Important: Please bring your laptop to the first class!

Administrative

Instructor: Eli Tziperman (eli@seas.harvard.edu);

Day, time & location: Wednesday 3â€“5:45; 26 Oxford, Museum building, 4th floor, center for the environment, room 440.

Main course resources:

- **Textbook:** *Global Warming Science: A Quantitative Introduction to Climate Change and Its Consequences, 2022* (a few physical and ebook copies available under Library Reserves on the left)
- **Slides** for each lecture, here.
- **Jupyter notebooks and data**, here.
- **Course forum:** Please post questions regarding HW/lectures to the course forums (Ed discussions, menu item on left), rather than emailing the teaching staff. You are very welcome to respond to other studentsâ€™ questions on the forum.

- Detailed syllabus: here.

Weekly Office hours and TFs:

- **Eli's office hours:** Mondays & Wednesdays 1â€“2 pm, 24 Oxford, 4th floor, room 456. Exceptions will be noted here:
- **Sophie's Office Hours:** Tuesdays 2-4pm in Geo 413. Exceptions will be noted here: April 30 will be 8-10am on Zoom. Please email me (sabourizk@g.harvard.edu) if you plan to come: https://harvard.zoom.us/j/6818133128
- **Jacob's Office Hours:** Mondays 2-4pm, 24 Oxford, 4th floor, room 412A. jbushey@g.harvard.edu. Exceptions will be noted here: March 25 on Zoom (https://harvard.zoom.us/j/91791763088?pwd=VWJSa2lLYVZ1bm5NVWRVdWxKSnYydz09)

- **Kara's Office Hours**: Fridays 3 - 5 pm, 24 Oxford, 4th floor, room 417. kara_hartig@g.harvard.edu. Exceptions noted here:

Homework Help session:

- Tuesdays 4â€“6 pm in GEO 413.

Sign up to be a coach here

Recommended Prep: Math 19a, 21b, or equivalent.

Description:

An introduction to the science of global warming, meant to assist students to process issues that often appear in the news and public debates. Topics include: the greenhouse effect and consequences of the rise of greenhouse gasses, including sea-level rise, ocean acidification, heat waves, droughts, glacier melting, expected changes to hurricanes, and more. The scientific basis for each subject will be covered, and every class will involve a hands-on analysis of observations, climate models, and climate feedbacks, using python Jupyter notebooks. Throughout, an ability to critically evaluate observations, predictions, and risk will be encouraged.

Requirements:

In-class participation is required. Students are asked to complete two assignments each week: (1) a weekly Jupyter-notebook-based workshop, (2) a one-page report addressed to the president's science

adviser, explaining the problem, motivation, methods, the science results based on the class and workshop outcome and the implications. You need to address all guiding questions while maintaining a coherent overall structure. Detailed guidelines here, with guiding questions here. Each student will serve as a *coach* in at least one workshop, helping other students after being prepared by the teaching staff the week before. Each group of coaches will also prepare a two-slide presentation for a special course session on critically reading popular press articles about climate change, and another such presentation for the last class on the interface between climate change science and policy.

Grading:

Weekly HW, including workshops, essays, and group presentations: 75% (the lowest weekly grade will be dropped, the presentations cannot be dropped), Coaching: 10%, Participation: 15%. The course may be taken pass/fail only in unusual circumstances and with instructor approval during the first week of classes. Late submissions would lead to a reduction of 2% per minute after the due time.

Jupyter notebook and one-page report should be submitted on Gradescope as separate PDFs by 2 PM on Wednesday the week after being assigned. Homework grades are posted to canvas, you need to check the posted grades and come to Eli's office hours within 7 days from the release of grades if you see a problem. Please approach (visit) Eli rather than the TFs with any issue related to grading.

Course meetings:

a weekly 3-hour session, including short lecture segments mixed with guided hands-on programming. **Group work is strongly encouraged during workshops.**

Recommended Prep:

Basic calculus and ordinary differential equations, as covered, for example, by Math 19a or Math 21b. Basic programming experience is assumed. The course will introduce the students to various science subjects, but no prior college-level science knowledge is assumed.

Programming

in Python, will be employed throughout the course. Students will be provided with template code (**in the form of easy-to-use Jupyter notebooks**) to start from and be closely guided in the weekly course workshops. **Students are requested to bring their laptops to the first class.** We will be using the FAS OnDemand Jupyter server (see the menu on the left), so no prior installation of software is needed.

Before downloading + submitting Jupyter notebook:
Before reviewing and submitting your finished Jupyter notebook, with the notebook open in JupyterHub go to Kernel -> Restart Kernel and Run All Cells. This ensures that the code output is up-to-date with what you have written in each cell.
How to download and submit a Jupyter notebook file as a PDF:

In order to submit your JupyterLab notebook for grading, do the following inside JupyterHub:

Click "File" -> "Save and export notebook as" -> "PDF"

Collaboration Policy

We strongly encourage you to discuss and work on homework problems with other students and with the teaching staff. However, after discussions with peers, you need to work through the problems yourself and ensure that any answers you submit for evaluation are the result of your own efforts, reflect your own understanding, and are written in your own words. In the case of assignments requiring programming, you need to write and use your own code, code sharing is not allowed. You must appropriately cite any books, articles, websites, lectures, etc that have helped you with your work.

Course outline

Lecture order

Lecture order this semester, see below for outlines of lectures:

1. Introduction
2. Hurricanes
3. The greenhouse effect
4. Sea level rise

5. Clouds
6. Temperature
7. Ocean acidification
8. Critically reading popular press articles about climate change
9. Floods
10. Sea ice
11. Ocean circulation
12. Forest fires
13. Last class! (mis)using climate science in setting policy

For more details: see the detailed syllabus in PDF linked above.