

Faculty of Science Course Syllabus
Department of *Oceanography*
OCEA 4000 / 5004
Oceans and Global Change
Winter 2025

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

We acknowledge the histories, contributions, and legacies of the African Nova Scotian people and communities who have been here for over 400 years.

Instructors: Markus Kienast e-mail: markus.kienast@dal.ca
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Lectures: M/W 11:35 – 12:55; LSC-OCEANOGRAPH 3655; **in person, not recorded**

Laboratories: n/a **Tutorials:** n/a

Course Description

This course examines the role and response of the Oceans to global change, including alterations in currents and circulation, increases in sea level and storm surges, changes in ocean chemistry, modification to the types and patterns of sediment deposition, alterations in the abundances and distributions of organisms, and overall productivity. The course will discuss means of predicting these changes and their effects. The course covers two main aspects: (1) "The present" will focus on the general functioning of biogeochemical cycles, oceanic and atmospheric circulation, and Earth's and the ocean's heat budget; (2) "The past" will review evidence for and consequences of past global changes including changes in the Holocene, over glacial/interglacial timescales, and during the Phanerozoic.

Course Prerequisites

Undergraduate students:

OCEA 3001.03, OCEA 3002.03, OCEA 4110.03, OCEA 4140.03 or permission of Instructor

Graduate students:

permission of Instructor

Course Objectives/Learning Outcomes

know the different time scales, modes and mechanisms of global change, from tectonic to interannual

describe the different modes of change in the Earth system

know governing mechanisms of temperature and climate regulation on Earth

summarize and explain fundamental biogeochemical processes of present and past climate states

know and discriminate fundamental circulation patterns of the oceans under current and past conditions

describe and explain oxygen isotope stratigraphy

summarize methods of reconstructing past sea surface temperatures

explain how carbon isotopes and Pa/Th ratios can be used to trace past changes in ocean circulation

illustrate the difference between static and kinematic tracers of ocean circulation

summarize the global carbon cycle, with particular reference to the ocean

illustrate and explore nitrogen isotopes as tracer of past changes in the marine N cycle

summarize changes in past oxygenation of the ocean

describe and explain the different oceanic respired carbon loops, and their link to Southern Ocean dynamics and atmospheric CO₂

Course Materials
Suggested Readings:

Sarmiento JL and Gruber N (2006) Ocean biogeochemical dynamics, Princeton University Press

Archer D (2006) Global Warming: Understanding the forecast, Blackwell Publishing

Vallis GK (2012) Climate and the Oceans

Schmittner A (2017) Introduction to Climate Science,

<http://library.open.oregonstate.edu/climatechange/>

Course Assessment

Component	% of final grade, undergraduate	graduate	Date
Mid-term exam	15	10	tbd
Final exam	25	20	tbd
Assignments, participation	20	10	tbd
Oral presentation	40	30	tbd
Term paper*	-	30	tbd

* Graduate students will need to write a ~10-page term paper on a topic of their choice. The topic has to be related to *Oceans & Global Change*, can be related in general terms to - but not overlap with - their thesis research, and has to be distinct from the topic of their research seminar.

Conversion of numerical grades to Final Letter Grades follows 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	(<50)
A- (80-84)	B- (70-72)	C- (55-59)		

Note: A minimum grade of B- is required for students enrolled in the graduate level course

Course Policies

General class format and communication:

All lectures for this course will be in person. Attendance and participation in all classes are essential and imperative. We will strongly encourage and support questions and discussion during class; it is in your best interest to take full advantage of this.

Assignments:

Students will generally have a week to complete an assignment, most often including a weekend. They are due at the end of class, not at the end of the day, and we will not generally answer questions concerning the assignment 24 hours prior to the due date. Late assignments may get 10% off for each day late, and will not be accepted once the marking process has been completed.

Participation, plagiarism and cheating:

Students are encouraged, indeed required, to participate in class. However, each student must pass in their own assignment, reflecting their own work. Similarly, cheating and plagiarism will not be tolerated during the tests. You are expected to know and adhere to the Dalhousie Regulations on Academic Integrity, as outlined in the calendar.

University Policies and Statements

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 at 1321 Edward St or elders@dal.ca. Additional information regarding the Indigenous Student Centre can be found at: 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>

Academic Integrity

At Dalhousie University, we are guided in all our work by the values of academic integrity: honesty, trust, fairness, responsibility, and respect. As a student, you are required to demonstrate these values in all 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. Additional academic integrity information can be found at: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

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>

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. The full Code of Student Conduct can be found at:

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



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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.

Student Resources and Support

University Policies and Programs

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

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

Classroom Recording Protocol:

https://www.dal.ca/dept/university_secretariat/policies/academic/classroom-recording-protocol.html

Dalhousie Grading Practices Policies:

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

Grade Appeal Process: https://www.dal.ca/campus_life/academic-support/grades-and-student-records/appealing-a-grade.html

Sexualized Violence Policy: https://www.dal.ca/dept/university_secretariat/policies/health-and-safety/sexualized-violence-policy.html

Scent-Free Program: <https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html>

Learning and Support Resources

General Academic Support – Advising (Halifax): https://www.dal.ca/campus_life/academic-support/advising.html

General Academic Support – Advising (Truro): <https://www.dal.ca/about-dal/agricultural-campus/ssc/academic-support/advising.html>

Student Health & Wellness Centre: https://www.dal.ca/campus_life/health-and-wellness.html

On Track (helps you transition into university, and supports you through your first year at Dalhousie and beyond): https://www.dal.ca/campus_life/academic-support/On-track.html

Indigenous Student Centre: https://www.dal.ca/campus_life/communities/indigenous.html

Indigenous Connection: <https://www.dal.ca/about-dal/indigenous-connection.html>

Elders-in-Residence (The Elders in Residence program provides students with access to First Nations elders for guidance, counsel, and support. Visit the office in the Indigenous Student Centre or contact the program at elders@dal.ca or 902-494-6803:

<https://cdn.dal.ca/content/dam/dalhousie/pdf/academics/UG/indigenous-studies/Elder-Protocol-July2018.pdf>

Black Student Advising Centre: https://www.dal.ca/campus_life/communities/black-student-advising.html

International Centre: https://www.dal.ca/campus_life/international-centre.html

LGBTQ2SIA+ Collaborative: <https://www.dal.ca/dept/vpei/edia/education/community-specific-spaces/LGBTQ2SIA-collaborative.html>

Dalhousie Libraries: <http://libraries.dal.ca/>

Copyright Office: <https://libraries.dal.ca/services/copyright-office.html>



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Dalhousie Student Advocacy Services: <https://www.dsu.ca/dsas?rq=student%20advocacy>

Dalhousie Ombudsperson: https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html

Human Rights and Equity Services: <https://www.dal.ca/dept/hres.html>

Writing Centre: https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html

Study Skills/Tutoring: http://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html

Faculty of Science Advising Support: <https://www.dal.ca/faculty/science/current-students/undergrad-students/degree-planning.html>

Safety

Biosafety: <http://www.dal.ca/dept/safety/programs-services/biosafety.html>

Chemical Safety: <https://www.dal.ca/dept/safety/programs-services/chemical-safety.html>

Radiation Safety: <http://www.dal.ca/dept/safety/programs-services/radiation-safety.html>

Laser Safety: <https://www.dal.ca/dept/safety/programs-services/radiation-safety/laser-safety.html>