UE Handling uncertainties in (large-scale) numerical models

Niveau d'étude
Bac +5

ECTS
6 crédits

Crédits ECTS Echange
6.0

Composante
UFR IM2AG (informatique, mathématiques et mathématiques appliquées)

Période de l'année
Automne (sept. à dec./janv.)

- **Langue(s) d'enseignement:** Anglais
- **Ouvert aux étudiants en échange:** Oui
- **Crédits ECTS Echange:** 6.0
- **Code d'export Apogée:** GBX9AM44

Présentation

Description

Numerical simulation is ubiquitous in today's world. Initially confined to well-mastered physical problems, it has spread to all fields (oceanography, biology, ecology, etc.), the aim being to make forecasts of the systems under study. This has been possible thanks to the combination of numerical models and access to a considerable amount of data. However, there are many sources of uncertainty in these modelling systems. They can come from poorly known processes, approximations in the model equations and/or in their discretization, partial and uncertain data, … The objective of this course is to explore in depth the mathematical methods that have allowed these two worlds to meet. Firstly, we will focus on sensitivity analysis approaches that allow us to study the behavior of the system and its response to perturbations. In particular, this permits to study the way in which uncertainties are propagated. Next, we will look at data assimilation methods that aim at reducing said uncertainties by combining numerical models and observation data. Finally, the notions of model reduction will be discussed, which allow the implementation of the previous methods on high dimensional problems.

This course is intended for DS and MSCI students and will start with a differentiated refresher course on the necessary basic mathematical notions.

Course outline

- General introduction and reminder of the basic concepts
- Sensitivity analysis
  - Local sensitivity analysis
  - Global sensitivity analysis
- Data assimilation
  - Variational methods
  - Stochastic methods
- Model reduction
  - Gaussian processes
  - Polynomial Chaos

Heures d'enseignement

CM	CM	36h

Période : Semestre 9

Infos pratiques

Contacts

Responsable pédagogique

Elise Arnaud

Campus

Grenoble - Domaine universitaire