The west Greenland shelf (64.7-70.6 °N) plankton community and downward carbon flux during summer – an Atlantic influenced ecosystem?

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Background

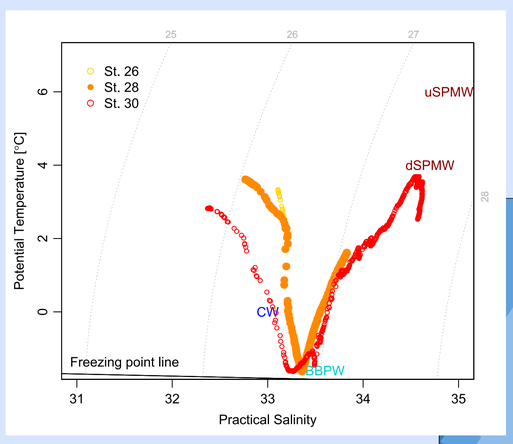
On the West Greenland Shelf (64.7-70.6 °N), Atlantic derived water flows northwards. This water gradually cools and becomes fresher at the surface, while it mixes with cold Baffin Bay Polar Waters (BBPW) at depth.

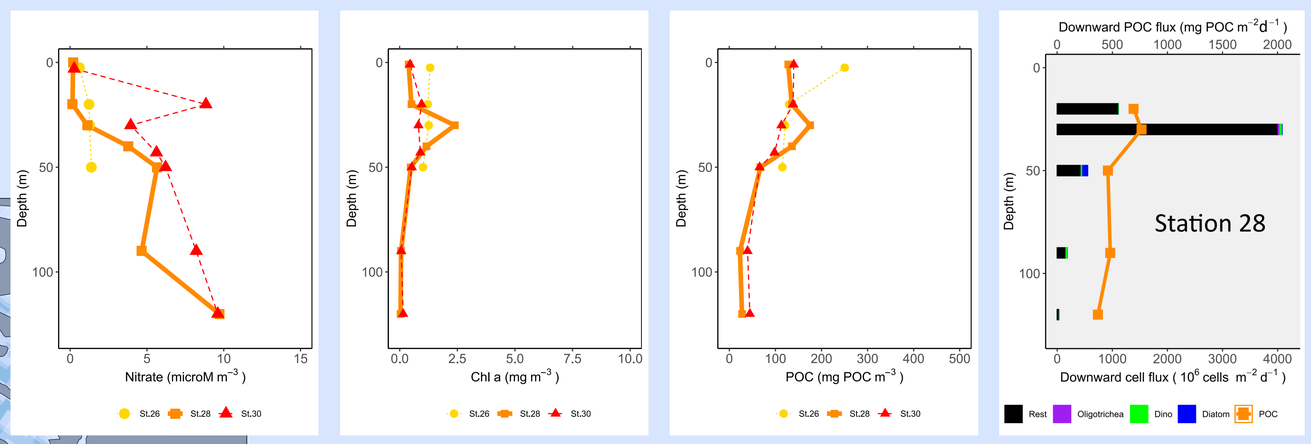
We conducted a field study in August 2021 and investigated potential effects of these lateral changes in the water masses on the pelagic system. In particular, we studied how it affects the concentration of nitrate, suspended chlorophyll a (Chl a) and particulate organic carbon (POC), as well as the downward flux of POC and the protist community.

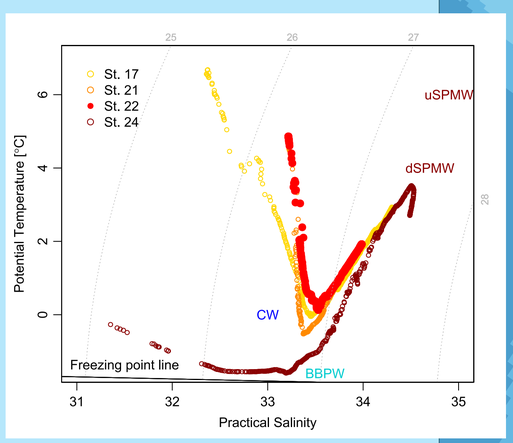
Goal

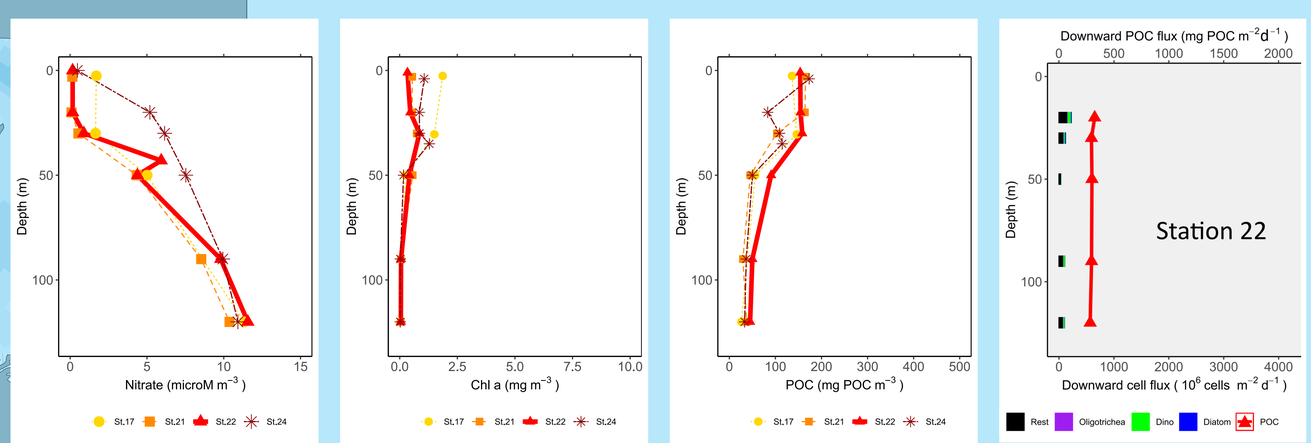
We investigate here how the plankton communities and the quality and quantity of the downward carbon flux is linked to different water masses on the West Greenland Shelf.

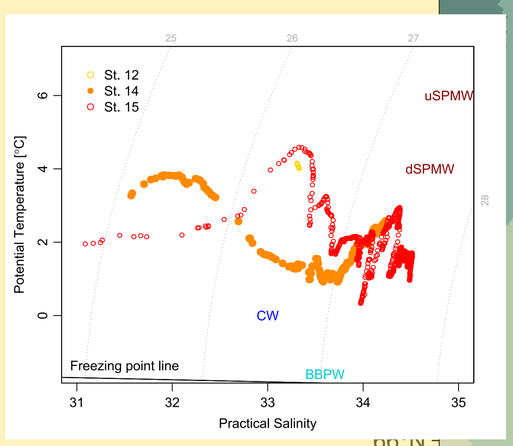
This helps to better understand better how intensified Atlantic influence may change the system.

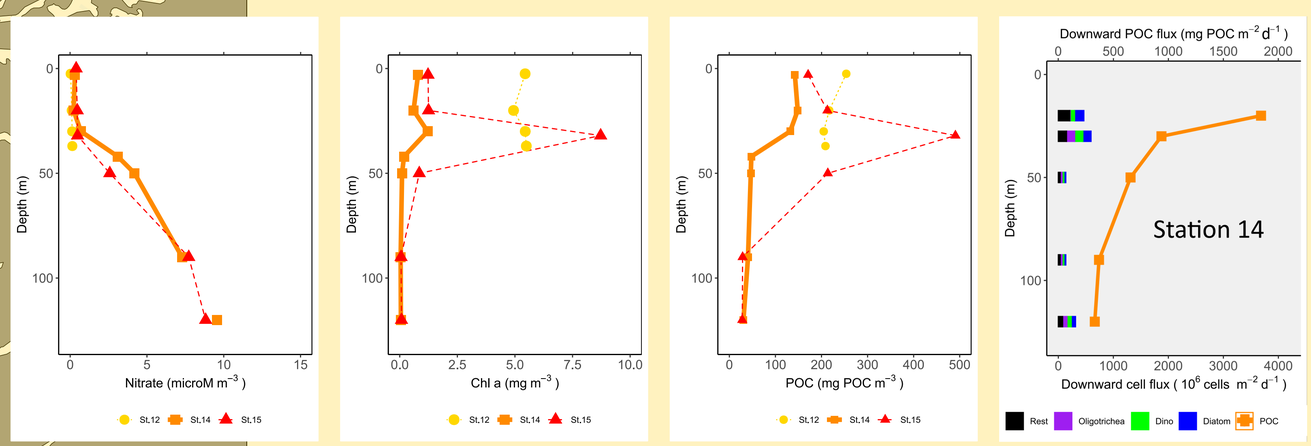












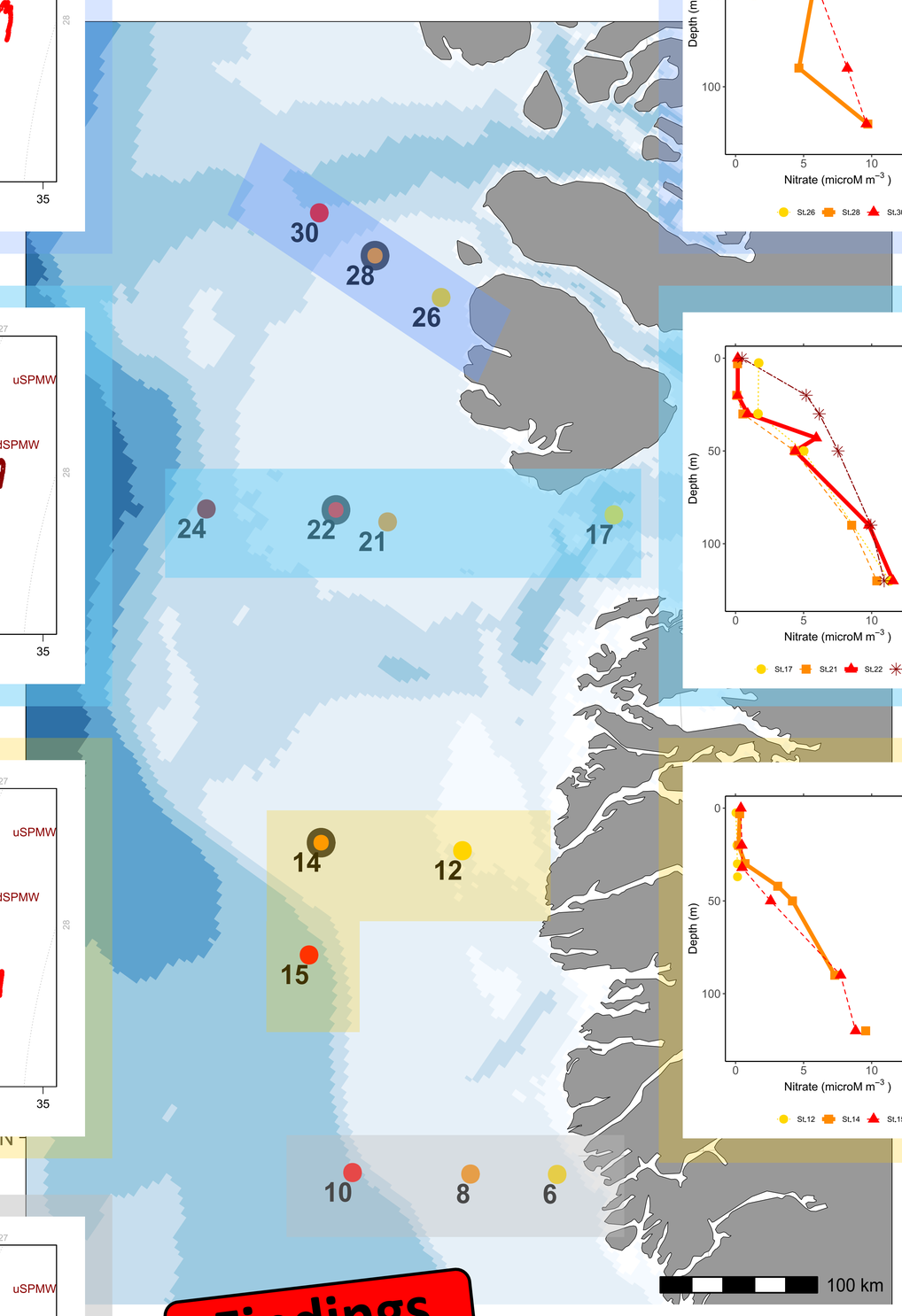


Figure 1: The TS-plots illustrate how the water masses change from south (bottom row) to north (top row). A CTD sonde measured the temperature and the salinity at the same time in the water column and these measurements are shown here. A shallow, well-mixed station (e.g., St.12) has all measurements close together, while a deep station at the shelf (e.g., St 24) has cold and fresh water at the surface, is affected by Baffin Bay Polar Water (BBPW) at intermediate depth, and by Atlantic derived deep Subpolar Mode Water (dSPW) at depth. Colour coding follows the colors in the map, and filled symbols represent the stations where sediment traps were deployed (correspond to cycles with black frame in map and data in Figure 2, right column).
Water mass definition follow Rysgaard et al. (2020): (doi:10.1029/2019JC015564)

BBPW: Baffin Bay Polar Waters CW: Coastal Waters

uSPMW: upper Subpolar Mode Water

dSPMW: deep Subpolar Mode Water

Figure 2: Concentration of nitrate (left column), chlorophyll a (Chl a, second left column), and particulate organic carbon (POC, second right column) at the stations in the northern, middle, and southern transect. The colour coding follows the colors used in the map and the bold line represents the stations where also the downward flux was studied with sediment traps. Right column shows the downward POC flux and the protist composition in the sinking biomass at station 28 (north), 22 (middle) and 14 (south). Abbreviations: "Rest" - mainly flagellated microalgae from the groups Chrysophyceae and Cryptophyceae, Dino - Dinoflagellates, Oligotrichea - group of ciliates.

Findings

In the southern transect, the upper 25 m were nutrient depleted, but at these stations we also found the highest Chl a and POC concentration. In the middle and northern transect, the water column was more stratified, the nutrient concentrations tended to be higher at the surface and the suspended POC and Chl a concentrations were mostly lower than in the southern transect.

Above 90 m, the downward POC flux was highest in southern transect (up to 1840 mg m^{-2} d^{-1}), but surprinsingly the flux at 120 m was similar in all three transects (280-370 mg m^{-2} d^{-1}). This suggest different pelagic recycling at the different latitutes - probably driven by the protist and zooplankton comminity.

The still unresolved question(s):

What would happen if Atlantification extends northwards?

Our study indicates that the intensity of the downward flux at 120 m was rather similar at the three locations - but does this mean Atlanticfication does not influence the benthos?

(OBS! The benthos samples are currently analysed, so stay tuned for new findings)

ECOTIP

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