ERSC 150L: Climate Change

Julien Emile-Geay

Spring 2016

General Information

Where/When Class meets Mon/Wed/Fri, 10:00–10:50am in SAL101.
Lab section meets in ZHS B56. Remember to register separately for lab and class!

Instructors

Professor:	Julien Emile-Geay	ZHS 275	julieneg@usc.edu
Teaching Assistants:	Hongrui Qiu	ZHS B15	hongruiq@usc.edu
	Jun Hu	ZHS 275	hujun@usc.edu
	Jessica Zaiss-Bowman	ZHS 237	zaissbow@usc.edu
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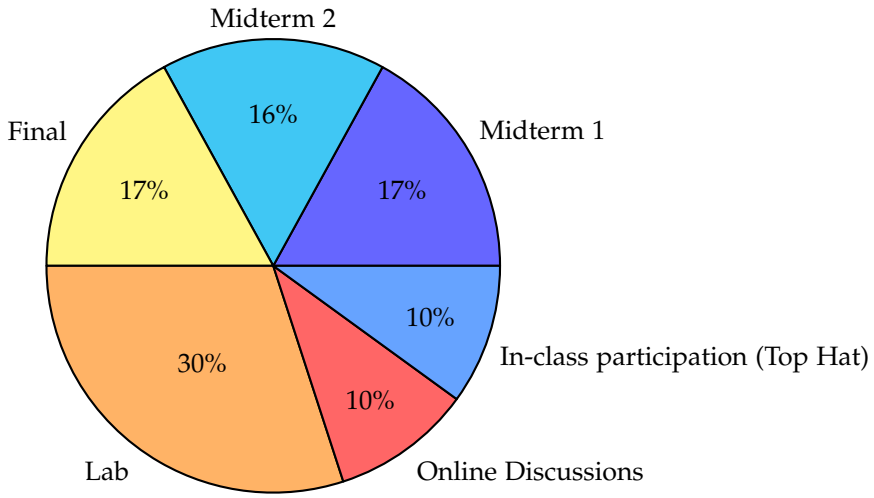
Office Hours MWF 11-12 in ZHS 275, or by appointment.

Overview

Synopsis This general education undergraduate course will introduce students 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 everyday weather and low-frequency phenomena (e.g. monsoons, El Niño), the greenhouse effect, and climate feedbacks. Building on this understanding, a succinct tour of geologic history will help us paint a more complete picture of Earth's climate variations and how they affected human evolution and history. With this context, we will be able to judge the anomalous character of recent climate change, establish its anthropogenic nature, and discuss solutions to the current climate crisis.



Grade

The class is worth 4 units, which means that it requires substantial work. Lab attendance is *mandatory* every week. 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 approximately 9 points. Further adjustments are non-negotiable. Haggling would only have negative impacts on your grade. Of course, you're too smart to resort to such vile tactics anyway. Extra credit is a much better way to boost your grade if you're worried about

it. JEP is the only way to achieve this, and worth up to 1/3 of a grade (e.g. from B+ to A-).

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

Rules There aren't many rules for the course, but they're all important. First, read the syllabus. 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, don't 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.

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

Note: the schedule of exams is not finalized yet.

I Physics of Climate

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

Week 1 — 01/11/16— Overview

Monday: The climate change roadmap

Wednesday: In the beginning... Earth's formation

Friday: The Climate system – an overview

Suggested reading: Dessler, Chapter 1

Week 2 — 01/18/16— Energy & Radiation

Monday: no class in observance of Dr Martin Luther King Jr day

Wednesday: Energy types & conversions

Friday: Radiation, heat and temperature

Suggested reading: Dessler, Chapter 2 & 3.

Week 3 — 01/25/16— Planetary Energy Balance

Monday: The greenhouse effect

Wednesday: Insolation and the seasons

Friday: Water in the atmosphere

Lab #1: Energy Balance

Suggested reading: Dessler, Chapter 4.

Week 4 — 02/01/16— Atmospheric Motion

Monday: The General Atmospheric Circulation

Wednesday: The Physics of Rain

Friday: Tropical Cyclones: Hurricanes and Typhoons.

Lab #2: Greenhouse Gases

Suggested reading: Dessler, Chapter 6. Discussion #1 due

Week 5 — 02/08/16— Oceanic Motion

Monday: Earth's Oceans

Wednesday: Ocean Circulation and climate

Friday: The Carbon Cycle

Lab #3: Atmospheric Circulation

Suggested reading: R.Seager: *Is the Gulf Stream responsible for Europe's mild winters?*

Week 6 — 02/15/16— Climate Variability

Monday: no class (President's Day)

Wednesday: Forcings & Feedbacks. The Seasonal Cycle. Monsoons

Friday: El Niño– dynamics and impacts

Lab #4: Oceanic Circulation

Suggested reading: Dessler, chapters 1 – 6. Discussion #2 due

Week 7 — 02/22/16— Midterm

Monday: Droughts and the Dust Bowl

Wednesday: Midterm Review

Friday: Midterm 1

Lab #5: The Seasonal Cycle

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

II History of 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 — 02/29/16— Ice Ages

Monday: Paleoclimatology: the science of Past Climates

Wednesday: Pleistocene Ice Ages: observations

Friday: Pleistocene Ice Ages: astronomical theory

Lab #6: El Niño-Southern Oscillation.

Suggested reading: Dessler, Chapter 5.

Week 9 — 03/07/16— Humans & Climate Change

Monday: Abrupt climate change

Wednesday: Societal collapse and climate change

Friday: The Hockey Stick Controversy

Lab #7: The astronomical theory of Ice Ages

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

SPRING RECESS : March 13 – 20

III Climate in the Age of Man

Week 10 — 03/21/16— Climate Models

Monday: The Anthropocene

Wednesday: Climate Modeling I. Early pioneers

Friday: Climate Modeling II : Global Climate Models

Lab #8: The Temperature Record

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

Week 11 — 03/28/16—Midterm 2

Monday: Midterm Review

Wednesday: Midterm 2

Friday: Detection and Attribution of climate change

Lab #9: The Carbon Cycle, Part 1

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

Week 12 — 04/04/16— Climate Projections

Monday: Climate Denialism 1: Top 10 contrarian points.

Wednesday: Climate Denialism 2: Merchants of Doubt

Friday: Climate change and the media

Lab #10: The Carbon Cycle, Part 2

Suggested reading: Dessler, Chapter 10, 11, 12

Week 13 — 04/11/16— Climate Denial

Monday: The Greenhouse Future

Wednesday: Climate Impacts

Friday: Climate, Energy and Water

Lab #11: How to talk to a climate contrarian

Suggested reading: *Hoffman, Climate Science as Culture War*. Discussion #5 due

Week 14 — 04/18/16— Climate Decisions

Monday: Climate Options

Wednesday: The Economics of Climate Change

Friday: Geoengineering (Guest lecture by J. Lawhead, PhD)

Suggested reading: Dessler, Chapter 9, 13.

Week 15 — 04/25/16— Climate & You

Monday: Climate Policy (Guest Lecture by Ryan Merrill)

Wednesday: Climate change solutions: individual action

Friday: Final Review Session

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

Monday May 9—Final Exam – 8-10am

IV Participation

Class participation is a critical aspect of this course. In takes place in two main avenues : in the classroom and on BlackBoard.

In-class participation

The first way to participate in class is to come to class. I somehow make it to class every day – so should you. However, just parking in the classroom and checking Facebook or Reddit is a waste of your parents' money, so *active participation* is what we're after: ask questions. Offer comments. You're not required to know anything for 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. However, with 240 students in the room, we understand that it can be daunting to raise your hand and speak your mind. So another way to participate is via in-class polls. Every class, I will ask you to answer some questions via a polling software called Top Hat (see corresponding section). Many polls will be informal, only aimed at getting your personal opinion on a climate-related question; those will be anonymous. Other questions will not be. Please do not freak out if you get questions wrong; you will not be graded based on correctness to these questions; only participation. In addition, Top Hat will be the platform of choice for in-class discussions. Again, those discussions will be aimed to elicit your participation, but there will be no right or wrong answer to these.

Together, in-class participation represents 10% of the final grade (more than half a midterm). That is not small potatoes. Treat it seriously.

BlackBoard Discussions

Another way to participate is via BlackBoard discussions. As the semester progresses, we will post Discussion boards related to assigned readings, within a specified time frame. Your participation will be judged by your peers and your TAs. You have the ability to rate your peers' posts, and we hope you will do so constructively.

Again, 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. If you want to get more involved, you can earn extra credit for moderating forums.

Discussions may be accessed via the Assignments tab, or via Tools>Discussions.

V Technology

Blackboard

BlackBoard is our primary mediator. It is where I post class notes, announcements, and assignment. Is is where you access that content, participate in discussions, and check your grades. **It is your responsibility to ensure that your receive BlackBoard announcements**. Make sure you enabled 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.

Top Hat

The tool we will use to gather live, in-class feedback is called Top Hat. You may submit your responses in one of three ways: Text messages, a Smartphone App, or a Web browser. In case you have not received an invitation to join the course on Top Hat, here's how to get started.

The economics are as follows: $20 for a semester-long license or $38 for a 5-year license (unlimited number of classes). **Purchase of a license is required to get in-class discussion points (10% of the grade)**
The course code is 306401.

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.
- Direct all Top Hat issues to the Top Hat customer service, unless they tell you to contact me.
- Don't expect an immediate answer. I have a life too, so it could be some time before I get around to answering your query. 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.
- The correct way to address a professor is "Professor"

Emails that break any one of these rules will not receive an answer. If you can spare the time, please come to office hours or see me after class. I'd much rather talk to a human than a computer, and I have yet to bite a student (fatally). Other email etiquette tips may be found here.

Laptops & Tablets

Laptops and tablets look way cool, but they have proven far less effective than good old pen&paper at information retention. Moreover, their use in the classroom can be disruptive to you and (more importantly) people around you if you use them to watch LOL cats, check Facebook, or otherwise engage in activities that have nothing to do with class. Please exercise best judgment in your use of those tools, and be considerate of others around you.

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.

Responsibility

You're now a grown up. Act like one. If you fail to show up for no good reason, own it.

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.*