GEOL 150L: Climate Change

Julien Emile-Geay

Spring 2025

General Information

Where/When Class meets Tues/Thurs, 11:00–12:20 in SAL 101. Lectures are recorded on Zoom; please use this link if you wish to join remotely. Remember to register separately for lab and class!

Instructors

Professor:	Julien Emile-Geay	ZHS 275	julieneg@usc.edu
Teaching Assistants:	Lily Dodd		ldodd@usc.edu
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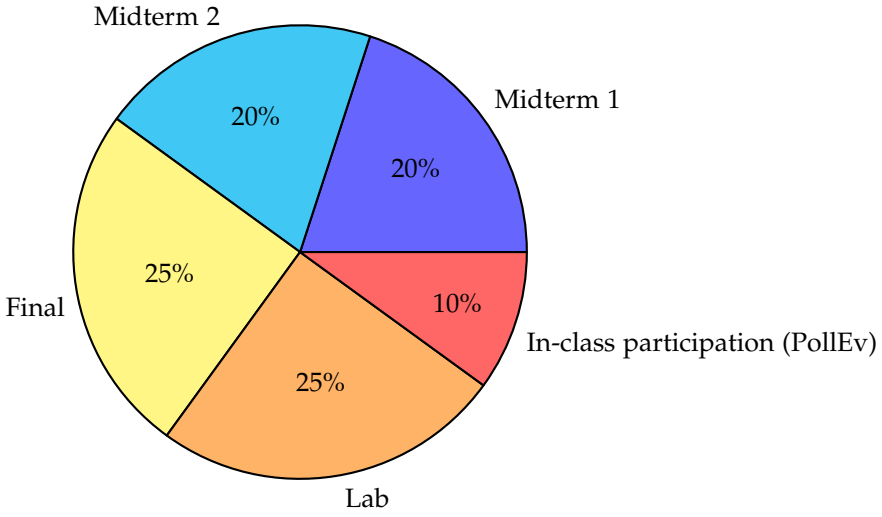
Office Hours T-Th after class, or by appointment.

Overview

Synopsis This general education undergraduate course will introduce you to the fundamentals of natural and anthropogenic climate change. After briefly recalling the formation of the solar system, our planet and its fluid envelopes, we will introduce the basic physics of the climate system, providing tools to understand climate variability (e.g. monsoons, El Niño), the greenhouse effect, and climate feedbacks. Building on this understanding, a succinct tour of Earth's history will help us paint a more complete picture of climate variations and how they interacted with human history. We will highlight the anomalous character of recent climate change, establish its anthropogenic nature, discuss the root causes of this crisis, and potential solutions.



Grade

The class is worth 4 units, which means that it requires substantial work. Lab attendance is mandatory every week. Lab quizzes are graded weekly and administered by Teaching Assistants (see separate lab syllabus). Exams are all multiple choice questions. The final (2h) is cumulative. Exam grades are curved so that the best score gets 100; everyone else is graded down from there. So if the test was hard and the best grade was 91, everyone else's grade gets shifted upward by 9 points. The numeric to letter grade conversion is shown in Table 1.

Table 1: Numeric to letter grade conversion (cutoffs)

< 60	60	64	67	70	74	77	80	84	87	90	94
F	D-	D	D+	C-	C	C+	B-	B	B+	A-	A

Extra credit One way to boost your grade is participating in the Joint Educational Project, worth up to 1/3 of a grade (3.33%) (e.g. from B+ to A-). Sign up early if you wish to participate.

Questions Questions are the soul of learning, and there are several ways to ask them. The preferred way is to ask questions in class so everyone can benefit (chances are you're not the only one with this question). The second best way is to use Slack, so other students can benefit from the answer. Finally, there is email, which is slower. Before writing, it is advised to check the syllabus and/or Brightspace, in case your question is already answered there.

Exams Exams are multiple-choice, in-person only in SAL101. Make-up exams can only be scheduled in exceptional circumstances, with adequate justification (e.g. doctor's note). If a conflict arises ahead of time, please let me know as soon as possible. The final is cumulative, but the midterms are not. Exams are closed-book, but study guides will be distributed about a week prior to each exam. Midterms will be preceded by a review session. About 20% of exam questions will be taken from past PollEverywhere quizzes (see "Participation") and lab quizzes, giving you a chance at practice before exam day.

Lab This is a physical sciences GE, and the main purpose of labs is to "get physical" with the class material. Every year I read reviews that say that the lab was either the most helpful/fun part of the class or [long list of expletives goes here]. Whether you like it or not, lab attendance is graded by weekly quizzes, and it is mathematically impossible to pass the class without attending labs. It is good for you, too!

Participation

Participation is an essential element of active learning. This class offers various opportunities for active learning, both synchronous and asynchronous. If you attend lectures (and manage to stave off distractions during them) you're setting yourself up for success. If you participate during said lectures, you're doing great. In-class polls, administered through Poll Everywhere are another way to participate. PollEverywhere is free of charge to USC students, and count for 10% of the total grade, so you can only lose by not participating.

Reading

Main book

Readings will be assigned out of Dessler, A., *Introduction to Modern Climate Change, 3rd Ed.*, Cambridge University Press, 2021. URL. Warning: my course material does not mirror this text exactly, so the book will be more detailed in some respects, and much less so in other respects.

Weekly readings

Will be either taken from the book or posted on Brightspace.

Relevant Books

The following texts might be interesting to those of you wanting to dive further:

- Weart, S., The Discovery of Global Warming.
- Emanuel, K., What we know about climate change.
- Diamond, J., Collapse: How Societies Choose to Fail or Succeed.
- Oreskes, N & Conway, M., The Collapse of Western Civilization.
- Davis, M., Late Victorian Holocausts: El Niño Famines and the Making of the Third World

Schedule

I How Climate Works

The first section of the class focuses on the climate system, what it is and how it works.

Week 1 — 01/13/25— Setting the stage

Tuesday: The Discovery of Global Warming
Thursday: How to make a habitable planet
Suggested reading: Dessler, Chapter 1 & 2

Week 2 — 01/20/25— Planetary Energy Balance

Tuesday: Energy transfers & radiation
Thursday: The greenhouse effect
Suggested reading: Dessler, Chapter 3. Kerry Emanuel: Phaeton's Reins.

Week 3 — 01/27/25— The Seasonal and Water Cycles

Tuesday: Insolation and the seasons
Thursday: Water in the atmosphere
Lab #1: Absorption & Emission
Suggested reading: Dessler, Chapter 4.

Week 4 — 02/03/25— Atmospheric Motion

Tuesday: The General Atmospheric Circulation
Thursday: Cyclones
Lab #2: Planetary Energy Balance

Week 5 — 02/10/25— Oceans & Climate

Tuesday: Oceans & climate
Thursday: Climate Variability.
Lab #3: Greenhouse Gases
Suggested reading: R.Seager: *Is the Gulf Stream responsible for Europe's mild winters?*. Dessler, Chapter 6.

Week 6 — 02/17/25— Carbon Cycle

Tuesday: The (short-term) Carbon Cycle
Thursday: The (long-term) Carbon Cycle
Lab #4: Atmospheric Circulation
Suggested reading: Dessler, Chap 5.

Week 7 — 02/24/25— Midterm 1

Tuesday: Midterm review
Thursday: Midterm 1
Lab #5: Ocean Circulation

Suggested reading: Dessler, Chap 1 – 6.

II History of Climate, History and Climate

The section focuses on how the climate system has behaved over the course of Earth's history. This history is rich in lessons about climate's future, and our own.

Week 8 — 03/03/25— Climate Variability

Tuesday: Modern Variability: the Alphabet Soup and the Dust Bowl

Thursday: Paleoclimatology: the science of Past Climates

Lab #6: The Carbon Cycle, Part 1

Suggested reading: Dessler, Chapter 7. Davis: *El Niño famines*.

Week 9 — 03/10/25— The Glacial World

Tuesday: Pleistocene Ice Ages

Thursday: Abrupt Change: Poking the Angry Beast

Lab #7: The Carbon Cycle, Part 2

Suggested reading: Dessler, Chapter 7

SPRING RECESS : March 16 – 23

Week 10 — 03/24/25— Climate Surprises

Tuesday: Taking Earth's temperature & the Hockey Stick

Thursday: Societal collapse. The Anthropocene

Lab #8: El Niño

Suggested reading: *E.Kolbert, the climate of man, part 2.* Dessler, Chapter 5.

III The Climate of Man

Week 11 — 03/31/25— Man-made warming

Tuesday: Climate Models I: Early pioneers

Thursday: Climate Models II: General Circulation Models

Lab #9: The astronomical theory of Ice Ages

Suggested reading: *Schmidt: the physics that we know*. Dessler, Chapter 8

Week 12 — 04/07/25— Climate Models

Tuesday: Midterm 2 review

Thursday: Midterm 2

Lab #10: Extremes in Context

Week 13 — 04/14/25— Climate Futures

Tuesday: The Greenhouse Future

Thursday: Climate Options

Lab #11: Climate Projections

Suggested reading: Dessler, Chap 8, 9, 11, 12. Hoffman, 2012:

Week 14 — 04/21/25— Climate Controversies

Tuesday: Deception & Denial

Thursday: Climate Economics & Policy

Suggested reading: Dessler, Chapter 10, 11, 12, 13.

Lab #12: Debunking contrarian myths

Suggested reading: Dessler, Chap 13. The American Denial of Global Warming David Finnigan TED talk.

Week 15 — 04/28/25— Climate Decisions

Tuesday: Climate Consciousness.

Thursday: Final Review.

Suggested reading: Dessler, Chapter 14. Climate engineering reconsidered. *Oreskes & Conway, The Collapse of Western Civilization* Climate Science as Culture War

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Tuesday May 13—Final Exam – 11:00-13:00 in SAL101

This time is set by the university and not in my power to change.

IV Participation

Class participation is a critical aspect of this course. It takes place in two main avenues: by old-fashioned hand-raising and speaking, and virtually on Poll Everywhere.

The first way to participate is to come to class and ask questions. You're not required to know much science to take this class, so there is no such thing as a stupid question; also, we will encounter many controversial topics, in which your opinion matters – it would be too bad to keep it to yourself. Remember that you're often not the only one to have a particular question.

In-class participation represents 10% of the final grade (i.e. half the final). That is no small potatoes. Treat it seriously. To obtain these 10 points, you need to maintain an average participation rate of at least 80% by the end of the term (excused absences are OK, of course).

V Technology

Blackboard

BlackBoard is our primary medium of communication outside the classroom. It is where I post class notes, announcements, and assignments. Is is where you access that content, participate in discussions, and check your grades. **It is your responsibility to ensure that you receive BlackBoard announcements**. Make sure you enable email notifications, and importantly, make sure your inbox is not full; every year I get emails bounced from students too neglectful to clean up their inbox. If you have a doubt about when an assignment is due, go check it on BlackBoard. Also note that BlackBoard messages are richer than the email notifications they generate. Frequently, the announcements I'll send will have links to content archived on BlackBoard – those links will not appear in the emails. If the email digest you read does not make sense, please check it on BlackBoard; it might have the answer you need over there. If it still doesn't, please email me.

Poll Everywhere

The tool we will use to gather live, in-class feedback is called Poll Everywhere. You may submit your responses in one of three ways: Text messages, a Smartphone App, or a Web browser. Dornsife College will support all costs of this platform; signup details to follow.

Email

Email is a relatively new advent in the world of education. It allows an unparalleled level of access to professors, which has both pros and cons. In some cases you will spot a mistake of mine in an assignment or a grade, and pointing it out will save everyone a lot of time. In many cases, however, emails unnecessary clog my inbox. Here are some rules to use email wisely:

- Check BrightSpace. Chances are the answer to your question is already there.
- Direct all lab-related queries to your TA.
- Be patient. Chances are, I'm not reading my email at 4am.
- Write exactly as if you were speaking to me in person. Not more, not less formally. Other email etiquette tips may be found here.

VI Generalities

Statement for students with disabilities

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to instructor (or to TA) as early in the semester as possible. DSP is located in GFS 120 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. Contact information: (213) 740-0776 (Phone), (213) 740-6948 (TDD only), (213) 740-8216 (FAX) dspfrontdesk@usc.edu.

Statement on academic integrity

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. SCampus, the Student Guidebook, contains the University Student Conduct Code (see University Governance, Section 11.00), while the recommended sanctions are located in Appendix A.

Emergency preparedness/course continuity in a crisis

In case of a declared emergency if travel to campus is not feasible, USC executive leadership will announce an electronic way for instructors to teach students in their residence halls or homes using a combination of USC Brightspace, teleconferencing, and other technologies. See the university's site on Campus Safety and Emergency Preparedness.

Discrimination

Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the Office of Equity and Diversity or to the Department of Public Safety . This is important for the safety whole USC community. Another member of the university community – such as a friend, classmate, advisor, or faculty member – can help initiate the report, or can initiate the report on behalf of another person. The Relationship and Sexual Violence Prevention and Services provides 24/7 confidential support, and the sexual assault resource center webpage describes reporting options and other resources.

Support Systems

A number of USC's schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the American Language Institute, which sponsors courses and workshops specifically for international graduate students. The Office of Disability Services and Programs for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, USC Emergency Information will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.

Past Tests

We are aware that some former tests from this class are available on the web, and remind you that we change the exams from year to year. However, using canned answers from past exams is a really good way of helping us catch lazy cheaters, so we encourage their use to ease our law-enforcement tasks!