Carbon Dioxide Removal with MBM-MEDUSA
(or *i*LOVECLIM-MEDUSA)

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Availability: by appointment

Thematics: climate, environment and oceanography

Description:

Due to the painfully slow progress in reducing atmospheric CO_2 emissions, Carbon Dioxide Removal (CDR) has over the years become a firm component in the cocktail of measures riquired to reduce atmospheric CO_2: fulfilling the requirements of the Paris agreement, i. e, keeping the mean global warming well below 2 °C above pre-industrial levels, and preferably below 1.5 °C by the year 2100, will at this stage require some form of CDR. CDR encompasses all kinds of processes that remove CO_2 from the atmosphere, be this by afforestation or reforestation, bioenergy with carbon capture and storage (BECCS), direct air capture and storage (DACS) or ocean alkalinization. The net efficiency of CDR methods is, however, subject to debate: positive emissions seem to be more efficient in increasing global temperature than negative emissions in decreasing them.

Here, I propose to adapt the coupled ocean carbon cycle-sediment model MBM-MEDUSA (Munhoven, 2007, 2021) so that it can be used to carry out the standard experiments of the Carbon Dioxide Removal Model Intercomparison Project (CDRMIP). The analysis will then also focus on the impact of CDR techniques and scenarios on the future evolution of the distribution se-floor carbonates. Alternatively, the Earth System Model *i*Loveclim which already includes all of the necessary carbon cycle related components, and which would furthermore allow to take into account the climate feedback, could also be used.

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 the carbon cycle would be useful, but is not indispensable, as this can be easily acquired from lecture notes, textbooks and scientific literature (rich collection available in the lab).

Infrastructure. Developments on MBM-MEDUSA can be done on the students own computing devices (laptop, desktop PCs). A dedicated computing server is nevertheless available if required.

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

Special terms and conditions. This subject can be adapted for a 15- or a 27-credit thesis.