

12.307: Weather and Climate Laboratory Syllabus, Spring 2022

Instructors: Tristan Abbott (he/him, thabbott@mit.edu), Glenn Flierl (glenn@lake.mit.edu)
I (Tristan) will make my best effort to respond to emails within one business day.

TA: Bill McKenna (wdmc@mit.edu)

Communications Instructor: Jane Abbott (jcabbott@mit.edu)

Class: T/R 2:30-4:30PM, 54-1623 (classroom) or 54-1527 (fluids lab)

Office Hours: (Tristan) M/W 4-5PM, virtual (mit.zoom.us/j/91934542275)

I'm happy to change the date and time or hold in-person office hours based on student preferences.

Websites: weatherclimatelab.mit.edu (course materials and schedule),
canvas.mit.edu/courses/12705 (submitting assignments)

Prerequisites: Calculus II (GIR), Physics I (GIR).

Textbooks: Marshall & Plumb: Atmosphere, Ocean and Climate Dynamics (Academic Press) is a useful reference, but is not required.

Important dates: March 4 (add date), March 21-25 (spring break), April 19 (drop date)

The goals of this course are to practice (1) using fundamentals of climate science to interpret experimental and observational data, and (2) communicating scientific results in oral presentations and written reports. By the end of the course, you should be able to

1. effectively analyze noisy data to highlight connections between simple theory, laboratory experiments, and observations of the climate system;
2. describe connections between principles discussed in class and current research in climate science;
3. summarize and discuss scientific results in clear, concise reports and presentations that follow best practices for professional communication as a climate scientist.

We accomplish these goals through notes and classroom sessions that introduce fundamental principles of climate science; guest lectures that highlight research by faculty in EAPS; communications workshops (run by Jane Abbott, jcabbott@mit.edu); and four projects that require analysis of laboratory rotating tank experiments and observational data, an oral presentation, and (for three projects) a written report plus revisions. This course satisfies CI-M and Institute Laboratory requirements.

The course is structured around four projects of 6 class periods each:

1. Weather and Extremes: force balances in weather systems including tornadoes, hurricanes, and blizzards.
2. Tracer Transport: transport of pollutants, including plastics in the ocean and particulates in the atmosphere.
3. Heat and Moisture Transport: transport of energy and moisture by the large-scale atmospheric circulation and implications for global climate.
4. “Dig Deeper”: self-driven project digging deeper into some aspect of projects 1-3.

For projects 1-3, we’ll use the first class period of each block to introduce the project, periods 2-3 for a fluids lab experiment, periods 4-5 for a data lab focused on analyzing observational data, and the final period for an oral presentation. You’ll do the projects, including the oral presentations, in groups of 2-3 students (depending on class size). Additionally, you’ll submit an individual written report describing and discussing your results (due 1 week after the oral presentation), receive comments on your written reports a week later, and submit a revised report addressing the comments (due not less than one week after we return comments to you). For the fourth “dig deeper” project, you can work either alone or as part of a group. You don’t have to submit a written report for the fourth project; instead, you’ll be graded on an individual conference-style (10-15 minute) oral presentation on the last day of class. Guest lectures will be in class during projects 1-3 and are listed on the course schedule.

Communications workshops and conferences. This class satisfies a CI-M requirement in part through communications workshops and one-on-one conferences led by Jane Abbott. Jane will hold three half-hour workshops during the first two months of the class. The first will focus on presentations, the second on reports, and the third on report revisions; all three will discuss strategies and best practices for effective professional communication as an Earth scientist. In addition to the workshops, Jane will schedule one-on-one conferences during the week of March 7 to discuss student presentations. *Communications workshops and conferences are both held outside of normal class hours.* Tentative dates and times for the workshops are on the course website but can be changed to accommodate student availability. Individual conferences during the week of March 7 should be scheduled in consultation with Jane.

Your grade for this course is based on project presentations and reports (80%), warmup assignments for the observational components of projects 1-3 (10%), and participation in class and in communications workshops and conferences (10%).

1. Project presentations and reports. For the first three projects, grades will be assigned based on *completion* of an oral presentation and a first draft of a written report, plus *evaluation* of a revised report. We’ll provide a provisional grade when we return the first draft of written reports with comments, but we expect everybody to submit a revised report that addresses comments from instructors even if you’re happy with the provisional grade. For the fourth “dig deeper” project, grades will be assigned based on *evaluation* of a short conference-style oral presentation. I (Tristan) will assign 75% of the grade for reports and presentations, and the remaining 25% will be based on a communications grade assigned by Jane. Guidelines and rubrics for presentations, reports, and revisions will be posted on the course website during the first week of class.

2. Warmup assignments. The observational components of projects require accessing and reading a variety of observational datasets, and we want to troubleshoot any problems accessing or reading data well before presentations and reports are due. To help catch problems early, we'll assign short warmup assignments for each project due at the start of the first data lab class session. You'll get full marks as long as you attempt them, and submit either the completed assignment or a description of issues you encountered.
3. Participation. This is a lab class, so participation (and, by extension, attendance) are important. Because of this, 10% of your grade is based on participation and attendance. Excused absences won't count against your participation grade, but please reach out to me as early as possible if you have to miss a class. That said, **if you're feeling sick, or if you're required to self-isolate, don't come to class!** Absences due to illness and/or COVID will never count against your participation grade, even if you don't reach out before the class(es) you miss.

Final grades will be assigned as follows: 100-90%: A; 90-80%: B; 80-70%: C; 50-70%: D; 50% or below: F.

Other policies and resources

- COVID:

I expect everybody in the class to comply with MIT's masking, vaccination, testing, and (if necessary) isolation requirements, and otherwise do your best to keep yourself and others safe. I also encourage you to wear N95/KN95 masks rather than cloth masks if possible—the former are much more effective at preventing COVID transmission, and MIT provides them at test drop-off sites. At the same time, you shouldn't feel bad if you do test positive for COVID, or that you're in any way at fault for contracting it. If you have to miss class because of a positive test, or because you need to care for a sick friend or family member, please let the instructors know—we'll be flexible with deadlines if necessary and will work with you to figure out the best way to make up missed classes and assignments.

- Programming:

This class will require some programming to analyze and plot data. We recommend using either MATLAB or Python. MATLAB is available for free to MIT students (ist.mit.edu/matlab/all) and will work out of the box. Python is free, but using it for class projects will require installing some external packages, so we recommend using MATLAB if you're not already familiar with package management in Python. Whenever projects require programming, we'll provide MATLAB and Python scripts for importing data and making some basic plots, and you should feel free to modify these scripts as needed while analyzing data. If you're concerned about programming requirements, please come talk to an instructor! We're happy to provide extra support to students with little or no programming experience. If you prefer to use another programming language or spreadsheet software, that's also ok—but be prepared to put in some extra time figuring out how to import data if you decide not to use MATLAB or Python.

- Inclusion:

Like MIT, I value an environment that welcomes individuals of all backgrounds, ethnicities, nationalities, gender identities, sexual orientations, and religious and political affiliations. I expect all students to strive to make this class comfortable and welcoming to everybody—and all students should expect the same of the instructors. If anything about the class environment

makes you feel uncomfortable or unwelcome, please feel free to reach out to an instructor, or to another resource (including S³, the Ombuds Office (ombudsoffice.mit.edu), or the Institute Community and Equity Officer (diversity.mit.edu)) if you're uncomfortable speaking with an instructor.

- Special accommodations:

If you need disability-related accommodations, we encourage you to meet with the teaching staff early in the semester, and we look forward to working with you to help with your approved accommodations. If you need accommodations but have not yet been approved for them, please contact Disability and Access Services (studentlife.mit.edu/das).

- Personal and/or medical issues:

If a personal or medical issue is making it difficult for you to attend class or complete work on time, please reach out to Student Support Services (S³, studentlife.mit.edu/s3). Staff in S³ are trained to provide advice, advocacy, and support for undergraduate students, and can help you make a plan for addressing missed work.

- Late work:

You start the semester with three “late days” that you can spend to avoid penalties for submitting assignments late. If you submit a late assignment and want to spend one or more late days, please indicate this clearly on the assignment. Otherwise, I’ll assume you want to save your late days for later. If you submit a late assignment without spending late days, the maximum possible grade will drop by 10% for each day the assignment is late. If you’ve spent all your late days and know something will make it difficult for you to complete an assignment on time, you can ask me for an extension, but please make the request at least 48 hours in advance. **COVID-related delays are exempt from the late policy.** If you’re late submitting an assignment because you’re sick, or because you need to care for a sick friend or family member, let us know and we’ll allow you to submit the assignment without penalty.

- Collaboration:

The projects in this course are collaborative, but we expect individual assignments (which include the written reports for projects 1-3, the presentation for project 4, and the warmup assignments) to be your own work. Sharing figures and data is acceptable, but figures in reports and the project 4 presentation should be clearly labeled with the name of the person who prepared it. Additionally, we expect you to include at least one figure you prepared yourself in each of your reports, and the writing in reports (including figure captions) and the design of slides for the project 4 presentation should be your own. If you’re unsure about the degree of collaboration allowed on any assignment, please ask an instructor.

- Academic Integrity:

All students should be familiar with MIT’s Academic Integrity policy (integrity.mit.edu), including resources for working under pressure. I will hold you to the high standards expected of all students at MIT, and am happy to answer any questions you have about sharing materials, citing sources, collaboration, or anything else related to the Academic Integrity policy.