CLIM 680: Climate Data – Fall 2025

Meeting times and Location

Tuesdays & Thursdays, 10:30 AM – 11:45 AM
Exploratory Hall | Room 1005

Requisite

MATH 115 or an equivalent course and familiarity with a computer language.

Required Materials

- Your laptop computer (a tablet will not be sufficient unless it has access to a terminal application)
- Access to Canvas. Need help with Canvas? See here: https://info.canvas.gmu.edu/getting-started-students/
- A Github Account (we will take care of this during class)
- Your own dataset (we will work on this during class)
- GMU Computing Account - https://wiki.orc.gmu.edu/mkdocs/Getting_an_ORC_Account/
- There is no book required for this course.

Course Information

3 Credit
Instructor: Luis E. Ortiz
Contact: lortizur@gmu.edu

This course prepares learners to be able to work with climate datasets for their research and practice. Upon completion of this course, students will be able to:

1. Work comfortably in a Unix environment.

2. Make maps of observational and/or model data using several different common languages/tools (e.g., Python).

3. Work comfortably with large datasets in a variety of common formats (i.e. NetCDF).

4. Calculate climatologies and anomalies of monthly and daily data.

5. Compare and graph the comparison of two climate model simulations in terms of monthly and seasonal means and variances, autocorrelation, power spectra, regressions between a climate index and global fields, composites, and climate patterns calculated via EOFs.

6. Compare climate model simulations in terms of monthly and seasonal means and variances, autocorrelation, power spectra, regressions between a climate index and global fields, composites, and climate patterns calculated via EOFs.

7. Calculate statistical significance with above comparisons and graph with a mask.

8. Access common climate data portals (i.e. PCMDI, ESG, IRIDL) and download observations and climate model datasets.

Best way to contact me:

1. Email: for questions directed at me, please use the your GMU email address to contact my email listed above.

2. Office Hours: Please email me if you wish to meet outside of class and I will schedule a time to meet in person via Microsoft Teams or Zoom.
3. Canvas discussion board: In this class we will use the Canvas discussion board to communications with the instructor and between students.

Class Attendance

This is a face-to-face course. It is in your best interest to attend class during the scheduled class time - please don't be late. Live Coding: One of the reasons you should attend class in person is that this class will utilize a methodology called "Live Coding". This means you will follow along with the Instructor(s) while we share and write code on the screen and explain the code as we go. There will be no PowerPoint presentations. This method is shown to be effective because it slows down the pace so everyone can keep up, allows us to take the time to explain what we are doing, helps you get accustomed to running codes yourself on your computer setup, and lets us see you make mistakes and how to correct them. Real-time diagnosis helps you learn faster.

If you miss class

We understand that there can be various reasons for missing class. If you miss class for whatever reason, the lesson material will be available online.

Tech Issues

We will try to minimize any technology issues and promptly address problems that arise on our end with the resources where we as instructors have responsibility (e.g.,Canvas content, provided code samples). However, you are responsible for the tech in your possession (namely your laptop, but also your network access). If you are having problems with your hardware that require service or repair, please let us know promptly so we can try to accommodate your disruption.

Continuity Plans

Given the current times, there are constant changes and new University guidance regarding University operations. There is also the possibility that a student, instructor, or family member that they care for may become ill and alternate arrangements will need to be made. We will follow all University guidance. Typically we learn official University guidance at the same time as you. We will promptly follow up with you about how the latest guidance impacts this class. In the event that you as a student are unable to continue with the course, please notify us immediately so that we can discuss your options. With two Instructors, hopefully there will be no disruptions, but we will continue as planned at the same day/time with a backup instructor if necessary.

How will you be graded?

This course requires students to apply the analysis techniques learned in class on sample datasets to a dataset used in their own research. Your grade will consist of 50% homework assignments and 50% your final project and calculated as follows:

- Homework Assignments: 50%
- Final Project: 50% (25% Github repository and website; 25% presentation)

Assignments

Assignments are given most weeks and require you to add something to the previous week's analysis of your dataset, building on your work. It is in your best interest to complete these assignments on time in order to keep up with the class. Assignments will be given in class. Several of the assignments will be formally graded. You will turn in each assignment by providing a Github link to it. Instructions will be

provided in class. Assignments will be graded as satisfactory (A), not satisfactory (C), or not/minimally attempted (F) promptly after the due date. Feedback will be provided via Canvas or Github Issues. If the assignment is graded not satisfactory or not attempted, you may redo the assignment until it is satisfactory until the last day of class (Dec 3). The point of analysis with climate data is to get it done right… ultimately! There is no shame in revising work to make it better - coding is an iterative process. But you must notify us if/when you wish us to re-grade a resubmitted assignment.

Final Project

In addition to the graded assignments, You are also expected to complete a project with a website in Github and give a presentation in class of your project. Project details will be provided in class and posted on Canvas.

Exams

This class has no exams.

University Policies

Academic integrity

It is expected that students adhere to the George Mason University Honor Code as it relates to integrity regarding coursework and grades. The Honor Code reads as follows: 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 and/or lie in matters related to academic work. More information about the Honor Code, including definitions of cheating, lying, and plagiarism, can be found at the Office of Academic Integrity website at (http://oai.gmu.edu). In this class, working together is strongly encouraged and doing so is not a violation of the Honor Code. However, each student must complete their own analysis codes and figures, and their own writeup of each assignment.

Policy on Student AI Use

When explicitly stated by the instructor, Generative AI tools are allowed on the named assignment. Students will be directed if and when citation or statement-of-usage direction is required. Use of these tools on any assignment not specified will be considered a violation of the academic standards policy. All academic standards violations will be reported using the Academic Standards Referral Form.
Use of Generative AI tools will sometimes be in alignment with the learning outcomes for this course; when meeting the outcome requires original human action, creativity or knowledge, AI tool use would not align with the stated course goals.

Some student work may be analyzed using an originality detection tool focused on AI tools. Generative AI detection tool use will be revealed when the assignment directions are provided to students.

Disability accommodations

Disability Services (http://dsgmu.wpengine.com/) at George Mason University is committed to providing equitable access to learning opportunities for all students by upholding the laws that ensure equal treatment of people with disabilities. If you are seeking accommodations for this class, please first visit Disability Services (http://dsgmu.wpengine.com/) for detailed information about the Disability Services registration process. Then please discuss your approved accommodations with me. Disability Services is located in Student Union Building I (SUB I), Suite 2500. Email: ods@gmu.edu | Phone: (703) 993-2474

Sexual Harassment, Sexual Misconduct, and Interpersonal Violence

As faculty members and designated ***Responsible Employee***, we are required to report all disclosures of sexual assault, interpersonal violence, and stalking to Mason's Title IX Coordinator per university policy 1412. If you wish to speak with someone confidentially, please contact the Student Support and Advocacy Center (703-380-1434) or Counseling and Psychological Services (703-993-2380). You may also seek assistance from Mason's Title IX Coordinator (703-993-8730; titleix@gmu.edu).

Class schedule

Week	Topic	Unit
1	Introduction	Introduction, Spreadsheets, Finding climate data
2	Observations and models of global climate	Greenhouse effect and atmospheric temperature
3		Historical climate data
4		Climate models, model ensembles, and future scenarios, Part 1
5		Climate models, model ensembles, and future scenarios, Part 2 Presentation topic selection
6	Mitigation and adaptation to climate change	Counting carbon: Carbon Inventories by sector
7		Climate adaptation: Reducing impacts of climate change Part 1
8		Climate adaptation: Reducing impacts of climate change Part 2
9		Climate solutions: Costs and benefits of renewable energy
10	Climate change impacts	Global disparities of climate change impacts: Global heat
11		Regional disparities of climate change impacts: Urban Heat
12		Invited Lecture: Climate Action in Practice
13		Final Presentations

Course Structure and Grading Criteria

Grading is based on laboratory exercises given during class. There are 11 laboratory sessions where students will work with real data from observations and models to answer questions about climate change, its impacts, and solutions. During each laboratory session, students will be given a short lecture on that day's topic to frame a technical work session. Work sessions will involve accessing prepared datasets and manipulating data to answer specific questions. The data in question will include observation records of weather variables like temperature and rainfall, technical data of available renewable energy resources, and information about human populations. For each laboratory session, students will prepare a report due at the start of the next class. The final grade will be made up from laboratory reports (70%) and the student presentation (30%). To accommodate emergencies and extenuating circumstances, the lowest grade laboratory report will be dropped.

Grading Scale

A+ = 97 – 100%	B+ = 87 – 89%	C+ = 77 – 79%	D = 60 – 69%
A = 93 – 96%	B = 83 – 86%	C = 73 – 76%	F = 0 – 59%
A- = 90 – 92%	B- = 80 – 82%	C- = 70 – 72%	

Final Presentation

As part of their work, students in this course will prepare a presentation on one of the topics covered throughout the semester. The presentation will consist of an in-depth exploration on a specific issue or topic related to one of the laboratory units they worked on. As part of the presentation, students should showcase skills learned in laboratory work.

Students will choose a topic on the first half the semester and share with their instructor during Week 5 unit. Instructors will provide feedback on their topic selection. Students are encouraged to look at upcoming topics. Final presentations will take up the last two weeks of class. Presentations will consist of a 12-15min presentation followed by a Question & Answer session (5min).

Late Homework Policy

Lab reports are due on Tuesdays at 11:59 PM, the day before the next lab meets. Students are allowed a 24-hour graced period to accommodate any technical difficulties. Submissions after this will be subject

to a 25 point drop in that lab's grade. If the lab is two days late after the grace period, a 50 point deduction will be applied.
Emergencies and Extenuating Circumstances
The class grading policies are designed to accommodate emergencies and extenuating circumstances. Specifically, the lowest lab, homework, and quiz grade will be dropped and labs can be turned in late (with penalty). Therefore, no special accommodations will be provided for lab, homework, or quizzes due to a short term emergency or extenuating circumstances.
GMU Email Accounts
Students must use their own Mason email and Canvas accounts to receive important University information, including messages related to this class. See http://masonlive.gmu.edu for more information.

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. If you have any doubts about what constitutes plagiarism, please see me.
Policy on Student Use of AI Tools
When explicitly stated by the instructor, Generative AI tools are allowed on the named assignment. Students will be directed if and when citation or statement-of-usage direction is required. Use of these tools on any assignment not specified will be considered a violation of the academic standards policy. All academic standards violations will be reported using the Academic Standards Referral Form.
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Some student work may be analyzed using an originality detection tool focused on AI tools. Generative AI detection tool use will be revealed when the assignment directions are provided to students.

Disability Accommodations

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

Privacy

Students must use their Mason email account to receive important University information, including messages related to this class. See http://masonlive.gmu.edu for more information

Cell Phones & Laptop Computers

Laptop or tablet computers are required for participation in the labs. Cell phones must be turned off or set to silent.
Gender identity and pronoun use
If you wish, please share your name and gender pronouns with me (lortizur@gmu.edu) and how best to address you in class and via email.

Mason Diversity Statement

George Mason University promotes a living and learning environment for outstanding growth and productivity among its students, faculty, and staff. Through its curriculum, programs, policies, procedures, services and resources, Mason strives to maintain a quality environment for work, study, and personal growth.

An emphasis upon diversity and inclusion throughout the campus community is essential to achieve these goals. Diversity is broadly defined to include such characteristics as, but not limited to, race, ethnicity, gender, religion, age, disability, and sexual orientation. Diversity also entails different viewpoints, philosophies, and perspectives. Attention to these aspects of diversity will help promote a culture of inclusion and belonging, and an environment where diverse opinions, backgrounds and practices have the opportunity to be voiced, heard and respected.

The reflection of Mason's commitment to diversity and inclusion goes beyond policies and procedures to focus on behavior at the individual, group, and organizational level. The implementation of this commitment to diversity and inclusion is found in all settings, including individual work units and groups, student organizations and groups, and classroom settings; it is also found with the delivery of services and activities, including, but not limited to, curriculum, teaching, events, advising, research, service, and community outreach.

Acknowledging that the attainment of diversity and inclusion are dynamic and continuous processes, and that the larger societal setting has an evolving socio-cultural understanding of diversity and inclusion, Mason seeks to continuously improve its environment. To this end, the University promotes continuous monitoring and self-assessment regarding diversity. The aim is to incorporate diversity and inclusion within the philosophies and actions of the individual, group, and organization, and to make improvements as needed.

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 703-380-1434 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.

Useful Campus Resources

Mason has several support services for students. Please go to https://stearnscenter.gmu.edu/knowledge-center/knowing-mason-students/student-support-resourceson-campus/ for a directory of services.