

GEOL 150L: Climate Change

Julien Emile-Geay

Spring 2021

General Information

Where/When Class meets Mon/Wed/Fri, 10:00–10:50am on **Zoom**.
Lab section meets on Zoom until further notice.
Remember to register separately for lab and class!

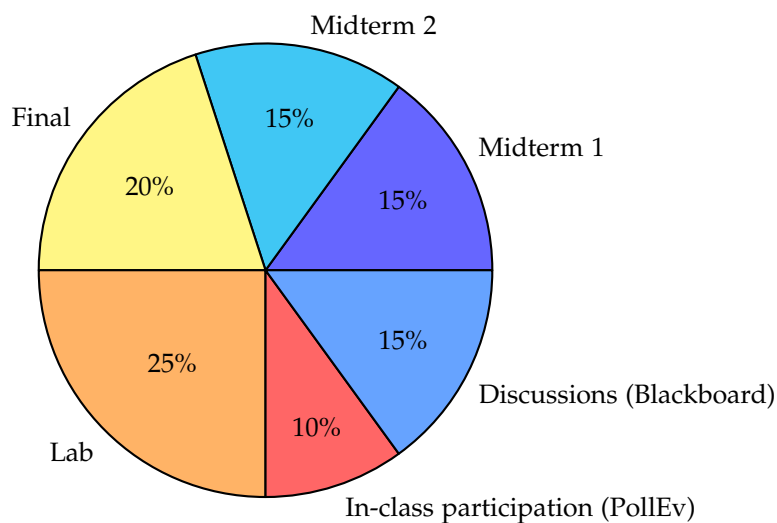
Instructors

Professor:	Julien Emile-Geay	ZHS 275	julieneg@usc.edu
Teaching Assistants:	Alexander Dill		alexdill@usc.edu
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Office Hours MWF 11-12 on Zoom, 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. Labs 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. Further adjustments are non-negotiable. Haggling would only have negative impacts on your grade (of course, you are too smart to resort to such vile tactics anyway). The numeric to letter grade conversion is as such:1.

Table 1: Numeric to letter grade conversion (cutoffs)

< 60	60	63	67	70	73	77	80	83	87	90	≥ 93
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 or forever hold your peace. I do not offer other extra-credit opportunities.

Discussions Another way to participate is via BlackBoard discussions. Throughout the semester we will post 6 discussion boards with assigned multimedia content, which are a great way to explore deeper topics and use your writing skills. You will be graded on the substance of the posts, out of 10. Together, your discussion grade makes up 15% of your total grade, as much as a midterm. Please take it seriously!

As should be obvious, the online world is but an extension of the physical world: only speak in ways you would like to be spoken to, stand up for your peers, and report abuse when you see it.

Discussions may be accessed via the Assignments tab, or via Tools>Discussions. Deadlines will be announced via the calendar.

Rules There aren't many rules, but they're all important. First, read the syllabus (if you've gotten this far, you're on the right track). Second, check BlackBoard. Third, ask questions when you don't understand things; chances are you're not alone. Fourth, don't miss class or lab. Fifth, please do not email the instructor with questions whose answer is in the syllabus. Sixth, under no circumstance should you ever even think of haggling for your grade. Seven, read the syllabus once more. Just in case.

Exams This semester exams will be administered through Blackboard, which is also where announcements will appear. The final is cumulative, but the midterms are not.

Blackboard exams will occur in a narrow time window (class time), but students participating from time zones other than PST will have the possibility of taking the exam at other times (arrangements should be made with the TAs a week before each exam).

Participation

Participation is an essential element of active learning. This class offers various opportunities for active learning, both synchronous and asynchronous.

Synchronous If you attend lectures (and manage to stave off distractions during them) you're ahead of the curve. If you participate during said lectures (via the chat, or piping up to answer questions), you're doing great. In-class polls, administered through [Poll Everywhere](#) are another way to participate. Note that this way is also available asynchronously.

Asynchronous A significant fraction of students are participating from remote time zones this semester, so there are several opportunities for asynchronous participation (i.e. on your own time):

Polls [Polls](#) are open for 24h, so give you the opportunity to participate on your own time.

Discussions As described above, there will be 6 Blackboard discussions throughout the term. Links to discussions boards are available under the "Assignments" tab. The first is due on Feb 7th.

Reading

Main book (optional)

Dessler, A., *Introduction to Modern Climate Change, 2nd Ed.*, Cambridge University Press, 2014.
[URL](#).

Weekly readings

Will be either taken from the book or posted on [BlackBoard](#).

Relevant Books

- Weart, S., *The Discovery of Global Warming*, [URL](#).
- Emanuel, K., *What we know about climate change*, [URL](#).
- Diamond, J., *Collapse: How Societies Choose to Fail or Succeed*, [URL](#).
- Davis, M., *Late Victorian Holocausts: El Niño Famines and the Making of the Third World*, [URL](#)

Schedule

I HOW CLIMATE WORKS

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

Week 0 — 01/11/21— Overview

Friday: The Discovery of Global Warming

Week 1 — 01/18/21— A brief history of the World

Monday: NO CLASS (Dr Martin Luther King Jr day)

Wednesday: Solar system formation

Friday: Energy types & conversions

Suggested reading: Dessler, Chapter 1

Week 2 — 01/25/21— Energy & Radiation

Monday: Radiation, heat and temperature

Wednesday: The greenhouse effect

Friday: Climate components

Lab #1: Energy Balance

Suggested reading: Dessler, Chapter 2 & 3.

Week 3 — 02/01/21— Planetary Energy Balance

Monday: Water in the atmosphere

Wednesday: Insolation and the seasons

Friday: The General Atmospheric Circulation

Lab #2: Greenhouse Gases

Suggested reading: Dessler, Chapter 4. Discussion #1 due

Week 4 — 02/08/21— Heat Transport

Monday: Earth's Oceans

Wednesday: Ocean Circulation and climate

Friday: The (short-term) Carbon Cycle

Lab #3: Atmospheric & Oceanic Circulation

Suggested reading: Dessler, Chapter 6.

Week 5 — 02/15/21— Carbon Cycle

Monday: NO CLASS (President's day)

Wednesday: The (long-term) Carbon Cycle

Friday: Carbon Cycle Malfunctions

Lab #4: The Carbon Cycle, Part 1

Discussion: Discussion #2 due

Week 6 — 02/22/21— Climate Variability

Monday: Forcings & Feedbacks. Seasons and Monsoons

Wednesday: El Niño– dynamics and impacts

Friday: Droughts and the Dust Bowl

Lab #5: The Carbon Cycle, Part 2

Suggested reading: Dessler, chapters 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 7 — 03/01/21— Midterm/Ice Ages

Monday: Midterm 1

Wednesday: Paleoclimatology: the science of Past Climates

Friday: Pleistocene Ice Ages: observations

Lab #6: Climate Variability.

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

Week 8 — 03/08/21— Ice Ages

Monday: Pleistocene Ice Ages: astronomical theory

Wednesday: Abrupt climate change

Friday: WELLNESS DAY

Lab #7: The astronomical theory of Ice Ages

Suggested reading: Dessler, Chapter 5.

Week 9 — 03/15/21— Humans & Climate Change

Monday: The Hockey Stick Controversy

Wednesday: Societal collapse and climate change

Friday: The Anthropocene

Lab #8: Extremes in Context

Suggested reading: Dessler, Chapter 2. *E.Kolbert, the climate of man, part 2*. Discussion #3 due

III THE CLIMATE OF MAN

Week 10 — 03/22/21—Midterm 2 - Instrumental Record

Monday: Taking Earth's temperature

Wednesday: The climate data patchwork

Friday: Midterm 2

Suggested reading: Kerry Emanuel: Phaeton's Reins. Discussion #4 due

Week 11 — 03/29/21— Climate Models

Monday: Climate Models I: Early pioneers

Wednesday: Climate Models II: General Circulation Models

Friday: Climate Models III: attributing climate change.

Lab #9: The Temperature Record

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

Week 12 — 04/05/21— Climate Futures

Monday: The Greenhouse Future

Wednesday: WELLNESS DAY (04/07)

Friday: Climate Impacts

Week 13 — 04/12/21— Climate Denial

Monday: The American Denial of Global Warming

Wednesday: Merchants of Doubt

Friday: Climate Psychology

Lab #10: The attribution of Climate Change

Suggested reading: Dessler, Chapter 10, 11, 12. Discussion #5 due

Week 14 — 04/19/21— Climate Decisions

Monday: Climate Options

Wednesday: The Economics of Climate Change

Thursday: WELLNESS DAY (04/22)

Friday: Climate Policy

Suggested reading: Dessler, Chapter 9, 13.

Week 15 — 04/26/21— Climate & You

Monday: Geoengineering

Wednesday: Individual action (breakout)

Friday: WELLNESS DAY (04/30)

Lab #11: How to talk to a climate contrarian

Suggested reading: Dessler, Chapter 14. Discussion #6 due

Monday May 10—Final Exam – 8-10am

IV PARTICIPATION

Class participation is a critical aspect of this course. It takes place in two main avenues : in lectures and on **BlackBoard**. The first way to participate in class is to come to class. I somehow make it to class every day – it requires no superhuman powers. However, just parking in the classroom and checking Facebook is a waste of your time and your parents' money, so *active participation* is what we're after: ask questions. Offer comments. 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 for yourself. 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. It 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 BlackBoard before you type. Chances are the answer to your question is already there.
- Direct all lab-related queries to your TA.
- Don't expect an immediate answer. 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](#).

Zoom etiquette

Thanks to COVID19, all our interactions are now mediated by screens. Rest assured that this is just as awkward for me as it is for you, so let's try to make it marginally less awkward. You can still show up to class in your pajamas, finish breakfast in lecture, have a cat on your lap, etc... The one thing upon which I am insistent is that you **turn your video on** (if your hair is a mess, find a hat solution!). See, lecturing to a black screen without any audience feedback is profoundly uninspiring. I need to know that there are live human beings somewhere at the other end of the line. Microphones should be on mute by default, but do check from time to time in case the neighbor's dog is barking. And do raise your electronic hand if have a question at any point – I am more than happy to answer them.

The other important thing is to **always log into Zoom via single sign-on (SSO)**; that is, authenticate with the USC Shibboleth. That way you let yourself into the Zoom session without bothering anyone. Not using SSO, and therefore asking instructors to monitor the waiting room, is the equivalent of loudly knocking on the door of a physical classroom and interrupting class. You can see how that would be entirely unmanageable with 135 students.

VI ACADEMIC CONDUCT

Most likely you are a responsible adult, so the comments below don't apply to you. However, for the small minority of childish students who sign up every year, here are a few admonitions for good measure.

Plagiarism

Presenting someone else's ideas as your own, either verbatim or recast in your own words, is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in [SCampus](#) in Section 11, [Behavior Violating University Standards](#). Other forms of academic dishonesty are equally unacceptable. See [additional information in SCampus](#) and university policies on scientific misconduct.

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 [Center for Women and Men](#) 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.

Cheating

We are aware that some former test results are available on the web. Use them at your own risk..

GradeBuddy

The following is a reminder from Academic Policies memo 11/25:

*Any student selling or distributing notes taken in a classroom is in violation of the University's Academic Integrity policy and is subject to university sanctions. This policy is clearly stated in Section 11.12 of the student handbook, **SCampus**, which identifies the following as violations of community standards:*

- Acquisition of term papers or other assignments from any source and the subsequent presentation of those materials as the student's own work, or providing term papers or assignments that another student submits as his/her own work.*
- Distribution or use of notes or recordings based on university classes or lectures without the express permission of the instructor for purposes other than individual or group study. This includes, but is not limited to, providing materials for distribution by services publishing class notes. This restriction on unauthorized use also applies to all information which had been distributed to students or in any way had been displayed for use in relationship to the class, whether obtained in class, via email, on the Internet or via any other media. (See Section C.1 Class Notes Policy.)*
- Recording a university class without the express permission of the instructor and announcement to the class. Recording can inhibit future free discussion and thus infringe on the academic freedom of other students as well as the instructor.*