**ATMOSPHERIC SCIENCES**

http://atmos.illinois.edu

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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 who 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 computer, usually a Windows PC or Mac. There is a departmental computer lab for hands-on class exercises, computers and display projectors in each of the classroom areas and wireless access throughout the buildings. 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, dozens 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.

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. We have a synoptic lab that is used for weather briefings. 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.

Additionally we have access to the resources of the University as well as supercomputing centers, such as those at NCSA (which is on campus), NCAR and others.

**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).

**Master of Science in Atmospheric Sciences**

**Thesis Option**

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<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
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<tbody>
<tr>
<td>ATMS 500</td>
<td>Dynamic Meteorology</td>
<td>4</td>
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<tr>
<td>ATMS 504</td>
<td>Physical Meteorology</td>
<td>4</td>
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<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 (min/max applied toward degree)</td>
<td>8</td>
</tr>
</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**

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<tr>
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<td>4</td>
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<tr>
<td>ATMS 504</td>
<td>Physical Meteorology</td>
<td>4</td>
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</tbody>
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Information listed in this catalog is current as of 03/2016
ATMS 505   Weather Systems   credit: 4 Hours.
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 506   Climate Dynamics   credit: 4 Hours.
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.

ATMS 507   Physical Meteorology   credit: 4 Hours.
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.

ATMS 508   Numerical Fluid Dynamics   credit: 4 Hours.
Examines the physical processes that occur in the atmosphere. Topics include atmospheric thermodynamics, cloud physics and atmospheric radiation.

ATMS 509   Thesis Research   credit: 4 Hours.

Total Hours 48

Final Exam/Dissertation Defense Required Yes
Dissertation Deposit Required Yes
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).

ATMS Class Schedule (https://courses.illinois.edu/schedule/DEFAULT/DEFAULT/ATMS)

Courses

ATMS 500   Dynamic Meteorology   credit: 4 Hours.

ATMS 504   Physical Meteorology   credit: 4 Hours.

ATMS 505   Weather Systems   credit: 4 Hours.

ATMS 507   Climate Dynamics   credit: 4 Hours.

ATMS 599   Thesis Research   credit: 4 Hours.

Total Hours 96

Qualifying Exam Required No
Preliminary Exam Required Yes
Final Exam/Dissertation Defense Required Yes
Dissertation Deposit Required Yes
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).

Doctor of Philosophy in Atmospheric Sciences

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

ATMS 500   Dynamic Meteorology   credit: 4 Hours.

ATMS 504   Physical Meteorology   credit: 4 Hours.

ATMS 505   Weather Systems   credit: 4 Hours.

ATMS 507   Climate Dynamics   credit: 4 Hours.

ATMS 599   Thesis Research   credit: 4 Hours.

Additional approved graduate level courses (excluding ATMS 599) 32
Additional approved graduate level courses (including ATMS 599) 32

Total Hours 96

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)

ATMS 599   Thesis Research   credit: 16 Hours.

Additional approved graduate level courses (excluding ATMS 599) 24
Additional approved graduate level courses (including ATMS 599) 24

*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.

Total Hours 64

Other Requirements

Other requirements may overlap

Information listed in this catalog is current as of 03/2016
ATMS 507 Climate Dynamics credit: 4 Hours.
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.

ATMS 510 Precipitation Physics credit: 4 Hours.
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.
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.
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.
Same as CEE 545. See CEE 545.

ATMS 571 Professional Development credit: 1 Hour.
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. Approved for S/U grading only. May be repeated to a maximum of 2 hours. Prerequisite: Graduate student in Atmospheric Sciences or consent of instructor.

ATMS 590 Individual Study credit: 2 to 4 Hours.
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.
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.
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 Atmos Sci credit: 0 to 4 Hours.
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. Approved for both letter and S/U grading. Prerequisite: Consent of instructor.

ATMS 599 Thesis Research credit: 0 to 16 Hours.
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.