Last updated: 1/19/2025

SYLLABUS

CLIM-314/GGS-314
Severe & Extreme Weather

Spring Semester, 2025
Mondays - Wednesdays, 12:00 - 1:15pm EST

Nguyen Engineering Building 1110

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:

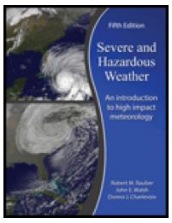
Associate Prof. Zafer Boybeyi
Research I, Room 217
Mail Stop 6A2
Email: zboybeyi@gmu.edu
Office Hours: Mondays and Wednesdays, 9:00-10:30am EST
Additional hours by appointment

Course Website:

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

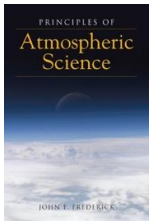
In order to comply with student privacy laws, faculty and students need to use their GMU e-mail accounts when corresponding with each other.

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:

N/A

Tentative Course Schedule:

Week 1 (Jan. 22)	**Syllabus & Introduction**
Week 2 (Jan. 27 & 29)	Chapters 1 & 2
Week 3 (Feb. 3 & 5)	Chapters 3 & 4
Reading Assignment	Chapter 5
Week 4 (Feb. 10 & 12)	Chapters 6 & 7
Week 5 (Feb. 17 & 19)	Chapters 8 & 9
Week 6 (Feb. 24 & 26)	Chapter 10 & 11
Week 7 (Mar. 3)	Chapters 12
Week 7 (Mar. 5)	**Midterm Exam**
Week 8 (Mar. 10 & 12)	**Spring Recess**
Week 9 (Mar. 17 & 19)	Chapters Skew-T/Log-P & 13
Week 10 (Mar. 24 & 26)	Chapters 14 & 15
Week 11 (Mar. 31 & Apr. 2)	Chapters 16 & 17
Week 12 (Apr. 7 & 9)	Chapters 18 & 19
Week 13 (Apr. 14 & 16)	Chapters 20 & 21
Week 14 (Apr. 21 & 23)	Chapters 22 & 23
Week 15 (Apr. 28 & 30)	Chapters 24 & 26
Week 16 (May. 5)	**Group Project Presentations**

Final Exam (Cumulative): May 12, Monday 2025 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 22, 12:00-1:15pm EST
- Midterm Exam: Wednesday, March 5, 12:00-1:15pm EST
- Final Exam: Monday, May. 12, 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%

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.

Academic Standards
Academic Standards exist to promote authentic scholarship, support the institution's goal of maintaining high standards of academic excellence, and encourage continued ethical behavior of faculty and students to cultivate an educational community which values integrity and produces graduates who carry this commitment forward into professional practice.

As members of the George Mason University community, we are committed to fostering an environment of trust, respect, and scholarly excellence. Our academic standards are the foundation of this commitment, guiding our behavior and interactions within this academic community. The practices for implementing these standards adapt to modern practices, disciplinary contexts, and technological advancements. Our standards are embodied in our courses, policies, and scholarship, and are upheld in the following principles:

- **Honesty:** Providing accurate information in all academic endeavors, including communications, assignments, and examinations.
- **Acknowledgement:** Giving proper credit for all contributions to one's work. This involves the use of accurate citations and references for any ideas, words, or materials created by others in the style appropriate to the discipline. It also includes acknowledging shared authorship in group projects, co-authored pieces, and project reports.
- **Uniqueness of Work:** Ensuring that all submitted work is the result of one's own effort and is original, including free from self-plagiarism. This principle extends to written assignments, code, presentations, exams, and all other forms of academic work.

Violations of these standards—including but not limited to plagiarism, fabrication, and cheating—are taken seriously and will be addressed in accordance with university policies. The process for reporting, investigating, and adjudicating violations is outlined in the university's procedures. Consequences of violations may include academic sanctions, disciplinary actions, and other measures necessary to uphold the integrity of our academic community.

The principles outlined in these academic standards reflect our collective commitment to upholding the highest standards of honesty, acknowledgement, and uniqueness of work. By adhering to these principles, we ensure the continued excellence and integrity of George Mason University's academic community.

Student responsibility: Students are responsible for understanding how these general expectations regarding academic standards apply to each course, assignment, or exam they participate in; students should ask their instructor for clarification on any aspect that is not clear to them.

Accommodations for 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 https://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.

Student responsibility: Students are responsible for registering with Disability Services and communicating about their approved accommodations with their instructor *in advance* of any relevant class meeting, assignment, or exam.

FERPA and Use of GMU Email Addresses for Course Communication

The Family Educational Rights and Privacy Act (FERPA) governs the disclosure of education records for eligible students and is an essential aspect of any course. **Students must use their GMU email account** to receive important University information, including communications related to this class. Instructors will not respond to messages sent from or send messages regarding course content to a non-GMU email address.

Student responsibility: Students are responsible for checking their GMU email regularly for course-related information, and/or ensuring that GMU email messages are forwarded to an account they do check.

Title IX Resources and Required Reporting

As a part of George Mason University's commitment to providing a safe and non-discriminatory learning, living, and working environment for all members of the University community, the University does not discriminate on the basis of sex or gender in any of its education or employment programs and activities. Accordingly, **all non-confidential employees, including your faculty member, have a legal requirement to report to the Title IX Coordinator, all relevant details obtained directly or indirectly about any incident of Prohibited Conduct** (such as sexual harassment, sexual assault, gender-based stalking, dating/domestic violence). Upon notifying the Title IX Coordinator of possible Prohibited Conduct, the Title IX Coordinator will assess the report and determine if outreach is required. If outreach is required,

the individual the report is about (the "Complainant") will receive a communication, likely in the form of an email, offering that person the option to meet with a representative of the Title IX office.

For more information about non-confidential employees, resources, and Prohibited Conduct, please see University Policy 1202: Sexual and Gender-Based Misconduct and Other Forms of Interpersonal Violence. Questions regarding Title IX can be directed to the Title IX Coordinator via email to TitleIX@gmu.edu, by phone at 703-993-8730, or in person on the Fairfax campus in Aquia 373.

Student opportunity: If you prefer to speak to someone ***confidentially***, please contact one of Mason's confidential employees in Student Support and Advocacy (SSAC), Counseling and Psychological Services (CAPS), Student Health Services (SHS), and/or the Office of the University Ombudsperson.

See the following for updates:
https://stearnscenter.gmu.edu/wp-content/uploads/24-Common-GMU-Syllabus-Policies.pdf

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.

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 assignment answers for this class; uploading of any of the instructor's materials or exams. Always consult your syllabus and your professor before using these sites.

Additional Resources for Students:

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.

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.

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.

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 ARE RESPONSIBLE FOR ALL OF THE MATERIAL IN THE ASSIGNED READINGS**
→ **YOU MUST OBTAIN THE REQUIRED THE TEXTBOOK**