

## **GEOG 15.01: Global Climate Change**

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**X-Hours:** Expected use as detailed in syllabus and for makeup classes  
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### **Course Description**

Climate is a fundamental driver of populations, economies, and cultures. Over the past century, humans have been modifying the atmosphere through the emission of greenhouse gases. This course will provide an overview of the Earth's climate system and the physical basis, impacts, and societal dimensions of climate change.

Lectures are designed to be interactive and will encourage participation through questions, discussions, and in-class exercises. Problem sets will include data analysis and the use of a simple global climate model in MATLAB, which will be introduced and is available in Rahr Lab. This course counts as a Natural and Physical Science without Lab (SCI) Distributive Course Requirement.

### **Learning Objectives**

By the end of this course, students will be able to:

1. Describe the Earth's climate system and the physical mechanisms of climate variability and anthropogenic climate change
2. Explain potential climate change impacts at local to global scales
3. Understand the basics of data manipulation and computer programming
4. Interpret and apply scientific literature
5. Analyze modeled and observed climate data
6. Evaluate strategies for climate change adaptation and mitigation

### **Prerequisites**

None

### **Textbook**

Aguado, E. and J.E. Burt, 2014. *Understanding Weather and Climate*. Pearson Prentice Hall, 600 pp. \*Note that book can be purchased with MyMeteorologyLab - Access Card Package, which you may find helpful but is not required

### **Course Resources on Reserve or Available Online**

Broder, J.M., 2012. Climate Talks Yield Commitment to Ambitious, but Unclear, Actions. New York Times.

Bullis, S., 2009. How SuperFreakonomics Gets Climate Engineering Wrong. MIT Technology Review, <http://www.technologyreview.com/view/415869/how-superfreakonomics-gets-climate-engineering-wrong/>.

- IPCC, 2013: Summary for Policymakers, in: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, T.F. Stocker, D. Qin, G.-K. Plattner, M. Tignor, S. K. Allen, J. Boschung, A. Nauels, et al., Eds., Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- IPCC, 2014a: Summary for Policymakers, in: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. C.B. Field, V.R. Barros, M.D. Mastrandrea, K.J. Mach, M.A.K. Abdurrobbil, W.N. Adger, Y.A. Anokhin (Russian Federation), et al., Eds. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- IPCC, 2014b: Summary for Policymakers, in: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. O. Edenhofer, R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, et al., Eds. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- Levitt, Steven D., and Stephen J. Dubner, 2010. Superfreakonomics: Global cooling, patriotic prostitutes and why suicide bombers should buy life insurance. Penguin UK.
- Marston, B., 2013. The Science of Climate Change. Upper Valley Sierra Club Presentation, <http://vimeo.com/77243727>.
- Moss, R. H., J.A. Edmonds, K.A. Hibbard, M.R. Manning, S.K. Rose, D.P. van Vuuren, T.R. Carter, et al., 2010. The next generation of scenarios for climate change research and assessment. Nature, 463, 7282, 747-756.
- NHCCPTF, 2009. The New Hampshire Climate Action Plan. [http://des.nh.gov/organization/divisions/air/tsb/tps/climate/action\\_plan/documents/nhcap\\_final.pdf](http://des.nh.gov/organization/divisions/air/tsb/tps/climate/action_plan/documents/nhcap_final.pdf).
- RGGI, 2012. About the Regional Greenhouse Gas Initiative (RGGI). [http://www.rggi.org/docs/RGGI\\_Fact\\_Sheet.pdf](http://www.rggi.org/docs/RGGI_Fact_Sheet.pdf).
- Stavins, R.N., 1998. What Can We Learn from the Grand Policy Experiment? Lessons from SO<sub>2</sub> Allowance Trading. Journal of Economic Perspectives, 12.3, 69-88.
- UN, 1998. Kyoto Protocol to the United Nations Framework Convention on Climate Change. <http://unfccc.int/resource/docs/convkp/kpeng.pdf>.

### **Grading**

Problem sets will contain a mix of data analysis, back-of-envelope calculations, and short answer questions. Problem sets must be uploaded as one document in doc, docx, or pdf format via Canvas on or before the date and time due. Assignments received after that are considered late. Late assignments will be penalized 10% per 24-hour period. In-class exercises will not be collected or graded, but will cover important concepts likely to appear on both problem sets and exams. Exams will contain a mix of definitions, multiple choice, true/false, data/figure analysis, simple back-of-envelope calculations, short answer questions, and long answer questions. Exam #1 will include material from classes up to the Exam #1 Review. Exam #2 will be cumulative, but weighted toward material not tested in Exam #1. No makeup exams will be given without prior consent or documented emergency. Class participation will be assessed primarily on reading reactions with some consideration of student engagement. Reading reactions consist of a brief summary of the reading, as well as a mix of questions, key insights, and critiques submitted via Canvas online text entry in advance of class. Reactions will be graded on a 1-3 scale.

<u>Assignment</u>	<u>Weighting</u>
Problem Set #1	15%
Problem Set #2	15%
Problem Set #3	15%
Exam #1	25%
Exam #2	25%
Class Participation	5%

### **Student Needs**

Students requesting disability-related accommodations and services for this course are encouraged to contact me as early in the term as possible. In order for accommodations to be authorized, students are required to consult with Student Accessibility Services (SAS; [student.accessibility.services@dartmouth.edu](mailto:student.accessibility.services@dartmouth.edu); SAS website; 603-646-9900) and to email me their SAS accommodation form. We will then work together with SAS if accommodations need to be modified based on the online learning environment. If students have questions about whether they are eligible for accommodations, they should contact the SAS office. All inquiries and discussions will remain confidential.

### **Academic Honesty**

All students must comply with Dartmouth's Academic Honor Principle, described here: <https://students.dartmouth.edu/judicial-affairs/policy/academic-honor-principle>, with additional guidance here: <https://writing-speech.dartmouth.edu/learning/materials/sources-and-citations-dartmouth>. If you have questions or concerns, please contact me or the Undergraduate Deans Office.

### **Mental Health**

The academic environment at Dartmouth is challenging, terms are intensive, and classes are not the only demanding part of your life. There are resources available on campus to support your wellness, including your Undergraduate Dean (<http://www.dartmouth.edu/~upperde/>), Counseling and Human Development (<http://www.dartmouth.edu/~chd/>), and the Student Wellness Center (<http://www.dartmouth.edu/~healthed/>).

### **Religious Observances**

If you have a religious observance that conflicts with your participation in this course, please meet with me before the end of the second week of the term to discuss appropriate accommodations.

### **Textbook Costs and Financial Difficulty**

If you encounter financial challenges related to this class, please let me know.

### **Schedule**

<b>Date</b>	<b>Topic</b>	<b>Assignments and Readings</b>
Class 1	Why I Must Speak Out Against Climate Change	
Class 2	Composition and Structure of the Atmosphere	Aguado and Burt 2014, Chapter 1
Class 3	Solar Radiation and Energy	Aguado and Burt 2014, Chapter 2
Class 4	Exercise – Earth's Energy Budget	Aguado and Burt 2014, Chapter 3

Class 5	Introduction to MATLAB	
Class 6	Radiation Summary and Global Temperature	Problem Set 1 Out
Class 7	Water in the Atmosphere	Aguado and Burt 2014, Chapter 5
Class 8	Precipitation and Water on the Surface	Aguado and Burt 2014, Chapter 6
Class 9	Atmospheric Pressure	Aguado and Burt 2014, Chapter 4
Class 10	Atmospheric and Oceanic Circulation	Aguado and Burt 2014, Chapter 8
Class 11	Atmospheric and Oceanic Circulation	Problem Set 1 Due
Class 12	Large-Scale Atmospheric Features	
Class 13	Exam #1 Review	
Class 14	Air Masses and Fronts	Aguado and Burt 2014, Chapter 9
Class 15	Exam #1	
Class 16	Earth's Climates	Aguado and Burt 2014, Chapter 15; Problem Set 2 Out
Class 17	Greenhouse Gases and the Carbon Cycle	Moss et al., 2010
Class 18	Observed Climate Variability and Change	Aguado and Burt 2014, Chapter 15
Class 19	Discussion - Climate Change Projections	IPCC, 2013
Class 20	Discussion - Climate Change Impacts	IPCC, 2014a
Class 21	Discussion - Climate Change Mitigation	IPCC, 2014b; Problem Set 2 Due; Problem Set #3 Out
Class 22	IPCC Summary and Reading Responses Addressed	
Class 23	Exercise - Climate Change Policy	
Class 24	Local Climate Change Adaptation	NHCAP, 2009
Class 25	Climate Change Policy	Broder, 2012; UN, 1998
Class 26	Geoengineering and Climate Change Skepticism	Levitt and Dubner, 2010; Bullis, 2009
Class 27	Current Research in Climate Change Science	Problem Set 3 Due
Class 28	Exam #2 Review	
Class 29	Let's Solve Climate Change	
Class 30	Exam #2	