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

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Sea ice plays a significant role in the exchanges of climate active gases between the ocean and the atmosphere. One of them, dimethysulfide (DMS), is a precursor of sulfate aerosols which affect the Earth radiation balance. DMS is produced by the degradation of two algal metabolites: dimethylsulfoniopropionate (DMSP) and dimethylsulfoxide (DMSO). The dynamic of these sulfur compounds in the sea ice ecosystem is poorly understood. In particular, little is known about the factors driving the production of DMS and of its biological precursors in the stressing environmental conditions (temperature, salinity) of the brine channels in which sea ice algae grows. In this context, the objective of this research project is to quantify the impact of seasonal environmental stress in brine on sea ice algae, focusing on the production of DMSP and DMSO. We will study the production of sulfur compounds by axenic cultures of two characteristic species of the polar ocean: a diatom, *Fragilariopsis cylindrus* and a prymnesiophyte, *Phaeocystis antarctica.* On one hand, as a reference point, we will determine the sulfur compounds production by both algae under typical ocean conditions in the polar area (temperature of 4°C and salinity around 34-35). On the other hand, we will focus on the DMSP and DMSO production under the seasonal environmental conditions encountered by both algae when their living environment is the sea ice: the incorporation into the sea ice matrix during the autumn, the survival in the brine channels during the winter and then the return to more favourable conditions in spring. For comparison, we will also perform the same experiments with natural sea ice algae samples collected in the Arctic and Antarctic. Globally, the outcomes of this research project should drastically improve our understanding and modelling capabilities of the sea ice sulfur cycle.

Keywords: sea ice; brines; DMS; DMSP; DMSO; microalgae; stress