CLIM-111/PHYS-111: DRAFT Syllabus 1/5/2011

Introduction to the Fundamentals of Atmospheric Science

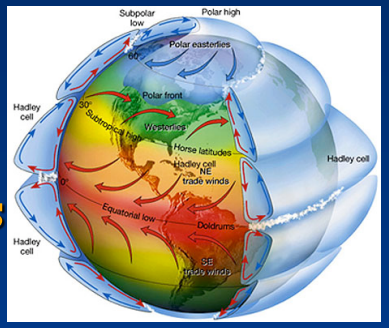
Lectures - Tuesday & Thursday, 1:30-2:45pm

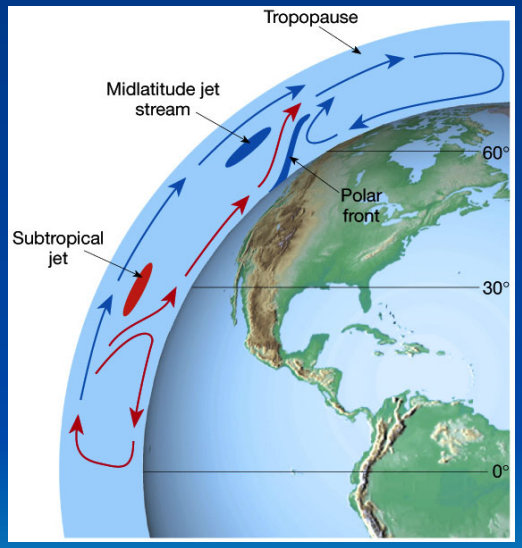
Laboratory - Friday: 9:30am-12:20pm

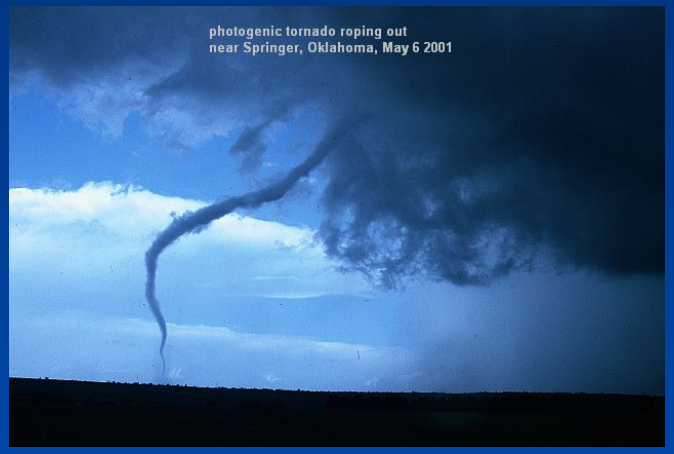
Spring Semester, 2011

Innovation Hall, Room 207

Profs. Zafer Boybeyi and Michael E. Summers







CLIM-111/PHYS-111
Introduction to the Fundamentals of Atmospheric Science
CLIM-112/PHYS-112 Lab

An overview of the Earth's atmosphere, its history, and the fundamental physical and chemical processes which determine its characteristics. The focus is on key concepts from thermodynamics, radiation, chemistry, and dynamics that are essential for understanding the state, variability, and long term evolution of the atmosphere, especially in the context of comparisons with other planetary atmospheres.

Instructors and Contact information

Prof. Michael E. Summers
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Prof. Zafer Boybeyi
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Email: zboybeyi@gmu.edu
Phone: (703) 993-1560
FAX: (703) 993-9229

Course Website: Blackboard

CLIM-111/PHYS-111 Course Goals:

The overarching goal of this course is to provide the student with a "big-picture" view of the field of atmospheric science as it relates to understanding the Earth's atmosphere, its complex history, its expected future evolution, and human influences.

This course is designed to ensure that students develop the essential skills of analytical and quantitative reasoning, information gathering, and communication related to issues in natural sciences.

CLIM-111/PHYS-111 Course Goals:

This general goal will be achieved by

(a) a focus on the planetary context of the Earth's atmosphere, i.e., what we have learned by the study of other planetary atmospheres,

(b) an emphasis on quantitative physical principles that control the atmosphere, and

(c) a heavy reliance on computer simulations for visualizing the complex interactions that occur in the atmosphere.

CLIM-111/PHYS-111

Introduction to the Fundamentals of Atmospheric Science

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.

CLIM-111/PHYS-111

This combined lecture and lab course is designed with a dual-purpose:

The first purpose is to provide a stand-alone course for students needing an introduction to scientific methods and critical reasoning as it relates to the environment. As such it will provide the necessary background information for understanding the many emerging societal problems that are consequences of human influences on the atmosphere.

The second purpose is to provide an introductory course for those students that are beginning their degrees in atmospheric science or related scientific fields. For those students this course will provide a solid foundation for future more specialized courses in atmospheric science.

The course is designed as the first course in the atmospheric science concentration but would be useful for any student wanting a one-semester overview of atmospheric science.

CLIM-112/PHYS-112 - Lab

Introduction to the Fundamentals of Atmospheric Science

The laboratory section is designed to enhance learning by applying the information acquired in the lecture portion of the course with practical applications covered in the student's lab books.

The student will engage in activities that are designed to expand and enrich the learning process through the use of state-of-the-art computer simulations that illustrate the complex phenomena that occur in the atmospheres of the Earth and other planets.

Learning Outcomes

Course Outcomes: By the end of the semester this course student will have developed a basic understanding of the following:

- Characterization of temperature and it variation in the atmosphere.
- Solar influences and heating which drive atmospheric thermodynamics and motions
- 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.
- The ability to read and interpret earth maps
- The climate system, variability, and climate controls.
- The properties and processes that control planetary habitability
- The atmospheric issues related to global change

CLIM-111/PHYS-111
Introduction to the Fundamentals of Atmospheric Science

FORMAT:

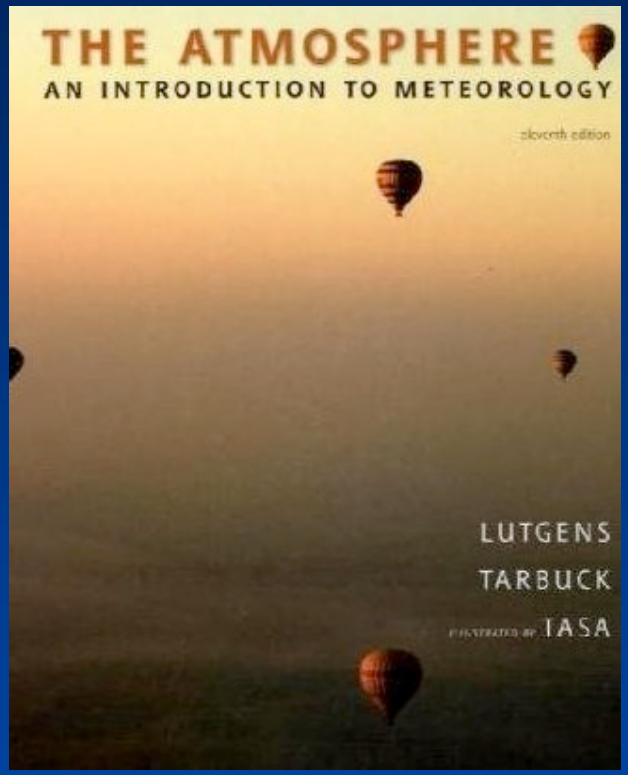
Lecture Section (3 credits): There will be approximately one lecture topic covered per week. These lectures will include class discussion of topical issues.

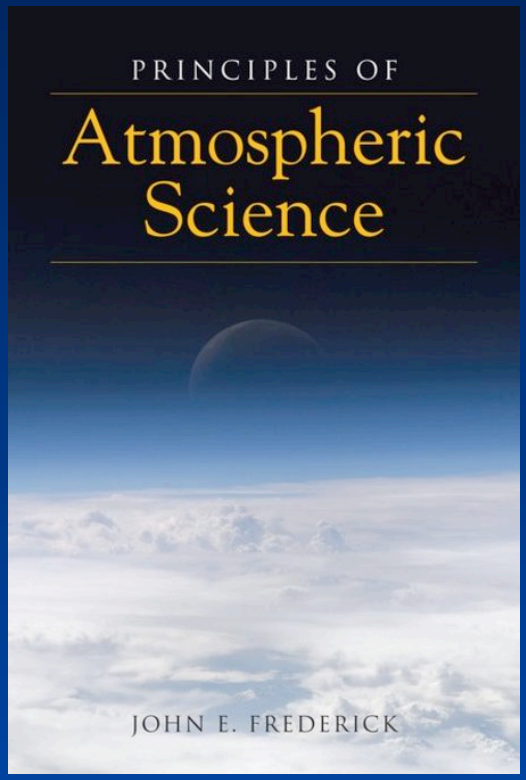
Selections from the Textbook of Lutgens, Tarbuck and Tasa, and its order of presentation, will provide the basic framework of the course and most of the qualitative discussions, while the John Frederick text will provide supplemental quantitative material.

Laboratory Section (1 credit): The Laboratory Section will provide insight into atmospheric processes via web-based simulations that can be manipulated by the student. The Laboratory simulations are chosen to parallel the lecture topics and discussions.

Classroom discussion is encouraged.
There are no stupid questions!!

Course Texts:





- The Atmosphere: An Introduction to Meteorology, 11th Edition **(Required)**
  Lutgens, Tarbuck, & Tasa (LTT)
  Prentice Hall, 2010
  ISBN 13-978-0-321-58733-6

- Principles of Atmospheric Science
  (For a more rigorous approach)
  John E. Frederick
  Jones and Bartlett (2008)
  ISBN 0763740896

Lutgens & Tarbuck: Chapter Structure

- Major content (Be sure to read everything!)
- Chapter Summary
- Vocabulary Review
- Review Questions (Excellent review for exams)
- Problems

The Atmosphere: Companion Website

www.mygeoscience.com

- Online review quizzes
- Critical thinking exercises
- Links to chapter-specific web resources
- Internet-wide key term searches
- GEODe: Atmosphere

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Introduction to the Fundamentals of Atmospheric Science

Tentative Grading Policy:

- ***Homework: 20%**
- **Two in-semester exams: 40%**
- **Final exam (comprehensive): 30%**
- **Participation: 10%**

**Homework mainly from end-of-chapter questions.*

You are responsible for all material from the texts, and any additional assigned readings.

LAPTOPS are permitted in class for taking notes. But PLEASE don't use laptops during class time for other activities such as web surfing and email.

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Introduction to the Fundamentals of Atmospheric Science

Tentative Exam Dates:

Two in-semester exams:

Exam 1 – Thursday, March 3

Exam 2 – Thursday, April 14

Final Exam: Comprehensive

TBD

Lutgens, Tarbuck & Tasa: Tentative Schedule

Lecture numbers correspond to chapters in Lutgens & Tarbuck:

Week 1 – January 24: Introduction to the Atmosphere (S)
Week 2 - January 31: Heating Earth's Surface and Atmosphere (B)
Week 3 – February 7: Temperature (B)
Week 4 – February 14: Moisture and Atmospheric Stability (S)
Week 5 – February 21: Forms of Condensation and Precipitation (S)
Week 6 – February 28: Air Pressure and Winds (B), Exam 1
Week 7 – March 7: Circulation of the Atmosphere (B)
March 14 – Spring Break
Week 8 – March 21: Air Masses (B)
Week 9 – March 28: Weather Patterns (B)
Week 10 –April 4: Thunderstorms and Tornadoes (S)
Week 11 – April 11: Hurricanes (S), Exam 2
Week 12 – April 18: Weather Analysis and Forecasting (B)
Week 13 – April 25: Air Pollution (S)
Week 14 – May 2: The Changing Climate (S)

Frederick - Tentative Reading Schedule

Chapter 1: Chemical Composition and Structure (8/26)

Parallel reading with LT chapter 1

Chapter 2: Solar and Terrestrial Radiation: Atmospheric Energy Balance (9/2)

Parallel reading with LT chapters 2 and 3

Chapter 3: Atmospheric Water (9/16)

Parallel reading with LT chapters 4 and 5

Chapter 4: Winds – The Global Circulation and Weather Systems (9/30)

Parallel reading with LT chapters 6, 7, 8, 9, 10, 11, 12

Chapter 5: Chemical Processes and Atmospheric Ozone (11/25)

Parallel reading with LT chapter 13

Chapter 6: The Earth's Climate (12/2)

Parallel reading with LT chapter 14

Suggested Readings

Basic and Introductory:

Clouds in a Glass of Beer: Simple Experiments in Atmospheric Physics, Craig F. Bohren, Dover Publications, 2001.

What Light Through Yonder Window Breaks: More Experiments in Atmospheric Physics, Craig F. Bohren, Dover Publications, 2006.

The Atmosphere: An Introduction to Meteorology, Frederick K. Lutgens, Edward J. Tarbuck, and Dennis Tasa, Prentice-Hall, 2006.

More Advanced:

An Introduction to Atmospheric Physics, David G. Andrews, Cambridge University Press, 2000.

An Introduction to Dynamic Meteorology, J.R. Holton, 4th Edition, International Geophysics Series, 2004.

Basic Physical Chemistry for the Atmospheric Sciences, Cambridge University Press, 2000.

Useful Websites:

American Meteorological Society:
http://www.ametsoc.org/

National Aeronautics and Space Administration:
http://www.nasa.gov

National Oceanic and Atmospheric Administration:
http://www.noaa.gov/

The Weather Channel:
http://www.weather.com/

The NASA Astrobiology Institute:
http://nai.nasa.gov/

Academic Integrity

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.

GMU Honor Code

Honor Code *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* **Honor Code**

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

Important Dates:

February 8 – Enrollment Deadline. This is the last day to add into a course. Students may not register into any section after this date. No exceptions. This is also the last day to drop a course without losing tuition money.

February 25 – Drop Deadline. This is the last day a student may drop a course. After this date, students may withdraw from a course, but only according to strict guidelines.

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.

Other Useful Campus Resources

WRITING CENTER: A114 Robinson Hall; (703) 993-1200;
http://writingcenter.gmu.edu

UNIVERSITY LIBRARIES "Ask a Librarian"
http://library.gmu.edu/mudge/IM/IMRef.html

COUNSELING AND PSYCHOLOGICAL SERVICES (CAPS):
(703) 993-2380;
http://caps.gmu.edu

The University Catalog,
http://catalog.gmu.edu
is the central resource for university policies affecting student, faculty, and staff conduct in university affairs.

Office Hours – Spring, 2010

Michael E. Summers
Office Hours
Tuesday: 3:00-4:00pm (by appointment)
Additional hours by appointment

Spring 2010: Tentative Travel

January 6-7, NYC

January 20-21, SPACS

February 28-March 3, NSRC, Orlando FL

Prof. Zafer Boybeyi
Office Hours
Wednesday:
Additional hours by appointment

Spring 2010: Tentative Travel

Homework Assignment #1: January 25

- Read: Lutgens & Tarbuck (LT) Chapters 1 & 2

  Chapter 1 Review Questions: 1, 2, 3, 4 (Essay type questions)
- Read Frederick, Chapter 1

  Chapter 1 Problems: 1, 2, 3, 4, 5, 6 (Quantitative problems)

  Homework Due: February 8
- Read: D. Bodanis article "It's in the air…"