

Senior Thesis Guidelines for Undergraduate Atmospheric Science Majors
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Overview

What is a thesis?

A thesis is a culminating written document that describes the context, methods, results, and conclusions of a body of research work that you have done during your undergraduate career. This document will display your work and knowledge over the past one or more years, and can serve as a writing sample for future job applications, graduate school applications, and other career development steps. Your undergraduate faculty advisor will guide you through the research and writing process, but the thesis should be your original work and a demonstration of your talent, understanding, and accomplishment in scientific research.

How do I start?

During your junior year or *early fall* senior year (sophomore or freshman year is okay, too!) you should reach out to a professor in the Department of Atmospheric Sciences. Tell the professor that you are interested in scientific research and that you want to consider writing a thesis. If you are already performing research, tell your current faculty advisor that you'd like to culminate your research work in the form of a thesis. It's okay if you don't know what you want to do after graduation – *you don't need to intend to go into an academic job in order to benefit from writing a thesis.*

Once you have confirmed with your advisor that you are planning to write a thesis, **email atmosadv@uw.edu stating that you intend to write a thesis.**

Can I get credit for writing a thesis?

YES! First, you can enroll in ATM S 498 or ATM S 390 to receive course credit for writing a thesis. Typically, students should enroll in 2-3 credits during the fall of their senior year and up to five credits during the winter and spring of their senior year. You may also enroll in credits during earlier years if you are actively performing research during any quarter before your senior year.

To receive credit toward your writing requirement, **tell your thesis advisor to mark “W” next to your enrollment in ATM S 498 or ATM S 390** at the time of grading.

Timeline

The following timeline is a suggestion for how to write a thesis. Some students may work on different portions of the thesis in a different order.

1. Junior winter (or earlier! Earlier is better):
 - 1.1. Approach a professor in the atmospheric sciences department and tell them that you'd like to write a thesis. Be prepared to tell them what you are interested in (it can be vague, e.g. "I like chemistry" or "I think tropical storms are cool").
 - 1.2. Think about your graduation requirements and figure out how much time and how many course credits you can devote to research.
 - 1.3. The professor you approached will work with other professors in the department to find you a thesis advisor.
 - 1.4. Once you have found a thesis advisor and confirmed your plans to write a thesis, email atmosadv@uw.edu.
2. Junior spring and senior fall:
 - 2.1. Begin working on research as early as possible under the guidance of your faculty advisor..
 - 2.2. Make sure you are enrolled in ATM S 498 or 390. Tell your thesis advisor you'd like to earn "W" (Writing) credit for your thesis.
 - 2.3. Read papers! Ask your advisor for recommendations of which papers to read and how to read them. It can help to download papers and save them on your computer to make it easy to access them multiple times. This can allow you to highlight or annotate relevant sections that you might want to cite later. Some people use citation software such as Mendeley.
3. Senior winter:
 - 3.1. Begin creating the figures and tables that you think you will want to include in your final thesis.
 - 3.2. Begin writing your introduction and methods. For more information on what should be included in your introduction and methods, see the next section of this guidance document.
4. Senior spring:
 - 4.1. In the first two weeks or the quarter, you should write your results/discussion and conclusion sections of your thesis.
 - 4.2. April 15: You should have finished the introduction, methods, and have made decent headway on your results, discussion, and conclusions sections.
 - 4.3. May 1: You should have a *strong* first draft of your thesis completed. It's okay if the introduction is missing a paragraph, and you don't need to write the abstract yet, but you should feel like you are getting closer to having a full thesis prepared.
 - 4.3.1. **Send this draft to your thesis advisor for review.** Your advisor will return the draft with suggestions and comments within one week of receiving the draft from you (May 8).
 - 4.4. May 15: You should review and update your draft based on your advisor's comments and then finish any incomplete sections by May 15. *By May 15, your thesis draft should be nearly final.* This draft should include Abstract, Introduction, Methods, Results, Discussion, Conclusions, and References.

- 4.4.1. Send this nearly final draft of your thesis to your reviewers. Your reviewers should include your primary advisor and anyone else advising you or working with you on your research, such as a graduate student or postdoc. **Your reviewers should return the draft to you within one week of receiving it** (by May 21).
- 4.5. Late May: You can present a poster at the undergraduate research symposium hosted by the department. This is required for 498 credit and encouraged for all other students writing a senior thesis.
- 4.6. June 1: **The final senior thesis should be uploaded to the department thesis repository at a link provided by the Academic Adviser.**

Recommended Thesis Structure

In general, your thesis should take the form of a scientific paper. This means it should include an abstract, introduction, methods, results, discussion, conclusion, and references. You may also include supplementary material if you'd like.

Cover Page

Your cover page should have your title, name, advisor name, other contributing authors, department, and the year.

Table of Contents

Your table of contents should include headers and sub-headers of each section and their page numbers.

Abstract

You probably want to write this section last. The abstract should provide the reader with a brief summary of the research presented in your thesis. The first few sentences provide a high-level overview of the research area followed by more detailed background, the following sentence should state the problem or unknown that you wish to address, and finally you should state your main result(s) and the broader implications for this result. A good example of abstract format is provided by [Nature](#), but you can also ask your advisor for good examples.

Introduction

Your introduction should be about 2-3 pages long (longer is okay, too), and should provide the reader with relevant background. This section of your thesis should have a citation (e.g. "Alexander et al., 2009") in almost every sentence because your job is to introduce the reader to the relevant literature. Knowing which papers to cite is a skill that can take a while to develop, so you are encouraged to ask your advisor for help finding the relevant papers.

In general, your introduction should flow easily. You should start with a high level, generally agreed upon statement ("The Arctic is warming at about twice the rate of the global average (citation)") and then proceed into more detail in a manner that makes sense. Look for examples in published papers and previous theses for guidance on how to make things flow.

Your introduction should also state any gaps or missing knowledge in the field. For example, "Although satellite measurements since 1979 provide a record of declining sea ice in the last forty years, the rate of decline prior to the satellite era is difficult to measure and has not been established. Furthermore..." In the last paragraph of your introduction, you should provide a description of the contribution you'd like to make to this problem.

Methods

This section should be 1-2 pages long, and you should provide an overview of the data you downloaded or collected, any statistical methods used (if you used “wavelet analysis,” describe what that actually is), or laboratory measurements you made. This section should also include an estimate of the error associated with your measurements. Be precise, but do not overwhelm your reader with details: this should *not* be equivalent to a laboratory procedure or how-to guide.

Results

Your results section should display your “findings” in a quantitative and visual form and should be 1-3 pages long (longer is okay if you have many figures). You should have your figures displaying measurements or model results. If you make a graph, your x- and y-axes should have tick labels and axes labels with units. Each figure should have a figure number and a caption below the figure. Each table should have a caption above the table. All font should be easy to read and figures should have easily separable colors. Figures can be made in python, matlab, excel, illustrator, or all of the above.

The writing between your figures should be succinct. You should not describe the figure (e.g., Figure 2 shows concentration vs. time) – that is what your figure caption is meant to do. Your writing should say what unarguable conclusions can be made by looking at the figure, e.g. “From 1980 to 2000, temperature increased by $20\pm 3\%$ ($p < 0.05$) relative to the preindustrial average, despite a coincident decline in sea-ice extent in the region (Figure 3).”

Discussion

This section should be 1-3 pages long. In the discussion, you should discuss what the results tell you about the problem discussed in the introduction. If your question was “how does sea-ice extent respond to temperature increases?”, you should discuss the answer to the question in the discussion. Discuss how this conclusion might be different from the existing literature or impression or expectation based on the context described in the introduction. Finally, discuss any implications of your work (e.g. “Based on these results, surface air temperature has no measurable effect on sea-ice extent. Therefore, sea-ice extent must have other driving factors.” Obviously this would be a very weird thesis...).

Note: In some cases, the Results and Discussion sections can be combined into one section called “Results and Discussion.” This is acceptable if you discuss this option with your advisor beforehand.

Conclusions

The conclusion should summarize your key findings and mention any future work needed to confirm your discoveries. This section should be brief (one paragraph), and can mention

the broader implications of your work if you did not already do so in your discussion section.

References

Every time you say anything in your paper that isn't directly from your data/analysis or isn't common knowledge, you *must* cite a source. The in-text citation is generally in the form of "statement followed by (Author last name et al., year)" or "Author et al. (year) found statement describing finding." At the end of your thesis, you will provide a longer citation of each work. If two more articles written by the same author in the same year are cited, you should add "a," "b," etc. in both the text and the reference list next to the year. Look to the end of scientific papers to find the appropriate reference format. You can also use this:

Last name, first name, first (two) initial(s). last name, first (two) initial(s). last name, [etc.] (year), "Title of paper with only the first letter capitalized aside from Proper Nouns," *Journal title which is sometimes abbrev.*, Volume (issue), doi: 10./#####/#####.

Supplement

This section is optional and can be as long or as short as you want it to be (within reason). Here you should include any tables, datasets, and/or additional figures that you have but can't fit into the main body of your thesis.

Final Notes

Your thesis is a major accomplishment. Add a line to your resume to describe that you wrote a thesis (see below for example).

Resume example:

Education

University of Washington, Seattle, WA

Bachelor of Arts, Major in Atmospheric Sciences

[Honors] thesis: [insert title here]

June 2021

GPA: xx/4.0

If your future potential employer asks for a writing sample, send them your thesis. Make sure you get course credit. Discuss your thesis in future job applications, interviews, and if you apply to graduate school (even if it's for something other than atmospheric sciences!). If anyone asks what you did in college, tell them you were super cool and the coolest thing you did was write a thesis. You should be proud. You have contributed to human knowledge, and isn't that amazing?

But don't stress. Your advisor is there along the way to make sure that you aren't lost. They should help you find a topic, decide how to explore that topic, send you relevant papers, and guide you along the way. Even though this will be your piece of original work, you aren't alone.

Questions?

Email atmosadv@uw.edu or reach out a professor in the department.