

Melting Patagonian Ice Fields as a source of nutrients to marine ecosystems

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Project description:



The Patagonian ice fields are the largest volume of glacial ice in the Southern Hemisphere outside of Antarctica. They contribute ~150 km³ per year of meltwater and icebergs to the ocean, and this is predicted to increase in future decades. A major sink for this water is an intricate network of fjords, channels and coastal waters on the Chilean western margin. Here, glacial meltwater forms an extensive freshwater lens over saline marine waters that extends 100s of km offshore. There is a growing body of evidence from other glaciated regions that suggests that freshwater export from glaciers and ice sheets contains vital elements for biological productivity in the oceans, including bioavailable organic carbon, nitrogen, phosphorus and silica (Hawkings et al., 2015; Hood et al., 2015). Several studies have shown that the input of this glacial nutrient into the oceans stimulates the growth of phytoplankton, which draws down CO₂ from the atmosphere.

There is virtually no published data on the nutrient content of Patagonian runoff, nor its potential impacts on marine productivity and biodiversity. Several studies suggest that Patagonian glacier-fed rivers are rich in dissolved silica, and may fuel diatom productivity in downstream waters. These marine waters are often highly productive and have important value for fisheries. Since the outer shells of diatoms become preserved in fjord and marine sediments, it is also possible that the geochemical composition of their remains records evidence of past glacial discharge, should the latter be associated with a distinct silicon isotopic signature. Specific diatom species assemblages in fjords may also be associated with this freshwater input. Unique geochemical dissolution processes beneath glaciers are likely to create the foundation for additional geochemical proxies for glacial runoff (e.g. U isotopes, trace and immobile elements and their ratios), which may be recorded in fjord dwelling fauna (e.g. the abundant cold water corals).

This project will evaluate the significance of nutrient export via glacially fed rivers in Patagonia, going on to develop palaeo-proxies for glacial runoff and past nutrient export, with the following objectives:

- 1) To determine the dissolved and sediment bound nutrient composition of major Patagonian glacially-fed rivers along a N-S transect
- 2) To identify suitable geochemical proxies for glacial runoff and nutrient content, as distinct from non-glacial runoff
- 3) To evaluate the utility of runoff geochemical proxies identified via 2) via an analysis of freshly collected and archived marine cores and cold water corals.

References:

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Hood, E., Battin, T. J., Fellman, J., O'Neel, S., and Spencer, R. G. M.: Storage and release of organic carbon from glaciers and ice sheets, *Nature Geosci*, 8, 91-96, 2015.