New insights in Antarctic fast ice biogeochemistry, the role of biofilm

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Antarctic fast ice is known for its high biomass levels at the ocean/ice interface where particulate organic carbon (POC) concentrations can easily exceed 2mmol C l-1 during spring bloom. Coinciding with these high POC levels, high concentrations of nitrate and phosphate were observed during three different fieldwork campaigns in the East Antarctic. At Davis Station, Dumont D'Urville Station and Scott Base, bulk concentrations for nitrate were up to 10-times higher than observed in the underlying seawater suggesting a strong remineralisation and nitrification in the ice. However a long time series at Scott Base showed that the accumulation of inorganic nutrients in the bottom ice started early in the growth season while biomass was still growing. This goes against the classic view of nutrients being consumed during the growth season and regenerated after the height of the bloom. Regardless of the high nitrate levels available in the ice, increasing total nitrogen concentrations also suggest still more nitrogen from the underlying seawater was brought into the ice. A qualitative NPZD-model was elaborated and used to understand these observations. Implementation of a second nutrient pool proved essential in successfully modelling and reproducing the field observations. A biofilm could act as a water retaining barrier and result in chemical gradients in the brine channels and create microenvironments. It can also explain other interesting observations for carbon and phosphate that will be discussed in more detail during the conference.

References

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