

Provisional Syllabus—Geosciences 320, Geology of Climate Change, Spring, 2014

(In the modern world, we are supposed to dot all “i”s and cross all “t”s. So, in this class, we are following the newly revised, recommended Earth and Mineral Sciences [EMS] syllabus format. You likely will see this in lots of classes. Some of this applies to most of you—who the prof and TAs are, and when things are due. Some of it may apply to one or a few of you, or even to none of you. There are many words from appropriate Penn State web sites. So, apologies for having such a long syllabus, which makes it a pain for you to find what you want, but here goes...)

Course Number and Title: Geosciences 320, Geology of Climate Change

Semester: Spring, 2014

Instructor: Richard Alley, 517 Deike, rba6@psu.edu, ph. 814-863-1700, office hours arranged (see us in class, or contact us by email, and we’ll figure something out; we have tried scheduling office hours before, but you tend to have such crazy schedules that the times selected almost never work for you, so we’ll find something that does)

Teaching assistants: John Fegyveresi, 426 Deike, jmf439@psu.edu, and Nate Stevens, 439 Deike, nts5045@psu.edu. Office hours arranged (see us in class, or contact us by email, and we’ll figure something out; we have tried scheduling office hours before, but you tend to have such crazy schedules that the times selected almost never work for you, so we’ll find something that does).

Please note: John and Nate are half-TAs, so we have the same amount of TA help as other classes, but split between two TAs rather than coming from just one.

Please also note (and, this is NOT in the official EMS Syllabus): TAs are overworked and underpaid (both are doing research and in other ways working a whole lot in addition to our class). We will always attempt to follow proper behavior regarding everything in this class, but if you cause trouble for a TA, I will be VERY unhappy, and you do NOT want to make me VERY unhappy. If you need to pick on someone, pick on me; at least I’m paid pretty well.

Support services available: If you need something, please let us know. Note also that the College of Earth and Mineral Sciences offers tutoring; see http://www.ems.psu.edu/current_undergrad_students/academics. As a student in EMS, you have no-additional-cost access to help with writing, science, math and technology, so you might as well take advantage of it.

Class meeting times and locations 2:30-3:45 PM in 012 Walker Building, except, on Tuesday, March 18, meet in W140 Pattee Library at 2:30 PM, for instruction in iMovie.

Course designation in curriculum: Upper-level elective.

Brief course description from *University Bulletin* (<http://bulletins.psu.edu/undergrad/courses>)

GEOSC 320 Geology of Climate Change (3) Geologic evidence for climate change and mechanisms of change, especially from the Ice Age through the near future.

The appropriate human response to global climate change is among the hot-button issues of the modern world. Geologic records provide a critical perspective on climate change, with implications for our behavior. Ice cores, ocean sediments, tree rings, and others reveal that agriculture and industry have arisen during a few thousand years of anomalously stable climate. Natural changes half as large as the entire difference between ice-age and modern conditions have occurred repeatedly in mere years, affecting hemispheric or broader regions. Such climate jumps have been linked to changes in greenhouse gases, but not driven by them. The students in Geology of Climate Change will learn how records of recent climate changes are recovered, read, and dated, how the climate system works and has worked, and the causes of ice-age cycles and faster climate jumps. The

students will demonstrate their mastery of this knowledge by assessing its implications for global warming and natural climate changes in the future. Geology of Climate Change will involve lecture/discussion, readings, and individual or small-group projects, with students graded on midterm and final exams, and presentations or papers. The course will serve as an upper-level elective for students in major and minor programs in Geosciences and Earth Science. Enrollment will be limited to 30, with one offering per year.

Prerequisites and concurrent courses

The course is intended as an upper-level elective for those with career interests and/or major in the Earth sciences and related fields, so the course prerequisites are that you need an upper-level elective and have career interests and/or a major in the Earth sciences or related fields. However, there is some flexibility in this; if you aren't majoring in an Earth or environmental science (including but not limited to Meteorology and Geography), please contact Dr. Alley and make sure this is an appropriate course. The "official" language on what it means if you don't fit is pasted in the following paragraph, for full disclosure, but best to talk to us.

Students who do not meet these prerequisites may be dis-enrolled during the first 10-day free add-drop period after being informed in writing by the instructor (see: <http://www.psu.edu/dept/oue/aappm/C-5.html>). If you have not completed the listed prerequisites, then promptly consult with the instructor if you have not done so already. Students who re-enroll after being dis-enrolled according to this policy are in violation of Item 15 on the Student Code of Conduct (<http://studentaffairs.psu.edu/conduct/codeofconduct/>).

Required textbooks and recommended textbooks: No required text. You may wish to read either *The Two-Mile Time Machine*, or *Earth: The Operators' Manual*, both by me (Dr. Alley), or *The Glacial World According to Wally* by Wallace Broecker (available through our Angel site), but they are not required. We will post "minitexts" on Angel, which will be both useful and "free" (which means that after you have paid a lot of thousands of dollars to be here, we won't charge you still more). You are responsible for the content of these minitexts.

Reserve materials, including location: We don't have anything on reserve now; if there is something you wish to have on reserve in the library, let us know and we'll see what we can do.

Internet materials and links: We will use Angel. NOTE: EMAILS FROM THE PROFESSOR AND TAS ARE PART OF THE COURSE. There are times when we need to tweak schedules, respond to changing conditions or weather closures, etc. If we send you an email, you are expected to read it and respond accordingly. Note also that this includes the full content of our emails including any attachments, not just the amount of text that shows up on the first screen of a small smartphone.

Course expectations: The new EMS guidelines require that we list the course objectives and outcomes developed for the Penn State-required program assessment or for ABET accreditation. To the best of my knowledge, our course doesn't have any ABET requirements, so that is easy. The objectives are that you learn how the climate works, how the climate is recorded in sediments and how we read the history (paleoclimatic indicators, and ages of sediments), and the history of Earth's climate, in ways that allow you to understand and explain these topics. Focus is especially on being able to explain the significance of Earth's climate history to your US Senator (yes, we know that you may not get the chance, but you should be able to do so if you do get the chance). Grading is discussed further below.

Course content (e.g., list of topics covered, pages for or sources of required and suggested reading)

Processes, Clocks, Recorders, and Stories:

"Processes" (~3 weeks)—Mostly this is how the Earth's climate system works, a bit on nature and

compounding of feedbacks, and then whatever else we can get to on causes of climate changes.

“Clocks” (~3 weeks)—How we tell when things happened that are recorded in the sedimentary archives of ice, including mud, trees, and more. Special focus on ^{14}C , U-series and cosmogenic techniques, but with various others.

“Recorders” (~3 weeks)—How do we tell what happened to make the sedimentary features we see? Overview of isotopic, biologic, physical and chemical indicators of past climates, with focus on ice cores, ocean and lake sediments.

“Stories” (~5 weeks)—Snowball Earth and long-term climate stability, slide from “saurian sauna” (Cretaceous warmth) to modern cold times, tectonic changes, onset of ice ages, switch to dominant 100,000-year variability, Milankovitch ice ages, abrupt changes (Dansgaard/Oeschger and Heinrich/Bond), the Holocene, changing CO_2 , changing biota. Emphasis on the last 100,000 years, and on the Holocene, with much consideration of what this means for the future (global warming, surprises in the greenhouse, etc.).

Course policies (e.g., attendance and class participation expectations; lab safety statements; cellphone and other electronic device usage)

This course abides by the Penn State Class Attendance policies given at <http://senate.psu.edu/policies/42-00.html#42-27>, <http://www.psu.edu/oue/aappm/E-11.html>, <http://www.psu.edu/ufs/policies/44-00.html#44-35>, <http://studentaffairs.psu.edu/health/welcome/illnessVerification/>, and <http://www.psu.edu/oue/aappm/R-4.html>. Students who miss class for legitimate reasons will be given a reasonable opportunity to make up missed work, including exams and quizzes. Students are not required to secure the signature of medical personnel in the case of illness or injury and should use their best judgment on whether they are well enough to attend class or not; the University Health Center will not provide medical verification for minor illnesses or injuries. Other legitimate reasons for missing class include religious observance, family emergencies, and regularly scheduled university-approved curricular or extracurricular activities. Students who encounter serious family, health, or personal situations that result in extended absences should contact the Office of Student and Family Services for help: <http://studentaffairs.psu.edu/familyservices/>. Whenever possible, students participating in University-approved activities should submit to the instructor a Class Absence Form, available at www.psu.edu/oue/aappm/classabs.pdf, at least one week prior to the activity.

The paragraph just above is the official EMS text. In addition, if you have a job interview, or something else that really matters, let us know ahead of time and we'll try very hard to make it work so you can make up work with us while still getting the job. Please, though, talk to us ahead of time! Also note that there is another course policy up under the TA heading—be nice to the TAs!

We do not have a lab, but we will ask you to make a short video, and you may choose to go somewhere with a camera to do this, although you will not be required to do so. We do require you to be careful, and observe all applicable rules and regulations.

Cell-phone use in the classroom is not acceptable, nor is disturbing the class or otherwise interfering with the learning environment.

Assessment tools

For a summary of General and Final Examination Policies 44-10 and 44-20 and alternative assessment practices, please see <http://handbook.psu.edu/content/examinations> and <http://senate.psu.edu/policies/44-00.html#44-10>.

Required written/oral assignments (e.g., summary of required problem sets, papers, oral presentations etc.; include weighting given to each assignment and its due date)

You will be graded based on two “homework” assignments (5% each, 10% total, due January 23 and January 30), two midterms (18% each, 36% total, February 13 and April 1), a take-home final (24%, due Monday, May 5 at 5 pm eastern), and your group-and-individual project (15% for your group video, to be presented in class April 10, 15, 17 or 22), 15% for your individual paper (due April 10), for 30% total), with up to 4% extra credit as described below.

The homework assignments come early in the semester, and involve simple calculations of interesting quantities in the Earth’s climate system.

Because of Spring Break, we miss class on March 11 and 13, in case you’re curious.

Examination policy (e.g., summary of quizzes and exams, including evening exams; include weighting given to each quiz or exam and its due date; provide your make-up exam policy)

The midterms are scheduled on February 13 and April 1, in class.

You will have a study period on April 24 instead of a regular class. Then, we will pull together the whole semester on April 29 and May 1. The take-home final will be handed out May 1, and due Monday, May 5 at 5 pm. That is during Finals Week. The rules are that you are on your honor to spend no more than 110 minutes writing the exam, but you may do it on your schedule. It is my understanding that this is fully compliant with the University Policy that prevents me from scheduling a final examination or an assessment worth more than 10% of the final grade during the last week of classes: see the information in <http://dus.psu.edu/handbook/exam.html> and <http://senate.psu.edu/policies/44-00.html#44-10> for a discussion of exam and alternative assessment practices. (Anyone who really desperately loves sitting in a classroom and writing frantically for almost 2 hours during Finals Week instead of doing it where and when you want within the stated constraints can see me; maybe we can find you an uncomfortable chair with an arm on the wrong side to give you the full experience.)

Grading policy (e.g., curving policy, if applicable; late penalties on assignments, if any): We’ll start with straight-scale, 93 and up is an A, 90 to <93 is an A- (92.9999 is less than 93, so an A-), and so on (87 is lowest B+, 83 is lowest B, 80 is lowest B-, 77 is lowest C+, 70 is lowest C, 60 is lowest D). If a curve is needed, we will add one to raise grades, but we will never use a curve to lower grades. Anything handed in late without prior approval from the instructional team loses 10% of its value per day or portion thereof; after 10 days you’re down to zero. If there is a good reason something must be late, talk to us and we’ll see what can be worked out.

Projects. You still will divide up into groups, but instead of an old-style Powerpoint presentation, we will expect a 3-5 minute iMovie presentation on your group’s topic. We will get you instruction in how to do this, through the Penn State Media Commons. The presentation will introduce the topic, and cover the key results, in any way that you think is interesting and informative. (Newscast? Debate? Parody of classic rock song? Interpretive dance?) After that introduction, we will use lecture and discussion to fill in the topic. You will be responsible for reading about your group’s topic in the refereed scientific literature (more on this soon), individually preparing a 10-page paper on the topic (due April 10), and then working with your group to develop the short presentation. By January 23, we will provide you with a list of possible topics and their presentation dates (which will be on April 10, 15, 17 or 22), January 28 is an “off” day when you can do background research and arrange groups, and we will take your group choices on January 30. You will get iMovie training during class, 2:30, March 18, by going to Pattee W140 rather than to our regular class. That will leave you a month to complete the filming and editing of your projects; you should have the research and planning done before then.

The group part of the project is worth 15% of your final grade. In addition, the research you do jointly can underpin your paper, which is also 15% of the final grade. The research must be more than the Wikipedia; you must use the refereed scientific literature. We expect you to actually write the term paper alone, not with your

classmates, although we clearly expect that the group research will inform your individual writing, and that you can learn from your group members. This paper should represent a good summary of what is known about your topic. We expect something like 10 pages total (double-spaced, approximately one-inch margins), but we won't grade based on length; you should use as much space as you need to cover your topic. You should use standard scientific in-line referencing to refereed scientific papers. (So, if you learned from the paper written by I.M. Herb and U.R. Blotz that the warming at the end of the Younger Dryas cold event was caused by gaseous emissions from oversized amphibians, you might write "Abrupt warming about 11,500 years ago was triggered by the enhanced greenhouse effect of giant farts from gargantuan frogs (Herb and Blotz, 2003)." Then, in the reference list, you would include "Herb, I.M. and U.R. Blotz. 2003. The role of methanogenic bacteria of amphibian guts in global climate change. *Journal of Vertebratology and Waste Management*, v. 32, p. 113-145.") You may use any format in the reference list that is consistent and gets us the information. As above, we expect primary reliance on refereed literature, not the Wikipedia or textbooks. The paper will be due on April 10.

Extra Credit: We'll do four in-class "minute paper" exercises, during the time that your classmates are presenting their group projects, which will allow you to raise your grade 4% (so, if you have an 89.3 but get all four extra credit points, you're up to a 93.3 and have turned a B+ into a full A). We don't require attendance (although we do strongly encourage attendance!), but at least when your classmates are presenting you should show up, so this is a way to reward those of you who do.

Academic integrity statement:

Students in this class are expected to write up their problem sets individually, to work the exams on their own, and to write their papers in their own words using proper citations. Class members may work on the problem sets in groups, but then each student must write up the answers separately. Students are not to copy problem or exam answers from another person's paper and present them as their own; students may not plagiarize text from papers or websites written by others. Students who present other people's work as their own will receive at least a 0 on the assignment and may well receive an F or XF in the course. For information about the Earth and Mineral Sciences Academic Integrity Policy, which this course adopts, please see: http://www.ems.psu.edu/current_undergrad_students/academics/integrity_policy.

Accommodations for students with disabilities:

The Office of Disability Services (<http://equity.psu.edu/ods/>) requests and maintains disability-related documents; certifies eligibility for services; determines academic adjustments, auxiliary aids, and/or services; and develops plans for the provision of academic adjustments, auxiliary aids, and/or services as mandated under Title II of the ADA Amendments Act (ADAAA) of 2008 and Section 504 of the Rehabilitation Act of 1973. A list of these services is provided at <http://equity.psu.edu/ods/student-information>.

Campus emergencies, including weather delays, are announced on Penn State News (<http://news.psu.edu/>) and communicated to cellphones, email, the Penn State Facebook page, and Twitter via PSUTXT (to sign up, please see <http://psutxt.psu.edu>).

Still more integrity information from Professor Richard Alley:

Penn State actually requires each professor to clarify his/her usage of integrity standards for that class. So, be nice.

In legalistic detail (and I apologize for having to do this):

****Additional insight is available above. Relevant Penn State rules take precedence over anything herein, and will be followed.**

****Outside of class, you are free to discuss work with others and to compare results, but you must actually do the work you hand in. Direct copying from others is not allowed. You may not download text, figures, etc. from the web or other sources and use them in a term paper or other materials you hand in largely or completely unchanged without attribution; any such usage must be referenced and limited. For any assigned group projects, all members of a group must contribute to the group effort.**

****During exams, keep your eyes on your own paper and do not talk to other students. Exams are “closed book” unless otherwise specified by me; do not consult books, notes, or other hard-copy, electronic, or liveware-beyond-your-own-brain recordings of information during closed-book exams. In particular, you may not use your cell phone or other wireless or wired electronic devices to store or access information during closed-book exams. Exams are the property of Penn State and must be returned at the end of each exam; do not steal test forms. I and my assistant(s) reserve the right to change student seating, to ask that ball caps be removed or turned backward, and to make other such changes as needed to prevent cheating or to allow us to see better what is occurring. Exams are to be taken only when scheduled unless you have prior arrangement with me.**

****Violation of these rules will lead to sanctions as detailed above.**

****Be polite to your neighbors and to me. Don't read the newspaper in class, talk to neighbors, play a radio, talk or text or communicate in any way on a cell phone, or otherwise make a nuisance of yourself. And don't try to save yourself 10 seconds by noisily packing up your books just before the class ends.**

****TAs are overworked and underpaid. We will always attempt to follow proper behavior regarding everything in this class, but if you cause trouble for the TA, I will be VERY unhappy, and you do NOT want to make me VERY unhappy. If you need to pick on someone, pick on me; at least I'm paid well.**

****In return, of course, you can expect me to be polite, punctual, fair, informative, etc. If you do not think I am meeting these requirements, there are several options open to you, including: i) talk to me, in public or in private, alone or with a group; or ii) talk to one of my superiors (Geoscience Undergraduate Program Chair Dr. Peter Heaney in 540 Deike, Geoscience Department Head Dr. Lee Kump in 503 Deike, or College of Earth and Mineral Sciences Associate Dean for Educational Equity Dr. Ron Redwing in 204 Deike). The University also has ways for you to complain, but you are probably better off staying closer to the source. If you are having problems unrelated to me, you are also welcome to contact any of these sources; they are good people.**

****It is my fond hope that the integrity rules here are unnecessary, and we all get along without needing to refer to them. Have a great semester.**

Schedule

Tuesday, January 14 Class

Thursday, January 16 Class

Tuesday, January 21 Class

Thursday, January 23 Class, **Homework 1 due**

Tuesday, January 28 **NO CLASS**

Thursday, January 30 Class, **Homework 2 due, Choices for groups and topics due**

Tuesday, February 4 Class

Thursday, February 6 Class

Tuesday, February 11 Class

Thursday, February 13 Class, **Midterm 1**

Tuesday, February 18 Class

Thursday, February 20 Class

Tuesday, February 25 Class

Thursday, February 27 Class

Tuesday, March 4 Class

Thursday, March 6 Class

Tuesday, March 11 **NO CLASS, SPRING BREAK**

Thursday, March 11 **NO CLASS, SPRING BREAK**

Tuesday, March 18 **iMOVIE TRAINING**

Thursday, March 20 Class

Tuesday, March 25 Class

Thursday, March 27 Class

Tuesday, April 1 Class, **Midterm 2**

Thursday, April 3 Class

Tuesday, April 8 Class

Thursday, April 10 Class, **Papers Due, First two group presentations**

Tuesday, April 15 Class, **Three group presentations**

Thursday, April 17 Class, **Three group presentations**

Tuesday, April 22 Class, **Last two group presentations**

Thursday, April 24 NO CLASS

Tuesday, April 29 Class—Synthesis

Thursday, May 1 Class—Synthesis, and **Take-Home Final handed out**

Monday, May 5, 5 pm, **Final Due**