Impact of seasonal environmental stress in sea ice on the production and emission of dimethylsulfide by microbial communities

WITTEK Boris[1,2], CARNAT Gauthier[1], GYPENS Nathalie[2], TISON Jean-Louis[1]
[1] Laboratoire de Glaciologie, DSTE, Université Libre de Bruxelles, Bruxelles, Belgium
[2] Laboratoire d'Ecologie des Systèmes Aquatiques, Université Libre de Bruxelles, Bruxelles, Belgium
bwittek@ulb.ac.be, FRIA grant

Context

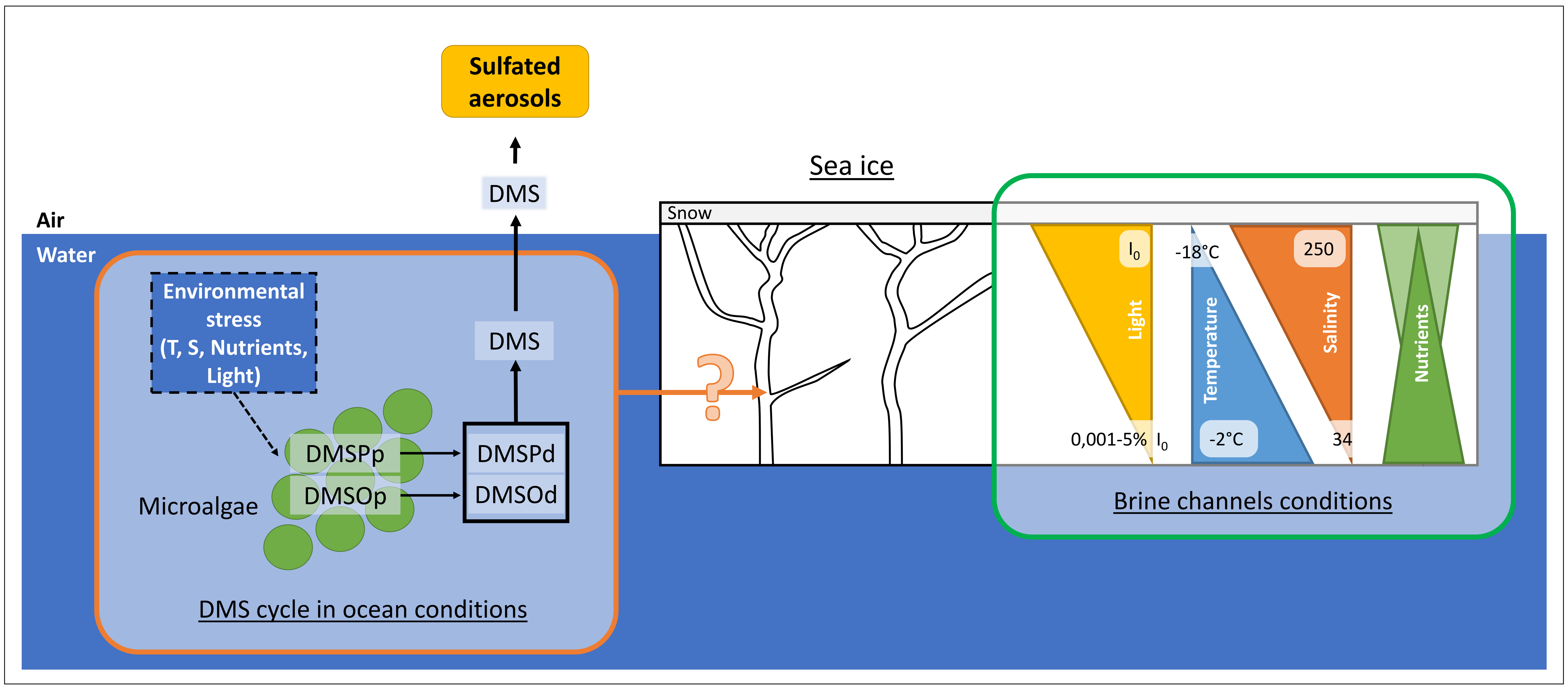
Here we focus on the **dimethylsulfide** (DMS), a volatile sulfur compound precursor of sulfated aerosols which affect the Earth radiation balance. DMS is produced by the degradation of two algal metabolites: **dimethylsulfoniopropionate** (DMSP) and **dimethylsulfoxyde** (DMSO). In ocean conditions, it is observed that algae produce DMSP and DMSO as cryoprotectant, osmoregulator or even antioxydant. But in other conditions, like the extreme conditions encountered in the brine channels of sea ice (see figure below), the cycle of DMS and its two precursors is not fully understood.

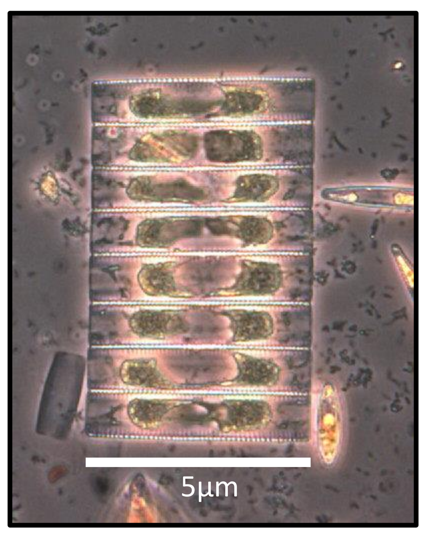
However:

- Flux of DMS have been measured at the ice-atmosphere interface
- Large quantities of DMSP and DMSO have been observed in sea ice
- Algae are able to live in brine channels and support the important shifts of temperature, salinity, light and nutrients.

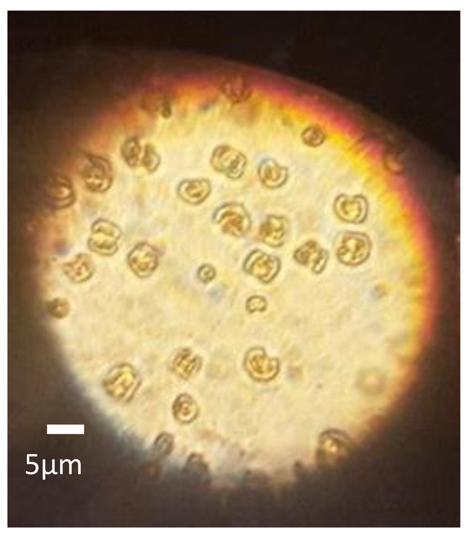
Goals

1. **Develop methods, protocols and materials to reproduce the brine channel environment in lab**
2. Determine the production of DMSP and DMSO by two characteristic polar algae, *Phaeocystis antarctica* (prymnesiophyte) and *Fragilariopsis cylindrus* (diatom), under oceanic and brine channel conditions
3. Quantify the impact of seasonal environmental stress in brine on sea ice algae in terms of DMSP and DMSO





Fragilariopsis cylindrus



Phaeocystis antarctica

Methodology

Culture of maintenance

Temperature	4°C
Salinity	34-35
Light	75 µmol photon/m²s (*F.cylindrus*) 100 µmol photon/m²s (*P.antarctica*)
Nutrients	No limits (F/2 medium)

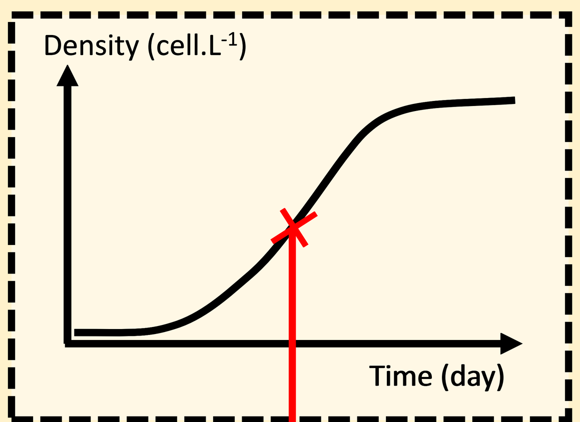
Oceanic conditions

Temperature	4°C
Salinity	34-35
Light	75 µmol photon/m²s (*F.cylindrus*) 100 µmol photon/m²s (*P.antarctica*)
Nutrients	No limits (F/2 medium)

Adaptative cultures

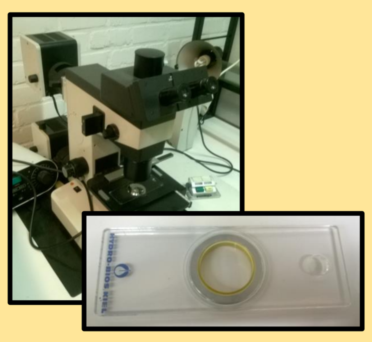
Temperature	Variable (from 4°C to -18°C)
Salinity	Variable (from 34 to 250)
Light	75 µmol photon/m²s (*F.cylindrus*) 100 µmol photon/m²s (*P.antarctica*)
Nutrients	No limits (F/2 medium)

Sampling and analysis



Sampling at half-growth
(18-20 days)

Density (cell/L)


Microscope counting

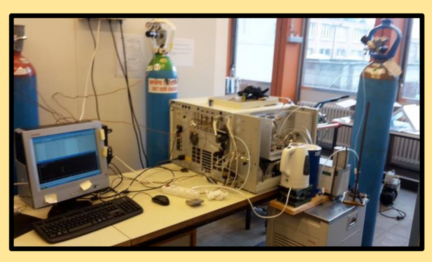
Biomass (pgC/L)


Cell size measurement + Menten-Deuer equation

Chlorophyl a (µg/L)


Fluorometry

DMSP and DMSO (nmol/L)


Gas chromatography

Expected results

DMSP,O / cell	→ Model
DMSP,O / Chl a	
DMSP,O / C	