UNSW SCIENCE

School of Maths and Statistics

Course outline

MATH3261/MATH5285

Fluids, Oceans and Climate

Term 3, 2022

Cricos Provider Code: 00098G

Staff

Position	Name	Email	Room
Lecturer-in-charge	Associate Professor Shane Keating	s.keating@unsw.edu.au	RC-2081

Please refer to your Timetable on MyUNSW for your Lecture Tut, Lab enrolment days and times.

Timetable weblink:

MATH3261: https://timetable.unsw.edu.au/2022/MATH3261.html#S3S

MATH5285: https://timetable.unsw.edu.au/2022/MATH5285.html#S3S

Administrative Contacts

Please visit the School of Mathematics and Statistics website for a range of information on School Policies, Forms and Help for Students.

For information on Courses, please go to “Current Students” and either Undergraduate and/or Postgraduate”, Course Homepage” for information on all course offerings,

The “Student Notice Board” can be located by going to the “Current Students” page; Notices are posted regularly for your information here. Please familiarise yourself with the information found in these locations. The School web page is: https://www.maths.unsw.edu.au

If you cannot find the answer to your queries on the web you are welcome to contact the Student Services Office directly.

By email	Undergraduate	ug.mathsstats@unsw.edu.au
	Postgraduate	pg.mathsstats@unsw.edu.au
By phone:	9385 7053	

Should we need to contact you, we will use your official UNSW email address of in the first instance. **It is your responsibility to regularly check your university email account. Please state your student number in all emails.**

Course Information

Assumed knowledge / Pre-Requisite: 12 units of credit in Level 2 Math courses including (MATH2011 or MATH2111) and (MATH2120 or MATH2130 or MATH2121 or MATH2221), or (both MATH2019 (DN) and MATH2089), or (both MATH2069 (DN) and MATH2099).

Exclusions: MATH3261, MATH3241

We are aware some course exclusions on the Handbook may be different to the School website. We are in the process of updating this information. Meanwhile, students should be following the Handbook course information with the School website information as a supplement.

Course Aims

The course aims to provide a solid foundation for the analysis of geophysical flows that arise in the study of the ocean, the atmosphere, and their interactions in the climate system. This course introduces the equations of motion and conservation laws that govern the fluid dynamics of the atmosphere and the ocean. These equations are then systematically simplified and solved to quantitatively model key phenomena selected from the enormously rich variety of atmospheric and oceanic flows. Emphasis is on large-scale phenomena important in the global climate system and on physically relevant approximations.

Course Description

The mathematical modelling and theory of problems arising in the flow of fluids, the oceans and the global climate. Cartesian tensors, kinematics, mass conservation, vorticity, Navier-Stokes equation. Topics from inviscid and viscous fluid flow, gas dynamics, sound waves, water waves. The dynamics underlying the circulation of the atmosphere and oceans are detailed using key concepts such as geostrophy, the deformation radius and the conservation of potential vorticity. The role of Rossby waves, shelf waves, turbulent boundary layers and stratification is discussed. The atmosphere-ocean system as a global heat engine for climate variablity is examined using models for buoyant forcing, quasi-geostrophy and baroclinic instability.

Assessment and Deadlines

Assessment	Weeks	Weighting %	Course Learning Outcome (CLO)
Assignments 1, 2 & 3	Monday week 4, 7 and 10	15% each (Total 45%)	CLO1, CLO2
Tutorial participation	Weeks 4, 8, 10	5%	CLO1
Final take home assessment	Exam period	50%	CLO1, CLO2

Late Submission of Assessment Tasks

A late penalty of 5% of the awarded mark will be applied per day or part day any assessment task is submitted more than 1 hour late. (Where "late" in this context means after any extensions granted for Special Consideration or Equitable Learning Provisions.) For example, an assessment task that was awarded 75% would be given 65% if it was 1-2 days late. Any assessment task submitted 7 or more days late will be given zero.

Note that the penalty does not apply to

- Assessment tasks worth less than 5% of the total course mark, e.g. weekly quizzes, weekly class participation, or weekly homework tasks.
- Examinations and examination-style class tests
- Pass/Fail Assessments

Course Learning Outcomes (CLO)

- CLO1 Model and describe common dynamical processes in the ocean and atmosphere using appropriately approximated dynamical equations and their solutions.
- CLO2 Communicate discipline specific information in a written form with appropriate referencing.

Course Schedule

The course will include material taken from some of the following topics. This is should only serve as a guide as it is not an extensive list of the material to be covered and the timings are approximate. The course content is ultimately defined by the material covered in lectures.

Weeks	Topic	Activity (Learning opportunity)
1	Rotating, stratified, and thin	Lectures, Lab 1
2	Fluid fundamentals	Lectures, Tutorial 1
3	Geophysical fluid dynamics	Lectures, Lab 2
4	Shallow water model	Lectures, Tutorial 2
5	Linear wave theory	Lectures, Lab 3
7	Shallow water waves	Lectures, Lab 4
8	Quasi-geostrophic theory	Lectures, Tutorial 3
9	Baroclinic instability	Lectures, Lab 5
10	Ocean circulation	Lectures, Tutorial 4

Textbooks

You are not required to buy a textbook for this course: the lecture notes are complete. However, if you would like another reference, here are some excellent textbooks on fluid dynamics and atmosphere- ocean science.

Atmospheric and Oceanic Fluid Dynamics: Fundamentals and Large-Scale Circulation

G.K. Vallis

• Excellent and comprehensive text on geophysical fluid dynamics and large-scale circulation of the atmosphere and ocean.

Atmosphere, Ocean, and Climate Dynamics: an Introductory Text

J. Marshall and R.A. Plumb

- Good mid-level text based on undergraduate course taught at MIT.

Introduction to Geophysical Fluid Dynamics

B. Cushman-Roisin

- Introductory level text, particularly good for physical understanding.

Moodle

Log in to Moodle to find announcements, general information, notes, lecture slide, classroom tutorial and assessments etc. https://moodle.telt.unsw.edu.au

School and UNSW Policies

The School of Mathematics and Statistics has adopted a number of policies relating to enrolment, attendance, assessment, plagiarism, cheating, special consideration etc. These are in addition to the Policies of The University of New South Wales. Individual courses may also adopt other policies in addition to or replacing some of the School ones. These will be clearly notified in the Course Initial Handout and on the Course Home Pages on the Maths Stats web site.

Students in courses run by the School of Mathematics and Statistics should be aware of the School and Course policies by reading the appropriate pages on the Maths Stats web site starting at:
https://www.maths.unsw.edu.au/currentstudents/assessment-policies

The School of Mathematics and Statistics will assume that all its students have read and understood the School policies on the above pages and any individual course policies on the Course Initial Handout and Course Home Page. Lack of knowledge about a policy will not be an excuse for failing to follow the procedure in it.

Academic Integrity and Plagiarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW staff and students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

The **UNSW Student Code** provides a framework for the standard of conduct expected of UNSW students with respect to their academic integrity and behaviour. It outlines the primary obligations of students and directs staff and students to the Code and related procedures.

In addition, it is important that students understand that it is not permissible to buy essay/writing services from third parties as the use of such services constitutes plagiarism because it involves

using the words or ideas of others and passing them off as your own. Nor is it permissible to sell copies of lecture or tutorial notes as students do not own the rights to this intellectual property.

If a student breaches the Student Code with respect to academic integrity, the University may take disciplinary action under the **Student Misconduct Procedure**.

The UNSW Student Code and the Student Misconduct Procedure can be found at: https://student.unsw.edu.au/plagiarism

An online Module "Working with Academic Integrity" (https://student.unsw.edu.au/aim) is a six-lesson interactive self-paced Moodle module exploring and explaining all of these terms and placing them into your learning context. It will be the best one-hour investment you've ever made.

Plagiarism

Plagiarism is presenting another person's work or ideas as your own. Plagiarism is a serious breach of ethics at UNSW and is not taken lightly. So how do you avoid it? A one-minute video for an overview of how you can avoid plagiarism can be found https://student.unsw.edu.au/plagiarism.

Additional Support

ELISE (Enabling Library and Information Skills for Everyone)

ELISE is designed to introduce new students to studying at UNSW.

Completing the ELISE tutorial and quiz will enable you to:

- analyse topics, plan responses and organise research for academic writing and other assessment tasks
- effectively and efficiently find appropriate information sources and evaluate relevance to your needs
- use and manage information effectively to accomplish a specific purpose
- better manage your time
- understand your rights and responsibilities as a student at UNSW
- be aware of plagiarism, copyright, UNSW Student Code of Conduct and Acceptable Use of UNSW ICT Resources Policy
- be aware of the standards of behaviour expected of everyone in the UNSW community
- locate services and information about UNSW and UNSW Library

Some of these areas will be familiar to you, others will be new. Gaining a solid understanding of all the related aspects of ELISE will help you make the most of your studies at UNSW.

The *ELISE* training webpages:

https://subjectguides.library.unsw.edu.au/elise/aboutelise

Equitable Learning Services (ELS)

If you suffer from a chronic or ongoing illness that has, or is likely to, put you at a serious disadvantage, then you should contact the Equitable Learning Services (previously known as SEADU) who provide confidential support and advice.

They assist students:

- living with disabilities
- with long- or short-term health concerns and/or mental health issues
- who are primary carers
- from low SES backgrounds
- of diverse genders, sexes and sexualities
- from refugee and refugee-like backgrounds
- from rural and remote backgrounds
- who are the first in their family to undertake a bachelor-level degree.

Their web site is: https://student.unsw.edu.au/els/services

Equitable Learning Services (ELS) may determine that your condition requires special arrangements for assessment tasks. Once the School has been notified of these, we will make every effort to meet the arrangements specified by ELS.

Additionally, if you have suffered significant misadventure that affects your ability to complete the course, please contact your Lecturer-in-charge in the first instance.

Academic Skills Support and the Learning Centre

The Learning Centre offers academic support programs to all students at UNSW Australia. We assist students to develop approaches to learning that will enable them to succeed in their academic study. For further information on these programs please go to:

http://www.lc.unsw.edu.au/services-programs

Applications for Special Consideration for Missed Assessment

Please adhere to the Special Consideration Policy and Procedures provided on the web page below when applying for special consideration.

https://student.unsw.edu.au/special-consideration

Please note that the application is not considered by the Course Authority, it is considered by a centralised team of staff at the Nucleus Student Hub.

The School will contact you (via student email account) after special consideration has been granted to reschedule your missed assessment, for a *lab test or paper-based test* only.

For applications for special consideration for *assignment extensions*, please note that the new submission date and/or outcome will be communicated through the special consideration web site only, no communication will be received from the School.

For Dates on Final Term Exams and Supplementary Exams please check the “Key Dates for Exams” ahead of time to avoid booking holidays or work obligations.

https://student.unsw.edu.au/exam-dates

If you believe your application for Special Consideration has not been processed, you should email specialconsideration@unsw.edu.au immediately for advice.

Course Evaluation and Development (MyExperience)

Student feedback is very important to continual course improvement. This is demonstrated within the School of Mathematics and Statistics by the implementation of the UNSW online student survey *myExperience*, which allows students to evaluate their learning experiences in an anonymous way. *myExperience* survey reports are produced for each survey. They are released to staff after all student assessment results are finalised and released to students. Course convenor will use the feedback to make ongoing improvements to the course.