Lectures 8 and 15: (Christel PINAZO)

Title: Physical and Biogeochemical Coupled Modelling (1) and (2)

Abstract:
These lecture is constituted by two sessions (1 & 2) focused on the physical and biogeochemical coupled modelling. The need of use coupled modelling to study functioning of ecosystems is presented. This kind of models allows both the simulation of environmental forcing conditions thanks to the physical model and the simulation of the ecosystem functioning thanks to the biogeochemical model. This scientific discipline is relatively recent, mainly developed since the 1990's with the increase of computing resources. The two different kinds of coupled models are described: box models and fine mesh grid models. For each type of models, equations, advantages, disadvantages and conditions of used are detailed. The two different ways of coupling the models are described, underlying the characteristics of the associated runs.

Outline:

- **Introduction**
  - **Why use Coupled Models ?**
  - **Historical considerations**

- **Different types of Coupled Models**
  - **Box models**
  - **Fine grid Models (1D, 2D and 3D)**

- **Different ways of Coupling Models**
  - **« Off-line » Coupling**
  - **« On-line » Coupling**

Lecture 19: (Christel PINAZO)

Title: A new Mechanistic Modular Ecological Model: Eco3M tool.

Abstract:
The lecture is focused on the presentation of the new mechanistic and modular numerical tool dedicated to biogeochemical modelling: Eco3M. This tool aims to be a modular tool, taking into account multi-element and multi-species state variables. The model uses varying C:N:P:Si ratios. Each state variable is defined by its group (phytoplankton, zooplankton, DOM, POM…..), its sub-group (species or functional group), and the element it is expressed in (C, N, P, Si…). A particular attention was paid to the modularity of the tool, and Eco3M was developed in Fortran 90-95 using powerful characteristics of this programming language such as derived types, modules, and dynamic memory through pointers. In addition, the numerical code was developed with matrix and vectors of undefined sizes allowing many variables and processes as needed. The functioning of the tool and the way to fill in the configurations files is presented.

Outline:

- **Introduction**
  - **What does simulate ECO3M ?**
  - **ECO3M Characteristics**

- **ECO3M functioning**
  - **State Variables**
  - **FLUX matrix**
  - **SELF Vector**

- **Configuration files**
  - **config.ini**
  - **modele.def**
  - **Mod_process.F90**