

GEOG 327 – Climate Change

Spring 2008

Instructor: Dr. Joseph W. Nicholas
Office: Monroe 307F
Office Hrs: 10:00–11:00 am MWF, 9:00–10:00 am TR
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Required Text:

Ruddiman, William F. 2008. Earth's Climate: Past and Future, 2nd ed. New York: W.H. Freeman and Company.

Course Description:

The earth has had a remarkably stable climate throughout its history. Given the complex nature of interactions among the earth's major systems – atmosphere, hydrosphere, lithosphere, and biosphere – it seems surprising that the earth could have maintained such stability. We will examine the variables that control climate and, hopefully, gain some real insights as to the nature of interactions that result in the relative stability of the climate. Yet, with all of that stability, a constant feature of climate is change over time, and so we will also explore the drivers of earth's climate that cause change.

Writing Assignments:

You will write an annotated bibliography on a topic of your choice, but I would recommend that you pick one of the topics, or an aspect of one of the topics, that we cover in class. That gives you a head start on research since you will have a topic and some suggested reading already picked out that can launch you into the relevant literature.

There are three parts to your research project:

- (1) A proposal, consisting of a brief (1-2 pages) description of the question that you are seeking to answer and the scope of the intended research: You are required to cite at least five primary sources that will serve to familiarize you with the literature and to help you define the boundaries of your research. With some editing, this proposal can also serve as the introduction to your annotated bibliography.
- (2) Citations and Reviews: This is the main part of the project. You must find at least 10 articles from the peer-reviewed scientific literature to serve as the basis of your bibliography. These articles must represent **primary research**, they must be **relevant**, and they must have been **peer-reviewed** prior to publication. You may use the five sources that you already have as part of the ten that you will need. Just make sure that they are all relevant to your topic as defined by your proposal, after it has been OK'd by me.
 - a. Citations: Some journals have an online presence and may be accessed via the internet, but they will have dates of publication, volume and page numbers, which will all be needed in the bibliographic citation. A URL will not be acceptable as a citation. The citation style is up to you, but it must be consistent throughout, and *you must also give me a copy of an article that uses that style.*
 - b. Article Reviews: Read the article and write a 100 – 200 word review of the relevant aspects of the article to your topic. (See an example of a review attached to this syllabus.) It will be very helpful if you also write some notes for yourself concerning where this article fits in to

the rest of your bibliography. For example, does the paper argue for or against a thesis of another researcher?

At least one article review is due every week on Friday, beginning February 8 until you have completed the ten minimum that are required. You may hand in more than one at a time if you wish and you may, of course, do more than ten. Until you have accumulated the ten, your article reviews must be handed in by the beginning of class each Friday. Reviews will be checked but not graded. If you fail to hand in a review on time, you will receive no credit for the review. You can only make up the zero by doing extra reviews.

- (3) A final compilation of your bibliography, typed, double-spaced: Include an introduction, which will introduce your topic and define its boundaries. Also, the introduction will give a brief outline that serves to organize the article reviews within the annotated bibliography. Finally, write a concluding section that summarizes the current understanding of the topic and points to areas needing further research.

Assessment:

Your grade will be a combination of exams, quizzes, and research project:

Exams (2, equally weighted).....	40%
Quizzes (4).....	20%
Research Proposal	5%
Article Reviews.....	15%
Final Annotated Bibliography.....	20%

The work that you submit for a grade must be your own, so the Honor Pledge is required on all exams and article synopses. Pledge your work by signing this statement:

I hereby declare upon my word of honor that I have neither given nor received unauthorized help on this work. (Signature)

Your letter grade for the course will be assigned as follows:

		93% and above: A	90 – 92.99%: A-
87 – 89.99%: B+		83 – 86.99%: B	80 – 82.99%: B-
77 – 79.99%: C+		73 – 76.99%: C	70 - 72.99%: C-
67 – 69.99%: D+		59 – 66.99%: D	below 59%: F

Week	Date	Topic (and Text Chapter)
1	January 14	Intro: Scope of the course
	16	Framework of Climate Science (1)
	18	Climate Archives, Data, and Models (2)
2	21	Climate Archives, Data, and Models (2); first article review due
	23	CO ₂ and Long-Term Climate (3)
	25	Plate Tectonics and Long-Term Climate (4)
3	28	Plate Tectonics and Long-Term Climate (4); research topic due
	30	Greenhouse Climate (5); Quiz 1
	February 1	Greenhouse Climate (5)

4		4	From Greenhouse to Icehouse: the Last 50 Million Years (6)
		6	From Greenhouse to Icehouse: the Last 50 Million Years (6)
		8	Astronomical Control of Solar Radiation (7); 1st research article review
5		11	Astronomical Control of Solar Radiation (7)
		13	Astronomical Control of Solar Radiation (7)
		15	catch-up day; Quiz 2; 2nd research article review
6		18	Insolation Control of Monsoons (8)
		20	Insolation Control of Monsoons (8)
		22	Insolation Control of Ice Sheets (9); 3rd research article review
7		25	Insolation Control of Ice Sheets (9)
		27	Midterm Exam
		29	Orbital-Scale Changes in CO ₂ and Methane (10); 4th research article review
8	March 3-8		Spring Break
9		10	Orbital-Scale Changes in CO ₂ and Methane (10)
		12	Orbital-Scale Interactions, Feedbacks, and Unsolved Problems (11)
		14	Orbital-Scale Interactions, Feedbacks, and Unsolved Problems (11); 5th research article review
10		17	Last Glacial Maximum (12)
		19	catch-up day; Quiz 3
		21	<i>No Class</i> ; 6th research article review
11		24	Climate During and Since the Last Deglaciation (13)
		26	Climate During and Since the Last Deglaciation (13)
		28	Millennial Oscillations of Climate (14); 7th research article review
12		31	Millennial Oscillations of Climate (14)
	April	2	Humans and Preindustrial Climate (15)
		4	Climate Changes During the Last 1000 Years (16); 8th research article review
13		7	Climate Changes During the Last 1000 Years (16)
		9	<i>Geography Symposium – No Class</i>
		11	Climatic Changes Since 1850 (17); 9th research article review
14		14	Climatic Changes Since 1850 (17)
		16	catch-up day; Quiz 4
		18	Causes of Warming over the Last 125 Years (18); 10th research article review.
15		21	Causes of Warming over the Last 125 Years (18)
		23	Future Climate Change (19)
		25	Final Thoughts; Annotated Bibliography due
16	Monday, April 28	8:30-11:00 a.m.	Final Exam

Sample Research Article Review

Giardino, J. R., J. F. Shroder, Jr., and M. P. Lawson. 1984. Tree-ring analysis of movement of a rock-glacier complex on Mt. Mestas, Colorado, USA. Arctic and Alpine Research 16(3):299-309.

Trees such as Englemann spruce and ponderosa pine, which grow in clumps on the surface of the largest of the Mt. Mestas rock glaciers, were cored or sectioned in an attempt to document movements in the deposit over the last several centuries. Using dendrogeomorphological techniques to detect such movement, the authors took 4 cores from each of 255 trees, and they took cross-sections from an additional 28. Data collected in the field included “the amount and direction of tree lean, orientation of cores and cross sections, slope angle and azimuth, tree height, crown characteristics, and the density of species.” (p. 203) Not all cores could be used, since responses had to be replicated within the tree on at least another core.

Since each year in the record was not represented by equal numbers of trees, the total number of responses for a given year is weighted by how many trees record that year, which then yields an index that is plotted to show relative number of responses per year (see Shroder 1978). Periods of movement for each cluster of trees was also determined. Viewed in tabular form, these data show in chronological order what tree clusters moved at any given time period. By mapping the clusters of trees on the rock glacier, one can see movement of the rock glacier surface through time, beginning in AD 1446, although the early years of the record are the most uncertain because they are the least well represented.

This technique appears useful, however, it should be recognized that many of the rock glaciers having trees are those at relatively low altitudes, where ice cores and even interstitial ice may not be present. These deposits may flow by means of landslip in addition to or in place of “conventional” rock glacier flow processes. (Note: Where movement is not caused primarily by internal ice deformation, many researchers would say that these deposits are therefore not rock glaciers at all. -JWN)

References Cited in Review:

Shroder, J. F., Jr. 1978. Dendrogeomorphological analysis of mass movement on Table Cliffs Plateau, Utah. Quaternary Research 9:168-185.