Dimethylsulfonopropionate would be a reactive oxygen species scavenger for phytoplankton cell

Aim of the project

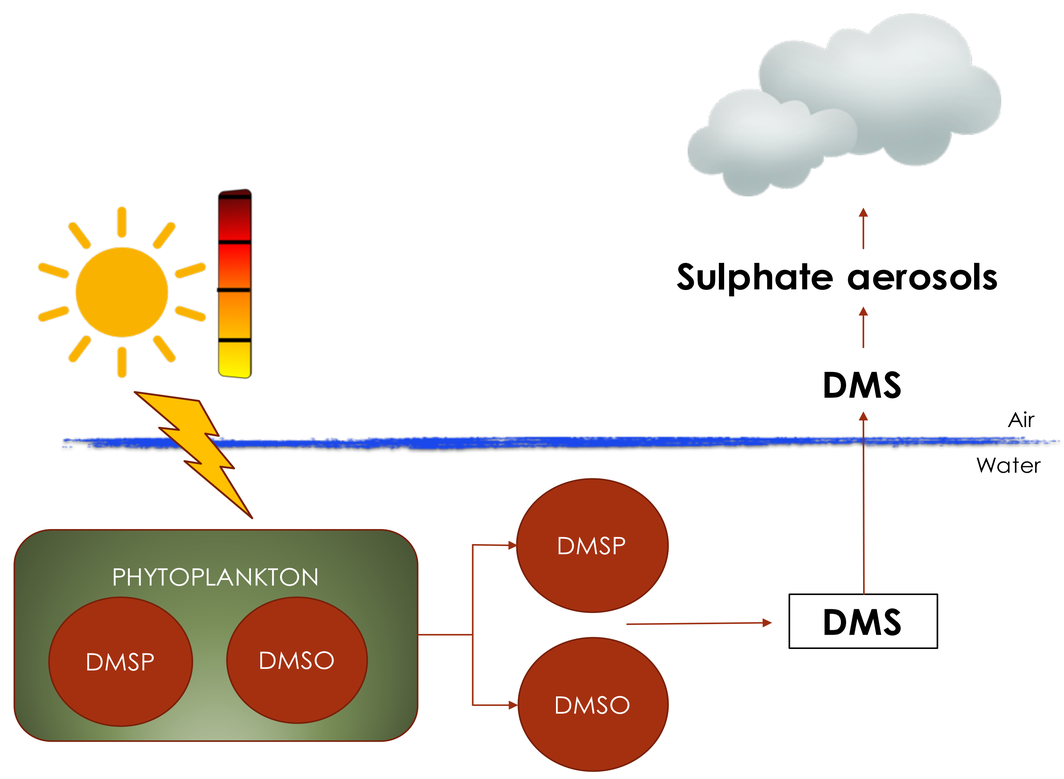
Dimethylsulfonopropionate (DMSP) and dimethylsulfoxide (DMSO) are the precursors of dimethylsulfide (DMS), a gas that allows the formation of sulphate aerosols impacting on the Earth radiation balance (Fig).

DMS(P,O) are playing several hypothetical roles on phytoplankton cells such as antioxidant, cryoprotectant or osmoregulator.

Goals

- Understand the role of DMS(P,O) as antioxidant for phytoplankton by the impact of light intensity
- Complete the DMS(P,O) cycle
- Validate candidate genes implied in DMS(P,O) production
- Understand the link between ROS production and DMS(P,O) measurements
- Include these results into a biogeochemical model (MIRO)

FIG: DMS(P,O) production in the phytoplankton cell would interact with the atmosphere and the light intensity



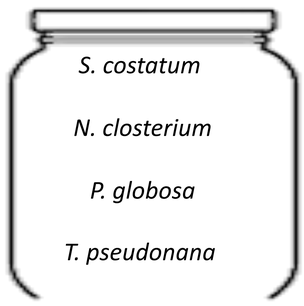
Methodology

It will include laboratory experiments, field measurements and mathematical modelization

Experiments

Different light intensities will be applied on several key species of the North Sea growing non limiting medium of culture

(0-1500 µmolq.m^{-2}.s^{-1}+ UV)



At exponential half-growth, we measure

- Density and cellular biovolume
- Fluorescence *in vivo* and Chlorophyll a
- The influence of light intensity on photosynthetic rate
- DMS(P,O) production
- Reactive Oxygen Species (ROS)
- Expression of candidate genes for their synthesis

Field measurements

DMS(P,O) concentration will be measured from the North Sea and correlated with the phytoplankton species, genes presence and environmental parameters

Mathematical Modelisation

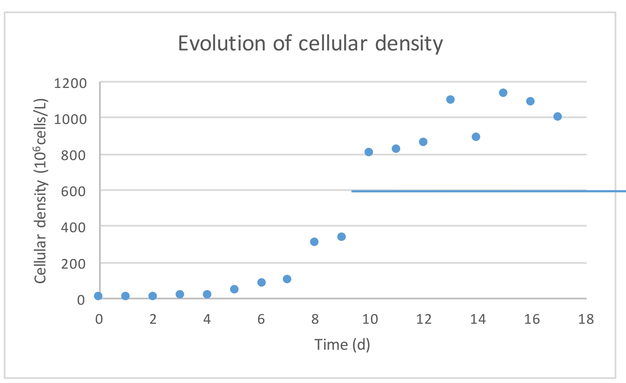
The model MIRO will be improved following the addition of the DMS(P,O) cycle and its transition from 2D to 3D

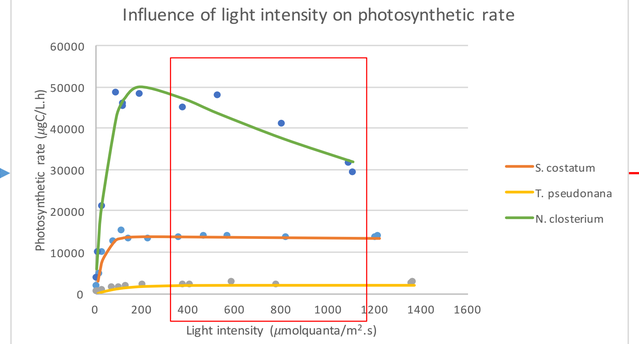
$$\frac{dDMSPp}{dt} = [\mu_n - lysis_n - grazing - sed_n] * SC_n$$

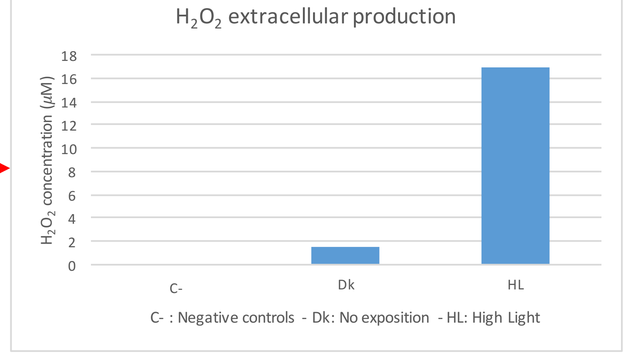
Conclusion

It would lead by the possibility to estimate the current and the future emissions of DMS

Preliminary Results







The oxidative stress will be measured with the hydrogen peroxide production as well as the presence of some antioxidant enzymes, compared to the DMS(P,O) production.

We are expecting different results depending on species, and according to the light intensity. Experimental results and field measurements will be included into the biogeochemical MIRO model to better understand the DMS(P,O) cycle and its role on the phytoplankton cell.

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