

Faculty of Science Course Syllabus  
Department of *Oceanography*  
*OCEA 4000 / 5004*  
*Oceans and Global Change*  
*Winter 2023*

*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 13:05 – 14:25; LSC-OCEANOGRAPH O3652; **in person, not recorded**

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

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### 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 CO<sub>2</sub>*

**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**

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

\* 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**

**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](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](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](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](mailto:elders@dal.ca)).

**Information:** [https://www.dal.ca/campus\\_life/communities/indigenous.html](https://www.dal.ca/campus_life/communities/indigenous.html)

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

<https://academiccalendar.dal.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&catalogid=117&chapterid=-1&topicgroupid=31821&loaduseredits=False>

**University Grading Practices**

[https://www.dal.ca/dept/university\\_secretariat/policies/academic/grading-practices-policy.html](https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html)

**Faculty of Science Course Syllabus (Section C) (revised April-2022)**  
**Fall/Winter 2022-23**  
**OCEA4000/5004**

## **Student Resources and Support**

### **Advising**

**General Advising** [https://www.dal.ca/campus\\_life/academic-support/advising.html](https://www.dal.ca/campus_life/academic-support/advising.html)

**Science Program Advisors:** <https://www.dal.ca/faculty/science/current-students/undergrad-students/degree-planning.html>

**Indigenous Student Centre:** [https://www.dal.ca/campus\\_life/communities/indigenous.html](https://www.dal.ca/campus_life/communities/indigenous.html)

**Black Students Advising Centre:** [https://www.dal.ca/campus\\_life/communities/black-student-advising.html](https://www.dal.ca/campus_life/communities/black-student-advising.html)

**International Centre:** [https://www.dal.ca/campus\\_life/international-centre/current-students.html](https://www.dal.ca/campus_life/international-centre/current-students.html)

### **Academic supports**

**Library:** <https://libraries.dal.ca/>

**Writing Centre:** [https://www.dal.ca/campus\\_life/academic-support/writing-and-study-skills.html](https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html)

**Studying for Success:** [https://www.dal.ca/campus\\_life/academic-support/study-skills-and-tutoring.html](https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html)

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

**Fair Dealing Guidelines** <https://libraries.dal.ca/services/copyright-office/fair-dealing.html>

### **Other supports and services**

**Student Health & Wellness Centre:** [https://www.dal.ca/campus\\_life/health-and-wellness.html](https://www.dal.ca/campus_life/health-and-wellness.html)

**Student Advocacy:** <https://dsu.ca/dsas>

**Ombudsperson:** [https://www.dal.ca/campus\\_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html](https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html)

### **Safety**

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

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

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

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

**Dalhousie COVID-19 information and updates:** <https://www.dal.ca/covid-19-information-and-updates.html>