General Information

Instructors

Professor: Julien Emile-Geay  ZHS 275  julieneg@usc.edu
Teaching Assistant: Emily Burt   ZHS 3__  eburt@usc.edu

Office Hours  T-Th 13:30-15:00 in ZHS 275, or by appointment.

Where/When  Class meets Tues/Thurs, 15:30–16:50 in GFS207.
Recitations meet Mon at 10 or 11 for 1h in ? (register separately).

Course Description

Synopsis  Today there is a quasi-absolute scientific consensus that human activities are warming the planet, despite some fierce resistance in sectors of the public sphere. How did we go from the idea that Earth was too vast and powerful for humans to possibly change, to the recognition that Earth’s surface is a collection of fragile ecosystems that humanity must manage and preserve for its own survival? This class will survey the discovery of global warming. Its nearly 200-year history mirrors the fundamental progress of fundamental physics and chemistry, like quantum physics, electromagnetism, fluid dynamics, biogeochemistry, radioisotope chemistry, chaos theory, supercomputing, state estimation, and the theory of complex adaptive systems. The journey will teach us much about the nature of scientific inquiry, the culture of “organized skepticism”, and the emergence of scientific consensus based on a consilience of evidence involving direct and indirect observations, as well as experiments in silico.

Requirements  An open mind

Books

Required Books


Supplemental Reading

The class is worth 4 units, which means that it requires substantial work. Lab attendance is mandatory (register separately, please). Labs are graded weekly and administered by Teaching Assistants (see separate lab syllabus). Exams are all multiple choice questions. The final (2h) is cumulative.

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**Schedule**

**I HEAT, ATOMS AND LIGHT**

**Week 1 — 08/20/18— What is there to discover?**

**Reading:** Weart, Chapter 1.

**Tuesday**  A brief history of global warming. Climate’s Three Big Questions.

**Thursday**  Earth’s temperature: Fourier’s Footing and Fourier’s Foray

**Week 2 — 08/27/18— What is temperature?**

**Reading:** Fourier, 1827. TBD (Mueller, Chap 1 -2?) Pierrehumbert, [2004].

**Tuesday**  The kind of motion we call heat. Enthalpy and the First Law.

Week 3 — 09/03/18 — Radiant Energy
Tuesday  The Nature of light. Maxwell’s equations. Planck’s law
Thursday  Light & Matter. The Quantum Revolution.

Week 4 — 09/10/18 — Planetary Energy Balance
Reading:  Pierrehumbert [2011]. Plass 1956 + nytimes story
Tuesday  The Greenhouse Effect
Thursday  Climate Feedbacks

Week 5 — 09/17/18 — Taking Earth’s temperature
Reading  A vast Machine, Chap 1. Callendar, 1938 Simple Climate, Callendar I & II
Tuesday  Instrumental (in-situ and remote) observations.
Thursday  Data infrastructure: Callendar’s Quest

Week 6 — 09/24/18 — The Carbon Cycle
Reading  Climate via the Heart of the Atom Simple Climate: Broecker. Simple Climate: Keeling.
Friday  Scripps Visit?

II FROM ATOMS TO PLANETS
Week 7 — 10/01/18 — Atomic Science, Cold War Science
Reading:  Changing concepts in the balance of nature Simple Climate, Dansgaard
Tuesday  Nuclear Physics: isotopes and atomic bombs
Thursday  Cold War Science (A. Lakoff)
Assignment  Midterm Paper due.

Week 8 — 10/08/18 — Space and Time
Reading  Weart: Venus & Mars; The Sixth Extinction
Tuesday  A journey in space: Mars, Earth, Venus and the solar system
Wednesday  Ken Nealson guest lecture
Thursday  A journey in time: from the Big Bang to the Anthropocene
Friday  Field trip to JPL?

Week 9 — 10/15/18 — Paleoclimatology
Reading:  Weart: Ice Age Cycles; Simple Climate: Milankovitch.
Tuesday  Quaternary Ice Ages
Wednesday  movie night: Taking Earth’s temperature
Thursday  Cenozoic climate change

Week 10 — 10/22/18 — Climate modeling
Assignment  Schmidt: the physics that we know; Simple Climate: Manabe; Weart: GCMs
Tuesday  Conservation Laws & Noether’s theorem.
Wednesday  The computing revolution
Thursday  Richardson’s “Forecast Factory”

Week 11 — 10/29/18 — Chaos and Order
Assignment  What is Chaos Theory?. Weart, "Chaos".
Tuesday  Laplace and Lorenz: living on a butterfly’s wings
Thursday  The science of prediction (guest lecture by Tom Jordan)

Week 12 — 11/05/18 — Experiments in silico
Reading  Oreskes & Conway: The Collapse of Western Civilization; Weart: Impacts
Tuesday  Detection and Attribution of climate change. Impacts.
Wednesday  movie night: Chasing Ice
Thursday  Climate Projections & Uncertainties

III  SCIENCE: FROM WAR WINNER TO CULTURE WAR

Week 13 — 11/12/18 — On the shoulder of giants
Tuesday  Scientific progress, scientific consensus
Thursday  Good Science, Bad Science, and Ugly Science
Reading  How do you know a paper is legit?; Schermer: Why Climate Skeptics Are Wrong.

Week 14 — 11/19/18 — The Psychology of Flawed Reasoning
Assignments  Podcast: tribal psychology
Tuesday  motivated reasoning, confirmation bias, identify-protective cognition

Thanksgiving Break Nov 21–25

Week 15 — 11/26/18 — Climate Science in the Public Sphere
Reading  Weart, Climate and the Public, part 1 & part 2; Hoffmann: Climate Science as Culture War
Tuesday  The American Denial of Global Warming
Wednesday  Movie night: Merchants of Doubt
IV Participation
Class participation is a critical aspect of this course. The first way to participate in class is to come to class. However, active participation is what we’re after: ask questions, offer comments. You are 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.

V Final Paper
Develop your own topic, or choose from one of the following: From Stasis to Crisis; Biosphere to Noosphere; Science & Agnotology; Civilization as a geosystem; Natural Laws vs Human Nature;

VI 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 contain 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. If it still doesn’t, please email me.

Email etiquette
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. 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 people around you if you use them for activities unrelated to the class. Please exercise best judgment and be considerate of others around you.

VII Academic Conduct
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

Student Counseling Services (SCS)  (213) 740-7711 – 24/7 on call
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.
https://engemannshc.usc.edu/counseling/

National Suicide Prevention Lifeline – 1-800-273-8255
Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.
http://www.suicidepreventionlifeline.org

Relationship & Sexual Violence Prevention Services (RSVP)  – (213) 740-4900 – 24/7 on call
Free and confidential therapy services, workshops, and training for situations related to gender-based harm.
https://engemannshc.usc.edu/rsvp/

Sexual Assault Resource Center For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: http://sarc.usc.edu/

Office of Equity and Diversity (OED) (Title IX compliance)  – (213) 740-5086
Works with faculty, staff, visitors, applicants, and students around issues of protected class. https://equity.usc.edu/

Bias Assessment Response and Support Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. https://studentaffairs.usc.edu/bias-assessment-response-support/

Student Support & Advocacy  – (213) 821-4710
Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic.
https://studentaffairs.usc.edu/ssa/

Diversity at USC Tabs for Events, Programs and Training, Task Force (including representatives for each school), Chronology, Participate, Resources for Students.
https://diversity.usc.edu/
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.