

OCEA 3004: The Last Billion Years Syllabus Fall 2022

Dalhousie University is located in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq. We are all Treaty people.

Welcome

This class examines major events and important biogeochemical cycles in the Earth system. The geological evidence of major events will be described, and the hypothesized causes will be examined critically in the context of that evidence. By going through this course, you will develop an understanding of how the complex and interconnected earth/ocean/atmosphere system works, how it has reacted to different perturbations in the geological past and how it will react to current perturbations in the future.

Prerequisites: OCEA 2001 and OCEA 2002, or EARTH 1080

Format: Blended

in-person:

all Wednesdays 8:35-09:55 am, Killam Library Room 2622
some Mondays 8:35-09:55 am, Killam Library Room 2622

online:

readings, short videos, quizzes, assignments

Professor

Stephanie Kienast, stephanie.kienast@dal.ca

Teaching Assistant

Jake Tan

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Office Hours:

in-person: before or after class

online: arrange by email and then come to the Collaborate room on Brightspace.

Course Format 2022 in a nutshell:

The course blends asynchronous online activities such as readings, short recordings, and quizzes with in-person classes. The in-person classes are on all Wednesdays and on some Mondays (tba) in the semester and include short lectures and workshops where you will apply what you learned. New materials are typically given out by mid-week (W,Th) and deadlines are typically early in the week (M,T).

Learning Outcomes

- Explain the Anthropocene in the context of earlier perturbations in the Earth System
- Identify couplings and feedbacks in the Earth System
- Analyze and quantify the global energy balance on Earth
- Recall the age of the Earth and the timing major events in its history, such as the formation of the moon, formation of the ocean, first life, first atmosphere, and others
- Describe various hypotheses for the origins of the Earth, moon, and life
- Explain the causes, timing, and evidence for oxygenation of the atmosphere
- Summarize the major reservoirs of organic and inorganic carbon on Earth

- Explain the relationships among reservoir size, flux, and residence time
- Apply knowledge of global energy balance, inorganic carbon cycle and fractionation of carbon isotopes to the interpretation of Snowball Earth events
- Apply knowledge of stable oxygen and strontium isotopes to assess competing models for Cenozoic cooling of the planet
- Formulate a hypothesis to explain the causes and consequences of the Paleocene-Eocene Thermal Maximum
- Infer the causes of Earth's two greatest mass extinctions
- Explain the evidence for repeated occurrence of glacial periods and the orbital parameters associated with them
- Appraise orbital forcing and anthropogenic forcing in the context of future climate change
- Communicate scientifically on a course-related topic of your choice

Course Materials

The primary reading material is the classic and well-loved textbook "The Earth System" (3rd edition by Lee Kump, James Kasting, Robert Crane). The book is available for purchase at the Dalhousie bookstore (~ 200\$). In addition, there are two hard copies at the Killam library circulation desk reserve which you can borrow for 2-hour intervals.

Brightspace

Intro videos, research articles, weblinks, podcasts etc., will be available on Brightspace. It is important that you keep up with the textbook and these additional materials every week.

Minimum Technology Required

Laptop (or desktop) with internet connection, microphone, and camera

Online Platforms used:

Brightspace, Microsoft Teams, Zoom

Assessments:

| Grade Item | % | Anticipated due dates |
|--|------|---------------------------|
| Mini Quizzes (online) | 10 | multiple |
| Assignment-1 | 13.3 | Sept 28 |
| Assignment-2 | 13.3 | Oct 19 |
| Assignment-3 | 13.3 | Nov 30 |
| Research Project - <i>topic approval completed</i> | - | Oct 26 |
| Research Project - <i>draft completed</i> | 10 | Nov 23 |
| Research Project - <i>peer review completed</i> | 5 | Nov 30 |
| Research Project - <i>conference participation</i> | 5 | Dec 5, Dec 6 |
| Research Project - <i>final submission</i> | 20 | Dec 7 |
| Final Exam | 10 | in exam period (Dec 9-20) |

Mini Quizzes (online, multiple, 10%)

The mini quizzes are intended to prepare you for the in-person class time and to self-assess your understanding of a given week's material. You will have the opportunity to take each quiz 2 to 3 times during the period of availability, with the higher attempt counting towards your final grade. Quizzes are open-book and available for 3-5 days.

Assignments (3, online and in person, 40%)

In the assignments, you will blend mathematical calculations with some basic assumptions to gain insight into global-scale problems. You will also provide written answers on important Earth System concepts. Tackling the assignments is where much of your learning will take place and they will take several hours to complete. Make note of the anticipated due dates in the table above. Assignments are open-book. We

will use in-person class time work on aspects of the on the assignments, and use the Monday time slot as needed. Working with peers is encouraged but see the note on plagiarism below.

Individual Research Project (online and in person, 40%)

The purpose of this independent research project is three-fold: (1) to engage with three pieces of primary or secondary literature on a relevant topic of your choice, (2) to synthesize what you learned from these readings into a poster, (3) to practice science communication. The process involves the several steps: getting approval of your topic and literature choice by the instructor, preparing your own poster for online peer review, providing helpful comments on other students' work, and finally, sharing your poster in an conference setting in person at the end of term. Additional information is available on Brightspace.

Final Exam (online, 10%)

The final exam will consist of (a) carefully chosen multiple choice and True/False questions and (b) written answers. The exam will cover material from the entire term and will be scheduled by the registrar's office during the exam period (Dec 9-20). Details on the format will follow but expect a closed-book exam that may be virtually proctored. Students must receive a passing grade on the final exam (50%) in order to pass the course.

Plagiarism

Students are allowed to work with each other, including on assignments. However, **each student must pass in their own assignment, reflecting their own work, speaking in their own voice**. Simply texting the solutions to each other is cheating, not learning. Plagiarism software will be applied (text and images). You are expected to know and adhere to the Regulations on Academic Integrity based on honesty, trust, fairness, responsibility and respect:

https://www.dal.ca/dept/university_secretariat/academic-integrity.html.

Late work

Quizzes: 0% if submitted after the deadline; but the lowest overall quiz will not count towards your final mark.

Assignments: 10% off for each day late (24 hours). Late submissions will be accepted until the marking process is completed. After marking is completed and the assignment solutions have been posted to the class, late submissions will no longer be accepted and result in 0%. Students have one "*Get out of jail free card*", meaning one late submission goes without penalty for the first 48 hours. Students need to inform the instructor if they wish to use the card with a given late submission. Use wisely.

Individual Research Project:

Draft not completed by deadline: 0%

Peer review not completed by deadline: 0%

Final submission no ready by deadline: 10% off for each day late (24 hours).

Illness and Emergencies

If you miss a deadline (other than for a quiz) due to illness, re-weighting of course components or make-up opportunities will be considered on a case-by case basis. If you are ill for an extended period of time, or find yourself in extenuating circumstances beyond your control, please let me know as soon as possible, and also contact Dr. Patricia Laws, Assistant Dean of Student Affairs at Scieasst@Dal.Ca.

Additional Course Policies

We are here to help you learn and succeed. Don't hesitate to contact us either during class,

via email, or during pre-arranged office hours. While we try to respond to emails within 24 hours from Monday to Friday, please note that a question asked by email within 24 hours before a deadline may go unanswered.

All course components (other than individual quizzes) must be completed with 50% or higher to complete the course. All deadlines are given in Atlantic Time.

If you have a power or technology issue during an online assessment, contact us as soon as you are able. A contingency plan for exceptional and verifiable technical circumstances (e.g., power or internet outage during final exam) will be developed on a case-by-case basis.

International students connecting to Dalhousie online resources from outside Canada are responsible for ensuring awareness and compliance with any applicable laws in the country from which they are connecting.

Let's make this a great semester together. You are expected to adhere to all public health guidelines in Nova Scotia and any additional Dalhousie health guidelines. **Masks must be worn** in the classrooms and hallways. You know where your nose and mouth are, please keep both properly covered. **If you feel unwell, do not come** to the in-person class. You will be able to catch up online.

Grade conversion

Numerical results will be converted to letter grades according to the Dalhousie Common Grade Scale:

| | | | |
|-------------|------------|------------|-----------|
| A+ (90-100) | B+ (77-79) | C+ (65-69) | D (50-54) |
| A (85-89) | B (73-76) | C (60-64) | F (0-49) |
| A- (80-84) | B- (70-72) | C- (55-59) | |

A grade of D is a passing grade.

University Policies and Statements

This course is governed by the academic rules and regulations set forth in the University Calendar and by Senate

Academic Integrity

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity.

Information: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (Canada and Nova Scotia).

Information: https://www.dal.ca/campus_life/academic-support/accessibility.html

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner—perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution.

Code: https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness

Statement: <http://www.dal.ca/cultureofrespect.html>

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel and support. Visit or e-mail the Indigenous Student Centre (1321 Edward St) (elders@dal.ca).

Information: https://www.dal.ca/campus_life/communities/indigenous.html

Important Dates in the Academic Year (including add/drop dates)

https://www.dal.ca/academics/important_dates.html

University Grading Practices

https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html