ATMOSPHERIC SCIENCES

Head of Department: R. Jeff Trapp
Director of Graduate Studies: Nicole Riemer
3072 Natural History Building
1301 W. Green Street
Urbana, IL 61801
(217) 333-2046
http://atmos.illinois.edu

Major: Atmospheric Sciences
Degrees offered: M.S., Ph.D.

Graduate Degree Programs

Graduate programs leading to the Master of Science and Doctor of Philosophy degrees are offered. Opportunity also exists for specializing in computational science and engineering within the department’s graduate programs via the Computational Science and Engineering (CSE) Option (http://www.cse.illinois.edu).

Admission

Applications for admission are encouraged from students with bachelor’s degrees in atmospheric sciences, meteorology, physics, mathematics, computer science, geography, engineering, oceanography, and related fields. It is strongly recommended that students intend to study for advanced degrees in atmospheric sciences know the fundamentals of classical physics and applied mathematics. Applicants whose native language is not English are required to take the English Placement Test if accepted. All applicants are required to take the Graduate Record Exam (GRE) and submit three letters of reference.

Faculty Research Interests

The atmospheric science degree programs are designed for students interested in research and applications on a wide variety of atmospheric topics. Faculty areas of research include the physics of aerosol, clouds and precipitation; atmospheric radiative processes, radar and satellite meteorology, remote sensing, convective phenomena including severe storms, synoptic and mesoscale meteorology, boundary layer meteorology, tropical meteorology, hydrometeorology, numerical weather prediction, atmospheric dynamics, climate variability and climate modeling including chemical, radiative, and transport effects; atmospheric chemistry, land-atmosphere interactions, oceanography, human and natural perturbations of global ozone and climate, biogeochemical cycles, and climate impacts, risks, and policy. This research is carried out in national field campaigns, in theoretical studies, and in numerical modeling efforts using a wide range of models.

Research Facilities

With more than 2.5 computers per person, the department maintains a capable and extensive computing infrastructure as this is a vital component of all of its educational, research and outreach endeavors. All graduate students, staff, and faculty members have a desktop or laptop computer, usually a Windows PC or Mac. There is a departmental computer lab for hands-on class exercises, computers and display projectors in classroom areas and wireless access throughout the buildings. The Department hosts a new synoptic/GIS laboratory, a data visualization laboratory, and an instruments lab all within the Natural History Building. An up-to-date high-capacity network connects these to various departmental computing resources including e-mail, file and web servers, resources provided by the campus as well as our linux-based research computing systems.

These research systems include the department’s ever-expanding computing cluster, hundreds of terabytes worth of storage, other departmental systems and a number of systems specific to each faculty member’s research group. These systems are used for numerical simulations, analysis and modeling of atmospheric processes ranging from the formation of individual ice crystals to century long climate simulations over the globe and are used for storing, analyzing and visualizing the results. Our faculty research groups regularly use supercomputers including Blue Waters, the NCAR Supercomputing facility, and other supercomputers nationwide.

We receive and process a large quantity of real-time meteorological data and numerical forecasts from a variety of sources including agencies like NOAA, UCAR, international sources and other peer institutions. These are available for visualization with a variety of tools to aid in the understanding of current weather events and case studies of recent major events.

Because computers are only good when they work and you understand how to use them, the department maintains a dedicated computer support staff which is responsible for maintaining everything and personally assisting users with problems, questions and accomplishing their research goals.

Financial Aid

Financial aid is available in the form of research and teaching assistantships, University fellowships, and waivers of tuition and service fees. More information is available at the Department Website (https://www.atmos.illinois.edu/cms/One.aspx?portalid=127458&pageId=187177).

Atmospheric Sciences, MS

Thesis Option

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATMS 500</td>
<td>Dynamic Meteorology</td>
<td>4</td>
</tr>
<tr>
<td>ATMS 504</td>
<td>Physical Meteorology</td>
<td>4</td>
</tr>
<tr>
<td>ATMS 505</td>
<td>Weather Systems</td>
<td>4</td>
</tr>
<tr>
<td>ATMS 507</td>
<td>Climate Dynamics</td>
<td>4</td>
</tr>
<tr>
<td>Additional Graduate-level courses in ATMS or approved courses in another discipline</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>ATMS 599</td>
<td>Thesis Research (min/max applied toward degree)</td>
<td>8</td>
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</tbody>
</table>

Total Hours 32

Other Requirements

Other requirements may overlap

The student is required to write a thesis and give a seminar on his/her thesis research.

Minimum GPA: 3.0

Non-Thesis Option

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
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<td>4</td>
</tr>
<tr>
<td>ATMS 504</td>
<td>Physical Meteorology</td>
<td>4</td>
</tr>
<tr>
<td>ATMS 505</td>
<td>Weather Systems</td>
<td>4</td>
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</table>

Information listed in this catalog is current as of 03/2019
Entering with an approved M.S. degree

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>ATMS 599</td>
<td>Thesis Research</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Additional approved graduate level courses* (excluding ATMS 599)</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Additional approved graduate level courses (including ATMS 599)</td>
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</tbody>
</table>

Total Hours: 64

Additional approved graduate level courses in ATMS or approved courses in another discipline

ATMS 596 Non-Thesis Research (max applied toward degree) 4

Other Requirements

For additional details and requirements refer to the department's Graduate Programs (https://www.atmos.illinois.edu) and the Graduate College Handbook (http://www.grad.illinois.edu/gradhandbook).

**Atmospheric Sciences, PhD**

**Entering with an approved B.S. (Direct to Ph.D.)**

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<tbody>
<tr>
<td>ATMS 500</td>
<td>Dynamic Meteorology</td>
<td>4</td>
</tr>
<tr>
<td>ATMS 504</td>
<td>Physical Meteorology</td>
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<td>ATMS 505</td>
<td>Weather Systems</td>
<td>4</td>
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<td>ATMS 507</td>
<td>Climate Dynamics</td>
<td>4</td>
</tr>
<tr>
<td>ATMS 599</td>
<td>Thesis Research</td>
<td>16</td>
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</table>

Additional approved graduate level courses (excluding ATMS 599) 32

Additional approved graduate level courses (including ATMS 599) 32

Total Hours: 96

Other Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Required</th>
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<tbody>
<tr>
<td>Qualifying Exam Required</td>
<td>No</td>
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<tr>
<td>Preliminary Exam Required</td>
<td>Yes</td>
</tr>
<tr>
<td>Final Exam/Dissertation Defense Required</td>
<td>Yes</td>
</tr>
<tr>
<td>Dissertation Deposit Required</td>
<td>Yes</td>
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<tr>
<td>Minimum GPA</td>
<td>3.0</td>
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</tbody>
</table>

For additional details and requirements refer to the department's Graduate Programs (https://www.atmos.illinois.edu) and the Graduate College Handbook (http://www.grad.illinois.edu/gradhandbook).

**Courses**

**ATMS 500 Dynamic Meteorology** credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/500)

Examines the observed behavior of the atmosphere through the application of physical and hydrodynamical principles to analyses of real meteorological data; develops concepts for studying atmospheric circulations, particularly extratropical cyclones and anticyclones. Laboratory work includes the development of diagnostic techniques suitable for a better understanding of the current weather.

**ATMS 501 Mesoscale Meteorology** credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/501)

Basic concepts and ideas on atmospheric processes that occur on scales of motions from a few kilometers to a few hundred kilometers, a scale loosely classified by meteorologists as "mesoscale". After an introductory discussion of mesoscale classifications and attendant forecast problems, the course will introduce various mesoscale phenomena, internally generated circulations, externally forced circulations, and mesoscale instabilities. Covers all three fundamental aspects of mesoscale meteorology: observations, theory and modeling, with particular emphasis on the dynamics of precipitating mesoscale systems. 4 graduate hours. No professional credit. Prerequisite: Graduate standing or consent of instructor.

**ATMS 502 Numerical Fluid Dynamics** credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/502)

Addresses numerical techniques for solving linear and nonlinear differential equations in initial value fluid flow problems. Students receive a thorough background in the principles used to evaluate numerical methods, the ability to critically interpret these methods as presented in the literature, and in particular, the practical application of these techniques in modeling multi-dimensional flow on high-performance computers. Temporal and directional splitting, finite differencing/volume methods, and adaptive nesting will be discussed. Same as CSE 566. 4 graduate hours. No professional credit. Prerequisite: MATH 285 or equivalent. Graduate Standing or Consent of Instructor.

**ATMS 504 Physical Meteorology** credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/504)

Examines the physical processes that occur in the atmosphere. Topics include atmospheric thermodynamics, cloud physics and atmospheric radiation. 4 graduate hours. No professional credit. Prerequisite: Graduate standing or consent of instructor.
ATMS 505  Weather Systems  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/505)
Examination of the structure and dynamics of mid-latitude weather systems, integrating weather observations, with the current state of dynamic theory, numerical weather prediction models, and the physical principles of atmospheric thermodynamics, cloud and precipitation physics, and radiation to the problems of weather analysis and forecasting. Students will be required to give weather forecast briefings to develop an understanding of the weather forecasting process, and gain experience in communicating weather forecasts. 4 graduate hours. No professional credit. Prerequisite: Graduate standing or consent of instructor.

ATMS 507  Climate Dynamics  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/507)
Investigates the dynamical and physical processes that govern Earth's paleo, current, and future climates. Emphasizes principles of climate change, natural and anthropogenic, and regional, national, and global. Global climate models and their predictions are examined in the context of scenarios for future population growth and energy consumption. 4 graduate hours. No professional credit. Prerequisite: Graduate standing or consent of instructor.

ATMS 510  Precipitation Physics  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/510)
Develops an understanding of precipitation processes through cloud observations, microphysics, dynamics, and comprehensive theoretical models; includes growth by condensation, coalescence, and riming; and studies ice crystals, hail, and weather modification. Prerequisite: ATMS 504 or consent of the instructor.

ATMS 511  Atmospheric Radiation  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/511)
Physical concepts and various methods of analysis of radiation scattering by atmospheric molecules, particulates, and clouds; infrared radiative transfer in a stratified inhomogeneous atmosphere; radiation and ozone photochemistry in the stratosphere; and remote temperature and composition sensing techniques using satellite radiation data. Prerequisite: ATMS 504 or consent of the instructor.

ATMS 512  Clouds and Climate  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/512)
The following topics are addressed to examine the role of clouds in the climate system: aerosols and aerosol cloud interactions, direct, semi-direct and indirect aerosol effects, in-situ measurements of clouds, properties of liquid and ice clouds, precipitation mechanisms and representation in models, scattering by cloud particles and model representations, remote sensing of cloud properties, and representation of clouds in climate models. Prerequisite: ATMS 504 or consent of instructor.

ATMS 535  Aerosol Sampling and Analysis  credit: 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/535)
Same as CEE 545. See CEE 545.

ATMS 571  Professional Development  credit: 1 Hour. (https://courses.illinois.edu/schedule/terms/ATMS/571)
Aimed at professional development in the atmospheric sciences so that students recognize the importance of breath of knowledge, effective oral and written scientific communication, and other skills they will need as professionals. 1 graduate hour. No professional credit. Approved for S/U grading only. Prerequisite: Graduate student in Atmospheric Sciences or consent of instructor.

ATMS 590  Individual Study  credit: 2 to 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/590)
Individual study or reading in a subject not covered in normal course offerings. May be repeated to a maximum of 8 hours. Prerequisite: Consent of instructor.

ATMS 591  Atmospheric Sciences Seminar  credit: 0 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/591)
Seminar on topics of current interest. Approved for S/U grading only. Prerequisite: Consent of instructor.

ATMS 596  Non-Thesis Research  credit: 0 to 12 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/596)
Non-thesis research in the Atmospheric Sciences. Approved for S/U grading only. May be repeated. No more than 4 hours may be counted toward a master's degree in ATMS. Prerequisite: Restricted to students in the non-thesis option.

ATMS 597  Special Topics in Atmospheric Sciences  credit: 0 to 4 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/597)
Lecture course in topics of current interest; subjects such as tropical meteorology, aerosol physics, and geophysical fluid dynamics will be covered in term offerings on a regular basis. 0 to 4 graduate hours. No professional credit. Approved for Letter and S/U grading. Prerequisite: Graduate standing or consent of instructor.

ATMS 599  Thesis Research  credit: 0 to 16 Hours. (https://courses.illinois.edu/schedule/terms/ATMS/599)
Check with the department to identify which CRN is needed for your advisor and any related registration questions. Approved for S/U grading only. Prerequisite: Consent of instructor.