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>
</tbody>
</table>

Additional Graduate-level courses in ATMS or approved courses in another discipline

| ATMS 599 | Thesis Research (min/max applied toward degree) | 8 |

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>
</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>
</tbody>
</table>

Information listed in this catalog is current as of 01/2019
Entering with an approved M.S. degree

Stage I Equivalent (32 Hours) Satisfied by previous Masters degree (from either within the ATMS department or an approved MS from outside the ATMS department)

*If the previous MS degree was earned outside of the Atmospheric Sciences department, these courses must include ATMS 500, 504, 505, and 507 if equivalent courses were not taken as part of the student’s M.S. degree. Equivalency will be determined by the department after review of the course syllabi.

Other Requirements

Other requirements may overlap

The student is required to develop a project in ATMS 596 that focuses on a topic proposed by the student and approved by the department head and present an informal (non-seminar series) talk to a committee.

Minimum GPA: 3.0

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

Atmospheric Sciences, PhD
Entering with approved B.S. (Direct to Ph.D.)

<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>ATMS 599</td>
<td>Thesis Research</td>
<td>16</td>
</tr>
<tr>
<td>Additional approved graduate level courses (excluding ATMS 599)</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Additional approved graduate level courses (including ATMS 599)</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Total Hours</td>
<td></td>
<td>96</td>
</tr>
</tbody>
</table>

Additional Graduate-level courses in ATMS or approved courses in another discipline

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATMS 596</td>
<td>Non-Thesis Research (max applied toward degree)</td>
<td>4</td>
</tr>
<tr>
<td>Total Hours</td>
<td></td>
<td>32</td>
</tr>
</tbody>
</table>

Other Requirements

Other requirements may overlap

Qualifying Exam Required: No
Preliminary Exam Required: Yes
Final Exam/Dissertation Defense: Required
Dissertation Deposit Required: Yes
Minimum GPA: 3.0

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 breadth 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.