GEOG – ENVIR ST – ATMOS OCN

331: CLIMATIC ENVIRONMENTS OF THE PAST

FALL 2005

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Office Hours: Tues 11am – 12pm,
Thurs 11am – 12pm
or by appointment

Lectures: 444 Science Hall, Tuesday/Thursday 9:30 – 10:45 am
URL: www.geography.wisc.edu/classes/geog331/Geog331.html

INTRODUCTION

This class focuses upon climatic changes during the Quaternary Period, which encompasses the last 1.6 million years, includes the rise of human civilizations, and extends to the present day. Climatically, the defining characteristics of the Quaternary are 1) regular cycles between glacial and interglacial periods and 2) abrupt shifts in the state of the climate system. Understanding the sources and causes of past climatic variability is a necessary precondition to making informed projections of future climate changes and impacts. The field is changing rapidly and new discoveries appear every week. The goals for this class are fourfold:

1) **History**: Review the major climatic events and trends during the Quaternary, spanning timescales from the last 1,000,000 years to the last 1,000 years. An emphasis will be placed on the global climate system, with some attention to regional climate changes.
2) **Mechanism**: Understand the physical processes controlling the behavior of the earth system and its components (atmosphere, oceans, cryosphere, biosphere, etc.). Understand also how climatic variability results from a combination of external forcings and internal dynamics within the earth system.
3) **Method**: Learn how paleoclimatologists collect, date, and analyze a staggering variety of paleoclimatic records, including ocean and lake sediment cores, ice cores, tree rings, corals, and speleothems.
4) **Communication**: Continue to develop skills in thinking and writing clearly, with particular attention to critically reading the scientific literature.

COURSE POLICIES

GRADING

Homework	20%
Term Paper	20%
Exam I	20%
Exam II	20%
Exam III	20%

Readings and Homeworks

Readings are drawn from the course textbook Earth's Climate: Past and Future and from supplementary articles, available on reserve at the Geography Library or on-line through the UW Reserve system.

The homework exercises are designed to give hands-on experience analyzing paleoclimatic datasets, conducting experiments with simple models of the earth system, reading the scientific literature, and writing. Homework assignments should be turned in by 5 pm of the due date. Overdue assignments will be penalized by 10% per day after the due date. Please contact me if any emergencies arise – but note that I get to decide what constitutes an emergency.

Examinations

There will be three non-cumulative exams during the semester. The exams will mostly be short essay. Other details on exam format TBA.

Term Paper

This paper gives you the opportunity to explore in more detail a topic of interest to you. Suitable paper topics include:

1) Methodological. Choose a paleoenvironmental line of evidence and explore its assumptions, limitations, and applications.
2) Historical. What happened and when? Pick an area of the world and report the major climatic events and trends during a particular time period (e.g. last 1000 years, last 10,000 years, last 100,000 years). Comment on the lines of evidence used to reconstruct past events, uncertainties in the data and models, and areas of agreement or disagreement among lines of evidence.
3) Issues in Paleoclimatology: Review an on-going debate in paleoclimatology, the lines of evidence supporting different positions, and ways forward.
4) Lessons from the Past. Pick a climatic or environmental issue of interest to you (e.g. global warming, nitrogen deposition, species conservation) and discuss, with examples, the insights gained from longer-timescale analyses.

Other topics are certainly possible. To generate ideas for paper topics, it may help to explore the Further Readings in the textbook and the Resources listed in the syllabus, or visit URLs on the Links page of the course website.

The paper will be developed over the course of the semester, with several stages of development:

Date	**Item**	**Proportion of Paper Grade**
Oct. 6	Outline and Initial Bibliography	10%
Nov. 1	First Draft	35%
Nov. 22	Reviews	20%
Dec. 15	Final Draft	35%

The Outline and Initial Bibliography should include a 1-2 page outline and at least five non-internet resources (i.e. journal articles, books).

The first and final drafts of the paper should 1) be 10-15 doublespaced pages long, 2) include a max 300-word abstract (not counted towards paper length), and 3) include a bibliography from the scientific literature (also not counted towards paper length). Figures are strongly encouraged but do not count towards (or against) paper length. Both drafts should include at least 10 citations, at least five of which must be scientific journal articles (see below for a list of paleoclimatology journals). Web pages should be cited if they are a source of information for your paper. Citations should follow the Council of Biology Editors' Name-Year style in which (Author, Year) is inserted directly after the relevant passage or fact within your paper within the paper and the full reference is included in a bibliography. See http://www.bedfordstmartins.com/online/cite8.html for more information -- especially with regard to citing internet resources.

Evaluation of the first draft will be based primarily on the comments of your classroom peers, following the standard peer-review process in academia. Evaluation of the second draft will be based primarily on my assessment of the overall quality of the paper and the improvements made between the first and second drafts.

RESOURCES

TEXTBOOKS

Earth's Climate: Past and Future by William F. Ruddiman. W. H. Freeman and Company, New York, 2001. (**Required**)

Paleoclimatology: Reconstructing Climates of the Quaternary by Raymond S. Bradley. Academic Press, San Diego, 1999. (**Optional**, available on reserve)

OTHER GOOD BOOKS

After the Ice Age: The Return of Life to Glaciated North America by E. C. Pielou, University of Chicago Press, Chicago, 1991.

Climate Modeling Primer (2nd ed.), by Kendal McGuffie and A. Henderson-Sellers. John Wiley and Sons, 1997

The Discovery of Global Warming by Spencer R. Weart, Harvard University Press, Cambridge, 2003.

Global Climates since the Last Glacial Maximum by Herbert E. Wright, Jr. et al. University of Minnesota Press, Minneapolis, 1993.

Ice Ages: Solving the Mystery by John Imbrie and Katherine P. Imbrie. MacMillan, London, 1979.

Principles of Paleoclimatology by Thomas M. Cronin. Columbia University Press, New York, 1999.

The Quaternary Period in the United States by A. R. Gillespie et al. Elsevier Science Ltd, Amsterdam, 2004.

The Two-Mile Time Machine: Ice Cores, Abrupt Climate Change and Our Future by Richard B. Alley. Princeton University Press, Princeton, 2000.

JOURNALS

Nature; Science; Geology; Quaternary Science Reviews; Quaternary Research; the Holocene; Palaeogeography, Palaeoclimatology, Palaeoecology; Global and Planetary Change…

Geography 331 Schedule, Fall 2005

	Date	#	Topic	Readings
WEEK 1	9/6	1	Introduction, The Earth System	ECPAR CH 1
	9/8	2	Atmosphere - Radiation	ECPAF CH 2
WEEK 2	9/13	3	Atmosphere - Dynamics	ECPAF CH 2
	9/15	4	Oceans	ECPAF CH 2
WEEK 3	9/20	5	Dating - Radiometric	ECPAF CH 3, Bradley 3.1-3.2.1, 3.2.3, 3.2.4
	9/22	6	Dating - Other	ECPAF CH 3, Bradley 4.1, 4.2.3, 4.3.2
WEEK 4	9/27	7	Library Resources	
	9/29	8	Stable Isotopes	ECPAF CH 3
WEEK 5	10/4	9	Biological Climate Proxies	ECPAF CH 3, Bradley 9.1-9.6, Webb 1993
	10/6	10	Marine Records	Bradley 6.1-6.4.0, 6.6, 6.7, **Outlines Due**
WEEK 6	10/11	11	Terrestrial Records	
	10/13	12	**Exam I**	
WEEK 7	10/18	13	Ice Sheets, Ice Cores	Two Mile Time Machine, pp. 31-75
	10/20	14	GCMs	Crowley Ch. 2.2-end
WEEK 8	10/25	15	Astronomical Controls on Climate	ECPAF CH 8
	10/27	16	Detecting Astronomical Controls in Climate Records	
WEEK 9	11/1	17	Insolation Control of Ice Sheets & Monsoons	ECPAF CH 9,10**, First Drafts Due**
	11/3	18	CO2, CH4 and the Glacial-Interglacial Carbon Cycle	ECPAF CH 11, 12
WEEK 10	11/8	19	The Last Glacial Maximum	ECPAF CH 13, COHMAP 1988
	11/10	20	Millennial Oscillations	ECPAF CH 15
WEEK 11	11/15	21	Deglaciation & The Younger Dryas	ECPAF CH 14
	11/17	22	**Exam II**	
WEEK 12	11/22	23	Holocene Climate Variability	Readings TBA, **Reviews Due**
	11/24	24	*Thanksgiving*	
WEEK 13	11/29	25	Welcome to the Anthropocene	ECPAF CH 17, Ruddiman 2005
	12/1	26	Historical Climate Change: Proxies	ECPAF CH 16
WEEK 14	12/6	27	Historical Climate Change: Sources of Variability	ECPAF CH 16
	12/8	28	The 'Hockey Stick' Controversy	Mann et al. 1998, 2002, Barton
WEEK 15	12/13	29	20th-Century Climate Change	ECPAF CH 18, Kolbert articles
	12/15	30	Midwestern Droughts	**Final Drafts Due**