PH.D. IN ATMOSPHERIC SCIENCES

Program Requirements
The applicable requirements will be those in effect during that academic year when the student first registered in the Program, unless stated otherwise in this Handbook or by the Program Director.

All RSMAS courses are listed on the GSO website. All courses taken by students should be approved by their advisors. Students are recommended to consult with their advisors and the ATM Program Director regarding their choices of courses. Deviations from the requirements must be approved by the advisor and the ATM Program Director.

ATM students follow one of two concentrations: Physical Sciences or Chemical Sciences.

Physical Sciences Concentration

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATM 651</td>
<td>Introduction to Atmospheric Science *</td>
<td>9</td>
</tr>
</tbody>
</table>

Physical Sciences Concentration

Students concentrating on Physical Sciences are required to take the following courses:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATM 611</td>
<td>Geophysical Fluid Dynamics I</td>
<td></td>
</tr>
<tr>
<td>ATM 765</td>
<td>General Circulation of the Atmosphere</td>
<td></td>
</tr>
</tbody>
</table>

Electives 2

Dissertation Research

ATM 830

Doctoral Dissertation

Required Examinations

Comprehensive Examination 3

Qualifying Examination 4

Additional Requirements

RSM 700

Research Ethics

ATM Seminar 5

ATM 701

Seminar in Atmospheric Sciences

Educational Training Program (TA) 6

RSM 771

Educational Training 1

RSM 772

Educational Training 2

RSM 773

Educational Training 3

Total Credit Hours 60

1 Minimum of 26 course credits and 12 dissertation credits.
2 Minimum of 9 course credits should be taken from 700 level courses if available in the student’s area of study.
3 The credit transfer and waiver of required courses should be done during the first year of graduate study at RSMAS with approval from the graduate advisor and the ATM Academic Committee.

* Required course for all ATM students.
2 The remaining course credits can be obtained by taking other graduate courses offered by ATM, RSMAS, or UM.
Ph.D. in Atmospheric Sciences

Chemical Sciences Concentration

The ATM Ph.D. degree requires 60 total credits. 1

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Core Courses</strong></td>
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</tr>
<tr>
<td>ATM 651</td>
<td>Introduction to Atmospheric Science *</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Chemical Sciences Concentration</strong></td>
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</tr>
<tr>
<td>ATM 634</td>
<td>Atmospheric Chemistry</td>
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</tr>
<tr>
<td></td>
<td><strong>Electives</strong></td>
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<tr>
<td>ATM 830</td>
<td>Doctoral Dissertation</td>
<td>34</td>
</tr>
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</table>

Required Examinations

Comprehensive Examination 3
Qualifying Examination

**Additional Requirements**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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<tbody>
<tr>
<td>RSM 700</td>
<td>Research Ethics</td>
</tr>
<tr>
<td>ATM 701</td>
<td>Seminar in Atmospheric Sciences</td>
</tr>
<tr>
<td>ATM Seminar</td>
<td></td>
</tr>
<tr>
<td>RSM 771</td>
<td>Educational Training 1</td>
</tr>
<tr>
<td>RSM 772</td>
<td>Educational Training 2</td>
</tr>
<tr>
<td>RSM 773</td>
<td>Educational Training 3</td>
</tr>
</tbody>
</table>
| Total Credit Hours |                                    | 60

1. Minimum of 26 course credits and 12 dissertation credits.
   - Minimum of 9 course credits should be taken from 700 level courses if available in the student's area of study.
   - The credit transfer and waiver of required courses should be done during the first year of graduate study at RSMAS with approval from the graduate advisor and the ATM Academic Committee.

2. Required course for all ATM students.
   The remaining course credits can be obtained by taking other graduate courses offered by ATM, RSMAS, or UM.

3. Material from the required core courses will appear on the Comprehensive Examination (along with material from other courses from the first year).
   - Grade of **Pass** or **High Pass** needed to fulfill requirement.
   - For full-time students, the Comprehensive Examination should be taken near the end of their first year of graduate studies at RSMAS. This examination will be arranged by a Comprehensive Examination Committee which comprises the ATM Graduate Program Director and the instructors (or assignees) of the first year courses taken by the students.
   - The purpose of this examination is to evaluate students' understanding of materials in the courses completed up to the time of the examination and their capability of integrating these materials, and to determine whether the students are permitted to proceed in the program.
   - The Comprehensive Examination will consist of an oral part and a written part. The written part, which lasts no longer than 8 hours, consists of closed-book questions in the courses taken in the first year by each individual student. Each student must choose to answer four questions from those submitted, with a minimum of 1 question per course (up to the maximum of 4 questions). The oral part is administered by the ATM Graduate Program Director and one or more of the course instructors (or assignees), and may include questions from all the courses taken by the student. The oral exam lasts no longer than 2 hours for each student. The GPA comprises 20% of the Comprehensive Exam grade, and the written and oral parts of the Comprehensive Exams comprise 40% each.

   - A student's performance in this examination, together with his/her cumulative grade point average, will determine whether the grade of **High Pass**, **Pass**, **Master's Pass** or **Fail** is given by the Comprehensive Exam Committee. The examining board consists of faculty whose questions are answered by the student and any other RSMAS faculty who wish to participate.

    a. **High Pass**: For students with no identifiable relevant weaknesses.
    - **Pass**: Students and advisors will receive feedback from the Comprehensive Exam committee on the strengths and weaknesses of the student, and possible recommendations of how to address those. This information can be used to help plan the next steps in the student's academic career.
    - **Master's Pass**: Students with this result will be required to defend a Master's thesis before considering whether to pursue a Ph.D. Students and advisors will receive feedback from the Comprehensive Exam committee on the strengths and weaknesses of the student, and possible recommendations of how to address those.
    - **Fail**: Students with this result will have an opportunity to re-take the exam once.

4. These guidelines complement those given in the UM Graduate Student Handbook.
   - All students are expected to take the Qualifying Exam and Proposal Defense by the end of their third year in the program. If the student needs to take the Exam in their fourth year, s/he will need to write a petition to the ATM Faculty with an explanation. A second extension after the end of the fourth year will not be permitted, unless there are exceptional circumstances.
   - While the exact format is left to the discretion of the Ph.D. Committee, a typical Oral Qualifying Exam comprises an hour of questions from the written Qualifying Exam and other related questions, and a second hour in which the student presents his/her Dissertation Proposal. It is recommended that the presentation emphasizes future work and is not a review of previous results, which are in the written Proposal.

    - **Expectations of the Qualifying Exam**
      a. **Dissertation Proposal**: Written by the student in clear English befitting the standard of writing in a peer-reviewed journal. The proposal should demonstrate the capability of the student to produce and present research that is of the quality suitable for a journal article. Emphasis needs to be placed on the proposed research: the questions and hypotheses to be tested, the data and methodology used to test the hypotheses, and some anticipated results (which may or may not be realized). A student is encouraged to discuss the proposal with the advisor, but the writing must be his/her own.
      b. **Oral Exam**: Demonstration of oral communication skills in responding satisfactorily to questions raised by the Committee in relation to the written questions, and any other questions asked by the Committee members.
      c. **Written Exam**: Written answers judged by each Committee member to demonstrate that the student has the ability to understand and investigate the concept asked in the question. The questions are usually related to the research described in the dissertation proposal.

5. Attendance to the ATM seminars is required every semester.
   - ATM Ph.D. students must give at least one 15-minute presentation each year after completing the Comprehensive Exam and a one-hour presentation after advancing to Ph.D. candidacy, and at least 6 months before the dissertation defense.
Ph.D. students are expected to be a Teaching Assistant (TA) for two courses while pursuing their degree.

The mandatory TA program will include training of new TAs, evaluation of their performance, and recognition of excellence. The goal is to make the experience as valuable as possible for the TA, the faculty, and the students taking our courses.

A training session and two teaching opportunities are offered as courses in educational training (RSM 771, RSM 772, RSM 773). Students will be registered accordingly.

Specific requirements for TAs are outlined in the RSMAS Student Handbook.