

SEMESTER AT SEA COURSE SYLLABUS

Discipline: Environmental Sciences

Semester and Year: Summer 2007

Course Number and Title: EVSC 181: **Climate Change: Past and Future**

Faculty Name: Jose D Fuentes

Pre-requisites: None

COURSE DESCRIPTION

This course examines the various factors which govern changes over time in the Earth's climate. This includes natural changes in greenhouse gas concentrations, the strength of energy output from the Sun, the Earth's orbit around the Sun, and effects of volcanic eruptions. The human or "anthropogenic" effects associated, for example, with industrial greenhouse gas concentration increases will be studied. The knowledge of past climate changes is used as a frame of reference for understanding and predicting current and future climate change. The focus of the course is to evaluate concepts to learn how many parts of the climate system (atmosphere, land, and oceans) interact. Although the course is intended primarily for non-science majors, students will learn basic concepts related to causes and effects of climate change.

COURSE OBJECTIVES

The goals of this course are to study the history of the climate of the Earth's atmosphere, and to learn the causes of the climate variability.

COURSE OUTLINE

TOPIC	BOOK CHAPTER
1. Introduction & Overview	
Introduction and Overview of Climate Science	1
Climate Forcing, Response Times and Feedbacks	1
Modern Climate: Solar Radiation and Heating	2
Modern Climate: Heat and Circulation	2
Ocean Circulation, Ice, Hydrological Cycle and Vegetation	2, 3
2. Tectonic-Scale Climate Changes	
Faint Young Sun Paradox: What is Earth's Thermostat?	4
Do Movements of the Continents Explain Ice Ages?	5
Long-Term carbon dioxide Variations: Tectonics, Uplift, and Weathering	5
Simulation of Climate using Numerical Models	3
Simulating the Greenhouse World of 100 Myr ago	6
NOVA Film: Uplift of Tibet & Creation of a Monsoon	7
Into the Icehouse: Cooling during the last 55 Myr	7
3. Orbital Effects and Ice Ages	
Variations in Earth's Orbit	8
Changes in Solar Radiation Received on Earth	8
Orbital Changes Drive Monsoon Cycles	9
Modeling Changes in Ice-Sheet Size	10
Orbital Changes Drive Ice-Sheet Cycles	10
Other Orbital Scale Changes	11, 12
4. Deglacial Climate Changes	
Other Orbital Scale Changes	11, 12
Climate During the Last 20,000 Yrs	13
5. Historical and Future Climate Changes	
Climate During the Last Deglaciation; Millennial Oscillations	14
Climate Changes in Past Centuries	16
The Little Ice Age" and "Medieval Warm Period"	16
Natural Causes: El Ninos & Ocean Circulation Changes	16
Natural Causes: Volcanic Eruptions, & Solar Changes	16
20th Century Climate Change: The Data	16, 17
Anthropogenic Causes: Effects of Humans on Climate	17
Anthropogenic Causes: The Greenhouse Debate	18

PAGE 3

FIELD COMPONENT: Students will learn how to obtain the basic measurements needed to define the climate of a given region. Examples of measurements include air temperature, humidity, wind speed, and air pressure. Students will also spend data analyzing climate records from local places in Latin America.

METHODS OF EVALUATION:

The class will meet three times a week. Attendance to all classes is expected. Although the instructor will closely follow the textbook, there is absolutely no substitute for attending the lectures in order to do well in the course. The course covers considerable ground, and the material will add up deceptively quickly over the term. Students are strongly encouraged to participate in class. Exams will draw heavily upon the topics and material covered in the lectures, a substantial portion of which may not be adequately covered in the textbook. Only by attending class students will obtain a firm understanding of what the course will cover, be able to ask questions about topics difficult to understand, and get a better sense of what material is truly central to the course.

Several problem sets will be assigned over the course of the semester and included in the final grade of the course. The problem sets are designed to help students put to practice the concepts and principles covered in the course. Cooperation among students is permitted while working on assignments, but the submitted work must represent the individual effort made by each student. Assignments submitted past the due date will not be accepted for grading. Three exams are scheduled during regular class hours. No make-up exams will be given. If students have any conflicts (i.e., officially sanctioned by the Semester at Sea program) with the exam dates, then students must immediately bring them to the attention of the instructor so that alternative arrangements can be made. Marks for the course will be allocated as follows:

Problem Sets:	20 %
Exam 1:	15 %
Exam 2:	25 %
Exam 3:	40 %

The final grade will be determined according to the following scale:

A+: Above 95	A: 90-94	A-: 85-89
B+: 80-84	B: 75-79	B-: 70-74
C+: 65-69	C: 60-64	C-: 55-59
D+: 50-54	D: 45-49	D-: 40-44

PAGE 4

ORDER FORM FOR REQUIRED TEXTBOOKS

AUTHOR: William F. Ruddiman

TITLE: Earth's Climate Past and Future

PUBLISHER:

ISBN #:

DATE/EDITION: 2001, 1st Editon

COST: \$90.95

RESERVE LIBRARY LIST

You may suggest a maximum of four books per course for the Reserve Collection. Our librarian will consult the library collection to see if we already have these books.

If we do not have the books, the librarian will purchase them for the permanent collection.

If you are listing more than four books, please indicate those books to which you place top priority, and the librarian will do her best to acquire those. If those you indicate are not available, she will try to acquire additional books that are on your list.

You may also bring books and materials from your own collection to be placed on Reserve.

AUTHOR: Raymond S. Bradley

TITLE: Paleoclimatology: Reconstructing Climates of the Quaternary

PUBLISHER: Academic Press

ISBN #:

DATE/EDITION: 2nd Edition,

COST: \$78.00

ELECTRONIC COURSE MATERIALS

In addition to course texts and reserve library materials, each faculty member will have an electronic course folder housed on the ship's intranet. The University of Virginia library will scan articles and chapters identified by the faculty member as needed supplementary materials for the courses they are teaching. These supplementary materials will be placed in the faculty member's intranet folder for students to access from their own computers or from the computer lab.

AUTHOR: William Ruddiman

ARTICLE/CHAPTER TITLE:

JOURNAL/BOOK TITLE: Plows, Plagues, and Petroleum: How Humans Took Control of Climate

VOLUME:

DATE: 2005

PAGES:

ADDITIONAL RESOURCES

Do you anticipate that students will be expected to locate and employ resources beyond required texts, reserve library reading and intranet resources? If yes, please identify these resources.

No. Students will be asked to analyze some data sets. The data sets need to be placed in a central computer.