



SYLLABUS

GEOG 3900

Global Climate Change: Causes & Consequences
Autumn 2020 – Online - Course # 20187

COURSE OVERVIEW

Course information

- Class periods: Tuesday, Thursday, 3:55 - 5:15 p.m.
- Credit hours: 3
- Prerequisites: None
- Mode of delivery: Distance Learning

Instructors

Instructor: Dr. Bryan G. Mark (address as Professor Mark)

- Email address: mark.9@osu.edu
- Phone number: 614-247-6180
- Office hours: T/R 2-3 pm on zoom or by appointment

Graduate Teaching Assistant: Jami Orrell

- Email: orrell.5@osu.edu
- Office hours: by appointment

Undergraduate Teaching Assistant: Geddy Davis

- Email: davis.5694@buckeyemail.osu.edu

Course description

Understanding the **causes** of **global climate change** requires knowledge of the **Earth system** – its climate, energy balance, and biogeochemical cycles – and both the natural and human-caused mechanisms that force climate change. Grappling with the **consequences** of climate change invokes broader political and economic dimensions related to development and **energy conversion technology**.

GEOG 3900 is a science class open to all majors. We will build upon fundamental concepts to understand Earth's changing climate over different time scales, and engage the consequences of climate changes currently facing our planet. We will examine the key evidence of climate change and learn directly from climate researchers how they conduct their science. In addition, we will study links between climate and society's energy demands, sources and usage. By the end of the class, students will be more energy literate, and able to **critically evaluate** divergent facts about climate presented in **media** sources.

There are no prerequisites for the class. We will use basic arithmetic and some algebra, but no calculus.

Course learning outcomes

By the end of this course, students should successfully be able to:

- Understand the fundamentals of Earth's climate system and how the radiative energy balance is altered by both natural and human-induced changes in biogeochemistry;
- Appreciate how climate science has developed historically and how technology has permitted observations of climate, climatic changes and testing hypothesized forcing;
- Identify specific features, hypothesized causes and implications of Earth's historical climate changes, with a particular focus on Pleistocene and Holocene;
- Demonstrate understanding and practical conversion of energy units related to societal needs and everyday personal use;
- Critically examine the options that human society faces for mitigating, adapting and geoengineering responses to the consequences of altered climate;
- Identify, locate and properly cite peer-reviewed scientific literature; and
- Thoughtfully engage with current events and media presentations related to climate change by connecting to relevant scientific understanding and uncertainty.

This course meets **General Education (GE)** requirements in one area - **Natural Science, Physical Science** (i.e. <http://ascas.osu.edu/curriculum/ge-goals-and-learning-outcomes>). Specifically this means we aspire to the following goals: Students understand the principles, theories, and methods of modern science, the relationship between science and technology,

the implications of scientific discoveries and the potential of science and technology to address problems of the contemporary world.

We aim to address the **expected learning outcomes** as follows:

1) Students understand the basic facts, principles, theories and methods of modern science.

In this class, a combination of lectures, readings, exercises, and discussions will help students comprehend the basic facts of Earth's climate system, including fundamental principles of energy balance, radiative forcing, the greenhouse effect (natural and 'enhanced'), the carbon cycle, feedbacks, natural climate variability, climate extremes and climate modeling. Students will access climate data, practice analyses, and critically evaluate evidence.

2) Students understand key events in the development of science and recognize that science is an evolving body of knowledge.

In this class, students will study the history of climate change science, with a particular focus on how we have understood ice ages, and the way the atmosphere functions.

3) Students describe the inter-dependence of scientific and technological developments.

In this class, students will examine how technology has informed our understanding of climate, what measurements document climate change, and how technology continues to provide critical observations of these changes, from the laboratory to satellites in space. We will visit an actual ice core paleoclimatology lab, and see it in action.

4) Students recognize social and philosophical implications of scientific discoveries and understand the potential of science and technology to address problems of the contemporary world.

In this class, students will confront the evidence of climate change impacts to human and natural systems, and get exposed to the implications of these for policy makers; climate change is considered one of the leading problems facing the contemporary world. We will provide the basic facts and physical principles involved, and what processes drives climate to change over different time scales. Students will practice with discussion and interact with concepts collectively in online discussions and group exercises, and evaluate dimensions of climate change mitigation, adaptation and geo-engineering during their final project.

HOW THIS COURSE WORKS

Mode of delivery: This course will be delivered 100% online, with all course materials accessible from OSU's Carmen Canvas interface. To insure regular and substantive interaction with instructor and TA, we will deliver lectures and class activities during regularly scheduled class periods using Zoom and record them. This will facilitate delivery of content to students in

both synchronous and asynchronous modes. There will be occasional required interactive sessions (that will be announced as scheduled) that will take place 'live,' utilizing Carmen Zoom, also during the scheduled lecture time periods. All lecture recordings will be posted to Carmen along with pdfs of presented slides.

Pace of online activities: This course is divided into **weekly modules** that are released one week ahead of time by the first scheduled class on Tuesday. These will include regular discussions, variable media, assignments, and regular quizzes on content from both lecture and assigned readings. Students are expected to keep pace with weekly deadlines and participate in scheduled class activities but may schedule their efforts on exercises and complete readings and quizzes freely within that time frame. Instructors will make weekly assessments of progress and be attentive to student discussion of coverage; because this is the first time this class is adjusted to fully online delivery, anticipated scheduling of content will be subject to change. However, all changes will be articulated clearly to class via Carmen Announcements.

Credit hours and work expectations: This is a **3-credit-hour course**. According to [Ohio State policy](#), students should expect around 3 hours per week of time spent on direct instruction (instructor content and Carmen activities, for example) in addition to 6 hours of homework (reading and assignment preparation, for example) to receive a passing grade.

Attendance and participation requirements: Because this is an online course, your attendance is based on your online activity and participation. The following is a summary of everyone's expected participation:

- **Participating in online activities for attendance: AT LEAST ONCE PER WEEK**
You are expected to log in to the course in Carmen every week. (During most weeks you will probably log in many times.) If you have a situation that might cause you to miss an entire week of class, discuss it with me *as soon as possible*.
- **Live interactive activities:** Attending and participation in the occasional live interactive activities will be expected. Any exceptions must be approved in advance.
- **Office hours: OPTIONAL.** Synchronous zoom sessions will be the mode of optional office hours. Two hours per week will be allocated, but additional meetings can be arranged by email.
- **Lectures:** Lectures will be conducted live during scheduled class period, and will have opportunities for student engagement (using Zoom polls and TopHat). They will also be recorded and posted on Carmen with slides for asynchronous access.
- **Participating in discussion forums: 2+ TIMES PER WEEK**
As part of your participation, each week you can expect to post at least twice as part of our substantive class discussion on the week's topics, and in response to peers in your assigned discussion group.

COURSE MATERIALS AND TECHNOLOGIES

Textbooks

We will use sections from **two primary textbooks** for the class. Required weekly readings will help organize our inquiry into global climate change AND provide good reference to basic principles. Because students can access them in different forms, we do not require purchase; the Dessler (2012, 204) it is listed as recommended with OSU Bookstore.

1. **Dessler, A. *Introduction to Modern Climate Change***. Cambridge University Press. A second edition has only recently been published, so the first edition is also still valid for the class.

First edition (2012): ISBN 978-0-521-17315-5. This has been ordered in previous classes and used copies should be available; it is on AMAZON. But it is also available for limited (2 users at a time) electronic resource through the OSU LIBRARY (accessible when on OSU computers):

<https://library.ohio-state.edu/record=b7011024~S7>

Second edition (2014): ISBN 978-1-107-48067-4. This newer version has been ordered and should be available at OSU Bookstore. It is also on online sites (e.g. Amazon or B&N for ~\$40, or as an eBook on Amazon or Google ~\$30).

A second available text is Mathez and Smerdon (2018).

2. **Mathez, E. and J. Smerdon. *Climate Change: The Science of Global Warming and our Energy Future***. Columbia University Press. Full open access version online (pdf chapter downloads): <https://doi.org/10.7312/math17282>. ISBN 9780231547871 (e-book).

We will also use have other assigned readings from additional sources (scientific articles, web pages, book sections). These will be announced in lecture and posted as assignments the modules where we will provide relevant web links or pdfs on Carmen. We will indicate the relevant weekly readings by date.

All other required articles, book sections, web paged, videos or podcasts are directly embedded in modules on Carmen (topics see course schedule).

Other readings, media:

We will introduce other readings from news and scientific journals, as well as mixed media (video, podcasts). These will all be provided as pdfs or URL links via Assignments in Carmen, and linked to the weekly modules. One of the valuable resources in the class will be a repository of articles, web media, and more that will be archived in Carmen.

Since our learning goals include becoming familiar with peer-review literature, and critically evaluating material from the internet, we will introduce students to many sources of information, and introduce tools to organize, cite and reference them.

Course technology

For help with your password, university email, Carmen, or any other technology issues, questions, or requests, contact the Ohio State IT Service Desk. Standard support hours are available at ocio.osu.edu/help/hours, and support for urgent issues is available 24/7.

- **Self-Service and Chat support:** ocio.osu.edu/help
- **Phone:** 614-688-4357(HELP)
- **Email:** servicedesk@osu.edu
- **TDD:** 614-688-8743

BASELINE TECHNICAL SKILLS FOR ONLINE COURSES

- Basic computer and web-browsing skills
- Navigating Carmen: for questions about specific functionality, see the [Canvas Student Guide](#).

REQUIRED TECHNOLOGY SKILLS SPECIFIC TO THIS COURSE

- [CarmenZoom virtual meetings](#)
- [Recording a slide presentation with audio narration](#)
- [Recording, editing, and uploading video](#)

REQUIRED EQUIPMENT

- Computer: current Mac (OS X) or PC (Windows 7+) with high-speed internet connection
- Webcam: built-in or external webcam, fully installed and tested
- Microphone: built-in laptop or tablet mic or external microphone
- Other: a mobile device (smartphone or tablet) or landline to use for BuckeyePass authentication

REQUIRED SOFTWARE

- [Microsoft Office 365](#): All Ohio State students are now eligible for free Microsoft Office 365 ProPlus through Microsoft's Student Advantage program. Full instructions for downloading and installation can be found [at go.osu.edu/office365help](https://go.osu.edu/office365help).

- [Zoom](https://osu.zoom.us/) (https://osu.zoom.us/) is the academic audio web conferencing solution for Ohio State, and we will be using it for lectures and interactive course elements.
 - [Getting started with CarmenZoom](#)
- [TopHat](#): We will use TopHat to deliver quizzes during lecture for synchronous student response.

CARMEN ACCESS

You will need to use [BuckeyePass](#) multi-factor authentication to access your courses in Carmen. To ensure that you are able to connect to Carmen at all times, it is recommended that you take the following steps:

- Register multiple devices in case something happens to your primary device. Visit the [BuckeyePass - Adding a Device](#) help article for step-by-step instructions.
- Request passcodes to keep as a backup authentication option. When you see the Duo login screen on your computer, click **Enter a Passcode** and then click the **Text me new codes** button that appears. This will text you ten passcodes good for 365 days that can each be used once.
- Download the [Duo Mobile application](#) to all of your registered devices for the ability to generate one-time codes in the event that you lose cell, data, or Wi-Fi service.

If none of these options will meet the needs of your situation, you can contact the IT Service Desk at 614-688-4357 (HELP) and IT support staff will work out a solution with you.

GRADING AND FACULTY RESPONSE

How your grade is calculated (% breakdown)

ASSIGNMENT CATEGORY	POINTS
Participation	5
Discussions & peer-responses	10
Proxy paper	15
Quizzes	20
Exercises	20
Final project: group infographic + individual paper	30

Total	100
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See course schedule below for due dates.

Assignment descriptions:

Participation: This will be assessed based on student activity in accessing material (regularity in logging on and responding to interactive activities) and responding in timely fashion to surveys.

Discussions & peer-responses: Students will be required to compose weekly responses to prompts in Carmen Discussion, as well as responses to peers' answers. Expectations for what comprises full credit discussion will be further articulated for each module.

Proxy paper: Students will write a short paper about a paleoclimate proxy of their choice, demonstrating proper citation of information, including at least two peer-reviewed sources.

Quizzes: At least one Carmen quiz will be given per module, based on material presented in lectures, readings, videos and other online material from the respective module. Note that some material from previous modules may also be on quizzes.

Exercises: Exercises will comprise problem sets and other activities related to material presented. Due dates may extend beyond the end of weekly modules, but will be specified in the assignment.

Final project: The final project will include both a group presentation and an individual term paper. The groups will be assigned early in the class, and students will be interacting throughout the semester to select a topic and complete a multi-media presentation.

Late assignments

Please refer to Carmen for due dates. Generally, modules will be completed by midnight on Monday night before new modules begin on Tuesdays (first class session of each week). Late assignments will be penalized by 10% per day late, and only accepted up to a maximum of 4 days late. If students anticipate having conflicts they are expected to discuss with instructors ahead of time.

Grading scale

93–100: A
 90–92.9: A-
 87–89.9: B+

83–86.9: B
80–82.9: B-
77–79.9: C+
73–76.9: C
70 –72.9: C-
67 –69.9: D+
60 –66.9: D
Below 60: E

Instructor feedback and response time

We provide the following list to give you an idea of our intended availability throughout the course. (Remember that you can call **614-688-HELP** at any time if you have a technical problem.)

- **Grading and feedback:** For regular weekly assignments, you can generally expect feedback within **7 days**. Some exercises and papers will take longer to grade.
- **Email:** We will generally reply to emails within **24 hours on days when class is in session at the university**.
- **Discussion board:** We will check and reply to messages in the discussion boards every **24 hours on school days**.

OTHER COURSE POLICIES

Discussion and communication guidelines

The following are my expectations for how we should communicate as a class. Above all, please remember to be respectful and thoughtful.

- **Writing style:** While there is no need to participate in class discussions as if you were writing a research paper, you should remember to write using good grammar, spelling, and punctuation. A more conversational tone is fine for non-academic topics.
- **Tone and civility:** Let's maintain a supportive learning community where everyone feels safe and where people can disagree amicably. Remember that sarcasm doesn't always come across online.
- **Citing your sources:** When we have academic discussions, please cite your sources to back up what you say. For the textbook or other course materials, list at least the title and page numbers. For online sources, include a link.

- **Backing up your work:** Consider composing your academic posts in a word processor, where you can save your work, and then copying into the Carmen discussion.

Academic integrity policy

POLICIES FOR THIS ONLINE COURSE

- **Quizzes:** You must complete the weekly quizzes yourself, without external help or communication from the internet or other people. Accessing personal notes from class material is permitted.
- **Written assignments:** Your written assignments, including discussion posts, should be your own original work. In formal assignments, you should follow a consistent citation style (e.g. MLA, APA, or AGU) to cite the ideas and words of your research sources. ***It will be essential that you use a proper citation style consistently in your proxy and final papers (further explanation will be provided).*** You are encouraged to ask a trusted person to proofread your assignments before you turn them in—but no one else should revise or rewrite your work.
- **Reusing past work:** In general, you are prohibited in university courses from turning in work from a past class to your current class, even if you modify it. If you want to build on past research or revisit a topic you've explored in previous courses, please discuss the situation with us.
- **Falsifying research or results:** All research you will conduct in this course is intended to be a learning experience; you should never feel tempted to make your results or your library research look more successful than it was.
- **Collaboration and informal peer-review:** The course includes opportunities for formal collaboration with your classmates. While study groups and peer-review of major written projects is encouraged, remember that comparing answers on a quiz or assignment is not permitted. If you're unsure about a particular situation, please feel free just to ask ahead of time.
- **Group projects:** This course includes group projects, which can be stressful for students when it comes to dividing work, taking credit, and receiving grades and feedback. We have attempted to make the guidelines for group work as clear as possible for each activity and assignment, but please let us know if you have any questions.

OHIO STATE'S ACADEMIC INTEGRITY POLICY

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the university's [Code of Student Conduct](#), and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must

recognize that failure to follow the rules and guidelines established in the university's *Code of Student Conduct* and this syllabus may constitute "Academic Misconduct."

The Ohio State University's *Code of Student Conduct* (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the university or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the university's *Code of Student Conduct* is never considered an excuse for academic misconduct, so I recommend that you review the *Code of Student Conduct* and, specifically, the sections dealing with academic misconduct.

If we suspect that a student has committed academic misconduct in this course, we are obligated by university rules to report my suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the university's *Code of Student Conduct* (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the university.

If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact us.

Other sources of information on academic misconduct (integrity) to which you can refer include:

- The Committee on Academic Misconduct web pages ([COAM Home](#))
- *Ten Suggestions for Preserving Academic Integrity* ([Ten Suggestions](#))
- *Eight Cardinal Rules of Academic Integrity* (www.northwestern.edu/uacc/8cards.htm)

Copyright disclaimer

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

Statement on Title IX

All students and employees at Ohio State have the right to work and learn in an environment free from harassment and discrimination based on sex or gender, and the university can arrange interim measures, provide support resources, and explain investigation options, including referral to confidential resources.

If you or someone you know has been harassed or discriminated against based on your sex or gender, including sexual harassment, sexual assault, relationship violence, stalking, or sexual exploitation, you may find information about your rights and options at titleix.osu.edu or by contacting the Ohio State Title IX Coordinator at titleix@osu.edu. Title IX is part of the Office of Institutional Equity (OIE) at Ohio State, which responds to all bias-motivated incidents of harassment and discrimination, such as race, religion, national origin and disability. For more information on OIE, visit equity.osu.edu or email equity@osu.edu.

Your mental health

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you find yourself feeling isolated, anxious or overwhelmed, please know that there are resources to help: ccs.osu.edu. You can reach an on-call counselor when CCS is closed at (614) 292-5766 and 24 hour emergency help is also available through the 24/7 National Prevention Hotline at 1-(800)-273-TALK or at suicidepreventionlifeline.org. The Ohio State Wellness app is also a great resource available at go.osu.edu/wellnessapp.

ACCESSIBILITY ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

Requesting accommodations

The university strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability including mental health, chronic or temporary medical conditions, please let us know immediately so that we can privately discuss options. To establish reasonable accommodations, we may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible

to discuss your accommodations so that they may be implemented in a timely fashion. **SLDS contact information:** slds@osu.edu; 614-292-3307; 098 Baker Hall, 113 W. 12th Avenue.

Accessibility of course technology

This online course requires use of Carmen (Ohio State's learning management system) and other online communication and multimedia tools. If you need additional services to use these technologies, please request accommodations with your instructor.

- [CarmenCanvas accessibility](#)
- Streaming audio and video
- [CarmenZoom accessibility](#)
- Collaborative course tools

COURSE SCHEDULE*

Week/Module	Dates	Topics
1	8/25-27	Introduction, "Global warming 101"
2	9/01-03	Climate vs weather; anomalies and variability
3	9/08-10	Earth's planetary energy balance, Greenhouse Effect
4	9/15-17	Synchronous lecture (with Dr. Dotson, class librarian): What is peer-review? How to maximize library resources Climate system fundamentals
5	9/22-24	Carbon cycle, human impacts, radiative forcing
6	9/29-10/01	Understanding climate of the past
7	10/06-08	Pacing the Ice Ages: Historical development of scientific idea
8	10/13-15	Quaternary climate history, abrupt changes, climate and society
9	10/20-22	Holocene climate & society Early Anthropocene hypothesis
10	10/27-29	Modeling future climate scenarios
11	11/03-05	Interactive synchronous activities: virtual tours of science in action & En-Roads solutions
12	11/10-12	Considering Ohio's future climate & energy
13	11/17-19	Interactive synchronous activity: Stabilization wedges
14	11/24-26	Mitigation, adaptation, geoengineering
15	12/01-03	Wrap up, final projects & peer-review

*Content is subject to change, and will be communicated using Announcements on Carmen.