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SYLLABUS

CLIM-314/GGS-314
Severe & Extreme Weather


Spring Semester, 2024
Mondays - Wednesdays, 12:00 - 1:15pm EST

Angel Cabrera Global Center 1320B

Instructor: Prof. Zafer Boybeyi

Introduction:

CLIM-314/GGS-314 is a cross-listed lecture course (3-credit) under the Departments of Atmospheric, Oceanic & Earth Sciences (AOES) and Geography & Geoinformation Science (GGS). This course focuses on severe and extreme weather, covering the key concepts from thermodynamics, radiation and dynamics that are essential for understanding severe and extreme weather events. This course would be useful for any student wanting a one-semester overview of our weather.

General Course Goals:

- The overarching goal of this course is to provide students with a "big-picture" view of the key concepts from thermodynamics, radiation, and dynamics that are essential for understanding severe and extreme weather.
- This course is also designed to help students to understand the basic scientific processes and to develop their essential analytical and quantitative scientific reasoning skills in the context of severe & extreme weather.

Specific Course Goals:

- An overview of the important physical and dynamical processes which control the intensity, frequency, and evolution of the severe weather events.
- An understanding of the key scientific discoveries and remaining unanswered questions in atmospheric science related to the severe and extreme weather.
- An overview of the primary scientific principles and analytical tools used in weather forecasting, such as remote sensing and in-situ techniques.
- An understanding of the application of the scientific method to analyze and interpret observations and components of the severe weather.
- An understanding of the application of weather maps and model predictions in weather

forecasting.

Course Learning Outcomes:

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

- Temperature variation cross the Earth and in the vertical
- Solar influences and related heating which drive atmospheric thermodynamics and motions
- Earth's energy budget
- In-situ observations, weather maps & basic weather features
- Weather analysis, forecasting & ensemble forecast
- Climate & global change
- Atmospheric stability, moisture and its role in stability considerations
- Skew-T/Log-P diagram and its role in nowcasting considerations
- Atmospheric forces, force balances & atmospheric motions
- Weather producing mid-latitude cyclones (i.e., high- and low-pressure systems)
- Air masses & fronts
- Extratropical cyclones
- Atmospheric condensation and its role in cloud formation & precipitation
- Lake effect snowstorms
- Blizzards & cold waves
- Terrain effect, mountain snowstorms & windstorms
- Thunderstorms, hailstorms & downbursts
- Role of El Nino, La Nina and the Southern Oscillation in our weather
- Tornadoes & tropical cyclones (hurricanes)
- Floods, drought & heat waves

Instructor and Contact Information:

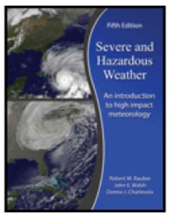
Associate Prof. Zafer Boybeyi
Research I, Room 217
Mail Stop 6A2
Email: zboybeyi@gmu.edu
Office Hours: Mondays and Wednesdays, 9:00-10:30am EST
Additional hours by appointment

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:



Severe & Hazardous Weather: An Introduction to High Impact Meteorology, Fifth Edition
Robert M. Rauber, John E. Walsh and Donna J. Charlevoix
Kendall/Hunt Publishing Company, 2017

Recommended Additional Textbook:

Principles of Atmospheric Science
John E. Frederick
Jones and Bartlet

Course Format:

1) Lectures
   - Covering material (chapters) in the textbook
   - Video presentations related to specific severe weather events
   - Group discussion
   - Analysis of current severe weather events
2) Weekly homework assignments
3) Reading assignments both from the text and supplemental material
4) Surprise quizzes
5) Group project:
   - First, identify a severe weather case and analyze the meteorological environmental conditions, including synoptic maps and available supporting observations such as sounding, surface observations, satellite images etc.
   - Then, analyze key characteristics of the selected severe weather case such as intensity, max wind speed, duration, amount of precipitation and type, etc.
   - Finally, write few pages term paper, submit the paper electronically and present the results in class using for example power point presentation. For each group presentation will be about 15 minutes.
6) Midterm exam
7) Final exam (comprehensive)
8) Class notes will be posted on GMU Blackboard

Textbook Content:

Chapter 1: Properties of The Atmosphere
Chapter 2: Meteorological Measurements
Chapter 3: Weather Maps
Chapter 4: Forecasting and Simulating Severe Weather
Chapter 5: Climate & Global Change
Chapter 6: Atmospheric Stability
Chapter 7: Forces & Force Balances

Chapter 8:	The Development of High- & Low-Pressure Systems
Chapter 9:	Airmasses & Fronts
Chapter 10:	Extratropical Cyclones Forming East of The Rocky Mountains
Chapter 11:	Extratropical Cyclones Forming Along The East & Gulf Coasts
Chapter 12:	Freezing Precipitation & Ice Storms
Chapter 13:	Lake-Effect Snowstorms
Chapter 14:	Cold Waves
Chapter 15:	Great Plains Blizzards
Chapter 16:	Mountain Snowstorms
Chapter 17:	Mountain Windstorms
Chapter 18:	Thunderstorms
Chapter 19:	Tornadoes
Chapter 20:	Hailstorms
Chapter 21:	Lightning
Chapter 22:	Downbursts
Chapter 23:	El Nino, La Nina & Southern Oscillation
Chapter 24:	Tropical Cyclones
Chapter 25:	Floods
Chapter 26:	Drought
Chapter 27:	Heat Waves

Tentative Travel Schedule:

I have travel plan from February 19 to 22.
February 19 and 21 lectures will be online via Zoom.

Tentative Course Schedule:

Week 1 (Jan. 17)	Syllabus & Introduction
Week 2 (Jan. 22 & Jan. 24)	Chapters 1 & 2
Week 3 (Jan. 29 & 31)	Chapters 3 & 4
Reading Assignment	Chapter 5
Week 4 (Feb. 5 & 7)	Chapters 6 & 7
Week 5 (Feb. 12 & 14)	Chapters 8 & 9
Week 6 (Feb. 19 & 21)	Skew-T/Log-P & Chapter 10 (This week lectures will be given online, via Zoom)
Week 7 (Feb. 26)	Chapters 11 & 12
Week 7 (Feb. 28)	**Midterm Exam**
Week 8 (Mar. 4 & 10)	**Spring Recess**
Week 9 (Mar. 11 & 13)	Chapters 13 & 14
Week 10 (Mar. 18 & 20)	Chapters 15 & 16
Week 11 (Mar. 25 & 27)	Chapters 17 & 18
Week 12 (Apr. 1 & 3)	Chapters 19 & 20
Week 13 (Apr. 8 & 10)	Chapters 21 & 22
Week 14 (Apr. 15 & 17)	Chapters 23 & 24
Week 15 (Apr. 22 & 25)	Chapters 25 & 26 & 27
Week 16 (Apr. 29)	Group Project Presentations

Final Exam (Cumulative): May 6, Monday 2024 at 10:30am – 1:15pm

Important Notes:

- Attendance Policy: Students MUST ATTEND all classes.
- IF YOU ARRIVE MORE THAN 20 MINUTES LATE FOR AN EXAM/QUIZ, OR AFTER ANYONE HAS FINISHED THE EXAM/QUIZ AND LEFT, YOU MAY NOT TAKE IT.
- Anyone caught cheating on an exam/quiz, or talking after the exams have been handed out, will be referred to the George Mason University Honor Council.
- The exams are closed book and no notes.
- If you have a schedule conflict and cannot take an exam on the scheduled day, let me know ahead of time and I will try to arrange an alternative test date.

Makeup Policy:

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 Course Dates:

- First lecture: Wednesday, January 17, 12:00-1:15pm EST
- Midterm Exam: Wednesday, February 28, 12:00-1:15pm EST
- Final Exam: Monday, May. 6, 10:30am-1:15pm EST

Course Grading Policy:

Homework*	15%
Quizzes**	5%
Group Project***	10%
Midterm Exam****	30%
Final Exam*****	40%

*There will be about 10 homework.
**There will be about 6 surprise quiz.
*** The students will work in *pairs* to analyze and present a historical severe weather event.
****You are responsible for all material from text and any additional assigned readings.
*****The final exam is comprehensive (covering all material covered in the course).

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%

Policy on Use of Personal Technology in the Classroom:

Laptops are permitted only for use only for this course and its related activities. Email and web surfing is not allowed and are distracting to both the student and to classmates. Please use common courtesy and do not use your laptop for any activities other than those related to this course. Cellphones must be turned off or on vibrate. Please do not take calls or text in the lectures.

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 classroom or be temporarily barred from participating class activities.

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 non-Mason email addresses.

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.

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.

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