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Impact of glacial meltwater on biogeochemical cycling in coastal and shelf waters off South West Greenland: Insights from ship-board and glider observations

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The high-latitude regions are experiencing some of the most rapid environmental changes observed anywhere on Earth, especially in recent years. The Greenland Ice Sheet, for example, is experiencing significant mass loss largely through surface melting, but also via ice discharge at glacier fronts. As well as changing freshwater budgets and ocean stratification and mixing, there has been increasing focus on the role of glaciers and ice sheets in supplying particulate and dissolved organic material and inorganic nutrients to marine systems. Here, we explore how a combination of ship-board and high-resolution ocean glider observations in shelf waters off SW Greenland inform on how these nutrients reach the coastal oceans and, eventually, mix off the shelf and into the open ocean. We find that the proportion of meltwater calculated using salinity and oxygen isotope mass balance agrees well with estimates from glider sensors. These meltwaters contain low dissolved macronutrients, but are characterised by high particulate and high dissolved organic content. Bio-optic sensors on the gliders reveal strong meltwater signals in fluorescing dissolved organic matter (FDOM), and a detectable signal in optical backscatter; these signals can be now observed extending further out into the open ocean in compiled biogeochemical (BGC) argo float data. The mixing of both dissolved and particulate macronutrients and organic matter off the shelf is likely driven by advection in geostrophic currents, tidal and buoyancy forcing, and is also impacted by storm events via wind-driven changes in mixed layer depth and resuspension.

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