Outline EOS431 and PHY441

Fall 2025

- Instructor: Giuliana Berden
- Email: gberden@uvic.ca
- Office Hours: By appointment (BWC A321)
- Meeting time: TWF 11:30-12:20
- Location:

Course Objectives

- Better understand geophysical fluid dynamics
- Practice data presentation and interpretation
- Practice data analysis, including numerical skills
- Practice written and oral presentation of ideas and concepts

Texts

Mostly Cushman-Roisin and Beckers, 2011, available electronically from the UVic library. You can also purchase a copy depending on your preference. See in texts section for more bibliography.

Grading

- 50% Assignments
- 45% Course project
- 5% Participation

Computing

This course has a relatively heavy computing component, so please take the time to set your computing environment. Go to Computing: Veros for more details. Note there is a (modest) computing assignment due the first Tuesday of class.

Calendar:

The calendar is attached to the outlines

Assignments: 50 % of the total grade

Most assignments (except the first and last) consist of two parts. The first is a quantitative analysis of the model output for the (approximately) two-week block. The second is a qualitative “first look” and a bit of thinking about the model output for the next block.

Due day of class before class, handed in on Brightspace. 10% late penalty per day overdue, or talk to the instructor at least 24 h before due date (unless suddenly ill).

There are 6 assignments:

- Assignment 0 – Qualitative analysis of a dense flow over an obstacle (deadline: September 10, 2025) - 5 points
- Assignment 1 - Quantitative analysis of a dense flow over an obstacle and qualitative analysis of wind-driven channel flow (deadline: September 24, 2025) - 9 points
- Assignment 2 - Quantitative analysis of wind-driven channel flow and qualitative analysis of wind-driven basin-scale flow (deadline: October 13, 2025) - 9 points
- Assignment 3 - Quantitative analysis of wind-driven basin-scale flow and qualitative analysis of waves (deadline: October 24, 2025) - 9 points
- Assignment 4 - Quantitative analysis of planetary waves and qualitative analysis of overturning circulation (deadline: November 5, 2025) - 9 points
- Assignment 2 - Quantitative analysis overturning circulation (deadline: November 25, 2025) - 9 points

Course project: 45% of the total grade

The goal of the class project is for you to start reading the primary literature, and to get some practice in writing and speaking. The final product will be a science proposal and a short 15 minutes talk to the class describing your proposal. In order to stay on track I've set the following milestones for you to meet.

The project is divided into 5 milestones:

- **Sept 17 —> Milestone 1: Paper selection** (5% of project grade)
- **Oct 3 —> Milestone 2: Bibliography** (10% of project grade)
- **Oct 29 —> Milestone 3: Introduction** (15% of project grade)
- **Nov 19–28 —> Milestone 4: Talk** (15% of project grade)
- **Dec 12 —> Final Proposal** (55% of project grade)

At each step you turn something in on Brightspace and talk to me about it, either via email or in person.

The project

The final project is to submit a research proposal based on the results of a recent journal article. It is very rare for a piece of science to not leave unanswered questions. Your project is to understand a paper, discern the questions that it leaves unanswered, or could use further work, and to write a proposal that tackles some aspect of that further work.

The science carried out in the proposal should be relatively detailed. You will need to decide on your approach, be it a field program, numerical modelling, or laboratory work. Your proposal should be practical, which will mean demonstrating some grasp of the limitations of the approaches. By "practical", I mean consuming less than $1 million dollars of resources. (It doesn't require any ingenuity to come up with a sampling plan requiring 30 ships, or a simulation requiring use of 20,000 computer nodes for a year).

Example proposal

Some colleagues at Scripps and UW have been kind enough to share a proposal they wrote based on modelling results from a GRL paper. This was a major proposal to the US National Science Foundation for almost $3M. Of course it underwent very critical peer review, and was written by two of the brightest oceanographers in the field. So, it is much more polished than what I would expect from you (or even myself!). However, it gives a good idea of what is involved.

GRL Paper

IwapProposal.pdf

Late policy for milestones and project

As for the rest of the course, 10% per day including weekends. If you require an academic concession please contact the instructor.

Fecha	Lectures	Assigment Due Dates	Project Due Dates	Class Number	Columna 1
Wed, Sep 3	Class Intro			1	
Fri, Sep 5	Class Intro computing			2	
Tue, Sep 9	**Qualitative: hydraulic flow**	Assigment 0		3	
Wed, Sep 10	Equation of state, continuity			4	
Fri, Sep 12	Lagrangian/Eulerian			5	
Tue, Sep 16	Pressure gradient force (external)			6	
Wed, Sep 17	Pressure gradient force (internal)		Milestone 1	7	
Fri, Sep 19	Viscous stresses			8	
Tue, Sep 23	Tutorial/catchup			9	
Wed, Sep 24	**Qualitative: Channel flow**	Assigment 1		10	
Fri, Sep 26	Coriolis Force			11	
Wed, Oct 1	Geostrophic balance			12	
Fri, Oct 3	Thermal wind		Milestone 2	13	
Tue, Oct 7	Ekman Balance: channel flow			14	
Wed, Oct 8	Tutorial/catchup			15	
Fri, Oct 10	**Qualitative: basin flow**	Assigment 2		16	
Tue, Oct 14	Ekman Convergence; wind stress curl			17	
Wed, Oct 15	Svedrup Balance			18	
Fri, Oct 17	Return flow			19	
Tue, Oct 21	Tutorial/catchup			20	
Wed, Oct 22	**Qualitative: planetary waves**	Assigment 3		21	
Fri, Oct 24	wave properties; shallow water waves			22	
Tue, Oct 28	Poincare waves			23	
Wed, Oct 29	Kelvin waves		Milestone 3	24	
Fri, Oct 31	Rossby waves			25	

Fecha	Lectures	Assigment Due Dates	Project Due Dates	Class Number	Columna 1
Tue, Nov 4	Tutorial/catchup			26	
Wed, Nov 5	**Qualitative: Overturning Circulation**	Assigment 4		27	
Fri, Nov 7	Thermal driven			28	
Tue, Nov 11	READING BREAK			29	
Wed, Nov 12	READING BREAK			30	
Fri, Nov 14	Sandstrom, and mixing			31	
Tue, Nov 18	Thermal/haline hysteresis			32	
Wed, Nov 19	student presentations		Milestone 4	33	
Fri, Nov 21	student presentations		Milestone 4	34	
Tue, Nov 25	student presentations	Assigment 5	Milestone 4	35	
Wed, Nov 26	student presentations		Milestone 4	36	
Fri, Nov 28	student presentations		Milestone 4	37	