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Spatial Variability of Nitrogen and Phosphorus Along a Transect on the Southwestern Greenland Ice Sheet

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The surface of the Greenland Ice Sheet has been darkening over the last two decades, reducing albedo and enhancing surface melt. A major contributor to this darkening is driven by biological growth (e.g., the proliferation of streptophyte glacier ice algae and/or cyanobacteria associated with dispersed cryoconites), yet the environmental controls governing their growth and spatial distribution remain poorly constrained. In particular, nutrient availability has been suggested as a key limiting factor for algal growth, but our understanding of nitrogen (N) and phosphorus (P) variability across the ice sheet is limited by sparse sampling and the detection limits of conventional analytical approaches.

In this study, we conducted a transect from Point 660 near Kangerlussuaq towards the snowline (~80 km inland from the margin), sampling at four distinct sites and collecting samples spanning a range of surface conditions. We photographed each site before and after sampling and used a novel MATLAB toolbox to quantify the “surface darkness” and to estimate the abundance of dispersed cryoconite granules. The surface ice scrapings collected at each site were then analysed for dissolved inorganic and organic N and P and for glacier ice algal cell counts.

Preliminary results show that marginal ice samples are considerably higher in P than samples collected inland, while they also had lower total dissolved N. Overall, lighter ice shows lower inorganic nutrient concentrations than darker ice. Ongoing work will refine these relationships and quantify the mass balance of inorganic versus organic nutrient pools in supraglacial ecosystems.