Université de Bretagne Occidentale

MASTER PHYSIQUE

PARCOURS PHYSIQUE OCÉAN ET CLIMAT

semestre 7 Physique POC

Introduction à la dynamique des fluides géophysiques

Présentation

This course provides an introduction to the fundamental concepts, mathematical techniques and canonical solutions of geophysical fluid dynamics (GFD). The philosophy of GFD is to obtain simplified equations and then use those to study specific atmospheric or oceanic flows. The course will mostly be restricted to the dynamics of rotating, incompressible and homogenous flows.

4 crédits ECTS

Volume horaire

Travaux Dirigés : 20h
Cours Magistral : 15h

Objectifs

On completing this course, students will be able to build and solve a simplified set of equations of motion applied to a basic atmospheric or oceanic phenomenon. Students will acquire knowledge about the physics of geophysical flows.

Pré-requis nécessaires

Vector calculus, fluid mechanics, partial differential equations

Compétences visées

- Relate oceanic phenomena to basic geophysical fluid dynamics processes
- Use mathematical techniques to solve geophysical fluid dynamics problems

Descriptif

Lecture notes (110pp, in English) are available for this course. Topics include

Chap 1. Governing equations

- quick reminder of classical fluid mechanics (Navier-Stokes equations)
- Boussinesq and hydrostatic approximations
- Equations of motion in a rotating frame
- Coriolis and centrifugal forces
- beta plane and f plane approximation

Chap 2. Geostrophic theory

- Geostrophic balance and divergence of geostrophic flow
- Taylor-Proudman theorem and its implications
- Thermal wind balance
- Impact of rotation and stratification on the hydrostatic balance

Chap 3. Shallow water dynamics

- Momentum and mass continuity equations for a single layer
- Potential vorticity in shallow water systems
- Linear wave dynamics
- Inertia-gravity waves
- Kelvin waves
- Barotropic Rossby waves
- Topographic Rossby waves
- Reduced-gravity shallow water system

Chap. 4 Wind-driven ocean circulation

- Reynolds stresses
- The surface and bottom Ekman layers
- Ekman transport and Ekman pumping
- Sverdrup balance
- The intensification of western boundary currents
- Inertial effects

Modalités de contrôle des connaissances

Session 1 ou session unique - Contrôle de connaissances

Nature de l'enseignement	Modalité	Nature	Durée (min.)	Coefficient	Remarques
	CT	Ecrit - devoir surveillé	180	50%	
	CC	Autre nature		50%	

Session 2 : Contrôle de connaissances

Nature de l'enseignement	Modalité	Nature	Durée (min.)	Coefficient	Remarques
	CT	Oral	30	100%	