

**Global Climate Change**  
**PGEOG 36100/73200**  
**Monday and Thursday 11:10am to 12:25 pm, HN 1090B-2**  
**Professor Randy Rutberg**

**Office location:** Hunter North room 1041 (10<sup>th</sup> floor)  
**Email** (preferred means of contact: [rrutberg@hunter.cuny.edu](mailto:rrutberg@hunter.cuny.edu)). Please (1) include the course name; (2) include your entire name. I try to answer all emails within 24 hours. Allow for a 48 hour delay on the weekends.

**Office Location:** 1041 Hunter North  
**Office Phone:** 212 772 5326  
**Office Hours:** Monday and Thursday 12:30 – 1 PM & by appointment

### **COURSE OVERVIEW**

This course will describe the physics and chemistry of the earth's climate system. It will also focus on factors that perturb the earth's climate and the range of responses of the Earth's climate system. Long, medium and short term climate variability and methodologies employed to study the Earth's paleo- and modern climate will be described. An ongoing discussion about modern climate change and recent weather patterns and events will take place throughout the course. Students will be expected to complete quantitative problem sets, read scientific journal articles, complete a research project and participate in the class discussions.

### **Course Objectives**

The objective of this course is to develop students' understanding of the Earth's climate system and the factors and feedbacks that influence global climate change on multiple time scales. An additional objective is to educate students about the consequences of modern climate change and provide the conceptual and technical skills that can be used in developing potential mitigation strategies. To accomplish these objectives, the course will provide

- a broad foundational knowledge of the basic physics and chemistry of the Earth's climate system;
- a well developed understanding of the Earth's climate history and the forcings and feedbacks that contribute to climate change on different timescales;
- an understanding of modern, human driven climate change and its consequences;
- an understanding of the tools and methodologies used by scientists to study the Earth's climate system.

The course is structured along three units, each with corresponding lectures, exercises, additional readings and discussions, designed to achieve the expected **LEARNING OUTCOMES** listed below.

- I. Unit 1** – Earth's Past Climate and Climate variations
  - a. Long Term Climate Change (10<sup>6</sup> of years)
  - b. Medium Term Climate Change (10<sup>5</sup> thousands of years)
- II. Unit 2** – Present (modern) Earth's Climate  
Rapid Climate Change (millennial to decadal)

### III. Unit 3 – Future Climate and Climate Change

Class project will be dedicated to a hands-on understanding, study of projections and gaining basic skills in predictions of future climate change

An introductory overview will include

- The Earth's Climate System
- The Earth's Energy Balance
- The Carbon Cycle
- The Earth's sensitivity
- Methodologies used in studying the climate system

### EXPECTED LEARNING OUTCOMES

1. Identify and apply the fundamental concepts of physics, chemistry, geology, biology, mathematics and engineering technologies to the study of the earth's climate.
2. Gather, interpret, and assess information from a variety of sources and points of view.
3. Evaluate evidence and arguments critically and analytically.
4. Articulate and evaluate the empirical evidence supporting a scientific or formal theory:
5. Understand the scientific principles underlying matters of policy and public concern as they relate to climate and climate science.
6. Produce well-reasoned written arguments using evidence to support conclusions.

### REQUIRED TEXT BOOKS

(<http://hunter.textbookx.com/institutional/index.php?action=browse#books/2099897/>)

*Earth's Climate Past and Present*, 2<sup>nd</sup> ed., William F. Ruddiman. W.H. Freeman, 2007 ISBN-13: 978-0716784906

In addition, other two are books about climate, written by experts in the field, are highly recommended. Materials from these books will be used in class.

*The Climate Crisis. An Introductory Guide to Climate Change* by David Archer and Stefan Rahmstorf, Cambridge University Press, 2010, ISBN 978-0-521-73255-0 (Paperback)

*The Warming Papers: The Scientific Foundation for the Climate Change Forecast*, David Archer and Pierrehumbert, eds, ISBN: 978-1-405-19616-1, Wiley-Blackwell.

Additional readings (articles, websites etc.) will be provided throughout the semester.

### GRADING METHOD AND SCALE

Grades will be based on class participation, homework assignments, two mid-term exams and one final exam. A detailed description of the Hunter College Grading System may be found at <http://catalog.hunter.cuny.edu/content.php?catoid=23%navoid=3149>.

**Your grade for the course will be based on two mid-terms (20% each), class participation (20%), homework assignments**

**(20%) and a final project (which includes an in-class short presentation) (20%).**

**For PGEOG 73200 grading: Your grade for the course will be based on two mid-terms (15% each), class participation (15%), homework assignments (15%), graduate student led discussions of peer review articles (15%) and a final project (which includes an in-class short presentation) (25%).**

### **EXAM GUIDELINES AND POLICIES**

Exams will be based on assigned textbook readings, journal articles, materials covered in class and case studies. Dates are **CLEARLY** posted on the Course Calendar and Content.

Examinations are 1 hour and 15 minutes for the mid-term and 2 hours for the final exam. No electronic devices or reference materials will be permitted on the desk during exams unless specified. Make-up exams are **ONLY** available in extreme cases, and with medical (or other) forms that confirm the absence.

Exams are designed to evaluate a student's ability to master content, integrate themes and concepts between sub-disciplines in oceanography, understand the usefulness and limitations of oceanographic data for studying processes, and apply logical arguments to support perspectives.

### **CR/NCR POLICY**

The CR-NCR option will be honored only if the conditions stated on the CR/NCR form are satisfied: all course work has been completed and you earned grades such that you accumulate at least 50 points total in the course. Students on probation are ineligible.

[HTTP://WWW.HUNTER.CUNY.EDU/ADVISING/HOWTO/FILE-CREDIT-NO-CREDIT-CR-NC](http://www.hunter.cuny.edu/advising/howto/file-credit-no-credit-cr-nc). **THIS INCLUDES BOTH THE CR/NC POLICY AND A LINK TO THE FORM.**

### **ATTENDANCE AND CLASSROOM POLICIES**

Attendance and class participation constitutes 20% of the final grade. Attendance is required at all lectures. All students are expected to abide by the following policies when in lecture in order to provide a more respectful and productive learning environment.

- All cell phones must be silenced.
- Laptops are permitted for note taking purposes only.
- Texting and other non-class related smart phone activities are not allowed. Students should quietly excuse themselves from the lecture if substantial external electronic communication is required.

### **SYLLABUS CHANGE POLICY**

Except for changes that substantially affect implementation of the evaluation (grading) statement, this syllabus is a guide for the course and is subject to change with advance notice. Updates will be posted regularly on BlackBoard.

### **ADDITIONAL HELPFUL INFORMATION**

**My Teaching Philosophy:** My goal in teaching is to help students in becoming confident and responsible professionals and to make this experience an enjoyable one. My approach to teaching involves being a facilitator in the learning process as opposed to being the authoritarian lecturer at the front of the room with a “one-way information transfer” style. I understand and respect individual differences in learning and do my best to promote learning in the classroom by working with individual differences rather than against them. At the same time, I wish to impart technical skills and a sense of responsibility by encouraging students to play the role of professionals in the classroom.

I expect students to put their best effort in this course. This involves participating in the in-class exercises, reading the assigned material, working out in-class assignments and Case Studies, editing when necessary until they are clear and correct, and preparing for quizzes and exams.

**Finally:** It is important to start with a good study habit. Consistency is the key. Forming study groups is extremely helpful. Use my office hours and any other resource available to you throughout the semester. Make progress steadily as the material in this course cannot be understood the night before the exam. Concentrate on understanding rather than ‘regurgitating’. Put out your best effort everyday.

The following are useful tips to do well in this or any class:

- Attend class and take detailed notes (by hand).
- Read the assigned material in the text (or other) *before* coming to class.
- Re-write your notes as soon as possible after class. This will allow you to fill in the details still fresh in your memory, and prepare questions for the next time the class meets.
- Test yourself by answering the questions in the book and in class.
- Carefully study the diagrams and charts in the book and in the lectures.

**\*\* A detailed schedule of classes, topics and reading assignments will be available on BlackBoard at the beginning of classes \*\***

## **HUNTER COLLEGE POLICY ON ACADEMIC INTEGRITY**

Hunter College regards acts of academic dishonesty (e.g., plagiarism, cheating on examinations, obtaining unfair advantage, and falsification of records and official documents) as serious offenses against the values of intellectual honesty. The College is committed to enforcing CUNY Policy on Academic Integrity and will pursue cases of academic dishonesty according to the Hunter College Academic Integrity Procedures.

## **ADA POLICY**

In compliance with the American Disability Act of 1990 (ADA) and with Section 504 of the Rehabilitation Act of 1973, Hunter College is committed to ensuring educational parity and accommodations for all students with documented disabilities and/or medical conditions. It is recommended that all students with documented disabilities (Emotional, Medical, Physical, and/or Learning) consult the Office of AccessABILITY, located in Room E1214B, to secure necessary academic accommodations. For further information and assistance, please call: (212) 772- 4857 or (212) 650-3230.

## **HUNTER COLLEGE POLICY ON SEXUAL MISCONDUCT**

In compliance with the CUNY Policy on Sexual Misconduct, Hunter College affirms the prohibition of any sexual misconduct, which includes sexual violence, sexual harassment, and gender-biased harassment retaliation against student, employees, or visitors, as well as certain intimate relationship. Students who have experienced any form of sexual violence on or off campus (including CUNY-sponsored trips and events) are entitled to the rights outlined in the Bill of Rights for Hunter College.

- A. ***Sexual violence***: students are strongly encouraged to immediately report the incident by calling 911, contacting NYPD Special Victims Division Hotline (646-610-7272) or their local police precinct, or contacting the College's Public Safety Office (212-772-4444)
- B. ***All other forms of sexual misconduct***: Students are strongly encouraged to contact the College's Title IX Campus Coordinator, Dean Jean Rose ([jtrose@hunter.cuny.edu](mailto:jtrose@hunter.cuny.edu) or 212-650-3262) or Colleen Barry ([colleen.barr7@hunter.cuny.edu](mailto:colleen.barr7@hunter.cuny.edu) or 212-772-4534) and seek complementary services through the Counseling and Wellness services Office, Hunter East 1123.

CUNY Policy on Sexual Misconduct Link:

<http://www.cuny.edu/about/administration/offices/la/policy-on-sexual-misconduct-12-1-14-with-link.pdf>

Global Climate Change  
 PGEOG 361/732  
 Monday&Thursday 11:10-12:25  
 Professor Randye Rutberg  
 rrutberg@hunter.cuny.edu

\*\*\* TENTATIVE SCHEDULE \*\*\*

**How to follow the schedule:** You are expected to have read the reading listed for each face-to-face class day *before class on that date*. This will greatly enhance our class discussions and your course experience. You are also responsible for doing assignments by their due date. *I reserve the right to alter or add topics and assignments as needed.*

Schedule of Topics & Readings			
Unit	Class No & Week	Topic: Chapter Title, Assignments	Readings
Unit 1	Week 1	<a href="#">Introduction to Class</a>	EC-Chapter 1
	Week 2	Chapter 1: Overview of Climate Science	EC-Chapter 1
	Week 3	Global Energy Balance - The Physics of the Radiation Balance of the Earth <a href="#">Assignment 1</a> Review of Chapter 2: Earth' Climate System Today	TCC-Chapter 1 EC-Chapter 2
	Week 4	Climate Models – General Circulation Models.	EC-Chapter 2
	Week 5	<a href="#">Assignment 1 due – 9/19</a> Climate Models	EC-Chapter 3 No class this week
	Week 6	Climate Models – General Circulation Models. <a href="#">Assignment 2</a>	EC-Chapter 3
	Week 7	Chapter 4 – CO <sub>2</sub> & long-term climate Chapter 5 – Plate Tectonics and long-term climate <a href="#">Assignment 2 due – 10/9</a>	TCC-Chapter 2 EC-Chapter 4 EC-Chapter 5
Unit 2	Week 8	Chapter 5 – Plate Tectonics and long-term climate	EC-Chapter 5 TCC-Chapter 3
	Week 9	<a href="#">Assignment 3</a> Chapter 6 & 7 – Greenhouse climate & From greenhouse to icehouse	TCC-Chapter 4 EC-Chapter 6 EC-Chapter 7
	Week 10	Chapter 6 & 7 – Greenhouse climate & From greenhouse to icehouse <a href="#">10/27 – Midterm I</a>	TCC-Chapter 5 EC-Chapter 6 EC-Chapter 7

	Week 11	Tutorial for Term Project – 10/31 Assignment 3 due – 11/3 Chapter 6 & 7 – Greenhouse climate & From greenhouse to icehouse	EC-Chapter 6 EC-Chapter 7 TCC-Chapter 6
	Week 12	Discussion of climate projection projects – 11/7 Chapter 6 & 7 – Greenhouse climate & From greenhouse to icehouse. Chapter 15 – Millennial oscillations of climate Assignment 4	EC-Chapter 6 EC-Chapter 7 EC-Chapter 15
Unit 3	Week 13	Discussion of climate projection projects – 11/14 Historical climate simulations – the last 125 years – Chapter 19 as a guide	TCC-Chapter 7 EC-Chapter 19
		Future Climate Change Assignment 4 due – 11/21	TCC-Chapter 8
	Thanksgiving Break 11/23 – 11/26 – College Closed		
	Week 14	Climate projections project – lab work Midterm II – 12/1	TBD
	Week 15	Climate projections project – lab work Students Project Presentations (12/8)	TBD
		Students Project Presentations	

EC = Earth's Climate. Past and Future, Ruddiman, 3<sup>rd</sup> Edition  
TCC = The Climate Crisis. An introductory guide to climate change