

Instructor: Mea S. Cook
Office: Bronfman 162
Phone: 413-597-4541
Email: Mea.S.Cook@williams.edu

Office hours are by appointment, or whenever my office door is open. You can stop by, phone, or email me with questions. I am usually in the office 8AM to 6PM on weekdays.

Course description

There is growing public and scientific interest in the Earth's climate and its variability. This interest reflects both concern over future climate changes resulting from anthropogenic greenhouse gas emissions and growing recognition of the societal and economic impact of climate change, especially in the developing world. Understanding the Earth's climate system and predicting future climate changes require both study of parameters that control present-day climate and climate changes in the past. In this course, we will review the processes that control the Earth's climate, like solar radiation, the greenhouse effect, ocean and atmosphere circulation, ice, plate tectonics, and climate feedbacks. We will then review the geological record of climate changes in the past and study the mechanisms behind them. Laboratory exercises and problem sets will emphasize quantitative problem solving skills, including developing and applying numerical models of the climate system.

Course format

Lecture MWF 9:00–9:50AM. Lab W 1:00–4:00PM every other week. Evaluation is based on weekly problem sets and labs (25%), two hour exams and a final exam (25% each).

Textbook

We will be using two texts, which are available at Water Street Books. There will be additional readings distributed during the semester.

David Archer, 2012, Global Warming: Understanding the Forecast. John Wiley and Sons, Hoboken, NJ. ISBN 9780470943410 (DA)

William F. Ruddiman, 2008. Earth's Climate: Past and Future. W. H. Freeman and Company, New York, NY. ISBN 9780716784906 (WFR)

Honor code

The Williams College Honor Code applies to all written work in this course. I encourage you to discuss the assignments with me and with each other, but ***I expect each student to independently complete each part of each assignment in their own words and relying on their own understanding.*** If you have questions at all how the Honor Code applies in this class, I'm happy to discuss it with you.

Late work

Assignments are due at the beginning of class on the day it is due. Late work is penalized by 10% per day.

Syllabus (Revised 2 April)

Date	Lecture topic	Textbook reading	Lab topic
3-Feb	Introduction		
6-Feb	Blackbody radiation	DA Ch. 2	
8-Feb	Greenhouse effect	DA Ch. 3	
10-Feb	Structure of atmosphere	DA Ch. 4	
13-Feb	Heat	DA Ch. 5	
15-Feb	Atmospheric circulation	SGP 93–105	Habitable planets ¹
17-Feb	No class, Winter Carnival		
20-Feb	Regional climates, weather	SGP 106–124	
22-Feb	Oceans and ocean feedbacks	SGP 125–139	
24-Feb	Cryosphere and ice feedbacks	TBA	
27-Feb	Biosphere and carbon cycle feedbacks	DA Ch. 8	
29-Feb	Feedbacks	DA Ch. 7	Daisyworld ¹
2-Mar	Exam 1 (on materials 3–27 Feb)		
5-Mar	Climate models	WFR 31–39	
7-Mar	Climate archives and dating	WFR 17–31	Tree coring
9-Mar	Long-term climate change	WFR Ch. 3	
12-Mar	Plate tectonics and climate	WFR Ch. 4	
14-Mar	Greenhouse climates	WFR Ch. 5	
16-Mar	Pangean climate, Cretaceous climate	WFR Ch. 5	
	Spring Break		
2-Apr	Cenozoic cooling, $\delta^{18}\text{O}$	WFR Ch. 6	
4-Apr	Climate proxies	WFR Appx 1&2	
6-Apr	PETM, $\delta^{13}\text{C}$	TBA	
9-Apr	Orbital cycles	WFR Ch. 7	
11-Apr	Glacial-interglacial cycles	WFR Ch. 9	Tree growth curves
13-Apr	Greenhouse gases and glaciations	WFR Ch. 10	
16-Apr	Last glacial maximum	WFR Ch. 12	
18-Apr	The last deglaciation	WFR Ch. 13	
20-Apr	Exam 2 (Lectures 29 Feb to 16 Apr)		
23-Apr	Millennial-scale climate change	WFR Ch. 14	
25-Apr	Interannual climate changes	SGP 143–160	Tree ring index
27-Apr	The last millennium	WFR Ch. 16	
30-Apr	The last century	WFR Ch. 17	
2-May	Global climate changes	IPCC 2007	
4-May	Anthropogenic climate forcing	WFR Ch 18	
7-May	Projections of future GHG forcing	DA Ch. 9	
9-May	Climate projections	DA Ch. 10	Tree ring index and climate
11-May	Climate sensitivity	TBA	
16-May	Exam 3 (cumulative)		

¹ In the Clark Hall Computer Lab