

Climate Change, Past and Present

PHYS 165

Instructor: Stephanie Spera

Office:

Science Center 1332

Email:

spera_stephanie@wheatoncollege.edu

Time and Location:

Lecture:

Tuesdays and Thursday 2-3:20 pm

Science Center 1343

Office Hours:

Tuesday 10 am – 12 pm

By appointment

Course Description

The Earth's climate is changing. Has the Earth's climate changed before?

How and on what time scales? What does this mean for us? In this class, we'll will learn about the feedback systems that naturally regulate the earth's climate, discuss how climate has changed and why it's changing now, and the means by which scientists understand these changes. Although we'll focus on learning the physics and chemistry behind earth's climate change, because this is a Connections course, we'll also discuss and write about climate change and its relevance to policy and current events.

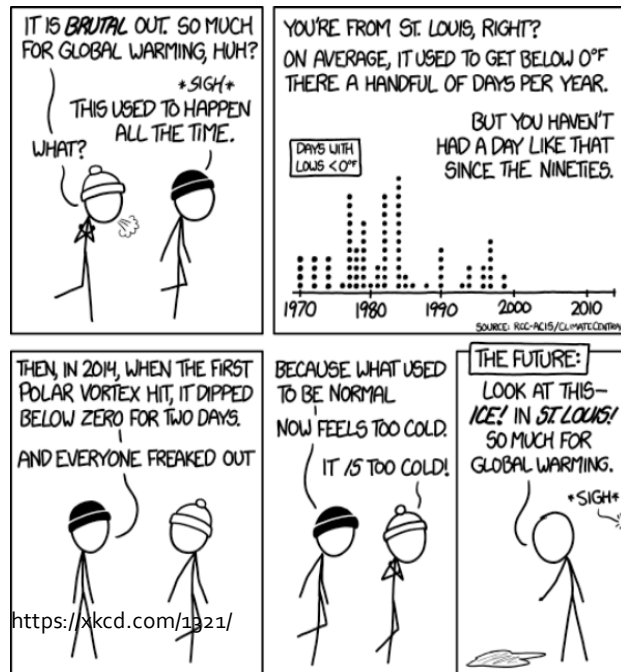
You will come away from this class with an understanding of:

- 🌀 Positive and negative feedbacks
- 🌀 Long- and short-term controls on the global energy balance
- 🌀 The composition and structure of the atmosphere and oceans
- 🌀 The means by which scientists reconstruct past climates
- 🌀 The earth's climate history
- 🌀 Observed climate changes over the past 250 years
- 🌀 The means by which scientists create projections of future climate

Course Objectives

Upon completion of this course, you should be able to:

- 🌀 Understand positive and negative feedbacks related to the Earth's climate system
- 🌀 Describe and explain the natural variations in the Earth's climate
- 🌀 Understand how scientists determine the differences between natural climate variability and anthropogenic climate change



- 👂 Critically evaluate the climate science presented in the popular press and media
- 👂 Approach life with the cautious skepticism inherent in a scientist

Course Work

This will be a participation heavy class. I believe that the best way to learn is by doing, so during our lectures, there will a lot of be in-class activities and short quizzes (that minimally affect your participation grade) that let me know both how well you are learning the material and how well I am teaching the material. You will be expected to do the material readings before each Tuesday class, because before each Tuesday class, you will have to answer three simple questions on the OnCourse website regarding the reading material. This is your class, and the answers to these questions will help me determine which material to focus on and expand upon during class time. There may also be short, in-class quizzes about the reading and the lectures. These will all count toward your participation grade.

Every Thursday we will be using what we've learned to critically evaluate published academic papers, science articles in the popular press, and news opinion pieces on the subject. I've picked out some of my favorite pieces, but if you come across an article that you want to share with the class, send it along, you'll get bonus points on your weekly assignment, and I may swap my article or paper out for yours.

The assignments for this course are designed to facilitate learning with two distinct goals: conceptual knowledge and practical applications. There will be weekly graded problem sets that build off of our lectures and in-class activities and discussions. These assignments may involve math, short answer questions, or completely written assignments. One assignment to note is the "Connections" essay. Because this class is part of a Connection entitled "Politics and Global Change", you will pick a climate-change-policy problem opinion piece, evaluate the climate science presented in the piece and present what you think the best solution would be.

Required Textbooks

(which can be rented on the cheap from Amazon)

Kump, Kasting, and Crane *The Earth System* (Third Edition)

Archer, David *Understanding the Forecast*

There will be other readings posted on the class website.

Rubric

Class participation (10%)

Weekly assignments (30%)

Midterm (15%)

Connections essay (15%)

Climate negotiations activity (15%)

Final (15%)

Prerequisites

A familiarity with high school physics, chemistry, and algebra.

Course Policies

Attendance is expected at all times. It will only work in your favor to attend all classes. Participation is heartily encouraged, especially as in-class assignments and discussions will comprise a large portion of class time.

If you have any questions, don't be afraid to ask them. I'll try my best to answer them: that's why they pay me the medium-bucks.

We will foster an inclusive and respectful environment in the classroom. Students from different backgrounds and perspectives make courses interesting, especially when we talk about current events, case studies, and papers.

Late work will not be accepted. However, I understand that sometimes life gets in the way, so if you know you're going to have a problem turning in an assignment, e-mail me or stop by my office to chat.

All students are expected to abide by Wheaton's Honor Code:

As members of the Wheaton community, we commit ourselves to act honestly, responsibly, and above all, with honor and integrity in all areas of campus life. We are accountable for all that we say and write. We are responsible for the academic integrity of our work. We pledge that we will not misrepresent our work nor give or receive unauthorized aid. We commit ourselves to behave in a manner which demonstrates concern for the personal dignity, rights and freedoms of all members of the community. We are respectful of college property and the property of others. We will not tolerate a lack of respect for these values.

I accept responsibility to maintain the Honor Code at all times.

Fun Resources

NASA's Earth Now app

<http://earthobservatory.nasa.gov/>

<http://dotearth.blogs.nytimes.com/category/climate-change/>

Calendar

| Topic | Tuesday | Thursday |
|---------------------------------------|----------------------------------|---|
| Course Overview & Feedbacks | | 28-Jan |
| Feedbacks & the Global Energy Balance | 2-Feb Archer Ch.2; Kump Ch. 2 | 4-Feb OnCourse Reading Assignment 1 Out |

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| The Greenhouse Effect Part 1 | 9-Feb <i>Archer Ch. 4; Kump Ch.3</i> | 11-Feb <i>OnCourse Reading</i> Assignment 1 Due Assignment 2 Out |
| The Greenhouse Effect Part 2: The Empire Strikes Back | 16-Feb <i>Archer Ch. 3, 5</i> | 18-Feb <i>OnCourse Reading</i> Assignment 2 Due Assignment 3 Out |
| Atmospheres and Oceans | 23-Feb <i>Kump Ch. 4, 5</i> | 25-Feb <i>OnCourse Reading</i> Assignment 3 Due Assignment 4 Out |
| Carbon, amirite | 1-Mar <i>Archer Ch. 7, 8; Kump Ch. 8</i> | 3-Mar <i>OnCourse Reading</i> Assignment 4 Due |
| Earth's Climate History & Mid- semester Feedback | 8-Mar | 10-Mar MIDTERM |
| SPRING BREAK, WOO! | | |
| Earth's Climate History & Milankovitch Cycles | 22-Mar <i>Kump Ch. 12; Ruddiman Ch. 9</i> | 24-Mar <i>OnCourse Reading</i> Assignment 5 Out Connections Essays Topic Due |
| Ice Ages | 29-Mar <i>InnovationLabs; Kump Ch. 14</i> | 31-Mar <i>OnCourse Reading</i> Assignment 5 Due Assignment 6 Out |
| Short Term Climate Variability | 5-Apr <i>Ruddiman Ch. 17</i> | 7-Apr <i>OnCourse Reading</i> Assignment 6 Due |
| Climate Post-Industrial Revolution | 12-Apr <i>Archer Ch. 11; Kump Ch. 15 to pg. 313</i> | 14-Apr Essay Draft Due <i>OnCourse Reading</i> Assignment 7 Out |
| GCMS & Climate Projections | 19-Apr <i>Kump Ch. 15 313-end, Ch. 16</i> | 21-Apr |

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| | | <i>OnCourse Reading Assignment 7 Due</i> |
| Climate Negotiations WEEK | 26-Apr | 28-Apr <i>Connections Essay Due</i> |
| Review & Semester Feedback | 3-May Built in flex-day | 5-May Review & Semester Feedback |

FINAL. THURSDAY 5/12 at 2 pm