

MASTER PHYSIQUE

## PARCOURS PHYSIQUE OCÉAN ET CLIMAT

### semestre 7 Physique POC

# Modélisation numérique 1

## Présentation

This course introduces the basic numerical methods used to solve fluid mechanics problems (finite differences, spatial discretization, integration in time, accuracy, order, convergence, stability). The course is taught in English. Practicing is an essential part of the course. The programming language is Python.

**4 crédits ECTS**

Volume horaire

Cours Magistral : 9h

Travaux Dirigés : 21h

## Objectifs

Objectives

Acquire the foundation concepts of numerical modelling. Be able to implement numerical methods in Python. Be able to test and validate a numerical code.

## Pré-requis nécessaires

Pre-requisites

Linear algebra, ordinary differential equations

## Compétences visées

Abilities provided

Identify numerical methods for problem solving and validate results ; know and know how to use numerical simulation codes to tackle complex problems

## Descriptif

Contents

Classes are done in computer rooms, they blend theory and practice with a computer. Small homework are asked from one class to another. The final mark is composed of a final exam (50 % of the mark), in computer room, and of two personal projects (25% each). The course is split in two parts

Part 1: Spatial discretization

- > finite vs volume methods
- > staggered grid
- > boundary conditions
- > matrix representation
- > eigenvectors and eigenvalues
- > iterative methods to solve system of equations

Part 2: Integration of ordinary differential equations

- > order, convergence, stability
- > explicit vs implicit schemes
- > Runge Kutta methods
- > multi-stages methods

## 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	Ecrit - devoir maison		50%	

## Session 2 : Contrôle de connaissances

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