, so they may offer ideas to help you as you work on your project. You should approach the professors you choose to ask them to be on your committee. You should include them in discussions of your research methodology and results as early as possible, so that you may include their comments and suggestions in your work. All the meteorology professors are eager to help you so that research quality is enhanced.

Q. What are the department's computing resources?

- A. The Department of Earth and Atmospheric Sciences at Saint Louis University has over a dozen SUN workstations located throughout the department. In addition, there are several IBM clone Pentium PCs which can be used to run PC programs, word processing, and databases. All SUN workstations have internet capability and all computers are linked through a local area network (LAN).

Weather data are received through the internet from Unidata, a division of UCAR. Data include: surface and upper air reports, numerical model output, NWS forecasts and discussions, satellite imagery, profiler data, and WSR-88 Doppler data. On the SUN workstations, software for accessing and displaying the data is used including the LDM, GEMPAK, and GARP. SLUBREW, software developed over the past two decades at Saint Louis University, is also used for synoptic scale diagnostics.

Several laserprinters and one color laserprinter are available for printing text or graphical output.

Q. What job opportunities await me upon graduation?

A. Our graduates have found employment in the National Weather Service, Federal Aviation Administration, National Aeronautics and Space Administration, Environmental Protection Agency and private meteorological firms (e.g., Dames and Moore). Some graduates have found opportunities in computer science-related activities. For this reason we urge students to take 1-2 computer science courses to help diversify their background. A rule of thumb is that it takes about 6 months to find a job, providing the economy is relatively robust and you are willing to accept a position in any region of the U.S. You should be flexible in this regard. As you gain experience and ability you can become more selective about what job you accept.

Q. What types of financial aid are available?

A. Financial aid is available either through a teaching assistantship or a research assistantship. These are available on a competitive basis. In some cases a student will be asked to pay his/her own way for the first semester (or two) until a TA position becomes available. We will do our best to help eligible students. Student loans can be arranged through the Financial Aid office (DuBourg Hall, Room 151, phone number (314) 977-2350).

Q. Is on-campus housing available?

A. Housing is available on campus. If an applicant is interested in on-campus housing, he/she must state so on the application to the Graduate School. The Housing office is located in Walsh Hall, 1st Floor, and the phone number is (314) 977-2797.

Q. How are international students supported?

A. Some international students are supported by their governments. Some are supported by the U.S. agencies (such as, NOAA - Office of International Programs). The Graduate School answers the inquiries of international students by sending a preliminary application form. Some international students can be offered a TA or RA.

Q. Are tests such as the GRE and TOEFL important?

A. Yes! The GRE in general is a good index of a student's capability. TOEFL is important to understand whether a student needs additional help with English. Letters of recommendation accompanying an application are valuable in arriving at a decision, in addition to these test scores and academic records.

Q. How many EAS-A 598 graduate reading courses can be taken?

A. The candidate should try to take as many regularly scheduled courses as possible. If that is impossible, then one may take a Graduate Reading course. In general, six hours of such reading or independent courses can be taken for MS studies.

Q. What about the transfer of credit from other universities?

A. If you wish to transfer courses taken at another university, they must be similar to our course offerings. Secondly, they should be recent. Third, the course material should not have changed substantially from when you took the course. Fourth, only upper division undergraduate and graduate courses are transferable. Fifth, petition to transfer can be initiated only after spending one semester here. Sixth, only a maximum of six hours can be transferred. Seventh, the Dean of the Graduate School has the authority to approve or disapprove the petition. It is best to check with the faculty to determine which courses can likely be transferred.

Q. Where can I obtain additional information about our meteorology program?

A. For addition information about the meteorology program at Saint Louis University, and/or for a tour of our facilities and an informal meeting with a faculty member write or call:

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CURRICULUM AND COURSE DESCRIPTION

METEOROLOGY PROGRAM

UNDERGRADUATE LOWER DIVISION COURSES

EAS-A 101: *Earth Systems I - Solid Earth*

Lecture three hours per week. Provides an introduction to all aspects of the solid Earth: origin and interior structure, plate tectonics, earthquakes, volcanoes, crustal evolution, rocks and minerals, ice and snow, surface and groundwater hydrology, erosion and deposition, and Earth resources. Fulfills three hours of science requirement. Fall and Spring semesters.

EAS-A 103: *Earth Systems II - The Atmosphere and Oceans*

Can be taken before EAS-A 101. Lecture is three hours per week. Provides an introduction to all aspects of Earth's oceans and atmosphere: physical properties of the oceans, ocean circulation, ocean currents and climate influences; atmosphere, composition and structure, radiation, heat, pressure and humidity, winds, planetary circulation, air-sea interaction, weather analysis and forecasting, air pollution, world climate, and global change. Fulfills three hours of science requirement. Spring semester.

EAS-A 107: *Understanding the Weather (3)*

Lecture is three hours per week. A nonmathematical description of the processes that effect the weather are provided. Topics include solar radiation, horizontal and vertical structure of the atmosphere, atmospheric motions, and climate. Fulfills three hours of science requirement. Fall and Spring semesters.

EAS-A 109: *Climate and Humankind in History (3)*

Treatment of the interaction of early people with the atmospheric environment on the basis of existing paleoclimatological evidence. Interplay between climate and civilization; recent historical events as related to contemporaneous climates. Course developed around the notions of weather systems and climates of various scales. Fulfills three hours of science requirements. Fall semester.

EAS-A 208: *Introduction to Environmental Science (3)*

Prerequisites: *EAS-A 101/102 and MT-A 141*

Corequisite: *CH-A 161*

Lecture is three hours per week. Examination of natural and man-made environmental hazards, their causes and possible solutions. Fulfills three hours of science requirement. Fall semester.

EAS-A 211: *Map and Chart Analysis (3)*

Weather maps and diagrams plotted and analyzed; decoding of surface observation and numerical model codes. Basic concepts of meteorology examined qualitatively, requiring only a cursory knowledge of mathematics. Fall semester.

EAS-A 253: *Physical Climatology (3)*

Prerequisite: *Calculus I*

Basic causes of climate and microclimate: meteorological interpretations of existing climates; methods of climate classification; emphasis on the physical processes of climate changes. Spring semester.

EAS-A 293: *Special Topics (1-4)*

EAS-A 298: *Special Study in Meteorology (0-3)*

UNDERGRADUATE UPPER DIVISION COURSES

EAS-A 315: *Broadcast Meteorology I (3)*

Prerequisites: *EAS-A102 and EAS-A 211*

Spend three and one-half hours per week when combining lectures and *hands-on* experience. The principles of broadcast meteorology will be introduced. Students will develop the skills necessary to communicate scientific information, with emphasis on weather forecasts. The campus radio station will be used by the students to present weather forecasts on a daily basis. Every Fall semester.

EAS-A 316: *Broadcast Meteorology II (3)*

Prerequisites: *Broadcast Meteorology I*

Develop a working knowledge and understanding of television weather—computer graphics. Various aspects of television weather production will be explored, not only the concepts behind the presentation, but also practical applications. The ultimate goal for this course is the knowledge and experience necessary to obtain the first position in a television station and the understanding on how to advance one's career in the field of broadcast meteorology. Spring Semester.

EAS-A 325: *Global Change (3)*

Prerequisites: *EAS-A 101, EAS-A 103, and MT-A 120*

Fundamentals of climate physics, global and regional scale average solar and terrestrial radiation regimes and respective radiation balances; radiation instruments of roof station; hydrologic cycle and water balance; energy balance for atmosphere, ground and total earth system; heat transfer in ocean and ground; paleoclimatology; and climatic change. Fulfills three hours of science requirement. Spring semester.

EAS-A 350: *Computational Methods in Meteorology (3)*

Prerequisite: *CS-A 366*

Computational techniques in Meteorology is designed to introduce students to computational tools and techniques. These computational techniques will be discussed with specific meteorological problems in mind. The course will concentrate on the benefits and drawbacks of the different numerical forecast methods and how they affect the interpretation of the results. During this course, the student will write a simple barotropic model. Each assignment will illustrate a numerical technique. This course assumes a background in Fortran and the use of a workstation.

EAS-A 370: *Mesoanalysis and Severe Storms (3)*

Prerequisites: *EAS-A 433 and EAS-A 444*

The structure, dynamics, and climatology of severe local storms are studied. Forecasting techniques for severe local storms are carried out. The tropical cyclone is studied with respect to its climatology, structure, and forecasting techniques. Fall semester. The course outline:

1. Description and Structure of Severe Local Storms
2. Severe Weather Air Masses
3. Severe Local Storm Climatology
4. Tornado Synoptic Patterns
5. Squall Lines and MCC's
6. Severe Local Storm Forecasting
7. Tropical Cyclone Structure and Climatology
8. Tropical Cyclone Formation and Movement

EAS-A 403: *Elements of Air Pollution (3)*

Prerequisites: *Calculus I and consent of instructor*

Basic concepts in air pollution meteorology are discussed including sources of air pollution, atmospheric chemistry, air pollution inventories, Gaussian air pollution models, effluent control strategies and air pollution legislation; current topics include acid rain, ozone depletion, and global change. Alternate Spring semesters.

UNDERGRADUATE UPPER DIVISION COURSES

EAS-A 415: *Instrumentation and Remote Sensing (3)*

Prerequisite: *Calculus II*

Meteorological instruments will be studied from the viewpoint of performance characteristics, sensitivity, dynamical error, and sinusoidal and step response. Statistical treatment of output data; digital measurement systems; computerized data processing and retrieval as it applies to the synoptic laboratory and climatology. Spring semester.

EAS-A 420: *Synoptic Meteorology I (3)*

Prerequisites: *Calculus III and concurrent registration in EAS-A 444*

Laboratory study of the structure and processes of the atmosphere including the equations of motion and thermodynamics, Norwegian cyclone theory and the quasi-geostrophic theory. Diagnostic and prognostic meteorological charts will be used. Fall semester.

EAS-A 422: *Synoptic Meteorology II (3)*

Those in the BS program should concurrently register for EAS-A 445. Topics include: Isentropic diagnostic analysis techniques, mesoscale meteorology and severe weather forecasting and numerical weather prediction (NGM, Eta models) including statistical products. Emphasis is placed on real-time map discussions and forecasts. Students must achieve a grade of C or better in EAS-A 420 (Synoptic Meteorology I) to take this course. Spring semester.

EAS-A 423: *Micrometeorology (3)*

Prerequisite: *Calculus III*

Physical relations between profiles of temperature, moisture, and wind in the atmospheric boundary layer; influence of low-level atmospheric turbulence, diffusion, and heat transfer processes on the boundary layer. Spring semester.

EAS-A 433: *Physical Meteorology I (3)*

Prerequisite or Corequisite: *Calculus III*

Physical principles underlying atmospheric processes: thermodynamics of dry and moist air, various thermodynamic diagrams, and formation of clouds and precipitation. Fall semester.

EAS-A 434: *Physical Meteorology II (3)*

Prerequisite or Corequisite: *Calculus III*

Principles of radiative transfer in the atmosphere; solar and terrestrial radiation; absorption and emission of radiation; theory and characteristics of Black-Body radiation. Energy transfer processes near the earth's surface; vertical fluxes of momentum; heat and water vapor in the boundary layer by turbulence; and energy budget at the earth-atmosphere interface. Refraction by water drops, and rainbow and atmospheric signal phenomena. Students must achieve a grade of C or better in EAS-A 433 (Physical Meteorology I) to take this course. Spring semester.

EAS-A 444: *Principles of Dynamic Meteorology I (3)*

Prerequisites: *Calculus III and concurrent registration in EAS-A 420*

Dynamic principles underlying large scale atmospheric motion: development of the primitive equations, horizontal wind approximations, thermal wind concept, coordinate system transformations, kinematics, circulation theorem, and flow in the planetary boundary layer. Fall semester.

EAS-A 445: *Principles of Dynamic Meteorology II (3)*

Corequisite: *MT-A 351*

Introduction to numerical weather prediction, atmospheric inertial and gravity waves, and barotropic and baroclinic instabilities. A student must achieve a grade of C or better in EAS-A 444 (Principles of Dynamic Meteorology I) to take this course. Spring semester.

UNDERGRADUATE UPPER DIVISION COURSES

EAS-A 447: Elementary Tropical Meteorology (3)

Prerequisites: *EAS-A 433 and EAS-A 444*

Tropical Climatology; Convergence Zones and Weather Systems; Trade Winds; El Niño, and Southern Oscillation; Hurricanes, Formation, Theories, and Prediction; Monsoons; Global Tropical Forecasting; and Satellite Estimation of Precipitation. Every Fall semester.

EAS-A 465: *Weather Forecasting (3)*

Prerequisite or Corequisite: *EAS-A 420 and EAS-A 444*

Students study and practice weather briefing techniques. Short term (48 hours) weather forecasts are prepared for St. Louis and two distant sites where students must depend on the department data base. Aviation forecasts are prepared for both low altitude small aircraft flights and for long distance high altitude jet flights. Number of lecture hours per week is 1 and number of laboratory hours per week is 4. Fall or Spring semesters. The course outline:

1. Weather Briefing Techniques
2. Local Weather Briefing and Forecasting
3. Forecasting at Remote Sites
4. Aviation Weather Forecasts
5. Verification of Forecasts

EAS-A 478: *COMET Modules (1-3)*

Prerequisites: *EAS-A 420, EAS-A 444, and EAS-A 422 (or concurrent enrollment)*

This is a self-study, self-paced course which utilizes the computer-based learning (CBL) modules on the laser video disk and CD-ROM, purchased from the Cooperative Program for Operational Meteorology, Education and Training (COMET). Credits earned are based upon the number of modules chosen. The modules vary in length and include frequent quizzes and lab exercises which are computer evaluated. The student will *contract* to finish a certain number of modules during the term, and complete them on the department PC which runs the modules. The completion of the modules will be monitored by the student's advisor. Fall or spring semesters. Current module topics include:

1. Workshop on Doppler Radome Interpretation
2. Heavy Precipitation and Flash Flooding
3. Numerical Weather Prediction
4. The Forecast Process
5. Satellite Meteorology-Remote Sensing Using the New GOES Imager
6. Hydrology for the Meteorologist
7. Anticipating Convective Storm Structure and Evolution
8. A Convective Storm Matrix: Buoyancy and Shear Dependencies

INT-A 480-XX: *Internship (1-3)*

EAS-A 488: *Senior Inquiry Research Project (1-3)*

EAS-A 490: *Senior Inquiry Future-Oriented Problems Course (1-3)*

EAS-A 495: *Senior Residency (1-3)*

EAS-A 498: *Advanced Independent Study (1-3)*

GRADUATE COURSES

EAS-A 520: *Numerical Methods of Prediction (3)*

Study of the concepts of dynamic meteorology underlying numerical weather prediction models, the development of the single and multi-level models and their applications. Climate modeling. Offered during the Summer Session.

GRADUATE COURSES

EAS-A 523: *Boundary Layer Meteorology (3)*

Comprehensive treatment of the Navier Stokes equations —development and solutions. Discussions of the three-dimensional modeling of the planetary boundary layer, the accompanying turbulence theory, and marine boundary layers. Offered every other Fall semester.

EAS-A 524: *Tropical Meteorology (3)*

Study of the fundamentals of circulation in the tropics, the importance of sea-air interaction, convection processes, monsoons, energy transfer and hurricanes. Offered every Spring semester.

EAS-A 526: *Synoptic and Dynamics of Jet Streams (3)*

The dynamic concepts useful in jet stream meteorology; methods of measuring various parameters in the free atmosphere; discussion of laboratory and computing models as they relate to planetary jet streams. Offered occasionally.

EAS-A 527: *Meteorology of Severe Storms (3)*

Comprehensive treatment of the synoptic and mesoscale meteorological aspects and the mechanics of thunderstorms, tornadoes and downbursts. Offered every other Fall semester.

EAS-A 528: *Diagnosis and Prediction of Severe Storms (3)*

Emphasis is placed on the development of short term (1-6 hours) forecasting techniques for severe storms. Topics included: instability mechanisms, severe storm structure and types, sounding analysis, low-level jet inversion wind maxima, jet streak coupling, boundary layer thermal gradients, satellite/radar signatures of severe convection, flash flood forecasting and statistical guidance. Case studies of severe weather are discussed in class. Offered every other Spring semester.

EAS-A 529: *Mesometeorology (3)*

Comprehensive synoptic and theoretical discussion of mesoscale meteorological events, thermally induced circulations and nonconvective circulations. Offered occasionally.

EAS-A 534: *Physical Meteorology (3)*

Microphysics of warm and cold clouds, including diffusion, collision-coalescence, riming, and aggregate processes. Offered occasionally.

EAS-A 536: *Principles of Radiation Transfer I (3)*

Concepts of transfer of solar and terrestrial radiation in the earth-atmosphere system studied on the basis of an introduction to precision radiometry. Topics include atmospheric turbidity, radiative transfer in cloudless and cloudy atmospheres, heat budget, role of radiative energy exchange in weather processes. Offered every other Fall semester.

EAS-A 547: *Turbulence (3)*

Prerequisites: *EAS-A 423 or equivalent.*

The main theoretical concepts of atmospheric turbulence, diffusion, evaporation and wind structure in the atmospheric boundary layer. Offered every other Spring semester.

EAS-A 550: *Advanced Meteorology Laboratory (3)*

Advanced applications of convective, dynamic, radiative, synoptic and numerical meteorological principles to model the problems of atmosphere. Offered every Spring semester.

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EAS-A 561: *Satellite Meteorology (3)*

Prerequisite: *EAS-A 536 or equivalent.*

Satellite instrumentation; rectification, analysis and interpretation of satellite radiation measurements and cloud photographs; use of these data in the solution of specific meteorological problems. Offered every other Fall semester.

EAS-A 565: *Radar Meteorology (3)*

Fundamentals of a pulsed Doppler and non-Doppler radar. Velocity and range folding. Doppler radar display and signature interpretation. Characteristics of convective storms and severe weather signatures. Offered every other Spring semester.

EAS-A 570: *Convection in the Atmosphere (3)*

Derivation of consistent equations to study thermal convective phenomena in the atmosphere, the interaction between convective elements and their environments, simulation of thunderstorms and arrangement of convection. Offered every other Fall semester.

EAS-A 588: *Independent Study (1-3)*

The Master's student undertakes an independent study of a chosen topic with the approval of sponsoring professor and the Program Director.

EAS-A 589: *Research Seminar (3)*

Professional degree students formulate research problems, obtain approvals of sponsoring professors and the Program Director, solve the problems, and present the results to a Faculty panel.

EAS-A 593: *Special Topics in Meteorology (1-3)*

EAS-A 595-01: *Special Study for Examinations (0)*

EAS-A 597: *Research Topics (1-3)*

Prior permission of guiding professor and program Director required.

EAS-A 598: *Graduate Reading Course (1-3)*

A critical evaluation of literature concerning a specific problem. Prior permission of guiding professor and Program Director required.

EAS-A 599: *Thesis Research (0-6)*

EAS-A 5CR-90: *Master's Degree Study (0)*

EAS-A 636: *Principles of Radiation Transfer II (3)*

Prerequisite: *EAS-A 536.*

A systematic approach to radiative transfer in absorbing, Mie scattering and emitting atmospheres, bounded by a lower surface, with the goal of computing local radiative heating and cooling. Offered occasionally.

EAS-A 648: *General Circulation of the Atmosphere (3)*

The nature and theories of the atmospheric general circulation, the energy and momentum budget of the atmosphere and the numerical simulation of the atmospheric general circulation. Offered occasionally.

GRADUATE COURSES

EAS-A 659: *Seminar in Numerical Methods of Atmospheric Sciences (3)*

Topics include the solution of linear algebraic systems, generalized Fourier Series methods of boundary-initial-value problems, finite difference solutions of partial differential equations and statistical techniques of geophysical data processing. Applications to problems of interest in the atmospheric sciences. Offered occasionally.

EAS-A 680: *Topics in Methodology of Atmospheric Science (3)*

A systematic discourse on the essential concepts of the scientific methods in meteorology. The function of data in research is stressed. Offered occasionally.

EAS-A 688: *Independent Study (1-3)*

The student understands an independent study of a chosen topic with the approval of a sponsoring professor and the Program Director.

EAS-A 693: *Special Topics in Meteorology (1-3)*

EAS-A 695-01: *Special Study for Examination (0)*

EAS-A 697: *Research Topics (1-3)*

Prior permission of guiding professor and Program Director required.

EAS-A 698: *Graduate Reading Course (1-3)*

Prior permission of guiding professor and Program Director required.

EAS-A 699: *Dissertation Research (0-6)*

EAS-A 6CR-99: *Doctor of Philosophy Degree Study (0)*