Fate of Fire Altered Organic Carbon in the Arctic River-to-Ocean Continuum: Resolving Dissolved Black Carbon in the Beaufort Sea

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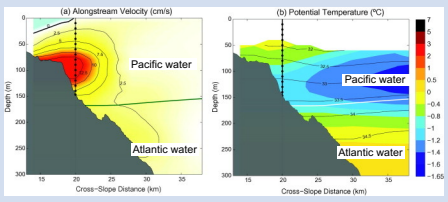
1 Introduction

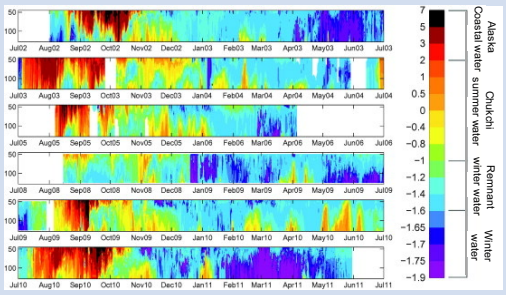
Climate change amplifies the production of Black Carbon (BC) by vegetations fires in the Arctic. The dissolved BC (DBC) is consequently transported by rivers, like the Mackenzie, to the ocean. Here it mixes with the major water masses of the Beaufort Sea and the Pacific. DBC is highly refractory and resistant for biodegradation, hence it can persist in the ocean and store carbon for millennia, acting as a potential carbon sink. Therefore we want to determine what the fate of DBC in the Beaufort Sea is?

Working Hypotheses:

- The Mackenzie River is the major source of DOC and DBC in the Beaufort Sea.
- The concentrations of DOC and DBC are lower in winter, with less river outflow.
- The Pacific water masses have lower DBC concentrations as the coastal shelf of the Beaufort Sea.



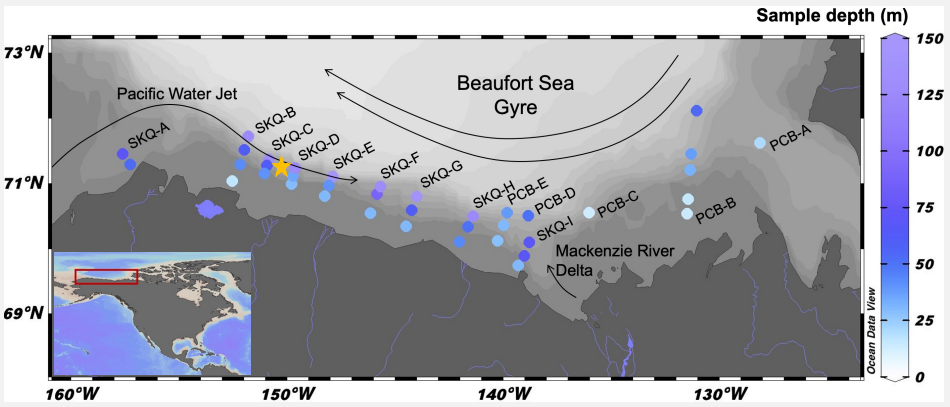
(a) Vertical sections of mean alongstream velocity (cm/s) and (b) mean potential temperature (color) and salinity (contours) for the year of August 2002–July 2003 [1].



Depth/time plot of potential temperature (°C) at the mooring from 45 to 130 m depth [1].

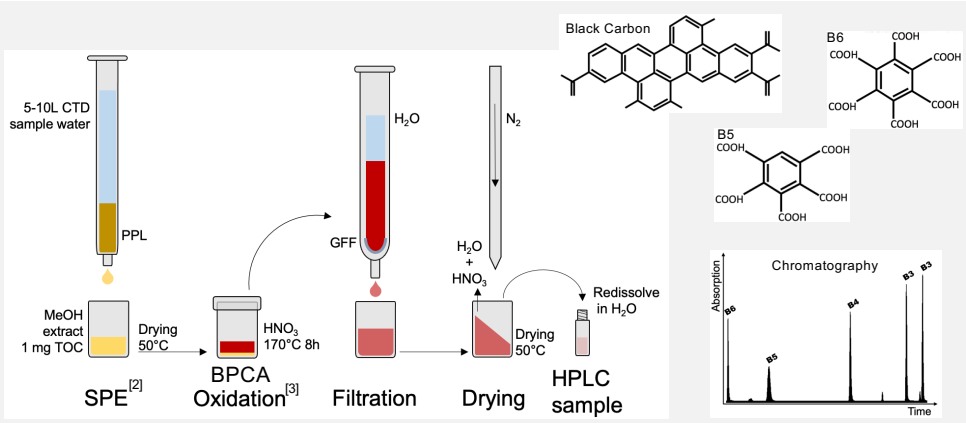
2 Study Area

Samples were collected during two cruises in the Beaufort Sea during September 2021 (PCB) and November 2022 (SKQ).

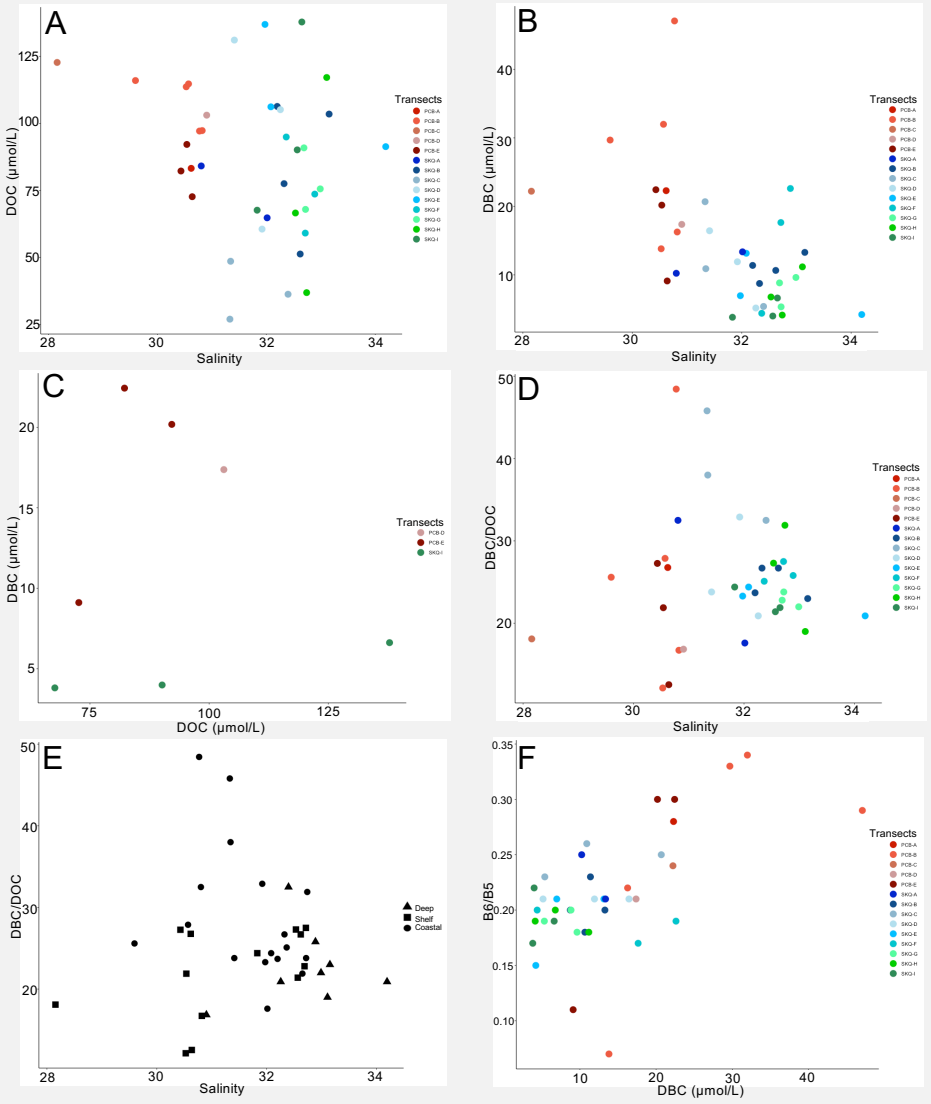


Sample stations transects in the Beaufort Sea from 2021 (PCB) and 2022 (SKQ). Black arrows represent important water mass flows. Color of the sample stations indicates the depth (m) the sample was taken. The Yellow star represents the location of the mooring station [1].

3 Method



4 Results and Discussion



DOC concentration (A) and DBC concentrations (B) compared to salinity of the September PCB and the November SKQ cruise. Comparison of the BC concentrations and the salinity (C) of the river outflow sample stations of PCB and SKQ. The DBC/OC rations (D) and Salinity of both cruises. DBC/OC ratios (E) and Salinity of both cruises, symbols represent the depth: circles coastal, square shelf slope, triangle deep water. Compound specific B6/B5 ratio (F) of DBC of both cruises.

5 Conclusions

- The Mackenzie River is in winter a minor source for BC in the Beaufort Sea.
- The Pacific water jet transports in winter higher concentrations of BC into the Beaufort Sea then the rivers.
- The DBC structure was more condensed in the summer samples and in winter less condensed close to the river.

Next Steps:

- Radiocarbon (14C) analysis
- Mackenzie River sampling

References

1. Brugler et al. (2014) Seasonal to interannual variability of the Pacific water boundary current in the Beaufort Sea
2. Dittmar et al- (2008) A simple and efficient method for the solid-phase extraction of dissolved organic matter (SPE-DOM) from seawater
3. Wiedemeier et al. (2016) Characterization, Quantification and Compound-specific Isotopic Analysis of Pyrogenic Carbon Using Benzene Polycarboxylic Acids (BPCA)

SKQ2022-15S