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Nutrient fluxes from a subarctic glacial river to the ocean

Glacial rivers play an important role in the biogeochemical cycles of macro- and micronutrients. Abiotic and biotic processes in supra-, sub- and proglacial environments enrich meltwaters with dissolved and particulate nutrient species that may undergo substantial changes in concentration and speciation along glacial rivers due to lateral inputs and in-channel processes. Once delivered to coastal waters, these nutrient fluxes can influence oceanic primary productivity, especially in the nutrient-limited subarctic waters.

The magnitude and timing of these exports remain poorly constrained for many glacial rivers globally. With the development of new in situ chemical sensors, it is now possible to monitor diurnal and seasonal changes in nutrient concentrations in these challenging environments.

This work presents results from multiple deployments of in situ microfluidic sensors for nitrate, phosphate and dissolved silica, and a water autosampler, combined with transects along an undammed Icelandic glacial river across seasons.

Diurnal fluctuations were observed in dissolved nitrate concentrations, with an increase during the day and a decrease at night. In contrast, dissolved phosphate only exhibited seasonal variability while dissolved silica remained relatively stable. Glacier-to-ocean transects also showed an enrichment in dissolved organic carbon (DOC) and iron (Fe) with distance from the glacier, likely reflecting soil-derived lateral inputs.

These findings highlight the spatial and temporal variability of nutrient export from glacial rivers to the ocean, showing the relative contribution of different nutrient sources depending on the season and distance from the glacier

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