Atmospheric Sciences M.S.

Contact Information

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Faculty

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Atmospheric Sciences

The Department of Atmospheric Sciences offers advanced undergraduate and graduate courses leading to the master of science degree in atmospheric sciences with specializations in meteorology or earth systems science, and doctor of philosophy degree in atmospheric and environmental sciences (AES). For more information on the AES program, see page 159. Faculty in the Department of Atmospheric Sciences are members of the Institute of Atmospheric Sciences (IAS), an active research group that conducts research with sponsorship from the State of South Dakota and various federal agencies.

The primary objective of the atmospheric sciences graduate program is to give students a basic understanding of the factors influencing atmospheric phenomena, including solar and terrestrial radiation, the laws of fluid motion and thermodynamics, microphysical and electrical processes in clouds, ecology, atmospheric chemistry, and biogeochemistry. Instruction is offered in the interpretation of conventional weather data, satellite data, and radar data; observations collected by specially instrumented aircraft, trace-gas flux towers, and laboratory gas analysis instrumentation; and output from numerical models of atmospheric processes. The graduate student is expected to carry out original research in the atmospheric sciences using some of these tools and resources. In addition, the student must successfully complete the course work and program requirements enumerated below.

A student applying for admission to the master's degree program in the Department of Atmospheric Sciences should have a baccalaureate degree in meteorology or atmospheric sciences, one of the biological or physical sciences, earth system sciences, mathematics, or engineering. It is desirable for applicants to have received undergraduate credit for mathematics through Calculus 2 (for the earth systems science specialization — see below) or ordinary differential equations (for the meteorology specialization). For the meteorology specialization, undergraduate physics is required, and for the earth systems specialization, undergraduate physics and chemistry are desirable. Experience with computer programming is recommended. Graduate Record Examination (GRE) scores from the General Test are required for all students except School of Mines graduates. TOEFL scores are required of all applicants from colleges outside the U.S.

Course requirements for the M.S. degree

1. Fifteen credit hours of course work in atmospheric sciences at the 500-level or above.

2. Nine additional credit hours of non-atmospheric sciences electives at the 400-level or above (300-level non-atmospheric sciences courses can be accepted if approved by the

Graduate Education and Research Council), or atmospheric sciences electives at the 500-level.

3. Thesis research — 6 credit hours.
(Please note undergraduate credit limitations given under "Advanced-Degree Grade Requirements" (p. 146) for master of science degrees.)

Other program requirements

The following program requirements apply to all students in atmospheric sciences:

- At least one course at the 500/600-levels must be taken in each of the following core areas: meteorology, earth system science, and techniques. Course descriptions in the catalog describe the area to which each ATM course belongs.

- Satisfactory performance on a general course work exam covering each of the core courses as well as selected elective course work.

- Registration in ATM 700 Graduate Research (thesis) each semester the student is receiving an assistantship, and in ATM 690 Graduate Seminar each spring semester.

- Completion of a master's thesis. The thesis must adhere to the format and content guidelines as set forth by the graduate school, and be approved by the student's graduate advisory committee and the Dean of Graduate Education.

In addition, there are requirements specific to the two ATM M.S. specializations. Each student will choose one of these specializations. The requirements are:

Meteorology Specialization

Students entering the program with a bachelor's degree in physics, mathematics, computer science, chemistry, or engineering must take the following courses: ATM 450 - Synoptic Meteorology I (not for graduate credit), ATM 555 - Synoptic Meteorology II, ATM 501 - Atmospheric Physics, and ATM 560 - Atmospheric Dynamics I.

Students entering the program with a bachelor's degree in atmospheric sciences or meteorology from another institution are required only to take ATM 501 (Atmospheric Physics), presuming that they have completed undergraduate work in the other areas listed in the preceding paragraph.

Earth System Science Specialization

All students will be required to take the following course: ATM 603 - Atmosphere-Biosphere Interactions. They also must complete at least one remote sensing course.

A specific plan of study will be determined on an individual basis with concurrence from the student's advisor and graduate advisory committee members. In either specialization, exceptions to these departmental requirements may be granted by the student's committee for good cause.

Elective courses offered by other departments are encouraged as long as the 15 hours of course work in atmospheric sciences at the 500-level or above are completed as outlined in course requirements for M.S. degree. Graduate students may take electives in the fields of physics, mathematics, computer science, chemistry, engineering, Engineering Management, social sciences, or the humanities to further integrate their course work in the atmospheric sciences with knowledge in other technical fields and with the general concerns of society.

A student may choose the meteorology specialization with the intent to qualify for employment in the federal civil service as a meteorologist. Specific course distribution requirements to do so are listed on page 62 earlier in this catalog within the general description of the Department of Atmospheric Sciences. Students in either specialization may pursue an M.S. degree in atmospheric sciences without satisfying these requirements and be qualified for careers in many non-federal and/or non-meteorological careers. Examples of such career options include research in and applications of remote sensing techniques; work in air quality either for non-federal government agencies, or for industry or the consulting firms industries often

employ; research and applications in the environmental sciences with an emphasis on atmospheric issues, and further graduate work in atmospheric or environmental sciences.

Undergraduate students at School of Mines may decrease the time required to obtain a master of science degree in atmospheric sciences by taking as electives the preparatory undergraduate and entry-level graduate courses available to them or by completing the bachelor of science in interdisciplinary sciences program with an emphasis on atmospheric sciences. They may then enter the graduate program with the necessary background for graduate study in atmospheric sciences as above.

Facilities and Resources

Students typically work directly with faculty on externally-funded research projects. Graduate research assistantships associated with these projects are available that provide part-time employment for students during the academic months and possible full-time employment during the summer. Facilities and resources of the IAS are utilized in these research efforts. These facilities comprise various meteorological instrument platforms and packages including several automated surface weather stations, an instrumented flux measurement tower in the Black Hills National Forest, portable equipment for land surface and plant canopy ecosystem studies, and atmospheric analytical chemistry field and laboratory instrumentation. Sophisticated computer facilities are available on campus, including a state-of-the-art 3-D computer visualization facility and a high-speed multiple-node computer cluster, with additional access to the larger computer complexes elsewhere.

Faculty Research

Current research projects include field investigations of thunderstorms; applications of weather radar data to rainfall measurements and remote inference of cloud microphysical characteristics; numerical modeling of clouds ranging in size from small cumulus to severe storms including storm electrification, lightning, and lightning-influenced atmospheric chemistry; analysis of field observations and numerical simulations of lake effect snow storms; satellite remote sensing; land-surface/atmosphere exchange processes; fire weather prediction and modeling; biogeochemical cycling; trace-gas flux measurements; and carbon sequestration and ecological modeling. In addition, IAS scientists are currently involved in activities to disseminate scientific knowledge to wider audiences and improve and enhance scientific literacy and educational opportunities for the people of South Dakota.