



Course Syllabus
GEOL 162: The Earth's Record of Climate
Spring Semester, 2012



Instructor	Dr. Kevin Theissen (kmtheissen@stthomas.edu)
Office	OSS 116
Office Hours	Wed. 1-2 p.m. or by appointment
Phone	962-5243
Lab Instructor :	Erik Smith (smit2885@stthomas.edu)
Lecture	MWF 9:35 -10:40 am, <u>Room: OWS 150 (3M Lecture Hall)</u>
Lab Sections	Tu: 10-12 a.m. and 1:30-3:30 p.m. <u>Rm. OSS 124</u>

COURSE DESCRIPTION:

In this course we will explore the Earth's climate system and the climatic changes that have occurred during the history of our planet. You will gain a hands-on introduction to the collection, analysis, and interpretation of climate data in laboratory sessions and course exercises designed with an emphasis on scientific inquiry and problem solving.

PREREQUISITES:

None. This course fulfills the core requirement of an introductory geology course for potential Geology majors or minors. Students who have taken another introductory geology course may take this course as well. After satisfactory completion of this course you will be eligible to take upper level courses in geology.

COURSE OBJECTIVES:

1. **Gaining factual knowledge and learning fundamental principles and theories.** You should be able to demonstrate your knowledge by defining key terms, identifying and classifying important Earth features, and explaining important concepts and theories about Earth's climate.
2. **Learning to *apply* course material.** You should be able to access climate and past climate data from sources such as the internet, analyze these data sets, make interpretations, and make comparisons between different data sets.
3. **Learning to *apply* course material.** You should be able to use different types of geological evidence (including sediment and rock types, fossils, and geochemical data) to make an interpretation of the geological and climate-related history of a given region.
4. **Learning to analyze and critically evaluate ideas, arguments, and points of view.** You should be able to evaluate climate-related arguments and information in scientific articles and the mainstream media.

REQUIRED MATERIALS:

Available from UST bookstore. A copy of each is on reserve at the O'Shaughnessy-Frey Library

1. *Earth's Climate Past and Future* by William F. Ruddiman, 2008. W.H. Freeman and Co., New York, 388 p.
2. *Dire Predictions: Understanding Global Warming* by Michael E. Mann and Lee R. Kump, 2009. DK, New York, 208 p.
3. A Turning Point RF ResponseCard ("clicker") is also required for this course.

Course web page

You need a St. Thomas email account. The course page (Blackboard) can be accessed from the UST homepage. Please let me know if you need help with this.

GRADING SCALE and BREAKDOWN:

A	93 - 100%	B	83 - 86%	C	73 - 76%	D	63 - 66%
A-	90 - 92%	B-	80 - 82%	C-	70 - 72%	D-	60 - 62%
B+	87 - 89%	C+	77 - 79%	D+	67 - 69%	F	< 60%

Assessment Category	Points	Percent of Grade
Exams (3)	350	35%
Quizzes, homework, in-class exercises	150	15%
In-class Participation	50	5%
Lab Assignments (10) and mineral and rock quiz	300	30%
Lab Synthesis Project	100	10%
Emissions Role Play	50	5%
	1000	100%

*****Please note:** The first two items constitute the lecture portion of the course and the last three constitute the lab portion. In order to receive a passing grade in this course you will need to achieve passing scores in both portions.

COURSE ORGANIZATION:

Readings:

You will be expected to complete assigned reading on your own prior to each lecture. Keeping up with the reading will help you become familiar with vocabulary and concepts, greatly enhancing what you take away from each lecture and laboratory exercise.

Knowledge Survey

In your first lab session and then again before each exam, you will complete a knowledge survey that is available on the course website in Blackboard. The knowledge survey is a series of questions and instructions that resembles an exam. However, instead of directly answering the questions on the survey, you are asked to reflect and give your level of confidence (on a 3 point scale) that you could answer them. This learning tool has specific uses for both you and your instructors. It will allow us to gauge your understanding of important concepts prior to, during, and at the end of the course. This will provide a measure of your learning in the course. The knowledge survey will also make a nice study guide for you as you prepare for quizzes and exams. You will always be able to refer to the questions on the survey. We will explain the knowledge survey more fully in class.

Exams: (2 midterms @ 100 points each; 1 final @ 150 pts; 350 points total)

Each exam is an individual, in-class effort, without the assistance of books, notes, or other students. There will be three exams in this class. The exams will use a combination of multiple choice, true/false, fill in the blank, diagram labeling, and sketch/short answer questions. Exams will cover lectures, textbook reading assignments, and lab activities. The final exam will be somewhat longer than the two midterms and will be cumulative.

Quizzes (3 quizzes at 20 points each = 60 points); Homework and In-class assignments (= 90 points)

You will complete three quizzes in class to firm up important concepts and to make sure you are keeping up with the reading assignments. Quizzes are scheduled and will take place in the first 10-15 minutes of the class period in which they are given. Periodically, I will ask you to complete a homework assignment and more frequently we will work on in-class assignments. Both of these tasks are designed to help you master the material and prepare for what you might expect on exams.

Participation (50 points)

We will use the student response system in this course. During each class session I will ask you to respond to questions related to lecture. You will receive feedback after each class session on your responses. As long as you are fully participating in responding to these questions you will receive credit.

Lab exercises (10 assignments at 25 points each = 250 points)

Mandatory two-hour lab sessions will be held each week of the semester. The lab activities are hands-on, in-class exercises designed to illustrate and reinforce concepts introduced in lecture. Your instructor will test your understanding of these concepts and provide you with immediate feedback during the lab.

Mineral and Rock Quiz (50 points)

In the seventh week of the course (Week of March 15) you will take a quiz in the first half of the lab session to test your knowledge of rocks and minerals examined during the previous two lab sessions.

Lab Synthesis Project (100 points)

This project will give you the opportunity to apply the skills and concepts that you have worked on in laboratory exercises. You will work with a partner to interpret the climate history of a region using geological tools that you have learned about in the course.

Emission Role Play Exercise (50 points)

During the final two lab sessions of the course you and your classmates will be cast into different roles and then challenged to research, debate, and vote on proposed legislation to reduce greenhouse gases in the atmosphere. Your grading will be based on your effort and the quality of the material you present during the exercise.

COURSE POLICIES:

- 1) **Attendance and late work:** Class attendance is essential. I allow one late assignment which will be penalized 10% for each day after the due date that it is tardy. All other late work is not accepted, and class assignments and lab activities cannot be made up without prior consent of the instructors. The class is based on activities and discussions, which require full attention and participation.
- 2) **Lectures:** We will use Powerpoint as a lecturing tool throughout this course. All Powerpoint slides will be available on the course Blackboard site. **Please Note: Lecture slides are not a substitute for attending class and many important concepts will be only partially represented on slides. Also, lecture slides will be made available after class for that particular lecture. Students have often asked if we could make them available before class meets. The reason we don't provide these materials in advance is that we often change things---even right up to the last minute before class!**
- 3) **Academic Integrity:** please review the Academic Integrity Policy in the *UST Student Policy Book*. Cheating, fabrication, plagiarism, and aiding others in these violations are all forms of academic dishonesty. At minimum the penalty for a violation will be automatic failure of the assignment along with a letter notifying the dean of the offense. In order to avoid plagiarism, always use quotation marks when directly quoting someone else's work, attempt to use your own words (paraphrase) wherever possible, and always properly cite sources of information.
- 4) **Accommodations:** If you have a learning disability or other disability, contact the Enhancement Program (651-962-6315) and discuss your needs with the instructor **at the beginning of the term**. Every effort will be made to ensure that this course is a valuable learning experience for all participating students.
- 5) **Communication:** If you have something important to tell us (i.e. you'll be late, absent, etc.) send an email reminder. Telling your instructor after class and hoping we will remember is not a good option.
- 6) **Cell phones:** Show respect for the instructor and other students in the classroom, by turning of your phone during class time.

Tentative course schedule. This schedule is subject to change.

<i>Date</i>	<i>Lecture Topics</i>	<i>Lab Exercise</i>	<i>Reading</i> EC = Earth's Climate Past and Future DP = Dire Predictions
Jan 30, Feb 1, 3	The Earth's climate system: forcings, responses, and feedbacks	Working with Climate Data in Excel *Knowledge Survey	EC: Chap. 1 DP: Introduction (pp 10-15)
Feb 6,8,10	Moving heat around the planet: Atmosphere and Ocean Circulation	Does a Heat island exist in the Twin Cities?	Reading posted in Blackboard: (pp 2 -27) Heat island article (Blackboard)
Feb 13,15,17	Climate archives and age-dating the climate record Quiz 1 Film: <u>Mystery of the Megavolcano</u>	Stump the chumps: Relative and absolute age-dating	EC: Chap. 2 (pp. 17-31)
Feb 20,22,24	CO ₂ and long-term climate change The Solid Earth: the Earth's interior and Plate Tectonics	Plate Boundaries *Knowledge Survey	EC: Chap 3 (pp. 43-56) and Chap 4 (pp. 60-66)
Feb 27,29 Mar 2	Plate tectonics and climate Greenhouse world Mid-term Exam I, Mar. 2	Minerals and igneous rocks	EC: Chap. 5 (pp. 81-92)
Mar 5, 7, 9	Catastrophic climate events: KT events and Snowball Earth	Sedimentary rocks and sedimentary structures	EC: Chap. 5 (92-95) Snowball Earth articles (Blackboard)
Mar 12,14,16	Icehouse and Oxygen isotopes The influence of changes in the Earth's orbit on climate Film: <u>Cracking the Ice Age</u>	Mineral and Rock quiz and "Web mining" for data: Geochemical records of past climate change	EC: Chap. 6 (pp. 97-102) Chap. 7 (pp. 119-129) Chap. 9 (pp. 155-158)
SPRING BREAK --- March 19 – 23			
Mar 26,28,30	The influence of changes in the Earth's orbit on climate Quiz 2	Northern Africa's paleolakes	EC: Chap. 8 (pp. 137-146)
Apr 2,4	The Last Glacial Maximum and Deglaciation Film: <u>Mystery of the Megaflood</u>	Streams and glaciers: Minnehaha Falls trip *Knowledge Survey	EC: Chap. 12 (pp. 209-218) Chapter 13 (pp. 229-240) Ice age module website
Apr 11, 13	The Holocene world and historical climate events Mid-term Exam 2, Apr. 11	Web-mining 2: Holocene rapid climate change	EC: Chap. 16
Apr 16, 18, 20	Fossil fuels and the climate of the twentieth century	Lab synthesis project	IPCC Report (blackboard) DP: Part 1
Apr 23, 25, 27	Climate models The evidence for global climate change, climate contrarians and their arguments	Lab synthesis project	EC: Chap. 2 (pp. 31-36) DP: Part 1

	Quiz 3		
Apr 30 May 2, 4	Future climate trends, climate change in Minnesota	Emissions role-play preparation	IPCC report (blackboard) DP: Parts 2 and 3
May 7, 9, 11	Climate change policy and solutions	Emissions role-play exercise *Knowledge Survey	IPCC Report (blackboard) DP: Part s 4 and 5
FINAL EXAM WEEK			

OTHER READINGS AND WEBSITES WE WILL USE:

Links /PDFs will be made available to you on the course Blackboard site

Allison, I. and many other authors, 2009. The Copenhagen Diagnosis, 2009: Updating the world on the latest climate science. The University of New South Wales Climate Change Research Centre, Sydney, Australia. 60 p.

Hoffman, P.F., Kaufman, A.J., Halverson, G.P., and Schrag, D.P., 1998, A Neoproterozoic snowball earth, Science, v.281, p.1342-1346.

Hoffman, P.F. and Schrag, D.P., 2000, Snowball Earth, Scientific American, v. 282, p. 68-75.

Intergovernmental Panel on Climate Change, 2007, In: Solomon, S., Qin, D., Manning, M., Chen, Z., Marquis, M., Averyt, K.B., Tignor, M., and Miller, H.L., editors. Summary for Policymakers, Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge, United Kingdom, Cambridge Press, p. 1-18.
http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf

Jauregui, E., 1997, Heat island development in Mexico City, Atmospheric Environment, v. 31, p. 3821-3831.

Mills, 2004, The urban canopy layer heat island IAUC teaching resources <http://www.urban-climate.org/> (note: click resources → teaching resources link)

NOAA Paleoclimatology Page: <http://www.ncdc.noaa.gov/paleo/paleo.html>

NOAA/PMEL El Nino Theme Page: <http://www.pmel.noaa.gov/tao/elnino/nino-home.html>

Press, F., 2008, Earth Science and society, Nature, v.451, p.301-303.

Stern Review on the Economics of Climate Change (short Executive Summary), 2007, p. vi-ix.

Sturm, M., Perovich, D.K., and Serreze, M.C., 2003, Meltdown in the north, Scientific American, v.285, p. 60-67.

TAO buoy data: <http://www.pmel.noaa.gov/tao/jsdisplay/>

Understanding Earth's Deep Past: Lessons for Our Climate Future, 2011, National Academies Press, 212 p.

I have read, understand, and will comply with the rules described above in this course syllabus.

Your printed name: _____

Your signature and today's date: _____

Please bring a signed copy of this page only to class by Friday, February 3