

OCEA 3004: The Last Billion Years Syllabus Fall 2023

Dalhousie University acknowledges that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People and pays respect to the Indigenous knowledges held by the Mi'kmaq People, and to the wisdom of their Elders past and present. The Mi'kmaq People signed Peace and Friendship Treaties with the Crown, and section 35 of the Constitution Act, 1982 recognizes and affirms Aboriginal and Treaty rights. We are all Treaty people. Dalhousie University also acknowledges the histories, contributions, and legacies of African Nova Scotians, who have been here for over 400 years.

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

Class meeting time and location

Tuesday, Thursday, 10:05-11:25 am, Killam Library Room 2622

Professors

Stephanie Kienast, stephanie.kienast@dal.ca (*primary instructor*)
Life Science Center, Oceanography Wing, room 5616

Markus Kienast, markus.kienast@dal.ca (*from September 05 to 21*)
Life Science Center, Oceanography Wing

Teaching Assistant

Wendy Muraoka
WMuraoka@dal.ca

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: some readings & videos, quizzes, assignments, announcements

Attendance

Attendance is important. It is your responsibility to find out what you missed from classmates and the course website if you were unable to be in class. The lecture files will generally be posted on-line, but keep in mind that these files may not contain everything we covered in class (e.g., in class discussions, notes on the white board). Announcements about due dates, quizzes, etc. are also made during class time.

Note:

On some days, the in-person class will not take place and an online module (asynchronous) is offered instead. These dates will be communicated ahead of time.

Office Hours:

In-person before or after class, or arrange by email

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

Grade Item	%	Anticipated due dates*
Brightspace quizzes	10	multiple
Assignment-1	10	Sept 26
Assignment-2	10	Oct 24
Assignment-3	10	Nov 21
Test 1	20	Oct 10
Test 2	20	Nov 09
Test 3 (Final Exam)	20	in exam period Dec 8-19

*Subject to change

Mini Quizzes (online, multiple, 10%)

The quizzes are intended to self-assess your understanding of the material and the readings. You will have the opportunity to take each quiz 2 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, 30% total)

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. Ask for help early if you are confused and make note of the anticipated due dates in the table above. Assignments are open book. If you use resources other than the course material, cite your sources (any style). Assignments will be posted and submitted on Brightspace.

Tests (3, 60% total)

The three tests are intended to test your general understanding of the subject matter. The tests will include long & short answer questions, and some calculations. Tests are closed book. The first two tests will be written in person during regular class time. The third test will take place during the Dalhousie exam period. Do not make any final travel arrangements before the final exam schedule has been

posted by the registrar's office. Students must receive a passing grade (50%) on the final exam to pass the course.

Plagiarism

You are expected to know and adhere to the Regulations on Academic Integrity based on honesty, trust, fairness, responsibility, and respect, which can be found here:

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

Students are allowed to work together on assignments. However, **each student must pass in their own assignment, reflecting their own work, speaking in their own voice**. Plagiarism software will be applied (text and images). Cheating during tests will not be tolerated, and instructors are required to report every suspected offence.

Late or missed work

Online 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, typically within one week. 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%. Missed assignments can generally not be made up. Students have one "Get out of jail free card", meaning one late submission goes without penalty for the first 24 hours. Students need to indicate if they wish to use their card for a given assignment when submitting the document on Brightspace. Use wisely.

Tests: Makeup tests, or re-weighting of grade items, is offered rarely, on a case-by-case basis only, and for a limited set of circumstances.

- Illness: If you are ill on the day of the test, contact me via email on that day.
- Extracurricular Activities: If you have an athletic event or equivalent activity that conflicts with a scheduled test, contact me by email or before/after class time at least 2 weeks in advance of the event.
- Emergencies: If you have an emergency or crisis that forces you to miss a test, contact me as soon as you are able.

Extenuating Circumstances

If you are ill for an extended period, or find yourself in extenuating circumstances beyond your control, please let me know as soon as possible, and contact Dr. Patricia Laws, Assistant Dean of Student Affairs at Scieasst@Dal.Ca.

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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.

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

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

Internationalization

At Dalhousie, 'thinking and acting globally' enhances the quality and impact of education, supporting learning that is "interdisciplinary, cross-cultural, global in reach, and orientated toward solving problems that extend across national borders." Additional internationalization information can be found at: <https://www.dal.ca/about-dal/internationalization.html>

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Accessibility

The Student Accessibility Centre is Dalhousie's centre of expertise for matters related to student accessibility and accommodation. If there are aspects of the design, instruction, and/or experiences within this course (online or in-person) that result in barriers to your inclusion, please contact the Student Accessibility Centre (https://www.dal.ca/campus_life/academic-support/accessibility.html) for all courses offered by Dalhousie with the exception of Truro. For courses offered by the Faculty of Agriculture, please contact the Student Success Centre in Truro (<https://www.dal.ca/about-dal/agricultural-campus/student-success-centre.html>)

Conduct in the Classroom – Culture of Respect

Substantial and constructive dialogue on challenging issues is an important part of academic inquiry and exchange. It requires willingness to listen and tolerance of opposing points of view. Consideration of individual differences and alternative viewpoints is required of all class members, towards each other, towards instructors, and towards guest speakers. While expressions of differing perspectives are welcome and encouraged, the words and language used should remain within acceptable bounds of civility and respect.

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 (Strategic Priority 5.2). Additional diversity and inclusion information can be found at: <http://www.dal.ca/cultureofrespect.html>

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

Fair Dealing Policy

The Dalhousie University Fair Dealing Policy provides guidance for the limited use of copyright protected material without the risk of infringement and without having to seek the permission of copyright owners. It is intended to provide a balance between the rights of creators and the rights of users at Dalhousie. Additional information regarding the Fair Dealing Policy can be found at:

https://www.dal.ca/dept/university_secretariat/policies/academic/fair-dealing-policy-.html

Originality Checking Software

The course instructor may use Dalhousie's approved originality checking software and Google to check the originality of any work submitted for credit, in accordance with the Student Submission of Assignments and Use of Originality Checking Software Policy. Students are free, without penalty of grade, to choose an alternative method of attesting to the authenticity of their work and must inform the instructor no later than the last day to add/drop classes of their intent to choose an alternate method. Additional information regarding Originality Checking Software can be found at: https://www.dal.ca/dept/university_secretariat/policies/academic/student-submission-of-assignments-and-use-of-originality-checking-software-policy-.html

Student Use of Course Materials

Course materials are designed for use as part of this course at Dalhousie University and are the property of the instructor unless otherwise stated. Third party copyrighted materials (such as books, journal articles, music, videos, etc.) have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law. Copying this course material for distribution (e.g. uploading to a commercial third-party website) may lead to a violation of Copyright law.