

CLIM-111/PHYS-111 Syllabus

Introduction to Fundamentals of Atmospheric Science

Fall Semester, 2022

Mondays and Wednesdays, 10:30-11:20am; **Supplemental Time TBD**

Horizon Hall, Room 3010

Instructors: Michael E. Summers (msummers@gmu.edu)

and Zafer Boybeyi (zboybeyi@gmu.edu)

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Introduction: This course is an introduction to the fundamental physical and chemical aspects of the Earth's atmosphere. This introduction includes an overview of Earth's history along with the processes that control the atmosphere's state, evolution, and climate. A central theme in this course is the development of a "big picture" view of the interacting spheres of the Earth's atmosphere-ocean system, e.g., clouds physics and precipitation, atmospheric heating and cooling processes, atmospheric dynamics, climate change and human influences.

Course Learning Outcomes: By the end of the semester students will understand:

- Temperature and its variation in the atmosphere.
- Solar influences and heating that drive atmospheric thermodynamics and motions.
- The Earth's energy budget.
- Atmospheric moisture and the role of water in stability considerations.
- Cloud formation, precipitation and the range of cloud occurrences on other planets.
- Atmospheric motions and the general circulation.
- Weather maps.
- The climate system, variability, and climate controls.
- The properties and processes that control planetary habitability.
- The atmospheric science issues that are related to global change.

Instructor and Contact Information

Prof. Michael E. Summers

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Prof. Zafer Boybeyi

Research I, Room 217

Mail Stop 6C3

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Office Hours: Mondays and Wednesdays, 9:00-10:30am (by appointment)

Additional hours by appointment.

Course Blackboard website: <https://gmu.blackboard.com/>

In order to comply with student privacy laws, faculty and students need to use their GMU email accounts when corresponding with each other.

Mason Core General Education Course: CLIM-111/PHYS-111 is part of the general education program at GMU and satisfies the requirements of the Mason Core for lecture courses:

“The general education natural sciences courses engage students in scientific exploration; foster their curiosity; enhance their enthusiasm for science; and enable them to apply scientific knowledge and reasoning to personal, professional and public decision-making.”

The central objectives of the Mason Core are to help the student:

1. Understand how scientific inquiry is based on investigation of evidence from the natural world, and that scientific knowledge and understanding:
 - a. evolves based on new evidence
 - b. differs from personal and cultural beliefs
2. Recognize the scope and limits of science.
3. Recognize and articulate the relationship between the natural sciences and society and the application of science to societal challenges (e.g., health, conservation, sustainability, energy, natural disasters, etc.).
4. Evaluate scientific information (e.g., distinguish primary and secondary sources, assess credibility and validity of information).
5. Participate in scientific inquiry and communicate the elements of the process, including:
 - a. Making careful and systematic observations
 - b. Developing and testing a hypothesis
 - c. Analyzing evidence
 - d. Interpreting results

CLIM-111/PHYS-111 is a Mason Core general education natural science course, designed to help students understand the scientific process and to develop their scientific reasoning skills in the context of atmospheric science. This course has for its subject the nature of the atmosphere of the Earth and how it changes with time.

The main goals of the CLIM-111/PHYS-111 include showing the student how atmospheric scientists have come to know what they know about the Earth’s atmosphere. The student will learn that this is accomplished by the study of the light from the sun that heats the atmosphere and biosphere, and by the study of how the atmosphere responds to the sun’s heat in terms of temperature changes, compositional changes, and dynamical changes. This satisfies the **Mason Core objective (1)**. Atmospheric science is a type of science known as applied science. As such it continually strives to understand more and more about how the atmosphere is changing and of

the causes of those changes. That satisfies **Mason Core objective (2)**. Students will also learn about the nature of the Earth, and how the state of the Earth is changing as a result of both natural and human-caused processes. This satisfies **Mason Core objective (3)**. And finally, students will learn about the processes by which science operates, and in particular how the careful evaluation of observational evidence is driver of scientific progress. The student will learn how scientists evaluate scientific evidence. This course is designed to help students develop the essential skills of analytical and quantitative reasoning, information gathering, and communication related to issues in natural sciences. This satisfies the **Mason Core objective (4)**. The mastery of Mason Core objective (5) is found in the associated lab course, CLIM-112/PHYS-112, which deals with careful scientific observations and their analysis.

The overarching goal of this course is to understand the Earth's atmosphere, its complex history, its expected future evolution, and human influences.

Specific Course Goals:

- 1) an overview of the important physical and chemical processes which control the state, variability, and evolution of the Earth's atmosphere in the context of what we have learned from exploration of other planetary atmospheres,
- 2) an understanding of the key scientific discoveries and remaining unanswered questions in atmospheric science,
- 3) an overview of the primary scientific principles and analytical tools used in atmospheric science studies, including both remote sensing and in-situ techniques, with special emphasis on model simulations to visualize the complex feedbacks involved in atmospheric processes, and
- 4) an understanding of the application of the scientific method to analyze and interpret observations of components of the atmospheric system.

Course format:

- (1) **Lectures** covering material in the Lutgens, Tarbuck & Tasa (LTT) 14th editions.
- (2) **Homework** assignments designed to illustrate various aspects of topics encountered in the lectures and readings.
- (3) **Reading assignments** both from the text and supplemental material
- (4) **Weekly Quizzes**
- (4) Two in-semester **exams**
- (5) **Final Exam**

Lectures: The lectures will follow the chapters of the text as shown in the Course Schedule below; additional materials that represent recent developments in atmospheric science will also be presented in class.

- **You are responsible for all the material covered in lectures, in addition to that in the text.**
- **You should read the assigned chapters BEFORE they are discussed in class; this will enable you to ask questions in class if you do not understand some aspect(s) of the chapters.**
- **Quizzes will be based on the assigned readings.**

- **You are expected to spend at least as much time reading the text and studying on your own as you spend in the classroom.**

Lectures and Presentations: After each lecture, that lecture's PowerPoint slides will be posted on Blackboard.

Attendance: Because you are responsible for all materials and announcements (including exam information, and e.g., important date changes), attending the online class lecture is very important.

After the mid-terms I always get students wanting to know how to improve their grades. The best way to get good grades is to read the chapters before the lectures and to attend the online lectures. There is no better advice that I can offer.

- **Oral announcements made in class are binding and it is your responsibility to find out what was announced in any class you might miss.**

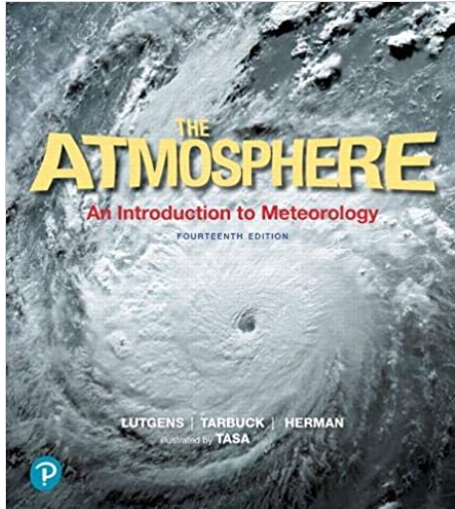
Required Text:

The Atmosphere: And Introduction to Meteorology, 14th Edition,
Lutgens, Tarbuck, Herman, & Tasa, **Publisher:** Pearson; 14 edition, **ISBN-10:** 0134758587
ISBN-13: 978-0134758589, 2016

- **YOU MUST HAVE THE 14TH EDITION OF THE TEXTBOOK! OLDER EDITIONS HAVE DIFFERENT INFORMATION AND THE MATERIAL IS IN A DIFFERENT ORDER.**

If you are enrolling in the corresponding lab, the required text and lab material is:

The Atmosphere: An Introduction to Meteorology, Plus Mastering Meteorology with Pearson eText -- Access Card Package (14th Edition)
by [Frederick K. Lutgens](#) (Author), [Edward J. Tarbuck](#) (Author), [Redina Herman](#) (Author), [Dennis G. Tasa](#) (Author)



DATES TO BE UPDATED

Tentative Course Schedule

Week 1 Aug. 22, 24: Chapter 1 - Introduction (Summers)

Week 2 August 29, Sept. 1; Chapter 2 – Heating (S)

Week 3 Sept. 5 (**no classes**), 8: Chapter 3 – Temperature (S)

Week 4 Sept. 12, 14: Chapter 4 - Moisture and Stability (S)

Week 5 Sept. 19, 21: Chapter 5 - Precipitation (S),

Week 6 Sept. 26, 28: Chapter 6 - Air Pressure and Winds (S)

Week 7 Oct. 3: Chapter 7 - Circulation of the Atmosphere (S)

Exam #1 (Wednesday, Oct. 5)

Change Instructor

Week 8 Oct. 10 (**Monday's Class meets Tuesday 12nd**), 12: Chapter 8 - Air Masses (Boybeyi)

Week 9 Oct. 17, 19: Chapter 9 - Weather Patterns (B)

Week 10 Oct. 24, 26: Chapter 10 - Thunderstorms and Tornadoes (B)

Week 11 Oct. 31, Nov. 2: Chapter 11 - Hurricanes (B)

Week 12 Nov. 7, 9: Chapter 12 - Weather Analysis & Forecasting (B)

Week 13 Nov. 14, 16: Chapter 13 - Air Pollution (B)

Week 14 Nov. 21 (**Exam #2**), 24th: Chapter 14 - The Changing Climate (B)

Week 15 Nov. 28, Dec. 1: Chapter 14 continued: The Changing Climate (B)

Final Exam (Cumulative): TBD

The Final Exam is Comprehensive – covering all material covered in the course

- **This will be a fast-paced course! It will be very important to keep up with the chapter readings.**

Course Policy and Grading:

Homework: 20%

Quizzes: 10%

*Two exams: 40%

****Final Exam:** 30%

Numerical Grade Ranges:

A: 94-100%
A-: 90-93%
B+: 87-89
B: 83-86%
B-: 80-82%
C+: 77-79
C: 73-76%
C-: 70-72%
D: 60-69%
F: Below 60%

Important Notes:

- If you begin more than 20 minutes late for an exam, or after anyone else has finished the exam, you may not take that version of the exam.
- **Anyone caught cheating on an exam will be referred to the George Mason University Honor Council.**
- **The exams are closed book, closed to notes and all outside materials. Use of outside materials constitute cheating.**
- **If you have a schedule conflict and cannot take an exam on the scheduled day, let me know ahead of time and we will try to arrange an alternative test date.**

Makeup Policy:

- **There will be no makeup for quizzes. I drop the lowest quiz score at the end of the semester.**
- Students will be permitted to submit late homework on a case-by-case basis.
- Late exams will be permitted if the instructor is provided with an acceptable explanation and if performed within one week of the original exam.
- Make-up exams **must** be scheduled **IN ADVANCE** with instructor permission.

Important Dates:

First lecture: Monday, August 22, 10:30-11:20am EST

Exam #1, October 5

Exam #2, November 21

Final Exam: TBD

Technology in the Classroom:

Cell phones and other communicative devices are not to be used during class. Please keep them stowed away and out of sight. Laptops or tablets may be permitted for the purpose of taking notes only. Engaging in activities not related to the course (e.g., gaming, email, chat, etc.) will result in a significant reduction in your participation grade.

Campus Closure:

If the campus closes, or if a class meeting needs to be canceled or adjusted due to weather or other concern, students should check Blackboard [or other instruction as appropriate] for updates on how to continue learning and for information about any changes to events or assignments.

Blackboard:

Activities and assignments in this course will regularly use the Blackboard learning system, available at <https://mymason.gmu.edu>. Students are required to have regular, reliable access to a computer with an updated operating system (recommended: Windows 10 or Mac OSX 10.13 or higher) and a stable broadband Internet connection (cable modem, DSL, satellite broadband, etc., with a consistent 1.5 Mbps [megabits per second] download speed or higher. You can check your speed settings using the speed test on this website.)

Academic Integrity:

The integrity of the University community is affected by the individual choices made by each of us. Mason has an Honor Code with clear guidelines regarding academic integrity.

Three fundamental and rather simple principles to follow at all times are that:

- (1) all work submitted be your own;
- (2) when using the work or ideas of others, including fellow students, give full credit through accurate citations; and
- (3) if you are uncertain about the ground rules on a particular assignment, ask for clarification.

No grade is important enough to justify academic misconduct. Plagiarism means using the exact words, opinions, or factual information from another person without giving the person credit. Writers give credit through accepted documentation styles, such as parenthetical citation, footnotes, or endnotes. Paraphrased material must also be cited, using the appropriate format for this class. A simple listing of books or articles is not sufficient. Plagiarism is the equivalent of intellectual robbery and cannot be tolerated in the academic setting.

To promote a stronger sense of mutual responsibility, respect, trust, and fairness among all members of the George Mason University community and with the desire for greater academic and personal achievement, we, the student members of the University Community have set forth this:

Student members of the George Mason University community pledge not to cheat, plagiarize, steal, or lie in matters related to academic work.

If you have questions about the meaning of the honor code please ask me. I expect you to hold to this standard by doing your own work on tests and assignments.

Classroom conduct:

Discussions, whether face-to-face or electronic, should be conducted with respect for each other and at a high level of civil discourse. Disruptive behavior may result in a student being asked to leave the virtual classroom or be temporarily barred from participating in online activities.

Religious Holidays and Observations:

<http://ulife.gmu.edu/calendar/religious-holiday-calendar/> is available to help minimize difficulties for students of different faiths. It is the student's responsibility to speak to the instructor in advance should their religious observances impact their participation in class activities and assignments.

Resources for Students:

Students with Disabilities:

Disability Services at George Mason University is committed to upholding the letter and spirit of the laws that ensure equal treatment of people with disabilities. Under the administration of University Life, Disability Services implements and coordinates reasonable accommodations and disability-related services that afford equal access to university programs and activities. Students can begin the registration process with Disability Services at any time during their enrollment at George Mason University. If you are seeking accommodations, please visit <http://ds.gmu.edu/> for detailed information about the Disability Services registration process. Disability Services is located in Student Union Building I (SUB I), Suite 2500. Email: ods@gmu.edu | Phone: (703) 993-2474

Diversity and Inclusion:

The College of Science seeks to create a learning environment that fosters respect for people across identities. We welcome and value individuals and their differences, including gender expression and identity, race, economic status, sex, sexuality, ethnicity, national origin, first language, religion, age and ability. We encourage all members of the learning environment to engage with the material personally, but to also be open to exploring and learning from experiences different than their own.

Sexual Harassment, Sexual Misconduct, and Interpersonal Violence:

Notice of mandatory reporting of sexual or interpersonal misconduct: As a faculty member, I am designated as a “Non-Confidential Employee,” and must report all disclosures of sexual assault, sexual harassment, interpersonal violence, stalking, sexual exploitation, complicity, and retaliation to Mason’s Title IX Coordinator per University Policy 1202. If you wish to speak with someone confidentially, please contact one of Mason’s confidential resources, such as Student Support and Advocacy Center (SSAC) at 703-993-3686 or Counseling and Psychological Services (CAPS) at 703-993-2380. You may also seek assistance or support measures from Mason’s Title IX Coordinator by calling 703-993-8730, or emailing titleix@gmu.edu.

Privacy:

In order to comply with student privacy laws, faculty and students need to use their GMU email accounts when corresponding with each other and the instructor. I will not respond to messages sent from or send messages to a non-Mason email address.

Student Use of Classroom Materials:

Some kinds of participation in online study sites violate the Mason Honor code: these include accessing exam or quiz questions for this class; accessing exam, quiz, or assignment answers for this class; uploading of any of the instructor's materials or exams; and uploading any of your

own answers or finished work. Always consult your syllabus and your professor before using these sites.

Counseling and Psychological Services:

Offers faculty and staff consultation about how to help students that experience difficulties that impact their learning, including how to respond to students in crisis. In particular, the Mason Cares, faculty referral guide, and students of concern are primary resources for faculty and staff. Students can take advantage of psychological services, a variety of learning services, multicultural services, and educational programs that support students' educational goals.

Mason Student Services Center:

Provides one-stop, integrated information and referrals regarding admissions, registrar, student accounts, and financial aid.

Office of Academic Integrity:

Provides information on the honor code and resources for students and faculty.

Student Health Services:

Provides high quality health care, counseling, education, and prevention services in support of student learning and retention.

University Life:

Enhances students' in- and out-of-class experiences, in addition to facilitating interactions among faculty, staff, and other students. These resources help students achieve academically, stay healthy, get involved with campus life, find jobs, and identify resources to enrich their learning.

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<http://ulife.gmu.edu/calendar/religious-holiday-calendar/> is available to help minimize difficulties for students of different faiths. **It is the student's responsibility to speak to the instructor in advance should their religious observances impact their participation in class activities and assignments.**

REMINDERS

- **THERE ARE NO MAKEUPS ON QUIZZES**
- **MAKEUPS ON EXAMS MUST BE SCHEDULED IN ADVANCE**
- **PLEASE SIGN YOUR NAME IN YOUR EMAILS TO ME**
- **THIS SYLLABUS IS TENTATIVE**

- **YOU ARE RESPONSIBLE FOR ATTENDING CLASS AND KNOWING IF CLASS OR SCHEDULE CHANGES ARE ANNOUNCED.**
- **OFFICE MEETINGS MUST BE SCHEDULED IN ADVANCE**
- **YOU SHOULD EXPECT A QUIZ EVERY WEEK ON THE ASSIGNED READING**
- **YOU ARE RESPONSIBLE FOR ALL OF THE MATERIAL IN THE ASSIGNED READINGS**
- **YOU MUST OBTAIN THE 9TH EDITION OF THE TEXTBOOK**