

MASTER PHYSIQUE

## PARCOURS PHYSIQUE OCÉAN ET CLIMAT

### semestre 7 Physique POC

# Analyse de données 1 - Data Analysis 1

## Présentation

This course concentrates on the basic concepts of two aspects of data analysis indispensable for a scientist working in any field : spectral methods and statistical methods. The emphasis is on the practical implementation (using Python language) although some elements of the theory are also considered. This course is taught in English.

### 4 crédits ECTS

Volume horaire

Cours Magistral : 17h

Travaux Dirigés : 15h

Travaux Pratiques : 6h

## Objectifs

Objectives

The goal of this course is to provide the students with a sound knowledge of the basics of the data analysis via practical examples.

## Pré-requis nécessaires

Pre-requisites

Calculus, scientific programming at L3 level

## Compétences visées

At the end of this course, the student should be able to:

- > Select an appropriate method to analyze laboratory, insitu, modelling data, and address a specific problem
- > Implement numerically a data analysis method using Python in order to tackle a scientific problem
- > Validate the results obtained and identify the limitations of the method

## Descriptif

Contents

The course consists of 2 parts:

### 1. Spectral analysis

Fourier series, Fourier Transform, Discrete Fourier Transform. Calculation of the different spectral representations of the signal : Linear and Power spectrum, Power spectral density. Zero-padding in time and frequency domain. Sampling theorem. Spectral leakage and window functions. Random signal, estimation of the Power spectral density of random signals and confidence intervals of the Power spectral density estimates. Spectrograms. According to the time available : the basics of the numerical filtering.

### 2. Statistical analysis

Students will learn to:

- Choose and use appropriate descriptive measures and visualization methods to summarize data; identify outliers in a data set
- Interpret a graph of a probability density function; identify and generate data drawn from the normal distribution; test whether or not data conform to a given probability distribution
- Construct confidence intervals; propagate errors
- Perform and interpret a hypothesis test, adjusting for sample size where necessary; explain the notion of statistical power
- Implement all of the above methods using Python

Classes comprise a mix of theory and practical work.

## 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	Ecrit - devoir surveillé	180	100%	