

EV 128: Introduction to Global Climate Change, Block 1, 2017

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Goals and Scope of the Course | The goal of this course is to give you a solid, scientific understanding of how the climate system operates and how and why climate change occurs. You will learn about climate from a whole-earth point of view that takes into account interactions between the atmosphere, terrestrial biosphere, cryosphere, and oceans.

A major focus of study will be current climate change and the impacts of climate change on ecosystems. In addition, we will consider historical climate change, natural climate variability, and the impacts of these changes on ancient societies and ecosystems. I expect you to leave this class better prepared to make day-to-day decisions based on sound understanding, accurate information, and reasonable conjectures, regardless of the exact career path that you take. You can expect to learn the following things:

- What the term 'climate' refers to and how it varies spatially
- What factors influence climate at any one place
- How climate impacts other aspects of the surface environment (e.g. processes of the terrestrial and marine hydrosphere, the atmosphere, and biosphere = 'critical zone') & the ability of humans to utilize this environment (e.g. live, farm or otherwise occupy it)
- What the possible causes of climate change are over time
- Examples of climate change in the past & our current 'climate context'
- How humans have responded to climate change in the past
- Climate change and associated impacts in the immediate future & possible human responses

Class Structure | Classes will begin at 9 AM and will involve a mix of lectures, labs, and discussions. There will be some lab activities that we will not be able to complete before 12 PM, I have noted these days on the schedule (see below). While you are not required to come to the afternoon session to finish the lab, I strongly encourage you to block out these times in your schedule so you can take advantage of the time *if* you need it. In addition to these help sessions, please utilize the QRC for additional assistance.

In our sessions I will introduce new concepts, and we will usually do a few exercises during the day to reinforce these concepts. Every evening as a review you should do the assigned reading and make notes on anything that still confuses you. There will be *several* occasions where you will need to be able to answer questions on this reading and/or material covered in previous classes – these short exercises serve multiple purposes: it provides me feedback on concepts you may be having trouble with, helps keep you engaged with the material outside of the classroom, and provides you a way to assess how you are doing (answering these questions will count towards your grade). We will always go over any questions you have before going on to new material – so if you have a question, please ask! Keep in mind that study groups are a great way to learn and review the different concepts of climate! I encourage you to work with your classmates on all assignments, of course with the exception of exams.

Required Reading

- Dessler, Andrew. 2016. *Introduction to Modern Climate Change*. 2nd edition. Cambridge University Press.
- Chapters and articles posted on Canvas

Field Trips | In addition to the above activities, we will be going on two field trips – a one-day trip to Florissant Fossil Beds National Monument and a 3-day trip to the Mountain Research Station at Niwot Ridge during week three of the block. You must sign up for the trips on Summit https://apps.ideal-logic.com/ccfieldstudy?key=29L66-D685_K9KH-5PTF_c9422255 (link is also on Canvas) – sign the consent form and fill out the medical form. I will pass around a sign up for food for the 3-day field trip in class, I ask that you bring a lunch for the Florissant field trip. To find out more about Niwot Ridge and the Mountain Research Center check out their website: niwot.colorado.edu.

Office hours | I will have office hours on most Monday and Wednesday afternoons (in addition to the course help sessions). You can sign up for time here: <https://docs.google.com/document/d/1SsmI2OFSs11uvYvIbZTuyX6Wj2SCHJS1ylFDmBs85y4/edit?usp=sharing>. If these times do not work for you please talk with me before or after class – I am sure we can find a time to meet.

Attendance | We will be covering a lot of material in this course, with every day building on the previous day. Therefore, it is necessary that you show up for *every* class, with the exception of lab days marked as optional on the schedule. If you have two unexcused absences, the Dean of Students will be notified. Please note that if you get sick during the block I will do everything I can to help you catch up on the material – but you *must* have a note from Boettcher or a doctor.

If you need to miss class for any justifiable reason during the block (e.g., athletic team travel, religious observance), please notify me **today** so we can make arrangements on how you will receive the material for that day.

Canvas & Online Questions | I will use Canvas extensively throughout the course. I will do my best to have readings posted multiple days in advance. In addition, there will occasionally be questions and/or writing prompts on Canvas that you must complete. These will always be posted by 5 PM for the following day (due by 9 AM). The goals of these questions/prompts is for me to (1) assess your comprehension on material, (2) to get you to start thinking about the material prior to classroom discussions, and (3) introduce you to how I ask questions so you are better prepared for quizzes.

Exams & Projects | There will be **one exam** in the course (2nd Friday of block). The exam will ask you to integrate material covered in lecture, discussions, and labs, as well as material from the textbook and readings. The exam is closed book and you should take no longer than 2-3 hours (though *all* students will have up to 6 hours to complete it). If you require additional time to take exams, please talk to me and schedule your day accordingly.

There will be **three labs** during the course. Each will involve some type of summary report, although these will vary from short and informal to long and in scientific format.

During the third week of the course, while at **Niwot Ridge**, you will receive several data sets that you will analyze, in groups, to answer questions about how the local climate and climate forcers have varied over the last few decades. Reflecting upon the analysis you do in small groups, you will explore one ecological consequence of shifting climate in mountain ecosystems. You will work in groups to examine the data provided and the scientific literature. You will individually work on a scientific abstract, figures, and an annotated bibliography. More details will be provided in week 3.

There are several misconceptions about climate change circulating in the public and amongst our elected officials. Some of these misconceptions are rooted in the general public's lack of scientific literacy while others were deliberately created as part of misinformation campaigns. After three weeks of immersing yourself in climate science you will create a short **Climate Change Public Service Announcement** (live action, animated, or a combination). You will work in groups on this project and they will be viewed (and graded) by the class on the last Wednesday of the block. Details will be discussed in class & posted on canvas. In addition, as a "warm up" for the PSA you will have two small **climate communication** assignments translating scientific concepts into easily digestible snippets of information (twitter/Instagram/blog/infographic).

Grading:

Labs & In-class exercises	15%
Exam	35%
Mountains and Climate Change Project	30%
Climate Change PSA	10%
Participation	10%

Grade Assignment ("+" and "-" will also be given when appropriate):

A = 90.0-100%

B = 80.0-89.9%

C = 70.0-79.9% S = 70.0-100%

D = 65.0-69.9% CR= 65.0-69.9% NC = below 65.0%

D+, D, CR, and NC do not fulfill EV Department major requirements.

Late assignment policy | Late assignments will get a deduction of 1/3 of a letter grade (3%) for every day it is late (part of 1 day counts as a day). For example, if the paper is due Monday at 9AM and you turn it in at 3PM on Monday, that would count as being 1 day late and the grade would go from a B to B-. There are a few instances when late assignments will not be accepted (e.g. when we are doing peer review) – these are noted on the syllabus.

Honor Code | Failure to properly document sources in papers, plagiarism, copying from other student's work, or turning in assignments that have already been submitted for credit in other courses are among some of the actions considered intellectual theft under the Colorado College Honor System. I encourage you to work together and talk through problems and assignments, but

your final work must be your own. I will give you further information on how the honor code applies to specific assignments as we go. If you are uncertain about the Honor Code's application to a particular project, please ask me. If you have questions or to read further details of the Honor Code see: <http://www.coloradocollege.edu/other/honorcouncil/constitution-bylaws/constitution.dot>

Disability Accommodations | If you have a disability and require accommodations for this course, please speak with me privately today or tomorrow so that your needs may be appropriately met. You may also simply email me your accommodations letter, if I have questions I can ask you. If you have not already done so, you will need to register with Accessibility Resources (Learning Commons in Tutt Library, 227-8285), the office responsible for coordinating accommodations and services for students with disabilities.

Tentative Course Schedule | The course will be broken up into ~4 sections: the climate engine & causes of change, climate change over thousands and millions of years (past), climate change effects on modern ecosystems (present), and climate communication. Each day's lectures, labs, and discussions will be based upon a question that we will try and answer. By the end of the course, you should be able to have a meaningful discussion about these questions.

The syllabus and schedule is subject to change depending on progress of the course.

Week 1: The Earth's Climate Engine

Day 1 – The Earth as a System

- Course Introduction & The Earth as a System

Day 2 – Radiation Balance

- Dessler Chapters 1, 2.1, & 3
- Radiation Balance (GIS Lab) – GIS Lab in Tutt Library
- *optional* extra help session from 1:30 - 3:30 PM - GIS Lab in Tutt Library

Day 3 – How Greenhouse Gases Work

- Dessler Chapter 4
- *Skim* Archer Chapter 4 [on Canvas]
- **GIS Radiation Balance due 5 PM** [submitted on Canvas]

Day 4 – Atmospheric & Ocean Circulation

- Ruddiman Chapter 2, sections 2.3- 2.8 [on canvas]
- *Optional reading: Kump Chapters 4 & 5 (additional background)* [on Canvas]
- Imaginary Earth Lab - *optional* extra help session from 1:30 - 3:30 PM

Day 5 – Feedbacks & Intro to Carbon Cycling

- Ruddiman pgs 8-13 [on Canvas]
- Ruddiman Chapter 2, pgs 30-35 [on Canvas]
- Dessler Chapter 6

- **Imaginary Earth Lab due 4 PM** [submitted on Canvas or in Professor Barnes' mailbox, Tutt Science 130]

Week 2: Climate of the Past

Day 6 – Carbon Cycling and Long Term Change

- Dessler Chapter 5
- Ruddiman pgs 84-91, 110-118, 138-155 [on Canvas]

Day 7 – How do we know what past climates looked like?

- **FIELD TRIP: Florissant Fossil Beds National Monument Meet @ 7:45 AM in front of Tutt Library on Cascade**
- What are proxies? Ruddiman pgs 56-69 [on canvas]

Day 8 – Intermediate Climate Change

- Ruddiman Chapter 10 [on Canvas]
- Kump Chapter 14, pgs 279-287 [on Canvas]
- *Optional:* Dessler Ch 7 brief overview

- Vostok Ice Core Lab *optional help session 1:30 – 3:30*

Day 9- Abrupt Climate Change & Short Term Climate Change

- Zachos et al. 2008 [on Canvas]
- *C-M:* Kump 2011 *or P-W:* Nash 2008 [on Canvas]
- Kump Chapter 15, skim 2nd part on ENSO [on Canvas]
- **Vostok Ice Core Lab due at 5 PM** [submitted to Canvas]

- Review/help session TBA

Day 10

- **Exam** closed-book, in-class. Starts at **9 AM**

Week 3: Climate of the present

Day 11 – How we measure change today

- **Niwot Field Trip! Meet 7:45 AM Tutt Science Circle**, leaving promptly at 8 AM
- Mountain Research Station (near Ward, CO)

Day 12 – Ecosystem response to modern climate change

- Mountain Research Station

Day 13 – Niwot Project Work Day

- Leave Mountain Research Station ~ 12 PM, back on campus by 3 PM

Day 14 – Niwot Project Work Day

- Group meetings with Professor Barnes. Sign up here:
<https://docs.google.com/document/d/1SsmI2OFSs11uvYvIbZTuyX6Wj2SCHJS1ylFDmBs85y4/edit>

Day 15 – Peer review of project elements

- **Niwot draft abstract and one figure** due by 8 AM on Canvas – *late work will not be accepted.*
- Group meetings with Professor Barnes. Sign up here:
<https://docs.google.com/document/d/1SsmI2OFSs11uvYvIbZTuyX6Wj2SCHJS1ylFDmBs85y4/edit>

Over the weekend:

- **Niwot Project due, Saturday 12 PM. Final** versions of **abstract, figures,** and **annotated bibliography** [uploaded to Canvas] -- *late work will not be accepted.*

Week 4: Climate Change and People

Day 16 – Climate & Civilization

- Alley et al. 2005 *Science* [on canvas]
- Read assigned article [all on canvas]
Maya | Mesa Verde | Akkadian | Saharan
- Guest Speaker: Todd Sanford, Climate Central

Day 17 – Climate Communication

- U.S. Opinions on Climate Change – know your audience.
 - Yale Program on Climate Change Communication
(<http://climatecommunication.yale.edu/visualizations-data/ycom-us-2016/>)
 - *Skim* Politics & Global Warming – May 2017 (YPCCC Report)

Day 18 – Climate Change PSA Presentations