Climate-change Impacts on Dissolved Organic Matter in Glacier-fed Streams

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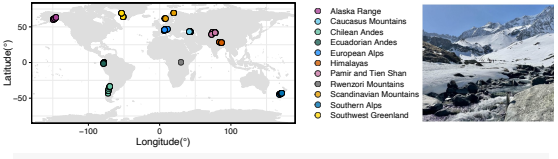
Introduction

Mountain glaciers are rapidly disappearing due to climate change, yet the downstream biogeochemical impacts on dissolved organic matter (DOM) remain poorly understood.

Global-scale differences in DOM composition and characteristics in glacier-fed streams (GFSs) require more in-depth investigation.

Data and methods

The Vanishing Glaciers Project



A global dataset of 170 GFSs

DOM optical properties
- Absorbance
- Fluorescent EEM+ PARAFAC

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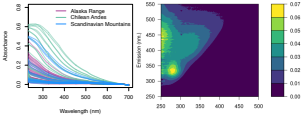
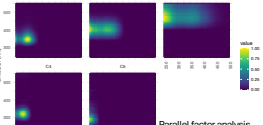
Environmental Data
- Biogeochemical variables
- Glaciological metrics



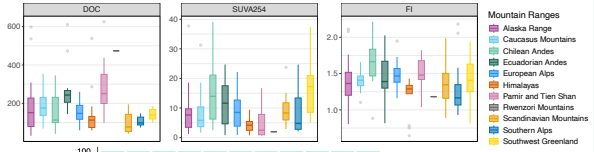
Absorbance data of some samples

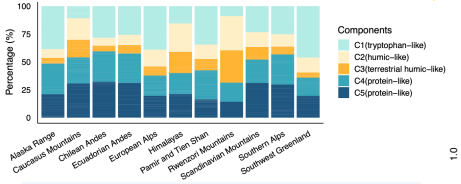
Excitation emission matrix (EEM), fluorescence intensity in Raman units



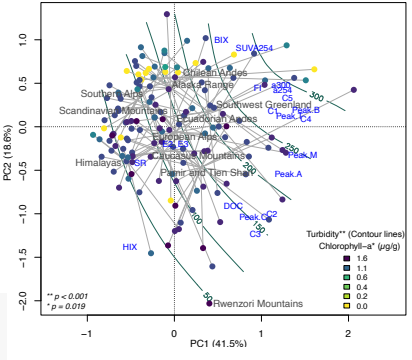
Parallel factor analysis (PARAFAC)

Results





- DOM composition and characteristics vary along water turbidity and benthic chlorophyll-a gradients.
- GFSs with high turbidity tend to be enriched in protein-like DOM, while those with high chlorophyll-a are dominated by humic-like substances.
- Different GFSs receive varying contributions from microbial and algal sources of DOM.



- Low dissolved organic carbon (DOC) concentration
- Regional differences in DOM optical characteristics
- Relatively high SUVA254 → high DOM aromaticity (also due to low DOC)
- Mixture of autochthonous and allochthonous sources

- Diverse PARAFAC components
- Protein-like components (C1, C4, C5) are prevalent in GFSs

Take home message

Glacier-fed stream DOM is characterized by low DOC concentration. Its optical properties vary globally and are shaped by environmental conditions. Microbial and algal production are key contributors to the DOM pool in these ecosystems. Future greening of GFSs, indicated by increased chlorophyll-a (Kohler et al., 2024), may further affect GFS DOM.

Outreach
The Vanishing Glaciers Project https://www.glacierstreams.ch/
River Ecosystems Laboratory https://www.epfl.ch/labs/river/

Abstract QR code

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