Geology 382 - Global Change
Spring 2007
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Introduction and Goals

When we think of global change we mostly think of "climate change", a trend away from what we expect in the long-term weather (e.g., temperature, precipitation). But global change is more than that. From a biologic or ecosystem view it is changes in atmospheric chemistry, biodiversity, water quality and human heath. At the geophysical level it is the response of the earth system to internal (tectonic) and external (astronomical) processes. Humans now rival, and sometimes surpass, many of these biologic and geophysical processes. This means that anthropogenic (human caused) factors may control, to a large extent, what the earth is like in the future. The purpose of this course is to examine these issues through lectures, readings, problem sets, homework, and discussions of various aspects of global change—from the origin of the earth's atmosphere and early climate to the present human-influences on the earth system. We will read and discuss two main categories of the global change literature: Earth system processes and how humans affect those processes.

Format and Grading

This course will be taught in a lecture and discussion format. I will present some framework and background material in lectures. This will help you understand the readings that you will use to supplement chapters in the text and topics we will discuss in class. There will be three exams during the term: two exams during the term plus a comprehensive final exam covering all the material presented. You will be expected to participate in discussion of the readings and graded on that participation. My expectation is that you will spend 6-8 hours out of class each week reading, solving problems, writing homework, and preparing for discussion of readings. The textbook for the class is:

- Kump, L.R., J.F. Kasting and R.G. Crane, *The Earth System, 2nd Ed.* Prentice Hall, New Jersey, 2004.

You will be responsible for all readings in the text, additional readings available on reserve and any assigned problems/homework.

If you want to delve deeper into various aspects of the topic there are a number of excellent books available. For example, an excellent book about the history of discovering the Ice Age and the understanding of global climate change until ca. 1978 can be found in:

- John Imbrie and K. P. Imbrie, Ice Ages: *The mystery solved*, Harvard University Press, Cambridge, MA, 1979.

This is an excellent book for background reading on the science of glacial geology and will make excellent Spring break reading in preparation for the second exam. I have not asked the bookstore to purchase this book, but you can buy it inexpensively on any of the online bookstores.

We will use the Krump, Kasting and Crane (KKC) book for background and explanatory material. KKC will define the main structure and content of the course. We will use that material as a jumping off point for reading more detailed work. Those readings will be in the Library on reserve or ERes at the Mansfield Library. You need to read all the papers and chapters for each week designated in the schedule and reading list. You should be prepared to discuss the main points where appropriate in the lectures. It will help you to arrange your thoughts if you outline all the reading assignments and prepare any questions for discussion and studying for exams. Any or all of the information in the papers and text readings may be incorporated into the exams.

The grading distribution will be approximately that given in the following table. The homework tally may change depending on the number and difficulty of assignments. The final point distribution may change during the term depending on time constraints, etc.:

Lecture Quizzes	50
Exams (2) 100 points each	200
Final Exam 200 points	200
Homework 20-40 points each	150
Class Participation	50
TOTAL	**650**

Your final grade will be earned based generally on the following distribution:

>90% = A
80-89%= B
65-79%= C
50-64%= D
<50% = F

Exams and Quizzes

There will some short quizzes during or at the end some lectures based on the material presented. You will be able to use your notes to answer these questions so make certain to take good notes. The two exams (those given during the term; see the schedule for exam dates) will cover material in lecture and readings previous to the exams. The final exam will cover all material in the course. All exams will be both information and problem-solving oriented. I will expect you to understand all the information and

principles that we have dealt with in the readings and homework. This may require mathematical solutions where appropriate, so, you should be knowledgeable of all formulas and mathematical concepts used in the lectures and readings. Make sure to bring a calculator to all exams. There may also be questions requiring knowledge of definitions of important terms, so you should also have a good understanding of the accepted vocabulary and be able to define/discuss important terms/concepts. There will be no makeup exams. If you cannot take an exam you will receive no grade for that exam and you will be assigned the grade of your other exam for the missing exam at the end or the term. If you miss two exams you will receive a zero on both. You must take the final exam during the final exam period. There will be no makeup final exam. If you do not take the final exam you will receive whatever grade you have earned based on your total points. The highest grade you would be able to receive is a C if you have 100% on all other assignments, exams, etc. If you miss one of the two exams and the final exam, you will receive an F for the course.

Homework and In-class Exercises

There may be some in-class group or individual assignments. They will be completed in class. These may or may not be graded depending on the goal of the assignment. Homework assignments will be given out more or less weekly to bi-weekly and are due the following week at the beginning of the class. All of homework will be graded. I will not accept late homework because we will discuss the homework in class before the lecture. You should be ready to present your answers to the class. You will be graded on your preparedness. If you do not turn in your assignment on time you will receive a zero for that assignment. All written parts of the homework problems must be typed and completely referenced, where appropriate. If you use equations in your work, use your word processor's equation editor or write them VERY clearly, and make sure all elements are defined. If you use a spreadsheet for numerical calculations make sure to explain what formulas you used in normal equation format. Either use your graphics/plotting program to make graphs or hand draw and label them VERY neatly in ink. I will expect a professional job on all work and you will be graded on grammar, spelling, organization, completeness, clarity, etc., as well as on content and correctness on homework assignments.

The answers for the homework will be posted on ERes after we discuss them in class.

Geology 382 – Global Change
Schedule—Spring 2007*

Date	Topic	Readings
01/26/2007	Introduction & Background	KKC-Chap. 1 and RR.
02/02/2007	System Thinking Fundamentals	KKC–Chap. 2 and RR.
02/09/2007	Global Energy Balance	KKC–Chap. 3 and RR.
02/16/2007	Atmospheric & Ocean Surface Circulation	KKC–Chap. 4, 5 and RR.
02/23/2007	Deep Ocean Circulation; Ocean-Atmosphere Controls on Climate	KKC–Chap. 4, 5 and RR.
03/02/2007	***EXAM 1*** Brief Review of Plate Tectonics	All information from start of class. KKC-Chap. 7
03/09/2007	Carbon Cycles	KKC-Chap. 8 and RR.
03/16/2007	Long-Term Climate Trends; Evolution of Earth's Atmosphere	KKC-Chap. 12, 11 and RR.
03/23/2007	Pleistocene Glaciations & Controls on Glaciation	KKC–Chap. 14 and RR. I&I.
03/30/2007	Spring Break—No class	
04/06/2007	***EXAM 2***	All information since last exam.
04/13/2007	Historical & Recent Climate Change	KKC-Chap. 15, 16 and RR.
04/20/2007	Modeling Future Climate & Predicting Climate Response	KKC-Chap. 6 and RR.
04/27/2007	Biodiversity & Ecosystem Effects of Climate Change; Ocean Acidification	KKC–Chap. 9, 18 and RR.
05/04/2007	Ozone & Other Pollutants	KKC–Chap. 17 and RR.
05/9/2007	**FINAL EXAM—1:10-3:10PM**	The final exam will be comprehensive and cover all material in the class.

KKC = Kump, L.R., Kasting, J.F. and R.G. Crane, 2nd Ed., 2004, *The Earth System*, Prentice Hall, Upper Saddle River, New Jersey.

I&I = Optional but useful: Imbrie, J. and K.P. Imbrie, 1979, *Ice Ages: Solving the Mystery*, Harvard University Press, Cambridge, Massachusetts.

RR = Readings from reading list on ERes via password: CLIMATE

*Schedule subject to change during the semester. Changes will be given in class if needed.