

**COURSE INFORMATION AND OBJECTIVES**  
**EARTH SYSTEMS SCIENCE I**  
**PGEOG250 Fall 2009**

Professor Allan Frei

**CLASS SCHEDULE:**

LECTURES: Tuesday / Thursday, 4:10-5:25, Room 1022 Hunter North

LABS: Section 1: Tuesday, 3:10-4:00, Room 1090B Hunter North

Section 2: Thursday, 3:10-4:00, Room 1090B Hunter North

**PROFESSOR FREI CONTACT INFORMATION:**

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Office Hours: by appointment

**COURSE DESCRIPTION & OBJECTIVES**

In this course we learn to think of our planet as a system. A system consists of several components that interact with each other, sometimes in very complicated fashions. The components of the earth system that we will consider include the atmosphere, the hydrosphere, the lithosphere, and the biosphere. While each of these components can, and should, be studied in more detail in separate courses, here we focus on interactions between them.

The three main objectives of this course are:

1. To introduce students to “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.
2. To introduce students to quantitative analysis. In the lab portion of this course we will be introduced to some of the concepts necessary to study environmental systems in a quantitative fashion. Labs are meant to provide students with a number of identifiable skills that can be applied in other courses as well as in work environments.
3. To provide students with a sufficiently broad, yet integrated, understanding of the earth system to identify particular areas or sub-disciplines that they would like to pursue in more detail.

**COMPUTER LABS**

Computer labs will be held once per week in room 1090B North. Labs will consist of exercises designed to introduce students 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.

Most labs take 2 weeks. Labs are expected to be emailed to the professor before the beginning of the next lab.

**GROUP WORK** – is allowed for all labs except labs 1, 2, and 5. If students choose to work in groups, students must: (1) inform the professor before the due date which students are working together; and (2) hand in only one lab per group, with all students names on the lab.

### **PREREQUISITES**

Each student must have passed at least one 100-level science course, or have permission of the instructor. Basic familiarity with the Windows operating system, and Microsoft Word and EXCEL, are assumed. Students will be taught to use additional software for running computer simulations in the laboratory.

### **REQUIRED TEXT BOOKS**

Students must obtain their own copies of:

Kump, Kasting, and Crane, 2004, *The Earth System*, (either 2nd edition or 3<sup>rd</sup> edition is acceptable), Pearson / Prentice Hall Publishers. This book has been ordered at the Hunter College book store, and can be obtained online. See table at the end of this file for outline of differences between the two editions

**ADDITIONAL READINGS AND LAB MATERIAL** will be provided, including excerpts from the following:

Bowler and Morus, *Making Modern Science*, University of Chicago Press, 2005

Greenleaf, Frederick P., *Quantitative Reasoning: Understanding the Mathematical Patterns in Nature*, McGraw-Hill

Lab exercises that have been designed specifically for this course

### **GRADES**

Grades are based on lab work, two midterm exams, one final exam, and four low-impact assignments (two labs and two written).

Labs	24%
Midterm 1	20%
Midterm 2	24%
Final	24%
Low impact	8%

### **EXAMS**

Three exams will be given, two in-class midterm exams and one final exam. See the syllabus for exam dates and information about which chapters will be covered.

### **LOW IMPACT ASSIGNMENTS**

There are 2 low impact lab assignments (labs 1 and 2) and two low impact written assignments. Low impact assignments are graded on a pass/fail basis. All students are

expected to pass and get full credit by (a) handing in the assignment on time, and (b) making a legitimate effort to complete the assignment. If you want credit, all you have to do is try. The purpose of these low impact assignments is to allow students to think about particular issues without the pressure of grades.

### **ATTENDANCE**

Attendance is required at all lectures and labs. Up to two unexcused absences from lectures will be tolerated. Only one unexcused absence is allowed from lab sessions. Each unexcused absence after the maximum allowable limit will result in a decrease of 5% from the student's grade in the course.

### **PLAGIARISM AND CHEATING**

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. See <http://www.geography.hunter.cuny.edu/~tbw/wc/Academic%20Honesty.doc>.

Chapter Titles for second and third editions of text

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

**PG250 (ESS 1) 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.

COURSE SCHEDULE  
 EARTH SYSTEMS SCIENCE  
 PGEOG250, Fall 2009

This schedule is tentative (Subject to change)

“chapters” and page numbers refer to Kump, Kasting, and Crane 2<sup>nd</sup> edition, text unless otherwise specified

“B&M” refers to chapters from Bowler and Morus, which will be provided to you

SESSION #	DATE	DAY	LECTURES	REQUIRED READING/ASSIGNMENT DUE ON THAT DAY	TUESDAY LAB	THURSDAY LAB
1	9/1	T	Introductory lecture, <b>Chapter 1 – Global Change</b>		<b>Lab 1. Introduction to EXCEL, Scientific Notation, Logarithms, unit conversion (low impact)</b>	
2	9/3	TH	Ch. 1 (continued)	Ch. 1 – Global Change		<b>Lab 1</b>
3	9/8	T	<b>Ch. 3 – Global Radiation Balance</b>	Ch. 3 – Global Radiation Balance p. 34-40	<b>Lab 2. Scientific notation and working with units (low impact)</b>	
4	9/10	TH	Ch. 3 (continued)	Ch. 3, p. 41-48		<b>Lab 2</b>
5	9/15	T	Ch. 3 (continued)	Ch. 3, p. 48-end of chapter	<b>Lab 3. Earth Radiation Balance</b>	
6	9/17	TH	<b>Ch. 2 – Systems Thinking</b>	Ch. 2 – Systems Thinking p. 18-23		<b>Lab 3</b>
7	9/22	T	Ch. 2 (continued)	Ch. 2, p. 23-end of chapter	Lab 3 (continued)	
8	9/24	TH	<b>B&amp;M ch. 5 – The Age of the Earth</b> <i>Review for midterm 1</i>	<b>B&amp;M ch. 5 – The Age of the Earth</b> <b>low impact assignment #1</b>		Lab 3 (continued)
	9/29	T	<b>NO CLASS (MONDAY SCHED)</b>			
9	10/1	TH		<b>MIDTERM 1 EXAM ch. 1-3</b>		<b>Lab 4</b>
10	10/6	T	<b>Ch. 4 – The Atmosphere</b>	Ch. 4 p. 55-63	<b>Lab 4 Daisyworld</b>	
11	10/8	TH	Ch. 4. (continued)	Ch. 4 (cont'd) p. 63-68		Lab 4 (continued)
12	10/13	T	Ch. 4. (continued)	Ch. 4 (cont'd) p. 68-end of chap.	Lab 4 (continued)	
13	10/15	TH	Ch. 4. (continued)	Ch. 4 (cont'd)		<b>Lab 5</b>

14	10/20	T	<b>Ch. 5 – The Oceans</b>	Ch 5 p. 83-87	<b>Lab 5. Geometric progressions and growth, and the exponential and logarithmic functions</b>	
15	10/22	TH	Ch. 5 (continued)	Ch. 5, p. 87-91		Lab 5 (continued)
16	10/27	T	Ch. 5 (continued)	Ch. 5, p. 91-end of chapter	Lab 5 (continued)	
17	10/29	TH	<b>Ch. 6 – Modeling the Atmosphere Ocean System FROM 2<sup>nd</sup> EDITION (</b>			<b>Lab 6</b>
18	11/3	T	Ch. 6 (continued) Math Review		<b>Lab 6. Measurements, Meteorological measurements, discuss low impact assignment #3</b>	
19	11/5	TH	<i>Math Review, Review for midterm 2 exam,</i>	<i>Study for midterm exam</i>		<b>Lab 7</b>
20	11/10	T		<b>MIDTERM 2 EXAM ch. 4-6</b>	<b>Lab 7. Thermal Damping, response times, seasons</b>	
21	11/12	TH	<b>Ch. 7 The Solid Earth</b>			Lab 7 (continued)
22	11/17	T	Ch. 7 (continued)	Ch. 7	Lab 7 (continued)	
23	11/19	TH	<b>Ch. 8 – The Carbon Cycle</b>	Ch. 8, p. 147-152		<b>Lab 8</b>
24	11/24	T	Ch. 8 (continued)	Ch. 8, p. 153-158	<b>Lab 8. The Carbon Cycle</b>	
	11/26	TH	<b>NO CLASS (Thanksgiving)</b>			
25	12/1	T	Ch. 8 (continued)	Ch. 8, p. 158-161	Lab 8 (continued)	
26	12/3	TH	Ch. 8 (continued)	Ch. 8, p. 161-end of chapter		Lab 8 (continued)
27	12/8	T	The Scientific Method	<i>No reading assignment</i>	<b>LAB 8 IS DUE</b>	
28	12/10	TH	Review for Final Exam	B&M ch. 10 – Continental Drift <b>low impact assignment #2</b>		<b>LAB 8 IS DUE</b>
FINAL EXAM	12/15 1:45 – 3:45	T		<b>Final Exam – Ch. 7,8</b>		