EOSC 471 : Waves, currents and ocean mixing, Fall 2016

September 6, 2016

1 Calendar Description

`Use of observations, theory and model results to solve physical oceanographic problems including applications to transport and mixing of pollutants or nutrients.`

2 Prerequisites

EOSC 211 and one of ATSC 201, EOSC 372, GEOB 200 and one of SCIE 001, PHYS 101, PHYS 107, PHYS 117, PHYS 153, PHYS 157.

3 Instructors

Susan Allen Office: Earth Science Building 3017 Phone: 604-822-2828. Email: sallen@eos.ubc.ca
Rich Pawlowicz Office: Earth Science Building 3019 Phone: 604-822-1356 Email: rich@eos.ubc.ca
Stephanie Waterman Office: Earth Science Building 3053 Phone: 604-827-2665 Email: swaterman@eos.ubc.ca

If you wish to see us, please make an appointment either after class or by phone or e-mail to save you waiting outside the door or not finding us in.

4 Meeting Times

Wednesdays 15:00-16:00 in West Mall Swing Space Room 406.
Fridays 14:00-16:00 in EOAS-Main Room 210.

Although listed as a lecture and a tutorial to make registration work, both times will be used for lectures, worksheets and discussions. The Friday class time will give us access to computers.

5 Course Learning Goals

By the end of the course, students will be able to:

1. use observations, theory and/or model results to solve physical oceanography problems;
2. use computational analysis to visualize and to extract quantitative results from observations and model results
3. use fluid dynamical scaling to determine what processes are important and to characterize flows using non-dimensional numbers
4. and, in addition by the end of the course, students will have an acquired appreciation of current research topics in physical oceanography

6 Web:

On Connect. Includes:

- Marks
- Submission of computer based worksheets
- Course notes

7 Contents

No	Date	Title	Resp	Inst
0.		**Introduction**		
	Sep 7	Syllabus, Scope of Course	RP	RP
1.		**Skin of the Ocean**		
1.1	Sep 7-9	Review of Waves and Nondimensionalization	RP	RP
	Sep 9	Modelling wave propagation	RP	RP
1.2	Sep 14	Wave Spectrum	RP	SEA
	Sep 16	Wind forcing, fetch, evolution	RP	SEA
1.3	Sep 21	Air-sea interaction	RP	RP
	Sep 23	Intro to Mini-project #1	RP	RP
1.4	Sep 28	Mixed layer Dynamics	RP	RP
	Sep 30	Mixed layer modelling	RP	RP
1.5	Oct 5	Gas & Gas Fluxes	RP	SEA
2.		**Large-scale overturning, mixing & stirring**		
	Oct 7	Internal waves	SW	SEA
	Oct 12	Shear-driven mixing	SW	SEA
	Oct 14	**Midterm**		
2.		**Large-scale overturning, mixing & stirring**		
	Oct 19	Review of the overturning circulation	SW	RP
	Oct 21	Intro to Mini-project #2	SW	SW/SEA
	Oct 26	Observations of mixing	SW	RP
	Oct 28	Horizontal stirring	SW	RP
3.		**Coastal Oceanography, the West Coast of Canada**		
3.1	Nov 2	Tides as Waves	SEA	SEA
3.2	Nov 4	Tidal Analysis	SEA	SEA
3.3	Nov 9	Estuarine Circulation	SEA	RP
3.4	Nov 16	Lagrangian Analysis, Fukishima	SEA	SEA
3.5	Nov 18	Intro to Mini-project #3	SEA	SEA
3.6	Nov 23	Wind-driven Currents	SEA	SEA
3.7	Nov 25	Model Data Comparison	SEA	SEA
3.8	Nov 30	WCVI Upwelling	SEA	RP
4.		**Course Summary**		
	Dec 3	Review Session		

8 In General

Comments on anything to do with the course: content, webpage, lecture style *etc.,* are welcome. Please come to our office and we can discuss it. There will be a formal course evaluation at the end of the term but if you tell us earlier we can start doing something about it for this term.

9 Grades

- Three mini-projects (3 x 20%)
- Work-sheets (8%)
- Midterm Test (12%)
- Final Exam (20%)

The in-class and computer-based worksheets will be marked only for participation. There will be a 10% "grace space" policy. The grace space policy is to accommodate a few missed classes due to illness, "away games" for athletes etc.

The midterm and final exam will address learning outcome 3 directly and also query students on techniques used for learning outcomes 1 and 2. The mini-projects will focus on learning outcomes 1 and 2. Learning Outcome 4 will not be assessed.

The midterm test and final exam will be run as "individual+group" tests. You will do the test individually and hand it in. Then you will redo the test as a group. Your mark will be 85% from your individual exam and 15% from your group exam. If your group mark is lower than your individual mark, you will get your individual mark.

A significant component of the course will be three mini-projects. At least one of these projects will be group based. Each project will be allocated 2 hours initial time in the computer laboratory to ensure you have access to the materials and tools you need and to facilitate group dynamics. Formal reports will be required and marked. More details and rubrics will be provided when the projects are assigned.

10 Reference Material:

- Holthuijsen, L.H. Waves in Oceanic and Coastal Waters, Cambridge, 2007.
- Simpson, J.H. and J. Sharples. Introduction to the physical and biological oceanogrrarphy of shelf seas. Cambridge University Press (2012)
- Talley, L. D, Pickard, G. L, Emery, W. J., and Swift, J. H. Descriptive physical oceanography: an introduction. Edition 6. Academic Press. 2011.
- Wells, N. The Atmosphere and Ocean, A Physical Introduction. Edition 2. 1997.
- Wunsch, C. Modern Observational Physical Oceanography: Understanding the Global Ocean. Princeton University Press, 2015.

11 Computer info:

This course requires access to MATLAB, which is available in the EOAS computer labs on payment of the annual lab account fee ($25 - CASH only. See Kimberly or Alicia, ESB 2020, 9:00 – 11:30 am or 2:00 – 3:30 pm, bring student card). Alternatively, it can be purchased online at `www.mathworks.com` for students' personal laptops. There are two student versions: one is $49 USD and one is $99 USD. The difference is the $99 version comes with additional toolboxes. The extra toolboxes are NOT needed for this course. Note, if you plan to use lab computers, you must purchase your account access *before* the first lab.

Do you already have MATLAB? Oh-oh. In the labs we make use of a 'Live Editor' that first appears in MATLAB 2016a. If you have an older version or MATLAB its not impossible to do the labs and miniprojects, but it is a little more difficult (sorry).

12 Important Dates

Date	Event
Sep 7	First class 3 pm
Sep 9	First computer class 2 pm
Sep 20	Last day to withdraw from course without a 'W' appearing on transcript
Sep 23	Mini-project 1 orientation
Oct 7	Mini-project 1 due
Oct 14	Mid-term Test
Oct 14	Last day to withdraw from course
Oct 21	Mini-project 2 orientation
Nov 4	Mini-project 2 due
Nov 11	No Class : Remembrance Day
Nov 18	Mini-project 3 orientation
Dec 2	Mini-project 3 due
Dec 2	Last class
Dec 6-21	Final Examination, within the official examination period. This examination period is set out in the Calendar and no work or vacation arrangements should be made for this period. Note: examination period includes Saturdays and evenings.