

**PGEOG 25000- Fall 2021**  
**Earth System Science II**  
**Lecture Instructor: Professor Randy Rutberg**  
**Lab Instructor: Dr. Angie Winner**

**CLASS SCHEDULE:**

LECTURES: Tuesday/Friday 11:10 AM to 12:25 PM, MOI: online, synchronous  
LABS: Tuesday/Friday 1:00 PM to 2:00 PM, MOI: in person

**PROFESSOR RUTBERG CONTACT INFORMATION:**

**Office** Virtual via BB Collaborate or Zoom  
**E-mail** [rrutberg@hunter.cuny.edu](mailto:rrutberg@hunter.cuny.edu) (\*)  
**Tel.** 212-772-5326 (NA for spring 2021)  
**Office Hours:** Following class and by appointment

**LAB INSTRUCTOR CONTACT INFORMATION:**

**Office** Virtual  
**E-mail** TBA  
**Office Hours:** by appointment

\* **Note:** the best way to contact us is via email: (1) You must include the course name or number in your subject line. (2) You must include your entire name as it appears in CUNYfirst in your email. We will try to answer all emails within 24 hours. Allow for a 48 hour delay on the weekends.

*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.*

**PREREQUISITES**

One 100-level Earth Science course (i.e. GEOL 180, GEOL 100, GEOL 101, PGEOG 13000, GEOL 10500)

**REQUIRED TEXTBOOKS**

Students must obtain their own copies of:

Kump, Kasting, and Crane, 2010, *The Earth System*, (3<sup>rd</sup> edition preferred), Pearson/Prentice Hall Publishers. ISBN-10: **0321597796** | ISBN-13: **978-0321597793**

This book has been ordered at the Hunter College bookstore and at Shakespeare and Company

Bryson, Bill, *A Short History of Nearly Everything*, Broadway Books, 2004, ISBN10: 076790818X

**ADDITIONAL READINGS AND LAB MATERIAL** will be provided, including lab exercises that have been designed specifically for this course

\*\*this list may be updated prior to course start date

## **COURSE DESCRIPTION AND OBJECTIVES**

This course is the first part of a two-course sequence. Here, we learn about our planet as a system of interacting components, including the atmosphere, the hydrosphere, the lithosphere and cryosphere. We will also learn about geochemical cycling of the elements with an emphasis on the carbon cycle and climate change.

The four main objectives of this course are:

1. To further your understanding of “systems thinking” in the context of the Earth system. Systems thinking is critical in all areas of study, and particularly in the fields of environmental studies and earth sciences. The second course of the sequence has a greater focus on the biosphere.
2. To expand your skills in quantitative analysis. In the lab portion of this course we will continue to learn concepts necessary to study environmental systems in a quantitative fashion. Labs are meant to provide you with a number of identifiable skills that can be applied in other courses as well as in work environments. The second course of the sequence will expand on the systems modeling work, and in addition, will focus more on introductory concepts in chemistry and statistics.
3. To provide you with a sufficiently broad, yet integrated, understanding of the earth system to identify particular areas or sub-disciplines that you would like to pursue in more detail.
4. To develop your writing and presentation skills so that you can clearly communicate scientific concepts and processes.

## **EXPECTED LEARNING OUTCOMES**

### **1. Theory**

At the end of the semester, you will be expected to be able to:

- Describe the evolution of the Earth System
- Understand basic ecological processes and ecosystem interactions
- Synthesize how processes function together to determine and regulate Earth’s climate.
- Analyze and describe the Southern Ocean’s role in regulating atmospheric CO<sub>2</sub>.

### **2. Skills**

At the end of the semester, you will be expected to have acquired basic quantitative skills that will allow them to

- Apply basic mathematical calculations to quantify physical processes under study;
- Visualize data and explain graphs and charts in detail;
- Perform calculations and generate charts using basic computer software such as EXCEL to gain a basic appreciation of modeling environmental systems through the use of the STELLA software; and
- Gather, organize and synthesize scientific data and literature
- Write/present clearly and concisely to communicate scientific concepts and processes.

## COMPUTER LABS

Computer labs are scheduled once per week. Labs will consist of exercises designed to introduce you to some of the concepts and skills necessary to study environmental systems in a quantitative fashion. These include basic mathematical concepts, as well as using computer simulations, or models, to understand the Earth from a “systems dynamics” perspective. STELLA® modeling software will be used in modeling exercises. No previous experience in computer modeling or STELLA software is expected, although basic familiarity with the Windows operating system, MS WORD and MS EXCEL, is expected. Computer labs will be provided to you.

**NOTE:** a greater emphasis will be placed on analysis of data and results.

Please see the lab syllabus for detailed instructions.

Be sure to read the lab guidelines found on the Course Information page. This document gives detailed instructions about how labs are to be structured as well as a grading rubric.

**GROUP WORK** – is allowed for all labs. If you choose to work in groups, you must: (1) inform me before the due date which of you are working together; and (2) hand in only one lab per group, with all your names on the lab.

Group is also very encouraged for problem sets and class work. However, group work does not mean that each member completes a single problem on their own and then the various problems are combined in a single document. The problem sets are intended to help you learn. Therefore, you all need to understand **all** the problems. Ideally, all group members should complete all the problems and then check their work against one another. Please use the group sign up link on BB so that your homework is automatically graded as a group assignment.

## GRADES

The emphasis of this class is on learning, not grades. To that end, I will provide as much feedback as possible and you will incorporate that feedback to improve your knowledge, communication and quantitative skills.

Your final grade will also include your intellectual growth and progress over the course of the semester.

Homework:

Voicethread/writing assignments	15%
Problem sets:	15%
Labs	30%
3 exams	30%
Independent project	10%

Up to an extra 5% for outstanding class participation (contributions to live discussions and/or comments on Voicethreads/Discussion Boards)

## EXAMS

The exams will be based on the material covered in class, in the textbook and concepts that are learned through the lab portion of the course. The exam dates are CLEARLY posted in the syllabus of the course. Exams will be taken during the scheduled class time. The dates are set from day one and cannot be changed. Three exams will be given. See the syllabus for exam dates and information about which chapters will be covered. You must follow the upload instructions. If you do not follow the instructions and your submission is cumbersome to grade, you will receive a zero.

### **About examinations and grades:**

- a) Grades follow Hunter's grading system:  
<http://catalog.hunter.cuny.edu/content.php?catoid=15&navoid=1433>. Grades will be curved at my discretion.
- b) Examinations are 1 hour and 15 in length. If you arrive late, you lose that time.
- c) Your exams must be written legibly using complete sentences, spelling and proper grammar. If you have a hand writing issue, practice. I cannot grade what I cannot read.
- d) Feedback and an opportunity for revision will be provided.
- e) Make-up exams are ONLY available in extreme cases, and students must provide documentation of the reason for missing the exam (medical or other forms)
- f) I will automatically agree to the CR/NC option ONLY if the conditions stated in 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 (this includes labs plus exams plus extra, if you earned any). Students on probation are not eligible for this option. Students must see me during office hours before the last day of class to discuss this option. Requests for CR/NC as a final grade will not be accepted during or after the final exam.

**Assignments:** Problem set type assignments will be largely based on critical thinking questions at the end of each chapter. All assignments must be submitted to Blackboard or Gradescope by the beginning of class on the due date specified. Your assignments must be typed or written very neatly. If I cannot read it, I cannot grade it. Assignments will be graded according to rubrics posted on BB/Gradescope.

Group work is also very encouraged for (some) problem sets and class work. However, group work does not mean that each member completes a single problem on their own and then the various problems are combined in a single document. The problem sets are intended to help you learn. Therefore, you all need to understand **all** the problems. Ideally, all group members should complete all the problems and then check their work against one another. When applicable, use the "add group member" option on Gradescope so that group work is graded as a group assignment.

When you upload assignments to BB, the document name must have the following format:

Lastname\_firstname\_assignmentname\_ESS2\_2021.doc

Examples:

Rutberg\_Randy\_HW#1\_ESS2021

Rutberg\_Randy\_HW#2\_ESS2022

This naming rubric helps me keep track of student work. If you do not name your documents as specified above, I do not guarantee that they will be graded.

In addition, within the document itself, you must include your full name, assignment title and any other students with whom you worked.

**Voicethread Assignments:** Voicethread assignments are designed to help you interpret and explain figures, charts and diagrams. These will be two-part assignments. The class has been divided into three groups. Each week, each member of the selected group will be responsible for creating a voice over for one figure/chart/diagram in the posted Voicethread. The group work schedule is at the end of this syllabus. In addition, students in the selected group must submit a written description of the figure that they have annotated. The companion written description will be turned in via the appropriate link. You must copy and paste the figure you describe into your written submission. The Voicethread voiceover and written description must be completed by Tuesday of a given week. The students who are not in this group are required to leave at least two comments on the Voicethread. These comments can be questions, suggests to improve the presentation, or additional insights into the figure. The comments are all due on Friday.

This may all sound overwhelming but keep in mind each student in the course will be presenting a slide only four times during the semester. In addition, these Voicethreads will serve as a mini-Kahn like academy that can be used as a study aide. Examples and rubrics will be provided to guide your efforts. Please see the Voicethread schedule at the end of the syllabus. In addition, make note of your Voicethread group number.

**Independent Project:** The independent project will require you to identify an area of interest that you would like to investigate, develop a hypothesis and a strategy to test that hypothesis using publicly available data. If you take PGEOG 251 in the spring you will develop this project into a research paper and presentation.

**Tardiness in handing in assignments and labs:**

Lab grades will be penalized for lateness. Lecture assignments will not be accepted after the due date. If you feel that you have exceptional circumstances that warrant an extension, you must meet with me during my office hours to discuss your situation.

**Classroom policies:** You are expected to have read the reading listed for each class day *before class on that date*. There is no texting permitted in the classroom. Laptops (and other tablets) are not necessary and will not be permitted in class. Special considerations will be given in exceptional cases, in which case permission to use laptop has to be obtained from the instructor.

*The professor reserves the right to alter or add topics and assignments as needed.*

**Classroom policies:** You are expected to have read the reading listed for each class day *before class on that date*. I encourage you to turn your cameras on for class meetings.

*I reserve the right to alter or add topics and assignments as needed.*

**ATTENDANCE**

I will take attendance for the first few classes. I expect you to turn your cameras on so I can link your names to your faces and try to get to know you. I will not take attendance for most sessions as I feel that

this will waste a large portion of class time. However, I will record attendance using BB Collaborate. You will enjoy the course and learn more if you attend class regularly. In addition, please turn off your mail, texts and other distractions during class if you want to master the material.

## **HELPFUL INFORMATION**

**My Teaching Philosophy:** My goal in teaching is to help you become 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 you to play the role of professionals in the classroom.

I expect you to put your best effort in this course. This involves participating in the in-class exercises, reading the assigned material, doing the homework, editing when necessary until they are clear and correct, and preparing for quizzes and exams.

**Lecture:** I will spend part of the lecture time explaining the key concepts of Earth systems and earth science and discuss, when appropriate, solution of problems. You are expected to devote time outside the classroom to understand the concepts, and review questions given at the end of chapters in the textbook, or questions that I may ask in class. You should plan on spending at least 3 (and up to 6) hours each week reading and studying the material. I expect that lectures will give you a clear idea of what is expected in 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 time and any 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 every day!

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

- Attend class and take detailed notes.
- 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.
- Read the rubrics associated with the assignments so that you understand the expectations.

### **As with all courses at Hunter College:**

#### **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 the CUNY Policy on

Academic Integrity and will pursue cases of academic dishonesty according to the Hunter College Academic Integrity Procedures. See the following report by the Hunter College Senate for more details: <http://www.hunter.cuny.edu/senate/assets/Documents/Hunter%20College%20Policy%20on%20Academic%20Integrity.pdf>

### **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, in Room E1214B, to secure necessary academic accommodations. For information and assistance: (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-based harassment retaliation against students, 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, on contacting the College's Public Safety Office (212-772-4444)
- B. All Other Forms of Sexual Misconduct: Students are also encouraged to contact the College's Title IX Campus Coordinator, Dean John Rose ([jtrose@hunter.cuny.edu](mailto:jtrose@hunter.cuny.edu) or 212-650-3262) of Colleen Barry ([colleen.barr7@hunter.cuny.edu](mailto:colleen.barr7@hunter.cuny.edu) or 212-772-4534) and seek complimentary 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-links.pdf>

**A Tentative Syllabus is provided below – an updated version will be available at the beginning of the semester from the course website and blackboard (look for file schedule.pdf). Syllabus gets updated throughout the semester, as needed. Check regularly for updates.**

**TENTATIVE COURSE SCHEDULE  
EARTH SYSTEMS SCIENCE I – PGEOG25100 SPRING 2021  
Department of Geography, Hunter College**

**Lecture Instructor:** Prof. Randy Rutberg

**Lab Instructor:** Dr. Angelika Winner

**Tentative Syllabus** Readings specified by chapter, with no author (e.g. “Ch. 9: The Biosphere and Biodiversity”) refer to the main text of the class (Kump, Kasting, and Crane) which the students are expected to have. Other readings, specified by author, are supplied as pdf files. Read Chapter 13 onward, one per week of “A Short History of Nearly Everything”.

**PGEOG 25000 – Fall 2021 (ESSI)  
Additional Information**

**Chapter Titles for Second and Third editions of text book**

**Titles listed in red are different for the two editions**

PGEOG25000 (ESSI) GOES THROUGH CHAPTER 8 ONLY.

<b>SECOND EDITION</b>	<b>THIRD EDITION</b>
1. Global Change	1. Global Change
2. Daisyworld: An Introduction to Systems	2. Daisyworld: An Introduction to Systems
3. Global Energy Balance: The Greenhouse Effect	3. Global Energy Balance: The Greenhouse Effect
4. The Atmospheric Circulation System	4. The Atmospheric Circulation System
5. The Circulation of the Oceans	5. The Circulation of the Oceans
<b>6. Modeling that Atm-Ocean System</b>	<b>6. The Cryosphere</b>
7. Circulation of the Solid Earth: Plate Tectonics	7. Circulation of the Solid Earth: Plate Tectonics
8. Recycling of the Elements	8. Recycling of the Elements
9. Focus on the Biota: Metabolism, Ecosystems and Biodiversity	9. Focus on the Biota: Metabolism, Ecosystems and Biodiversity
10. Origin of the Earth and of Life	10. Origin of the Earth and of Life
11. Effect of Life on the Atmosphere: The Rise of Oxygen and Ozone	11. Effect of Life on the Atmosphere: The Rise of Oxygen and Ozone
12. Long-Term Climate Regulation.	12. Long-Term Climate Regulation.
13. Biodiversity Through Earth History.	13. Biodiversity Through Earth History.
14. Pleistocene Glaciations.	14. Pleistocene Glaciations.
<b>15. Short-Term Climate Variability</b>	<b>15. Global Warming, Part 1: The Scientific Evidence.</b>
<b>16. Global Warming</b>	<b>16. Global Warming, Part 2: Impacts, Adaptation, and Mitigation</b>
17. Ozone Depletion.	17. Ozone Depletion.
18. Human Threats to Biodiversity.	18. Human Threats to Biodiversity.
19. Climate Stability on Earth and Earth-Like Planets.	19. Climate Stability on Earth and Earth-Like Planets.

**PGEOG 25000 – ESSI, Fall 2021: COURSE SCHEDULE**

**\*\* Tentative \*\***

Readings refer to textbook by Kump, Kastang, and Crane 3<sup>rd</sup> edition; “Bryson” refers to “A Brief History of Nearly Everything” .

<b>Class No &amp; Date</b>	<b>Lecture Subjects</b>	<b>Reading</b>	<b>Assign Due</b>	<b>Bryson Chapter</b>
Friday 8/27	Introduction	Ch. 1 – Global Change		

Tuesday 8/31	Global Change	Ch. 1 – Time Scales		
Friday 9/10	Global Energy Balance	Ch. 3 – Radiation Physics		1
Tuesday 9/14	Atmospheric Structure	Ch. 3 – Planetary Energy Balance		
Friday 9/17	Greenhouse Effect	Ch. 3 – Physics of Greenhouse Effect. Climate Feedbacks		2
Tuesday 9/21	The Systems Approach	Ch. 2 – Systems Approach	HW#1 assigned	
Friday 9/24	The Systems Approach	Ch. 2 – Systems Approach		3
Tuesday 9/28	Feedbacks. Forcing.	Ch. 2 – Daisyworld climate system	<b>HW#1 DUE</b>	
Friday 10/1	<b>Chapter 4</b>	Earth's Atmosphere – Ch. 4		4
<b>Tuesday 10/5</b>	<b>Exam</b>	<b>Chapters 1-3 &amp; part of 4</b>		
Friday 10/8	Atmospheric Circulation	Ch. 4 – Global Patterns. Precipitation	<b>HW#2 assigned</b>	5
Tuesday 10/12	Hurricanes	Ch. 4 – Finish chapter		
Friday 10/15	The Oceans	Ch. 5 – Surface currents		6
Tuesday 10/19	The Oceans	Ch. 5 – Surface currents		

Friday 10/22	The Oceans	Ch. 5 – Deep Ocean Circulation	<b>HW#2 due</b>	7
Tuesday 10/26	The Oceans	Ch. 5 – Deep Ocean Circulation		
Friday 10/29	The ocean and Climate	Ch. 5 – Ocean Circulation ENSO		8
Tuesday 11/2	Ch 6	The Cryosphere		
Friday 11/5	Ch 6	The Cryosphere		9
Tuesday 11/9	<b>EXAM 2</b>	<b>Chapters 4,5 &amp; 6</b>		
Friday 11/12	Ch 7.	The Solid Earth		10
Tuesday 11/16	Physiology of Solid Earth	Ch. 7 – Plate Tectonics. The Rock Cycle.		
Friday 11/19	Physiology of Solid Earth	Ch. 7– Systems approach to C cycle	<b>HW# 3 assigned</b>	11
Tuesday 11/23	Short Term Cycle	Ch. 8 – Short-term organic C cycle; the biological pump		
11/26	College Closed	Happy Thanksgiving!		
Tuesday 11/29	Inorganic Carbon	<b>Ch. 8 – Long-term organic C cycle</b>		
Friday 12/3	Inorganic Carbon	Ch. 8 – Long-term organic C cycle	<b>HW#3 DUE</b>	13
Tuesday 12/7	Links between organic & inorganic C	Chapter 8 – Finish the chapter.		

<b>Friday 12/10 –</b>	<b>Review for Final Exam</b>	<b>Last Day of Class</b>		14
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\* Other Readings – to be assigned on a weekly or bi-weekly basis.

### **Voicethread/Figure write-up schedule**

Voicethread posts and companion figure descriptions are due each Tuesday prior to class. Voicethread comments are due each Friday **prior** to class. Late posts and comments will NOT be graded. Group numbers can be found on BB.

<b>Date</b>	<b>day</b>		
Friday 8/27		<b>First Day of Class</b>	
Tuesday 8/31	Tues	Group 1 posts and figure description submission	
Friday 9/10	Fri	All student comments due	
Tuesday 9/14	Tues	Group 2 posts and figure description submission	
Friday 9/17	Friday	All student comments due	
Tuesday 9/21	Tuesday	Group 3 posts and figure description submission	
Friday 9/24	<b>Friday</b>	All student comments due	
Tuesday 9/28	Tues	Group 1 posts and figure description submission	
Friday 10/1	Friday	All student comments due	
Tuesday 10/5	Tues.	Group 2 posts and figure description submission	
Friday 10/8	Friday	All student comments due	
Tuesday 10/12	Tuesday	Group 3 posts and figure description submission	
Friday 10/15	Friday	All student comments due	
Tuesday 10/19	Tues	Group 1 posts and figure description submission	
Friday 10/22	Friday	All student comments due	

Tuesday 10/26	Tues	Group 2 posts and figure description submission	
Friday 10/29	Friday	All student comments due	
Tuesday 11/2	Tuesday	Group 3 posts and figure description submission	
Friday 11/5	Fri	All student comments due	
Tuesday 11/9	Wed	Group 1 posts and figure description submission	
Friday 11/12	Fri	All student comments due	
Tuesday 11/16	Tues	Group 2 posts and figure description submission	
Friday 11/19	Friday	All student comments due	
Tuesday 11/23	Tues	Group 3 posts and figure description submission	
11/26	Friday	All student comments due	
Tuesday 11/29	Tuesday	Group 1 posts and figure description submission	
Friday 12/3	Friday	All student comments due	
Tuesday 12/7	Tuesday	Group 2 posts and figure description submission & Group 3 posts and figure description submission	
<b>Friday 12/10 -</b>	Friday	All student comments due	