

GEOL 150
Climate Change
4 Units
Fall 2021, Lecture M, W, F, 10:00-10:50am
Taught in Class Monday and Wednesday and
Prerecorded lecture on Friday

Instructor: Professor, Lowell D. Stott, Department of Earth Sciences
Office Hours: MWF: 11-12
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Teaching Assistants: TBD

Lecture: Monday (in class), Wednesday (in class), and Friday (Online), 10:00-10:50 a.m.
Lecture Hall SAL 101
Laboratory Sections: See schedule

Textbook: None required. Reading will be from provided materials

Course Description: Climate variability and change is potentially one of the most serious challenges the world has ever faced. This class will examine the scientific basis of global warming and future climate change and the possible impacts that will accompany that change. We will examine the factors that influence climate system behavior on our planet. To provide perspective on the climate changes taking place today we will also examine how the Earth's climate has varied in the past, prior to the short period that humans have inhabited the planet. We'll see that the Earth has experienced significantly different climate conditions in the past. There are important lessons to be learned from Earth's past. We will learn how scientists are estimating how the climate will change in the future, depending on the amount of greenhouse gas the accumulates in the atmosphere. We will end by looking at how society can engage in mitigation strategies to avoid the worst climate change outcomes.

Learning Outcomes: Students will gain an understanding of the major processes that affect the Earth's climate system including the energy balance that maintains the atmosphere's temperature and distinguishes our planet from every other planet in the solar system. Students will learn how the sources of greenhouse gas concentrations vary over time, contributing to climate change and the impact of climate change on the droughts, flooding, health, and the economy. Students will also learn how climate science is carried out and how new scientific knowledge can aid in policy decision making.

e-Book (Not Required): If you'd like to have a text for your personal library and for use in this class, I recommend, **Our Changing Climate: Introduction to Climate Science**. The author is

Chad Kauffman. The book is published by the American Meteorological Society as an e-book. You can purchase a rental at the following link: <https://edubooks.ametsoc.org/CLTX-Ed1>.

In Class Questions: You'll be asked questions during lecture. These will provide feedback to me so that I understand how well you are understanding the material we are discussing.

Midterm Exams. Two midterm exams will be conducted. Each is 50 questions, multiple choice. The questions are taken from Lecture.

Laboratory: You are required to do a laboratory section, which will be taught by a TA. These labs provide experiences designed to give you exposure to how climate science is conducted and how scientists formulate visualize data and then form hypotheses that are tested against observations and model experiments.

Grading: Details about grading are summarized at the end of the syllabus. Scores on all assignments and exams will be posted on Blackboard.usc.edu

Academic Integrity: University policies on academic dishonesty are printed in SCAMPUS and SJACS, s. Because cheating negatively affects everyone in the class, we will follow USC guidelines and report all academic misconduct. USC policies on cheating are strict and the minimum punishment is a "0" on the assignment. The instructor and TA's are always available for extra help and advice. If the Prof. thinks you are at risk of failing the course, he will let you know via email and will encourage you to get extra help.

Disability Services: Students requesting academic accommodations based on a disability are required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP when adequate documentation is filed; *please be sure the letter is delivered to the professor as early in the semester as possible, and at least 2 weeks prior to the first midterm.* DSP is open Monday-Friday, 8:30-5:00. The office is in Student Union 301 and the phone number is (213) 740-0776.

Course Syllabus

PART I- Earth's Climate as a Dynamic System

Week 1

Mon. Aug. 23, Introduction: The Scientific Method, Questions, Hypotheses, Theory

Wed. Aug. 25, Importance of Earth's Climate System

Fri. Aug 27, Current Climate Paradigm

Week 2 Observing Climate Change

Mon. Aug. 30, Climate System Variables, Observing, Detecting and Assessing Change vs Variability

Wed. Sept. 1, How Climate System Observations are used by scientist to understand Climate System behavior

Fri. Sept. 3, Review of Climate Observations

Week 3 Tools for Investigating Earth's Climate

Mon. Sept. 6, **Labor Day Holiday**

Wed. Sept. 8, Defining Climate Zones on Earth (Deserts, Rainforests, Ice Caps etc)

Fri. Sept. 10, Observations and Analysis of Climate Change

PART II Principles of Climatic Processes

Week 4 Radiation Flux and Heat within the Climate System

Mon. Sept. 13, Energy and Entropy (Energy Distribution, The Greenhouse Effect)

Wed. Sept. 15, Global Radiation (Incoming vs Outgoing Energy)

Fri. Sept. 17, Global Radiation (continued)

Week 5 Water in Earth's Climate System

Mon. Sept. 20, Earth's Energy Budget Discussion (continues from last week)

Wed. Sept. 22, Properties of Water in Earth's Climate System

Fri. Sept. 24, Clouds and Precipitation Types

Week 6 Global Atmospheric Circulation

Mon. Sept. 27, **Midterm 1**

Wed. Sept. 29, Forces that Cause Air to Move

Fri. Oct. 1, Forces that Cause Air to Move

Week 7 Atmosphere-Ocean Relationships

Mon. Oct. 4, Atmospheric Circulation

Wed. Oct. 6, Ocean Circulation

Fri. Oct. 8, A Changing Ocean in a Changing Climate (carbon uptake, ocean

acidification, sea level rise)

PART III Climate Variability vs Climate Change

Week 8 Natural Drivers of Climate Change

Mon. Oct. 11, Natural Drivers of Climate Variability and Change

Wed. Oct. 13, Short and Long-term Feedbacks that influence Climate Behavior

Fri. Oct. 15, **Fall Recess**

Week 9 Paleoclimatic (Past Climate Changes): Lessons from Past Climate Changes

Mon. Oct. 18, Reconstructing Earth's Climate of the Past

Wed. Oct. 20, Climate Changes over Geologic Time

Fri. Oct. 22, The Appearance of Humans and the Pleistocene Ice Ages and CO₂

Week 10 Future Climate Projections: Numerical Climate Model Simulations

Mon. Oct. 25, What is a Climate Model and What does it do?

Wed. Oct. 27, How do Scientists Conduct Climate Model Experiments to Assess the Future?

Fri. Oct. 29, Assessing Model Skill and Uncertainties

PART IV Our Relationship to Climate Variability

Week 11 Human Involvement

Mon. Nov. 1, **Midterm 2**

Wed. Nov. 3, The Intergovernmental Panel on Climate Change (IPCC)

Fri. Nov. 5, Future Greenhouse Gas Emission Scenarios and Atmospheric CO₂

Week 12 Climate Change Projections (Pathways for the future)

Mon. Nov. 8, Future Climate Change Projections from Models

Wed. Nov. 10, Future Climate Simulations from Models

Fri. Nov. 12, How do the IPCC Scenarios Project onto the Future?

Week 13 Human Needs vs Mitigation Strategies

Mon. Nov. 15, How are humans influencing Earth's Energy Budget?

Wed. Nov. 17, Mitigation

Fri. Nov. 19, Adaptation

Week 13 Human Needs, Actions and Public Policy

Mon. Nov. 22, Climate Policy Making at the National and International Level

Wed. Nov. 24, In class discussion about prospects for intervention

Fri. Nov. 26, **Thanksgiving Break**

Week 13 Human Needs, Actions and Public Policy

Mon. Nov. 29, Communicating about Climate and Climate Change

Wed. Dec. 1, In Class Discussion about Communicating about Climate Change

Fri. Dec. 3, **Final Day of Class-Summary**

Week of Dec. 8-15 Final Exams

Course Policies and Grading

Grading and Grade Calculation

Lab Portion: 33% of course

In class Exams: 33% of course. 2 midterms

Final exam: 33%

Calculating Your Final Course Score

$(0.33 * \text{Lab}) + (0.33 * \text{Midterms}) + (0.33 * \text{Final Exam}) = \text{Final Score}$

Notes about Exams

Midterm Exams (2), 50 questions. Multiple Choice. Each question is worth 1pt.

Final exam 100 questions. Multiple Choice Each question is worth 1pt. Approximately ½ of the questions will be based on material from midterms 1 and 2.

No early exams are allowed.

Exams must be taken at the scheduled time unless special circumstances justify.

Students who do not take an exam receive zero points as a grade on that exam.

Make-up exams can be only taken in cases of illness or family emergency or other university event.

Make-up exams are scheduled and set by the instructor.

Notes about Grade Curves

A curve is applied to the final score distribution at the end of the semester.

USC Statement on Academic Conduct and Support Systems

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 Part B, Section 11, “Behavior Violating University Standards” policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct>.

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. 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. www.suicidepreventionlifeline.org

Relationship and 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. 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: 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. 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. studentaffairs.usc.edu/bias-assessment-response-support

The Office of Disability Services and Programs

Provides certification for students with disabilities and helps arrange relevant accommodations. dsp.usc.edu

Student Support and Advocacy – (213) 821-4710

Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. studentaffairs.usc.edu/ssa

Diversity at USC

Information on events, programs and training, the Diversity Task Force (including representatives for each school), chronology, participation, and various resources for students. diversity.usc.edu

USC Emergency Information

Provides safety and other updates, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible. emergency.usc.edu

USC Department of Public Safety – UPC: (213) 740-4321 – HSC: (323) 442-1000 – 24-hour emergency or to report a crime.

Provides overall safety to USC community. dps.usc.edu