

OCES 4001 Ocean and Climate Change

Spring 2026

3 credits

1. Instructor

Prof. Jiying LI (JL)

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2. Teaching Assistants

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3. Time and Location:

Tuesday and Thursday 10:30 AM – 11:50 AM

Room: Rm1409, Lift 25-26

4. Office hours

- 1) Every **Monday** 2:30 - 4:30 pm in CYT2012 office;
- 2) Email the instructor to schedule.
- 3) Email the instructor (or the TAs) your questions (simple questions that need short answers only).

4) Course Description

Credits: 3

Pre-requisite: OCES 2002, OCES 2003

Brief description: This course describes the chemistry of the ocean based on distributions and dynamics of elements, atoms and molecules. This ranges from fundamental physical, thermodynamic and kinetic chemistry to interactions of ocean chemistry with biological, geological and physical processes. It encompasses both inorganic and organic chemistry, and includes studies of ocean-atmosphere dynamics and marine sediments.

5) Intended Learning Outcome

On successful completion of the course, students will be able to:

- 1) Demonstrate a solid foundation in earth's climate system, and physical and biogeochemical processes shaping Earth's climate.
- 2) Understand global warming, natural climate variations and climate anomalies
- 3) Understand the roles of ocean plays in Earth's Climate, particularly the how ocean and atmosphere are a coupled, interacting system.
- 4) Explain the fundamental principles governing oceanic and atmospheric variability in association with climate changes at different temporal and spatial scales.
- 5) Explain causes and evidence of climate change in the past and the future,
- 6) Explain human impacts on weather and climate and the consequence of climate change to ecosystems

6) Assessment and Grading

- Class participation: 10%, including attending classes, taking in-class quizzes, etc.
- Problem assignments: 50%;
- Mid-term exam (closed book): 15 %
- Final exam (open book): 25%

Detailed rubrics for each assignment will be provided after the grades are released. Assessment marks for individual assessed tasks will be communicated via Canvas within two weeks of submission. Students who have further questions about the feedback including marks should consult the instructor within five working days after the feedback is received.

Final Grade Descriptors:

Grades	Short Description	Elaboration on subject grading description
A	Excellent Performance	Demonstrates a comprehensive grasp of subject matter, expertise in problem-solving, and significant creativity in thinking.
B	Good Performance	Shows good knowledge and understanding of the main subject matter, competence in problem-solving, and the ability to analyze and evaluate issues.
C	Satisfactory Performance	Possesses adequate knowledge of core subject matter, competence in dealing with familiar problems, and some capacity for analysis and critical thinking.
D	Marginal Pass	Has threshold knowledge of core subject matter, potential to achieve key professional skills, and the ability to make basic judgments. Benefits from the course and has the potential to develop in the discipline
F	Fail	Demonstrates insufficient understanding of the subject matter and lacks the necessary problem-solving skills. Shows limited ability to think critically or analytically and exhibits minimal effort towards achieving learning goals. Does not meet the threshold requirements for professional practice or development in the discipline.

7) The course policy on the use of generative AI.

Students may use Generative Artificial Intelligence tools (AI) to support their learning. However, using AI to generate contents for assignments is NOT permitted, except for correcting grammatical errors and improving the clarity of text originally composed by students. Students are fully responsible for all contents produced by AI tools and must disclose how AI was used in completing the assignment.

8) Student Learning Resources:

Primary textbook:

- Kris Karnauskas, Physical Oceanography and Climate, Cambridge University Press, 2020. Library access: <https://lbdiscovers.hkust.edu.hk/bib/991013554198903412>

Additional textbook(s):

- Geoffery K. Vallis, Climate and the Oceans. Princeto University Press, 2012. Library access: <https://lbdiscovers.hkust.edu.hk/bib/991013321714003412>
- Kevin E. Trenberth, The Changing Flow of Energy through the Climate System, Cambridge University Press, 2022. Library access: <https://lbdiscovers.hkust.edu.hk/bib/991013065027203412>
- John Marshall and R. Allen Plumb, Atmosphere, Ocean and Climate Dynamics, Academic Press, 2007. Library access: <https://lbdiscovers.hkust.edu.hk/bib/991013553704503412>
- Gerold Siedler (Ed.), Stephen M. Griffies (Ed.), John Gould (Ed.), and John A. Church (Ed.), Ocean Circulation and Climate, Academic Press, 2nd Ed., 2013. Library access: <https://lbdiscovers.hkust.edu.hk/bib/991013067405303412>

9) Academic Integrity

Students are expected to adhere to the university's academic integrity policy. Students are expected to uphold HKUST's Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct. Please refer to [Academic Integrity | HKUST – Academic Registry](#) for the University's definition of plagiarism and ways to avoid cheating and plagiarism.

10) **Course Outline (subject to adjustment):**

Wk	Date	Topic
1	3 Feb	Climate system and climate variables
	5 Feb	Mathematical preliminaries
2	10 Feb	Earth's energy balance I
	12 Feb	Earth's energy balance II
3	17 Feb	HOLIDAY
	19 Feb	HOLIDAY
4	24 Feb	The heat budget and air-sea heat exchange I
	26 Feb	The heat budget and air-sea heat exchange II
5	3 Mar	The salt budget and air-sea freshwater exchanges
	5 Mar	The momentum budget I
6	10 Mar	The momentum budget II
	12 Mar	The atmosphere: structure and general circulation I
7	17 Mar	The atmosphere: structure and general circulation II
	19 Mar	The atmosphere: winds and the Jet Streams I
8	24 Mar	Midterm Exam
	26 Mar	The atmosphere: winds and the Jet Streams II
9	31 Mar	The ocean, its dynamics, and circulation I
	2 Mar	The ocean, its dynamics, and circulation II
10	7 Apr	HOLIDAY
	9 Apr	Ocean response to wind forcing I
11	14 Apr	Ocean response to wind forcing II
	16 Apr	Coupled climate variability, El Nino and the South Oscillation I
12	21 Apr	Coupled climate variability, El Nino and the South Oscillation II
	23 Apr	Response to buoyancy forcing I
13	28 Apr	Response to buoyancy forcing II
	30 Apr	The carbon cycle, ocean biogeochemistry and climate I
14	5 May	The carbon cycle, ocean biogeochemistry and climate II
	7 May	Climate models and predictions
