CLIM-112/PHYS-112 Syllabus
Introduction to Fundamentals of Atmospheric Science Laboratory

Fall Semester, 2020
Mondays, 1:30 - 4:15pm
Online Synchronous Lectures (recorded)
Instructors: Zafer Boybeyi & Michael Summers
Tentative Syllabus: Updated 24 August 2020

Introduction:

CLIM-112/PHYS-112 (1-credit lab course) and CLIM-111/PHYS-111 (3-credit lecture course) are a coordinated paired course and cross-listed under Department of Atmospheric, Oceanic & Earth Sciences and Department of Physics & Astronomy. CLIM-112/PHYS-112 is designed to enhance learning with practical applications by applying the information acquired in CLIM-111/PHYS-111, "Introduction to Fundamentals of Atmospheric Science". The students will engage in activities that are designed to expand and enrich the learning process through the exercises for weather and climate, scientific observations and their analysis that illustrate the complex phenomena that occur in the Earth's atmosphere.

General Goals:

- The overarching goal of this lab is the development of the basic processes that control the state and behavior of the Earth's atmosphere (e.g., clouds physics and precipitation, atmospheric heating and cooling processes, atmospheric dynamics, climate change and human influences).
- This course is also designed to help students to develop their essential analytical and quantitative scientific reasoning skills in the context of atmospheric science.

Specific Goals:

- An overview of the important physical and dynamical processes which control the state, variability, and evolution of the Earth's atmosphere.
- An understanding of the key scientific discoveries and remaining unanswered questions in atmospheric science.
- An overview of the primary scientific concepts encountered in atmospheric science, e.g. the role of thermodynamics, the greenhouse effect, heating and cooling, atmospheric motions, and climate change.
- An understanding of the application of the scientific method to analyze and interpret observations of components of the atmospheric system.

Learning Outcomes:

By the end of the semester students will able to demonstrate a basic understanding of:

- Why atmospheric temperature varies cross the Earth and in the vertical

- Solar influences and related heating which drive atmospheric thermodynamics and motions
- Earth's energy budget
- Atmospheric moisture and its role in stability considerations
- Atmospheric condensation and its role in cloud formation & precipitation
- Air parcel concept, lifting air & adiabatic processes
- Atmospheric forces & force balances
- Atmospheric motions & circulations
- Terrain effect
- Air masses & fronts
- Weather producing mid-latitude cyclones
- In-situ observations & weather maps
- Weather analysis & forecasting
- Greenhouse gases effect
- The climate system, variability & climate controls

Mason Core General Education Course:

CLIM-112/PHYS-112 is part of the general education program at GMU and satisfies the requirements of the Mason Core for natural science courses!

Mason Core course purpose:

"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-112/PHYS-112 is designed to help students to understand the scientific process and to develop their scientific reasoning skills in the context of atmospheric science.

The main goals of the CLIM-112/PHYS-112 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 an 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, both natural and anthropogenic, as we learn more and more about how the atmosphere operates. That satisfies Mason Core objective (2).

Students will 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, and how scientists have summarized these effects. This satisfies objective (3) of the Mason Core.

Students will also 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 and present scientific evidence. This satisfies the Mason Core (4).

And finally, students will be performing exercises for weather and climate, analyzing scientific observations, and interpreting the results. This satisfies Mason Core (5).

Instructors and Contact Information:

Prof. Zafer Boybeyi
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Mail Stop 6C3
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Office Hours: Mondays and Wednesdays, 9:00-10:30am

Prof. Michael E. Summers
Professor of Planetary Sciences and Astronomy
Planetary Hall, Room 235
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Office Hours Tuesdays 1:00-2:00pm (Appointment Required!)

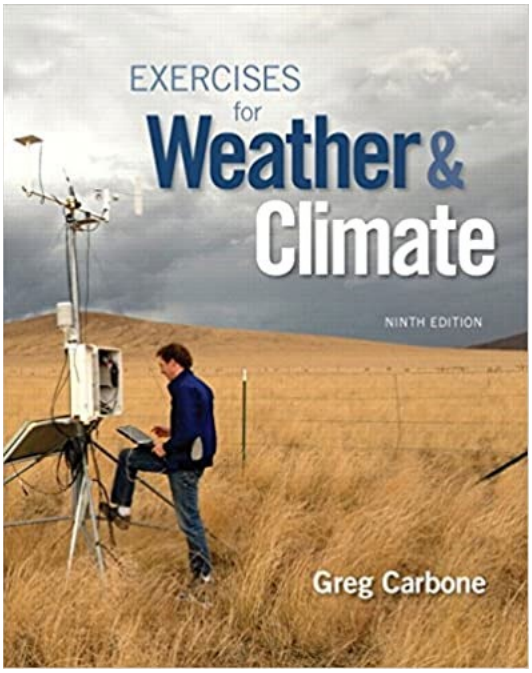
Course Website:

GMU Blackboard: https://gmu.blackboard.com/

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

Required Textbook:

Exercises for Weather & Climate Plus Mastering Meteorology with eText -- Access Card Package (9th Edition) 9th Edition
by Greg Carbone (Author)
Series: Masteringmeteorology
Publisher: Pearson; 9 edition (January 25, 2015)



Laboratory Format:

1) Background Lecture:

- An overview of relevant background material.

2) Lab Exercises

- About 12 lab exercises.
- Pre-lab Quiz. Can be taken 3 times
- Including exercises for weather and climate, scientific observations and their analysis.
- The instructions for the lab exercises will be posted on GMU Blackboard.

Laboratory Report:

- **Carbone Laboratory Pre-Quiz must be completed before the Laboratory session begins.**
- **Lab reports must be submitted by the student within one week following the lab in which the laboratory module was performed.**
- **Reports must be completed on the Carbone Laboratory worksheet. Once completed, they must be scanned and emailed to me.**

- **Anything submitted more than 1 WEEK late will be subject to a 10% grade penalty.**
- **Lab reports will not be accepted more than 2 WEEKS LATE!**

Tentative Schedule for Laboratory Exercises:

Week 1 (Aug. 24)	Introduction (Summers)
Week 2 (Aug. 31)	Carbone Lab 1: Vertical Structure of the Atmosphere (Summers)
Week 3 (Sept. 7)	**Labor Day University Closed**
Week 4 (Sept. 14)	Carbone Lab 3: The Surface Energy Budget (Summers)
Week 5 (Sept. 21)	Carbone Lab 5: Atmospheric Moisture (Summers)
Week 6 (Sept. 28)	Carbone Lab 6: Saturation and Atmospheric Stability (Summers)
Week 7 (Oct. 5)	Carbone Lab 7: Cloud Droplets and Raindrops (Summers)
Week 8 (Oct. 12)	Carbone Lab 8: Atmospheric Motion (Summers)
Switch Instructors	
Week 9 (Oct. 19)	Carbone Lab 9: Weather Map Analysis (Boybeyi)
Week 10 (Oct. 26)	Carbone Lab 10: Mid-latitude Cyclones (Boybeyi)
Week 11 (Nov. 2)	Carbone Lab 12: Thunderstorms and Tornadoes (Boybeyi)
Week 12 (Nov. 9)	Carbone Lab 13: Hurricanes (Boybeyi)
Week 13 (Nov. 16)	Carbone Lab 14: Climate Controls (Boybeyi)
Week 14 (Nov. 23)	Carbone Lab 15: Climate Variability & Climate Change (Boybeyi)
Week 15 (Nov. 30)	General Review & Discussions (Boybeyi)

Important Notes:

• **Materials:** The student is required to purchase the required **Exercises for Weather & Climate Plus Mastering Meteorology (9th Edition)** by Greg Carbone (Author)

• **Attendance** Policy: Students **MUST ATTEND** all labs.

• If you are **ABSENT OR LATE** to lab, you will **NOT** be brought up to speed on the introduction and will only have the remaining class time to complete the lab.

Makeup Policy:

• Makeup labs will be permitted if the instructor is provided with an acceptable explanation.

• Makeup labs **must** be scheduled **IN ADVANCE** with instructor permission.

Important Lab Dates:

First lab: Monday, August 24, 2020 at 1:30-4:15pm EST

Lab Grading Policy:

12 Lab Exercises 90%

Participation 10%

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%

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.**

Students with Disabilities:

If you are a student with a disability and you need academic accommodations, please see me and contact the Office of Disability Resources at 703/993-2474. All academic accommodations must be arranged through that office.

George Mason University Honor Code:

GMU is an Honor Code university; please see the University Catalog for a full description of the code and the honor committee process. The principle of academic integrity is taken very seriously and violations are treated gravely.

What does academic integrity mean in this course? Essentially this: when you are responsible for a task, you will perform that task. When you rely on someone else's work in an aspect of the performance of that task, you will give full credit in the proper, accepted form.

Another aspect of academic integrity is the free play of ideas. Vigorous discussion and debate are encouraged in this course, with the firm expectation that all aspects of the class will be conducted with civility and respect for differing ideas, perspectives, and traditions. When in doubt (of any kind), please ask for guidance and clarification.

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.

http://www.gmu.edu/departments/unilife/pages/honorcode.html