# Greenhouse gases gradients from Southern Greenland fjords to subpolar North Atlantic Ocean

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Since the beginning of the industrial era, the atmospheric greenhouse gases (GHG) have increased continuously (around +50% for carbon dioxide ($CO_2$) and +150% for methane ($CH_4$), for the two most important), causing the current climate change. In November 2023, the World Meteorological Organization (WMO) highlighted once again there are still significant uncertainties about the carbon cycle, its fluxes, and they stressed the importance to follow the non-$CO_2$ GHG with greater global warming potential.

The ocean, as a sink of anthropogenic $CO_2$, plays a crucial role in climate regulation, whereas the surface seawater is naturally supersaturated in $CH_4$, and shallow coastal waters are a source of $CH_4$ to the atmosphere. However, the air-sea $CO_2$ and $CH_4$ fluxes are driven by different key processes depending on the region of the open or coastal ocean.

To improve the understanding of the processes driving the air-sea exchange of GHG, we investigate the $CO_2$ and $CH_4$ concentrations and fluxes in open ocean and coastal areas affected by sea ice, glacier runoff and riverine inputs within the context of the European project GreenFeedBack. To do so, we measured $CO_2$ and $CH_4$ concentrations and calculated the fluxes, in surface water during a summer cruise (July-August 2023) conducted on board the RV Belgica in the subpolar North Atlantic Ocean, between Iceland and Southern Greenland Fjords. The data were obtained using a custom-made air-water equilibration system, that was connected to the vessel's non-toxic seawater supply (equilibrator and Cavity Ring Down Spectrometer) and discrete sampling.

Our first results show a pronounced gradient of $CO_2$ and $CH_4$ concentration between open ocean and the fjords. The oceanic $CO_2$ concentration is minimal in the fjords where the $CH_4$ concentration is maximal, indicating a potential impact of freshwater discharge on the GHG exchanges.

**Keywords**
Observations; Greenhouse Gases; Carbon Cycle; Subpolar North Atlantic Ocean