Erosion of ice-rich permafrost coasts and the release of dissolved organic carbon into the Arctic Ocean

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Background

- 34% of global coasts affected by permafrost
- Arctic coasts erode on average 0.6 m yr⁻¹
- Annual TOC fluxes of 4.9 to 14 Tg yr⁻¹

Permafrost coasts in the Canadian Arctic are very ice-rich and erode rapidly

- Amount of DOC in ground ice unknown
- Fluxes of DOC fraction unknown
- DOC assumed to be highly bioavailable

Effects on nearshore ecosystems unknown

Study area and methods

Map of the Yukon coast in the Canadian Arctic showing sampling sites on Herschel Island and the main coast

Sampling of massive ice (A - ice wedges, B - massive ice beds) and non-massive intrasedimental ice (C)

Calculation of DOC stock

- Volumetric ice content
- Density of pure ice at -10°C

Calculation of DOC flux

- Coastline length
- Cliff height
- Annual erosion rate
- DOC stock

Results and conclusion

- Very low DOC storage in ground ice
- DOC fluxes outrunners DOC fluxes
- DOC/POC ratio of ~1:900
- DOC fluxes dominated by river input
- But: DOC fluxes from coastal erosion could play an important role in late summer, when river discharge is low
- The western Canadian Arctic could be a key region for DOC transport due to very high ground ice contents

References

Couture, N. (2010), Fluxes of soil organic carbon from eroding permafrost coasts, Canadian Beaufort Sea, PhD thesis, Department of Geography, McGill University, Montréal, Canada.


