Variable Redfield-Ratio Organic Matter

Contact person: Guy Munhoven (LPAP)

e-mail: Guy.Munhoven@uliege.be

Phone: (+32) (4) 366 9771

Office: B5c building – room 0/13

Availability: by appointment

Thematics: climate, environment and oceanography

Description:

Most existing ocean biogeochemical models adopt a comparatively simple approach to represent the coupling of the nutrient (essentially nitrate and phosphate) and carbon cycles that arise from the production, transport and remineralization of organic matter: they adopt fixed C:N:P ratios, generally called Redfield ratios, to quantify the stoichiometry of organic matter. While this approach is justified to first order, there are regional deviations from these global average characteristics, and it seems that these ratios may also change in time, e. g., in response to the ongoing ocean acidification and global warming, or in relation to past climate changes, such as the Pleistocene glaciations. Hence, more and more biogeochemical models start to adopt variable organic matter stoichiometry to take into account this improved understanding of the coupled nutrient-carbon cycles.

Here, I propose to go one step further with these improvements, by also analysing the impact on the ocean-sediment exchange of nutrients, carbon and oxygen, using the the coupled ocean carbon cycle-sediment model MBM-MEDUSA (Munhoven, 2007, 2021): the ocean carbon cycle part will have to be extended to allow for variable C:N:P compositions of organic matter and a compatible MEDUSA configuration to be set up. Applications can address scientific questions of the past or the future evolution of the global carbon cycle.

Requirements and prerequisites This thesis project requires programming skills. MBM-MEDUSA is written in Fortran 95 and needs to be adapted. Introductory training in Fortran 90/95 can be provided if required. Processing and analysis of the results has so far been done with IDL, but is progressively transiting to Python.

Basic knowledge of biogeochemical cycles (carbon, phosphorus, nitrogen) would be useful, but is not indispensable, as this can be easily acquired from textbooks and scientific literature (rich collection available in the lab).

Infrastructure Usual developments and test simulations can normally be done on the student's own computing devices (laptop, desktop PCs). For computationally demanding work, a dedicated calculation server is available.

Stays abroad It should normally be possible to carry out this work completely in Liège.