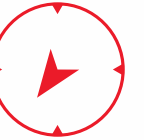


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Open Forum
continued

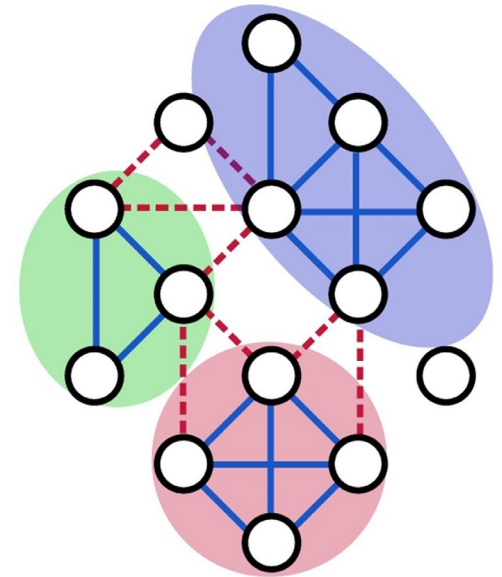
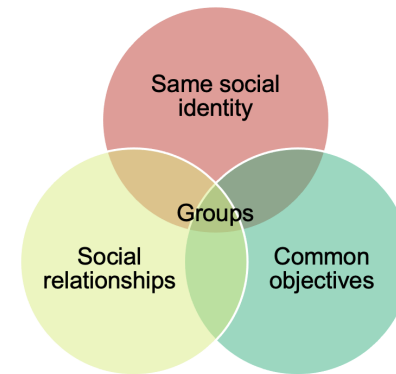


Exploration of Linked People for Innovation in Science (ELPIS Project)

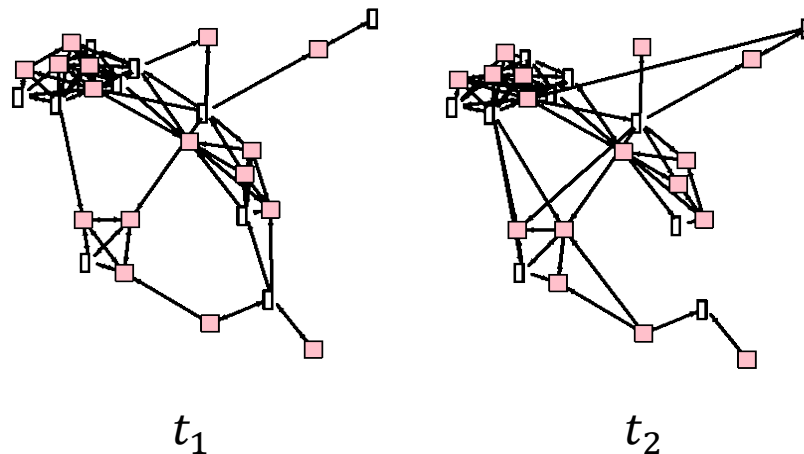
How can group well-being, leadership, and cohesion during the expeditions foster innovative knowledge?

Previous research in the Antarctic and NASA's Human Exploration Research Analog (HERA) project demonstrated that:

- Clear types of **leadership** (i.e., expressive leadership) and groups that were highly **cohesive** achieved better outcomes (Johnson et al., 1986; Johnson et al., 2003; Johnson, 2019; Johnson et al., 2019, 2020; Zurek et al., 2020)
- Researchers who were **emotionally well-adjusted** confronted better the 'winter-over syndrome' (that involves depression, insomnia, and cognitive disorientation) (Palinkas & Johnson, 2000)



Statistical models to analyse social networks:



More information:



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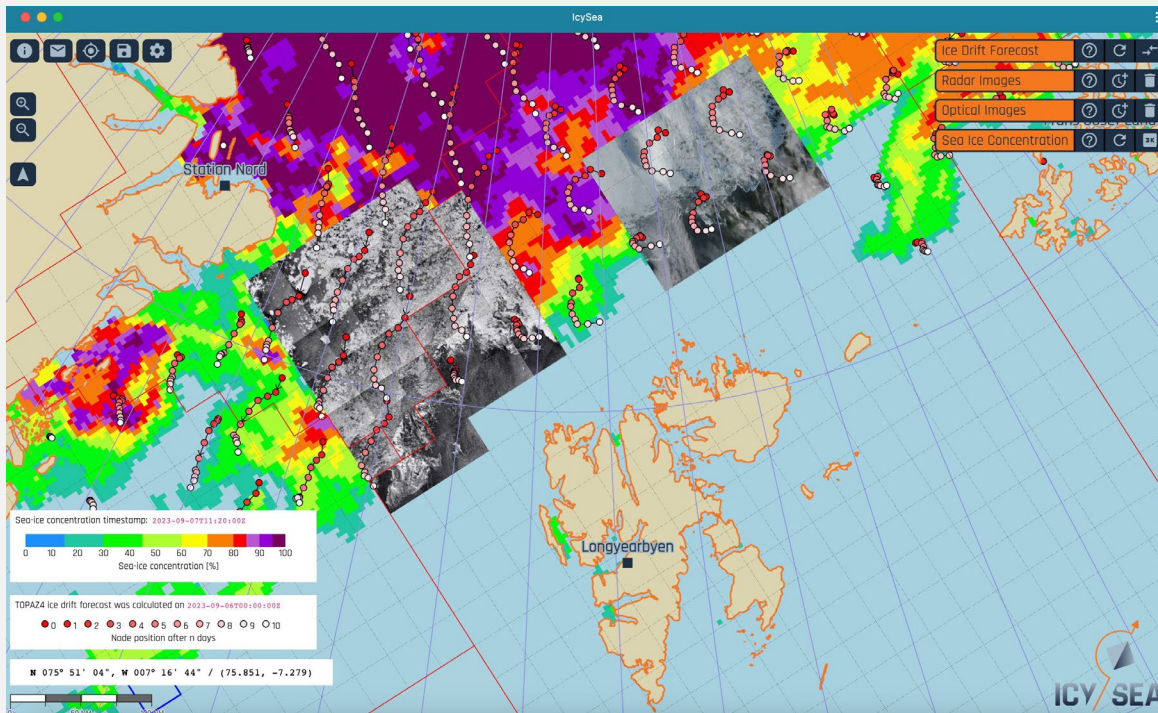


DRIFT+NOISE
Polar Services

Supporting polar operations with near-real time sea ice information

IcySea App

Map-based application for user-friendly, on-demand access to sea ice information.



<https://driftnoise.com>

In-person

- Endurance 22 (February-March 2022)
- AWI RV Polarstern expedition PS137 (June-July 2023)



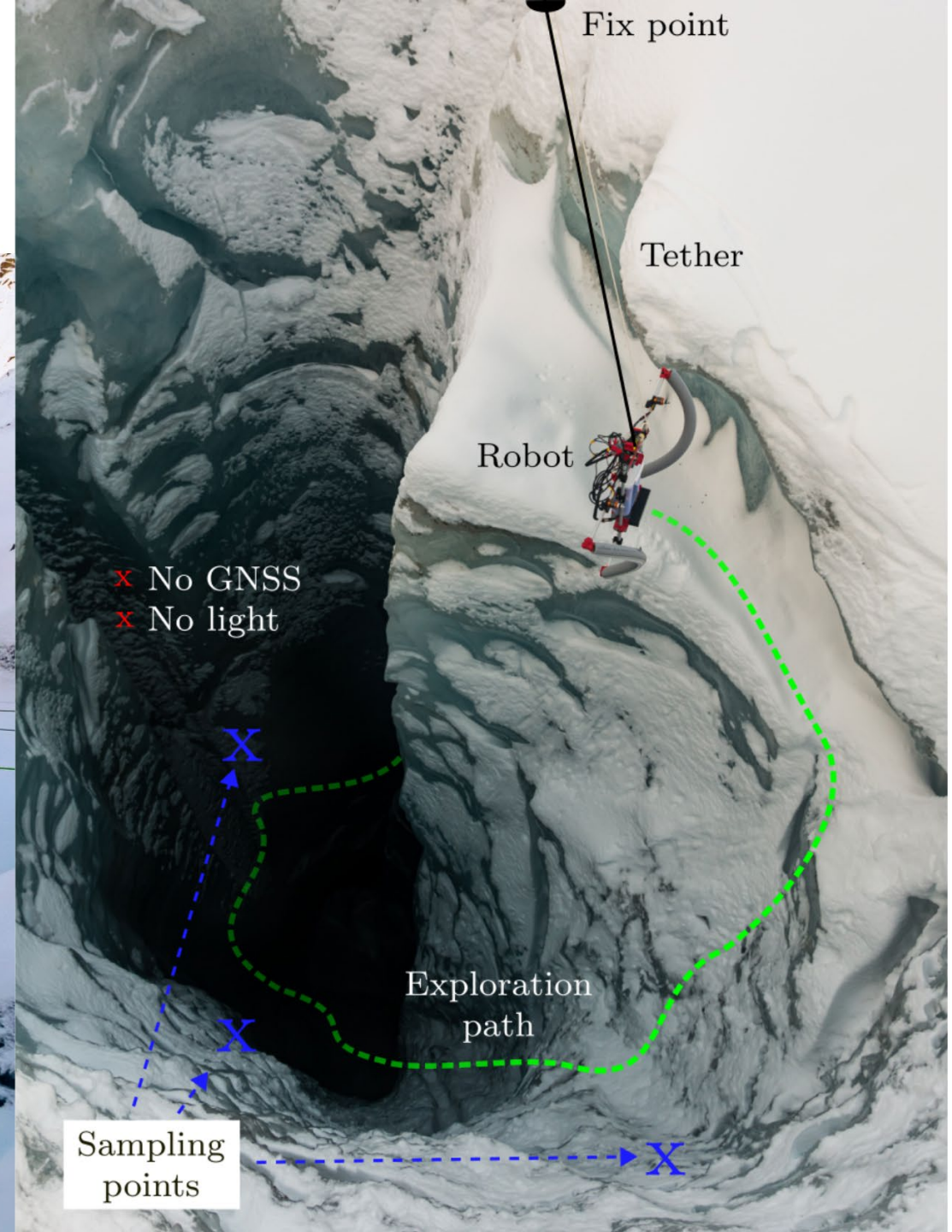
Picture credits: Falklands Maritime Heritage Trust / National Geographic

Tethered robot exploring glacial moulins

Max Polzin, max.polzin@epfl.ch

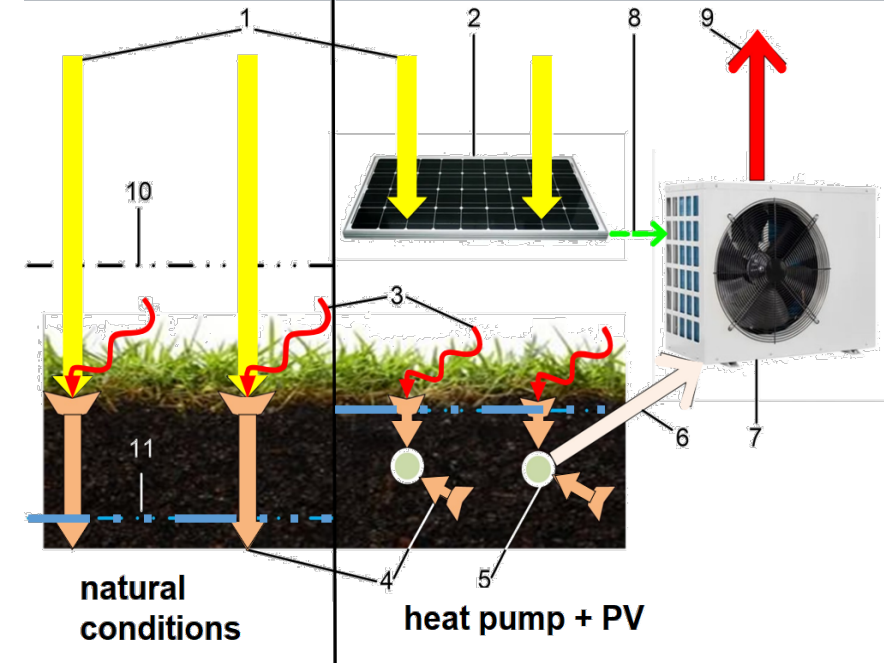


A tethered robot equipped with horizontal propellers designed to operate in hazardous, inaccessible glacial moulins is deployed to autonomously explore, map and gather critical data during field trials on the Mer de Glace glacier.

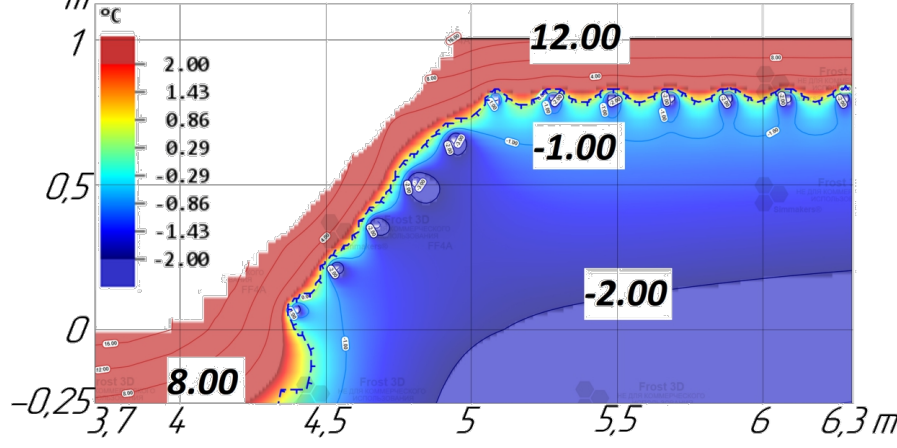


A solar-powered system for alpine permafrost thermal stabilization

System schematic



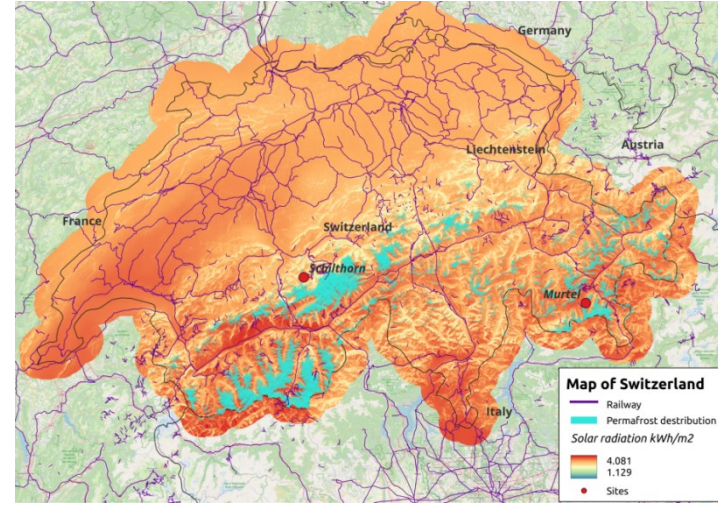
1 - solar radiation; 2 - energy converter; 3 - convection; 4 - heat conduction; 5 - ground probes; 6 - heat carrier; 7 - chiller; 8 - converted solar energy; 9 - heat sink; 10 - snow level; 11 - thawing layer.



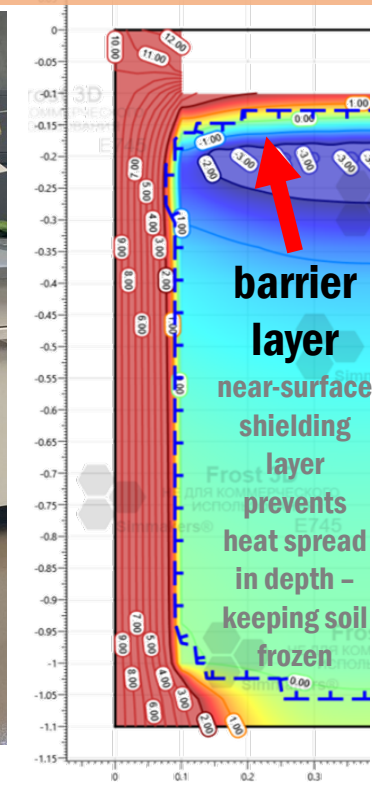
Numerical tests for permafrost site



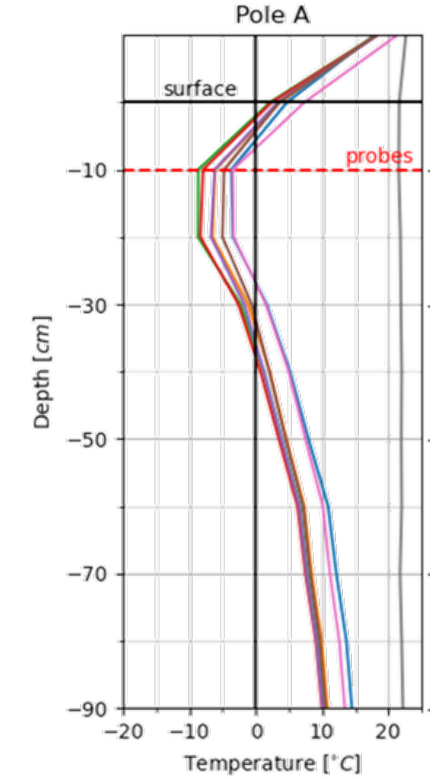
Experimental setup in the lab at Alpole



Map of Switzerland with possible application sites



Numerical tests of setup




Experimental tests of setup

PhD student: Elizaveta Sharaborova
Director: Prof. Michi Lehning
Co-director: Dr. Hendrik Huwald



POLARQUEST



POLARQUEST is an international team of arctic explorers and researchers with a passion for the Arctic ocean and its preservation. We **unite polar experts with scientific projects** to conduct groundbreaking, pioneering research in the Arctic.

In 2018, our team **circumnavigated the Svalbard archipelago** onboard Nanuq, a 60-foot eco- expedition sailboat, achieving the following scientific milestones:

- **Highest-latitude study of Cosmic Rays**
Achieved record-latitude measurements of cosmic ray flux at sea level using particle detectors built at CERN through a unique partnership between students and scientists.
- **Northernmost study of Microplastics**
Conducted microplastics sampling in remote Arctic waters. The highest concentration of microplastics among all samples was recorded at the northernmost latitude: 82°07'N.
- **3D mapping using drones**
Pioneering the use of low-cost drones for 3D mapping of points of interests (geo-historical and environmental relevance) in remote areas of north Svalbard

Discover all Polarquest expeditions, meet our team & partners at
POLARQUEST.ORG

Polarquest expeditions have been supported by ACAPELA
igloo.sailworks.net

Wintertime Tree Surface Temperature Dynamics in Boreal and Subalpine Forests Revealed by Thermal Infrared Imaging

Vincent Haagmans^{1,2} (vincent.haagmans@slf.ch), Clare Webster^{1,3}, Giulia Mazzotti^{4,1}, Tobias Jonas¹

¹WSL Institute for Snow and Avalanche Research SLF; ²Institute of Environmental Engineering, ETH Zürich; ³Department of Geosciences, University of Oslo; ⁴Univ. Grenoble Alpes, Université de Toulouse, Météo-France, CNRS, CNRM, Centre d'Études de la Neige

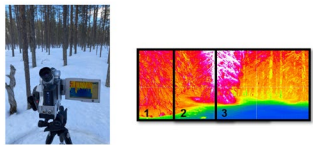
Motivation

- Vegetation surface temperature ($T_{\text{vegetation}}$) is a critical state variable in forest-snow models as it mediates mass and energy fluxes between snow, forest, and atmosphere.
- Improved understanding of $T_{\text{vegetation}}$ dynamics to inform tree-scale parameterizations of 3D mass & energy fluxes.

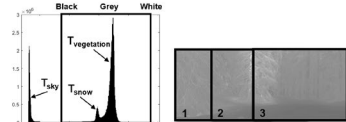
Methods

1. Producing 360° Thermal infrared (ThIR) composites:

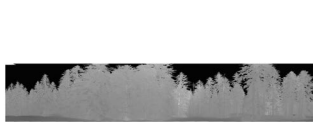
1. Overlapping Image Acquisition (~100x)



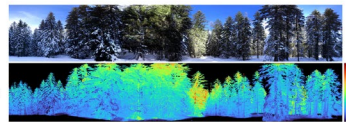
2. Temperature Thresholding & Greyscaling



3. Stitching to Greyscaled Composites

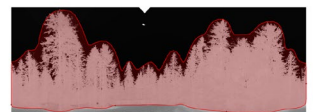


4. Rescaling to Temperatures

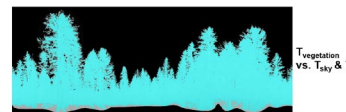


2. Isolating $T_{\text{vegetation}}$ signal from ThIR composites:

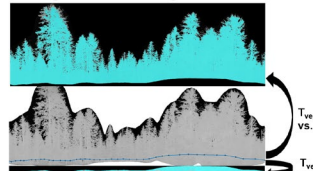
1. Draw Vegetation Outline



2.1. Vegetation Masking: Single Thresholding



2.2. Vegetation Masking: Double Thresholding



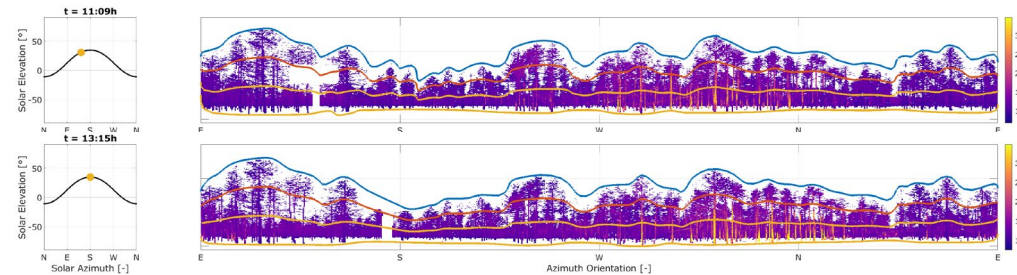
3. 'Mixed' Vegetation Pixels: Kernel Filter



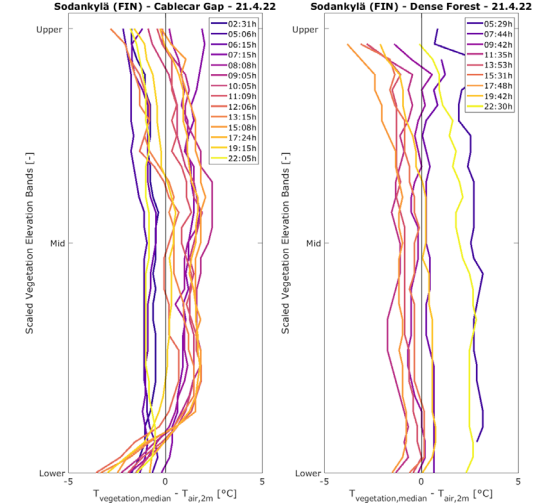
Results

- 169x calibrated 360° ThIR composites from forested sites in Davos (CH) & Sodankylä (FIN) capturing effects of diurnal cycles, meteorological conditions, seasonality, forest stand heterogeneity on $T_{\text{vegetation}}$ dynamics.
- Examples of information available include:

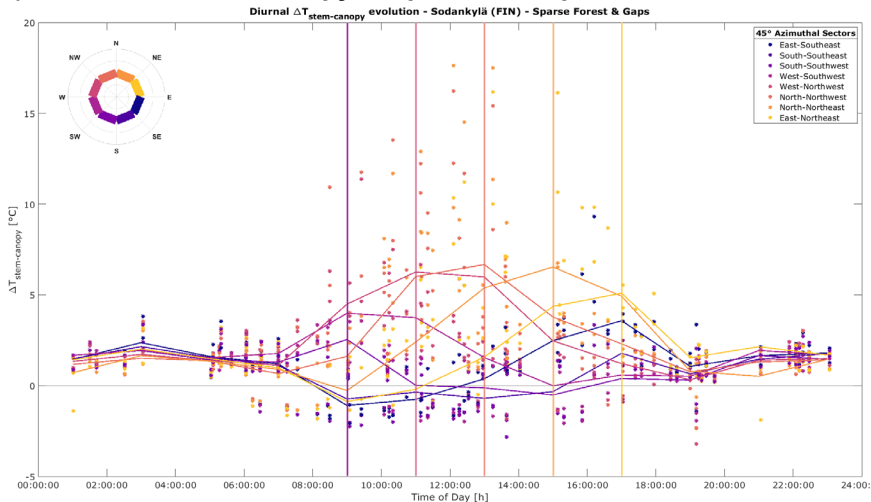
A) High resolution 360° diurnal $T_{\text{vegetation}}$ dynamics description in each composite.



B) Vertical profiles of $T_{\text{vegetation}}$ vs. T_{air}

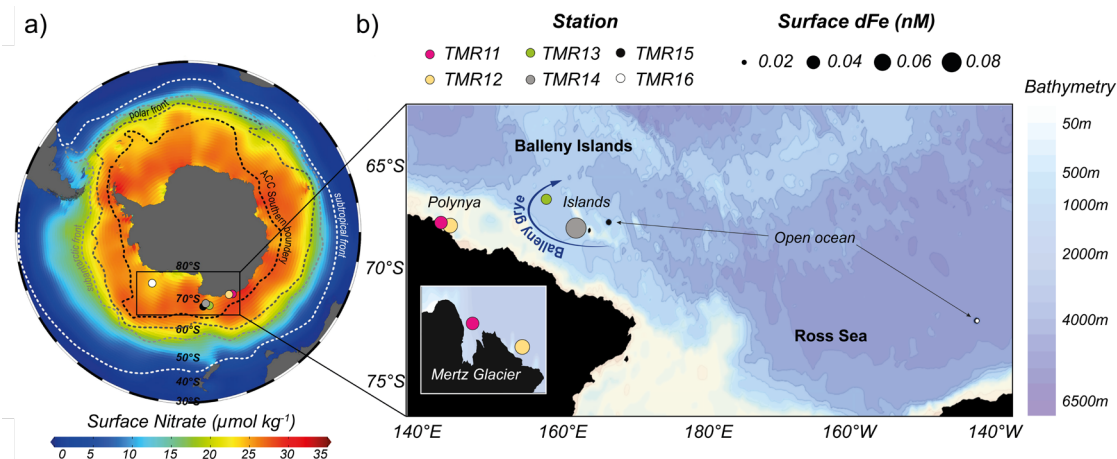


C) Diurnal stem vs. canopy temperature response to insolation as a f(azimuth).



Outlook:

- Take away: tree surface temperature dynamics matter for (sub)tree-scale forest-snow modelling.
- Manuscript in preparation.
- Winter '23/'24 fieldwork using drone-based ThIR imaging of $T_{\text{vegetation}}$ and below-canopy micro-meteorological observations at different sites across Switzerland.



Iron bioavailability in the Southern Ocean is more variable than elsewhere

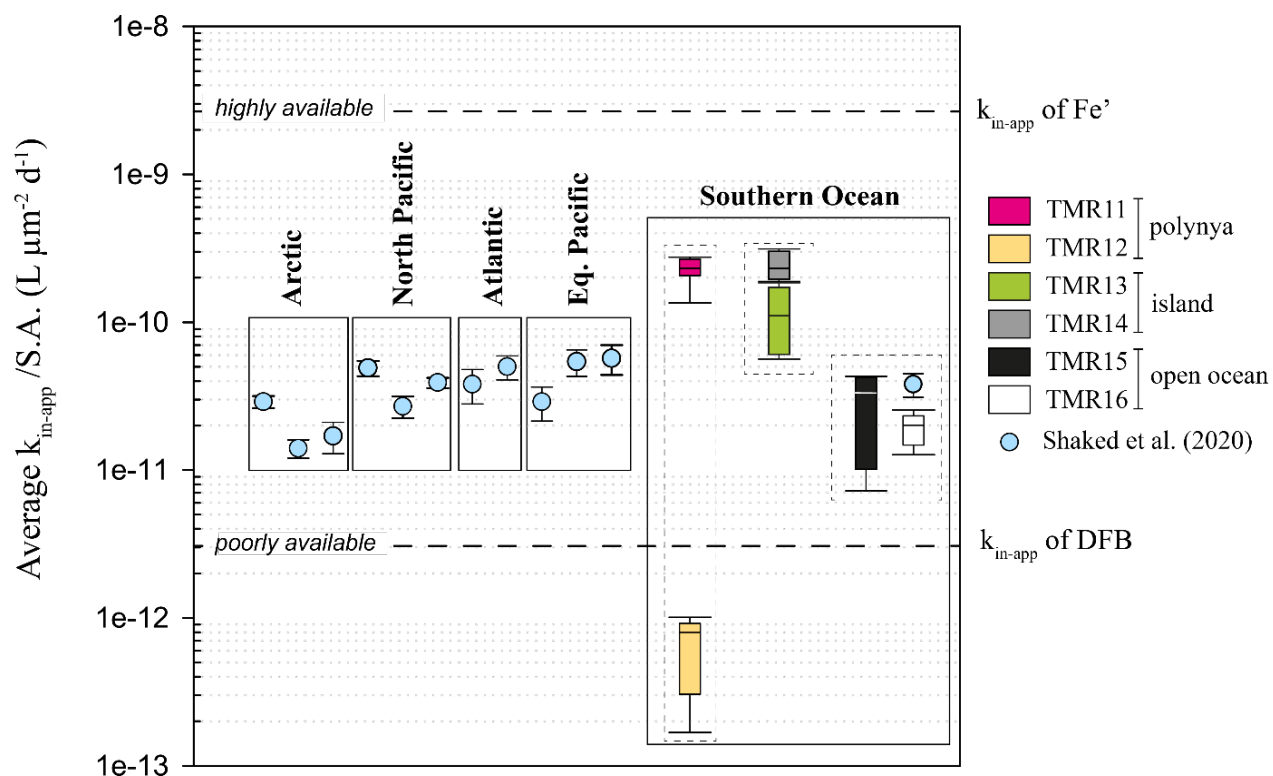
Fe' is an important pool of bioavailable Fe, yet humics also seem to play a key role

Unexplained variability in the Mertz Polynia

Intriguing relationships with $\delta^{56}\text{Fe}$

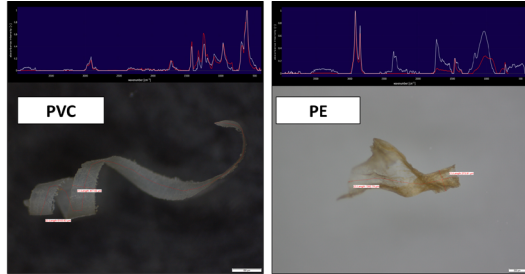
Chasing iron bioavailability in the Southern Ocean: Insights from *Phaeocystis antarctica* and iron speciation.

Fourquez et al. Sci. Adv. 2023. DOI: [10.1126/sciadv.adf9696](https://doi.org/10.1126/sciadv.adf9696)

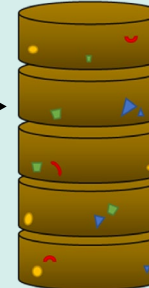


Microplastic in Swiss alpine lentic waters: the case of Cadagno lake.

Serera M. Abel
(Serena.abel@unibas.ch)



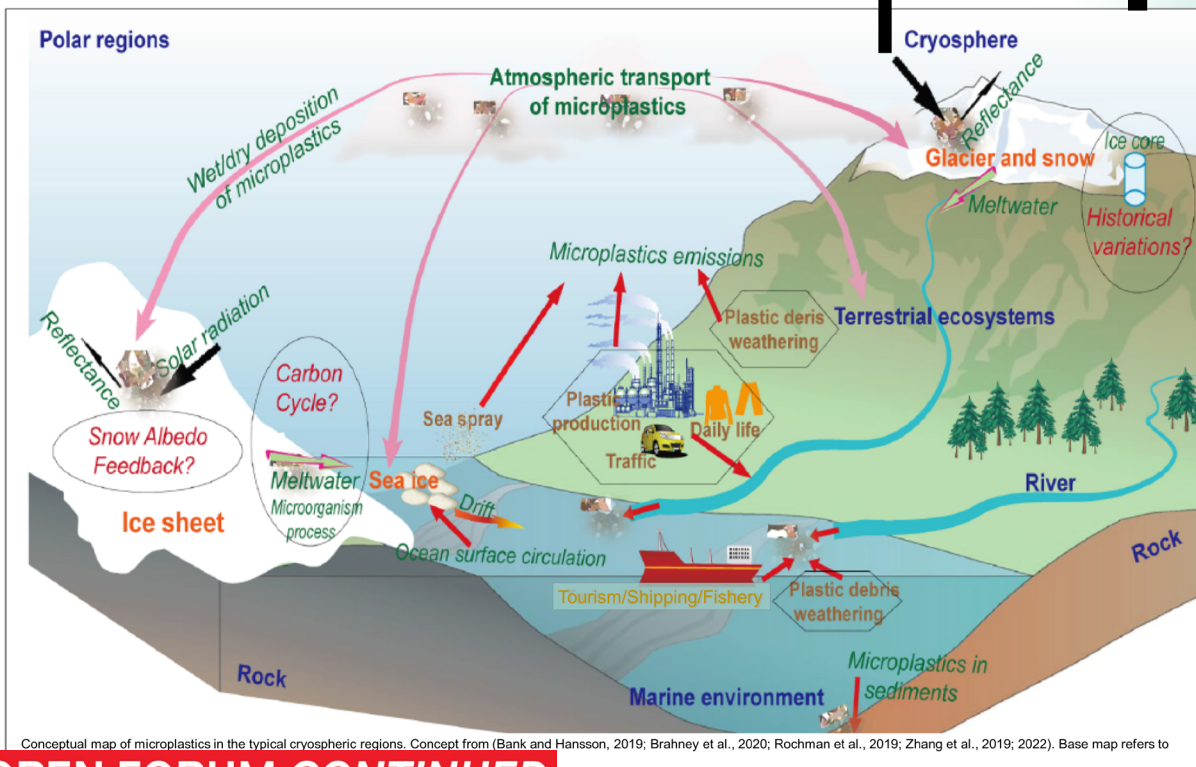
- Investigation of Background contamination.
- Microplastic contamination sources.



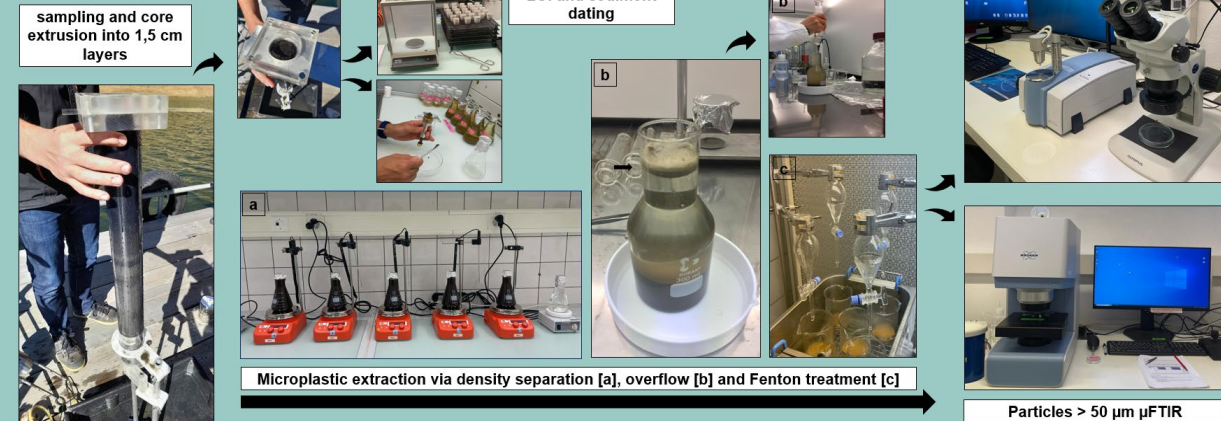
- Spatiotemporal microplastic accumulation trends along the sediment column.



Proof of concept: presence of microplastic ($> 500 \mu\text{m}$) in the lake sediment. Cadagno lake shows plastic contamination.
Outlook: draft the spatial-temporal deposition of MP in alpine lakes and have new insights about the main sources of MP in the Alpine realm.



Microplastic extraction procedure



ETH+ PROJECT ARCTIC GREENING – Accelerated soil development in arctic environments and its role for plant-microbial-soil feedbacks to climate change

S. Doetterl (Soil Resources, D-USYS)
J. Alexander (Plant Ecology, D-USYS)
C. Magnabosco (Geobiology, D-ERDW)

Runtime: 2021- 2025

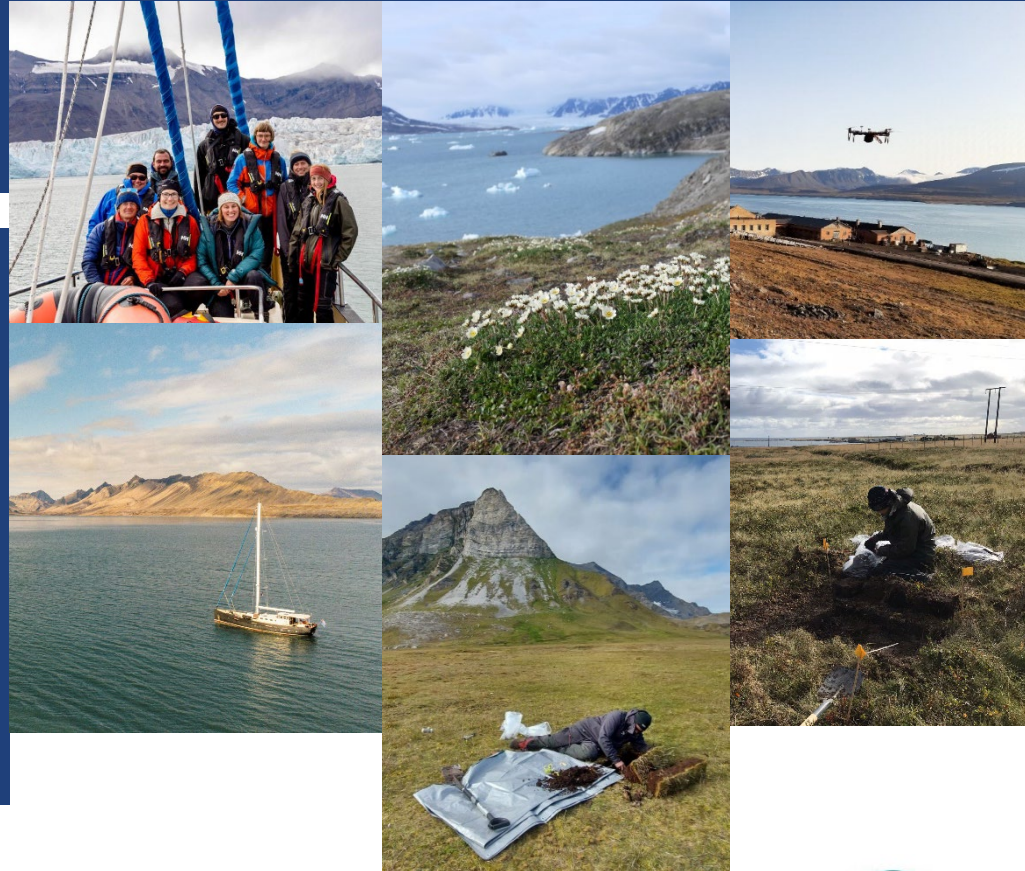
Size: 1.3 Mio CHF + (in-kind)

Study sites in Svalbard & Northern Norway
4 PhD students

Status:

- First Field campaigns completed:
Follow ups pending
- Lab work ongoing: Analysis of
several hundred soil, vegetation
and microbial samples

Large difference between seemingly similar
tundra found in almost all biologically relevant
parameters



ETH zürich

 NTNU

Norwegian University of
Science and Technology



Thriving in Isolation: Confinement, Resilience, and Effective Teamwork (CRET)

At UZH Applied Team Research lab,
we study extreme teams
(e.g. analog astronauts and polar researchers) and we investigate
how team processes promote effective collaboration
under the challenges of confinement.

Interested? Contact us at:
monika.maslikowska@psychologie.uzh.ch

Dr. Monika Maślikowska and Prof. Jan Schmutz
Applied Team Research
Psychology Department



**University of
Zurich**^{UZH}



Distributions of trace metals in rivers of Southern Greenland

Norberto Jr Aquino & David J Janssen

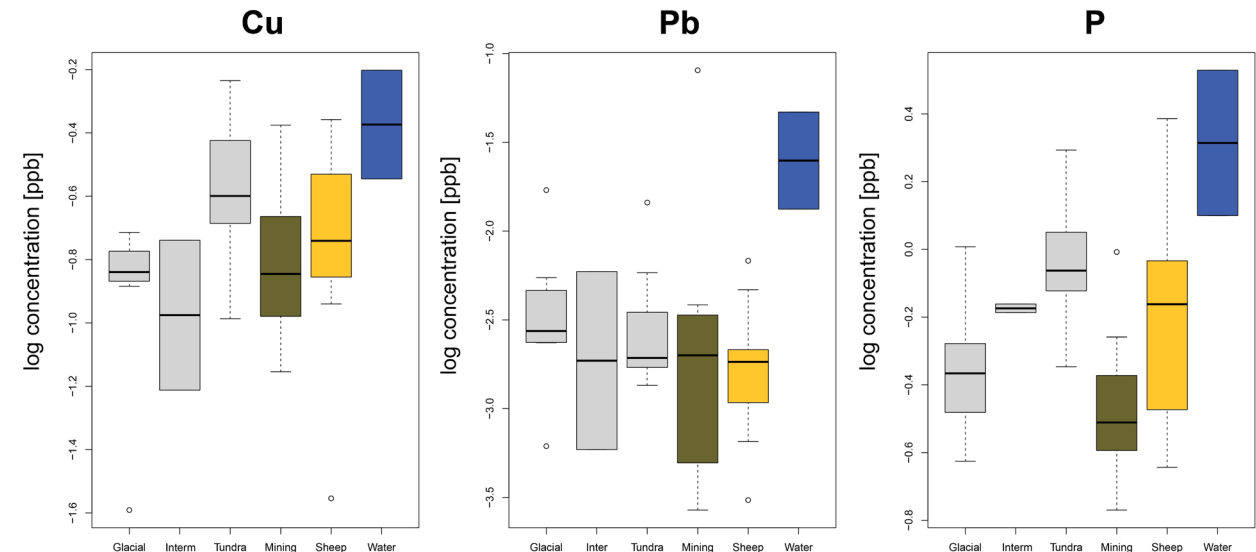
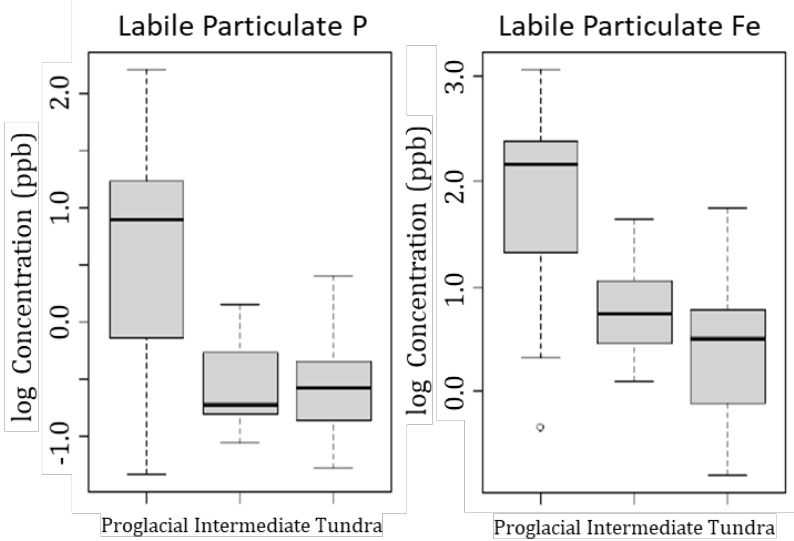
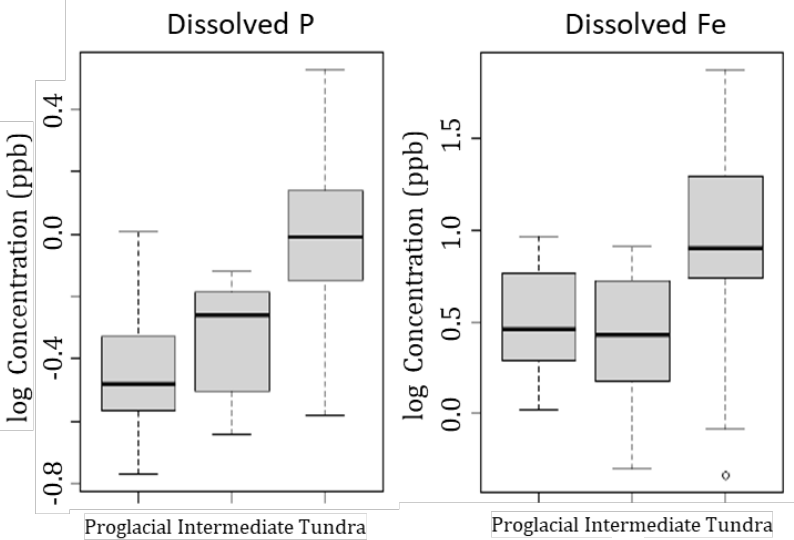
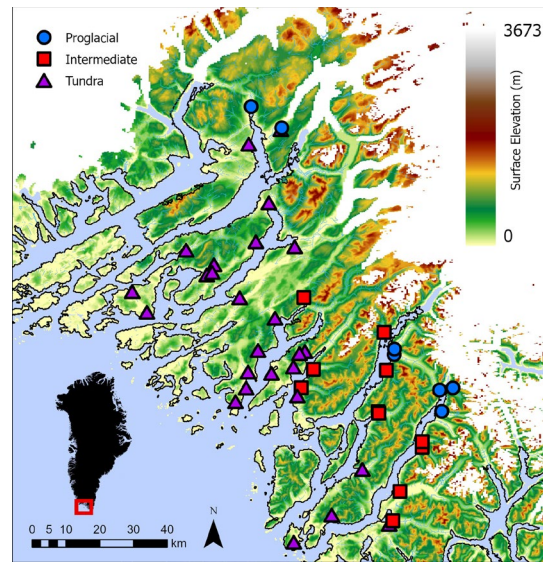
Eawag: Swiss Federal Institute of Aquatic Science & Technology

SPI Exploratory Grant: SPIEG-2021-003

eawag
aquatic research

Dissolved metals and nutrients

Blue = Drinking Water, Yellow = Sheep Farming; Olive = Mining & Minerals



- Tundra: higher dissolved nutrient concentrations
- Proglacial: high labile (potentially bioavailable) particulate levels
- Proglacial: higher total potentially bioavailable (labile + dissolved)
 - Both likely important nutrient sources to coastal waters
- **Differing climate controls** (tundra rainfall, river length, ice melt) can **alter their relative importance under climate change**

- **No evidence of increased toxic metals near mining or mineral deposits**
- Rivers **near farming sites do not have elevated nutrient or metal levels**
- **Highest concentrations** were observed **near municipal water supplies.**
 - May reflect **anthropogenic sources**, e.g. fuel combustion (Pb)
 - **Levels are still very low relative to water quality standards**

Development of low-cost and robust electrical resistivity tomography monitoring system for remote permafrost environments - ERT-PERM (University of Fribourg – University of Lisbon)

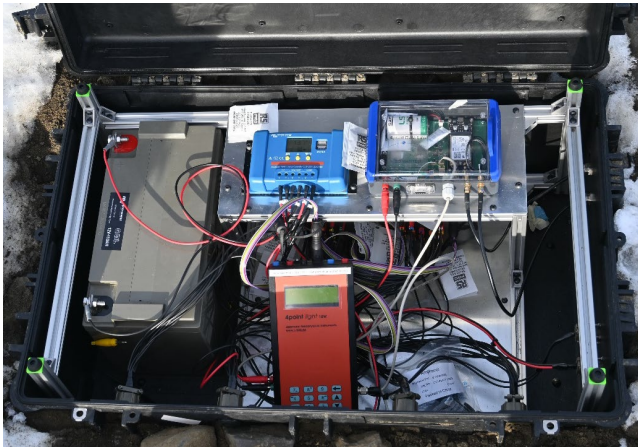
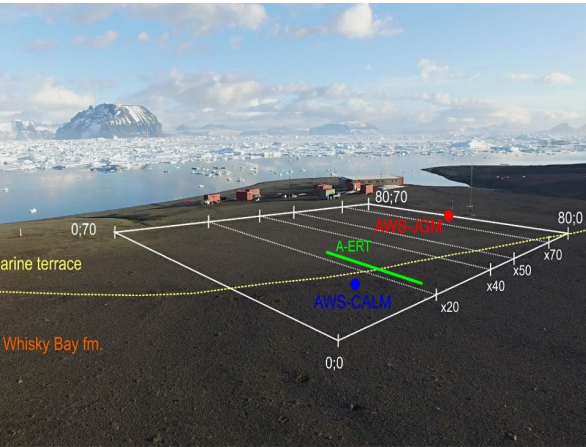
Aims:

The ERT-PERM project is a SPI technogrant project and aims to develop a robust, low-power, low-cost, and autonomous **Electrical Resistivity Tomography** system (**A-ERT**) for **permanent** installation in the remote **permafrost** regions of the world. The project's technology development focuses on remote data transfer and system control via satellite datalink for continuous communication, energy consumption optimization in polar regions, multi-configuration measurements for active layer and permafrost monitoring, and improving electrode contact. Further development of filtering, inversion, and visualization of large data sets.

A-ERT Installations:

Four instruments are developed and planned to test under field conditions in four different cold and remote environments, including the Antarctic Peninsula region, Arabel valley/Central Tien Shan, Yukon and the European Alps. Two of these instruments were already installed in 2022 (European Alps) and 2023 (Antarctica), with other systems expected to be completed by the end of 2023.

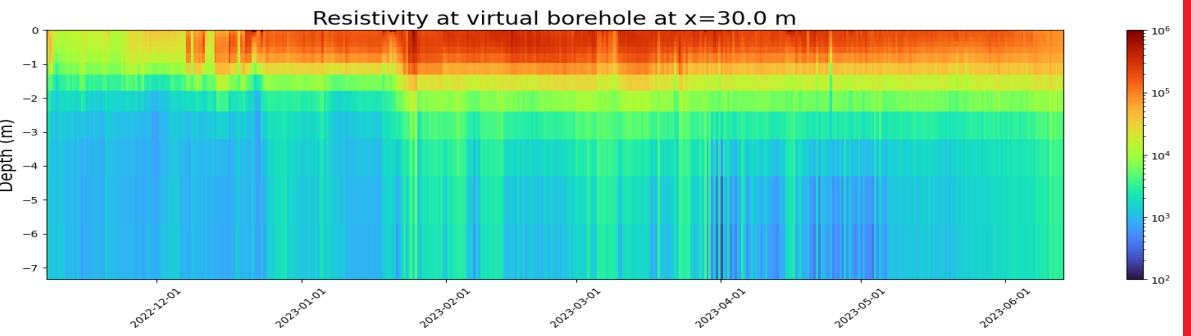
Antarctica: James Ross Island, Antarctic Peninsula region (2023)



Prototype installations in Antarctica, Central Tien Shan, Swiss Alps and Yukon



Preliminary results from the test installation at Stockhorn/VS (3400m)



C and N cycling and stabilization in natural Arctic tundra soils of Svalbard

Annina Maier¹, Aline Frossard², Marco Griepentrog¹, Sebastian Doetterl¹

¹Soil Resources, Department of Environmental Systems Science, ETH Zurich, Switzerland; ²Rhizosphere Processes, WSL, Switzerland

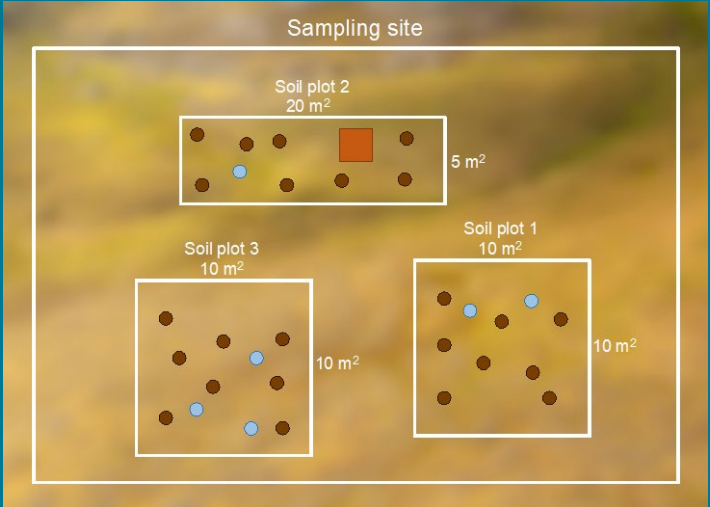
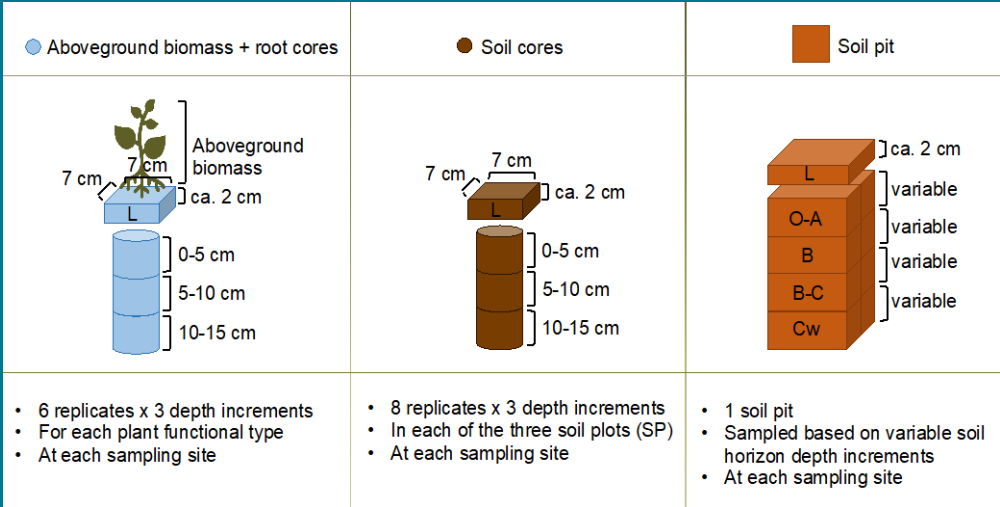
annina.maier@usys.ethz.ch
soilres.ethz.ch



1 Introduction

- A warming Arctic will lead to:
- Prolonged periods of vegetation growth and higher productivity
 - Increased growth of microbial communities
 - Higher nutrient release, reactive mineral phases formation and thicker and deeper soil development
 - Fast (years – decades) responses and feedbacks between plants + soils

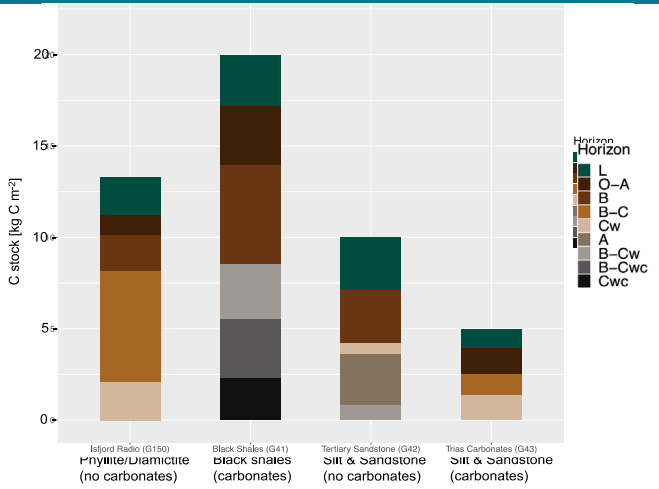
2 Sampling Design Overview



3 Research questions + hypotheses

- Q1. How do soil organic carbon stocks vary across natural arctic tundra soils formed on different parent materials?
- Q2. In which soil fraction(s) does ¹³C¹⁵N-labelled litter end up in natural arctic tundra soils and what is the relative distribution?
- Q3. Which microorganisms actively participate in ¹³C stabilization in natural arctic tundra soils and how efficient is their C use?
- H. Higher incorporation and stabilization of labelled-litter higher C use efficiency and greater carbon stocks are expected in soils on parent material of higher weathering reactivity due to higher reactive mineral formation, nutrient release etc. compared to parent material of low weathering reactivity.

4 Preliminary Results – Festningen Carbon Stocks



1. Varying total Carbon (C) stocks across soils developed on different parent materials at same sampling site (Festningen)
2. Soil mineral layers contain ≥ 50% of C stocks in relation to organic layers (L, O-A)

The Greenland Ice Sheet's rising runoff limits

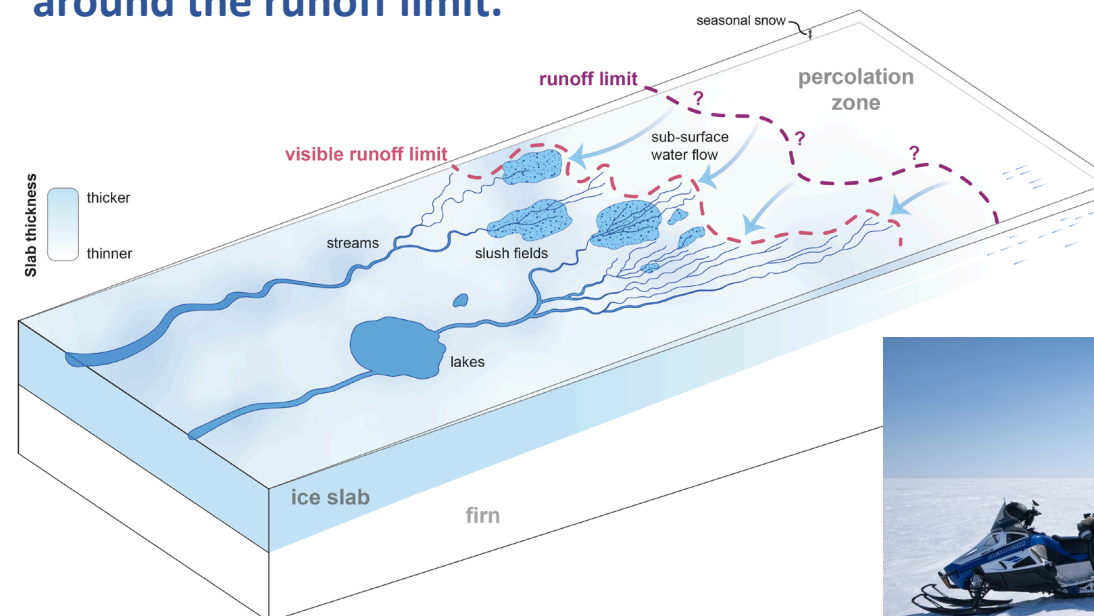
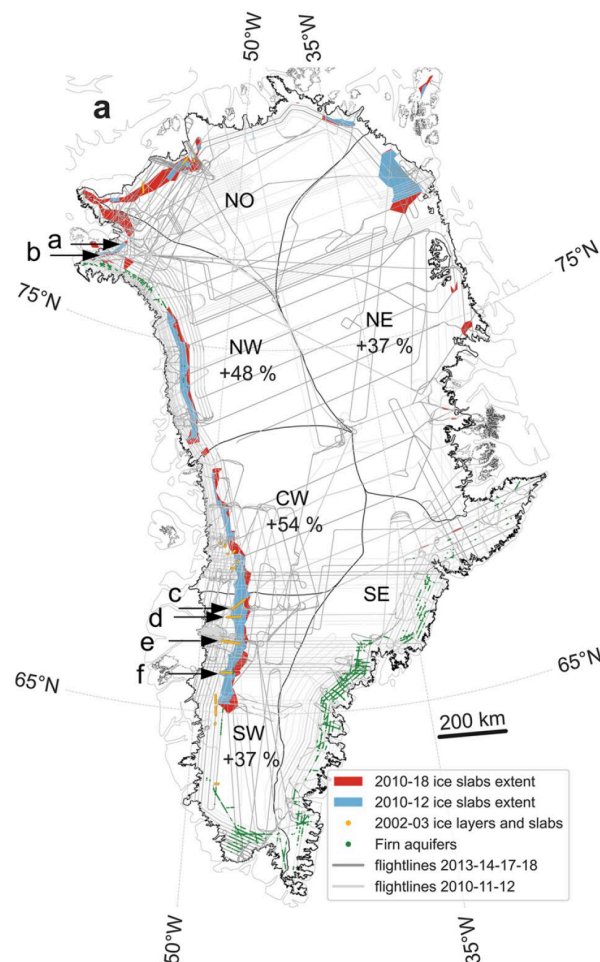
Nicole Clerx - Nicolas Jullien - Horst Machguth - Andrew Tedstone

here today

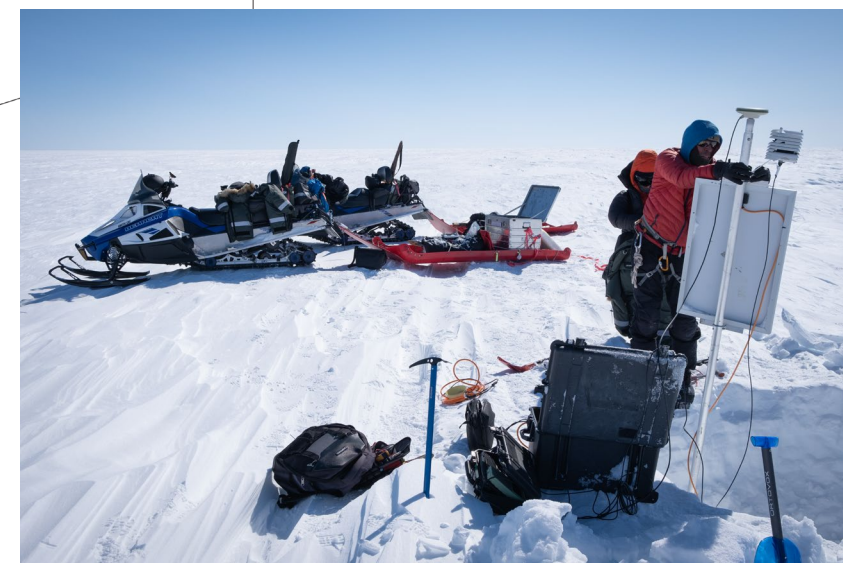
Ice slab expansion and thickening is driving rising runoff limits.

We are developing a model of water flow around the runoff limit.

Initial results from the SPI project 'HI-SLIDE' use GPS to show that ice flow at the runoff limit has sped up recently.



Coming up:
- In 2024, SPI 'MAGNOLIA' will quantify how the ice flow is changing and how much meltwater refreezes.



YESSS

Year-round EcoSystem Study on Svalbard: Seasonally resolving marine ecosystem functioning in a warming Arctic ...in context of the International Kongsfjorden Year 2024/25



Bundesministerium
für Bildung
und Forschung

AWIPEV
Arctic Research Base Ny-Ålesund

Universität
Konstanz



Universität Bremen

Kongsfjorden System
Flagship



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HELMHOLTZ-ZENTRUM FÜR POLAR-
UND MEERESFORSCHUNG

GEOMAR
Helmholtz-Zentrum für Ozeanforschung Kiel

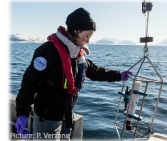
Universität Hamburg
DER FORSCHUNG | DER LEHRE | DER BILDUNG

CIAU
Kiel University
Christian-Albrechts-Universität zu Kiel

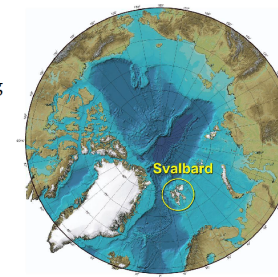


Motivation

- The Arctic is warming more than twice as fast as the global average and emerging ecological consequences may change foodweb structures and put the livelihood of people inhabiting the high North at stake.
- Still, our understanding of Arctic ecological processes is based predominantly on studies conducted during spring and summer, so that many seasonal aspects (e.g. life-cycling, foraging, overwintering) and their sensitivity to global change are poorly understood.

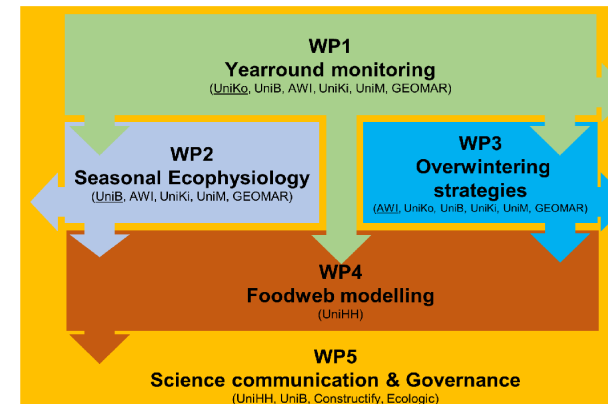


- To close this knowledge gap, YESSS is venturing a large, interdisciplinary effort to study the responses of key species of the Arctic ecosystem, including the rarely studied fall and winter months.
- In context of the International Kongsfjorden year, researchers from around the globe are joining this effort and expand the dataset with more measurements and expertise.



Study objectives

- **Monitoring:** Year-round, weekly assessments of oceanographic and biological 'core' parameters from summer 2024 to summer 2025
- **Experiments:** dedicated season-specific multifactorial experiments on temperature responses of key species
- **Key species** from multiple trophic levels: phytoplankton, seaweeds, mollusks, echinoderms and fish
- **Modeling and communication** of implications for ecosystem and food web stability to stakeholders and the general public



Come and join us!

We are welcoming international collaborators from all disciplines.

Don't miss this opportunity to add your expertise to this interdisciplinary dataset at a rare, comprehensive year-round research effort on the Arctic ecosystem!

Interested? Talk to Klara Wolf at this event or write an email to her (klara.wolf@awi.de)
or to the project coordinator (clara.hoppe@awi.de)

OPEN FORUM CONTINUED

Klara Wolf



Hydro-Kite CTD-probe for water body mapping

The University of Applied Sciences of Western Switzerland has developed a towed CTD probe (conductivity, temperature, depth), of which an advanced prototype is now available.

The principle is to carry out successive dive cycles using an autonomous control mechanism, thereby saving time and boat resources to measure the characteristics of a water column up to a depth of 100 m. Developing this kind of probe is relevant for research in polar regions and other extreme environments, such as remote high-altitude lakes.

The standard probe records temperature and salinity data every second. Other sensors can be added at the request of laboratories and research teams.

Development team: Jonathan Selz, Ruiliang Lin, Luca Bardazzi, Matteo Di Luca, Flavio Noca and Peter Gallinelli*

The development of this probe is supported by the Swiss Polar Institute's Technogrants.

*mail : peter.gallinelli@hesge.ch



Testing the probe in Lyse Fjord, Norway. © 2023 Dolores Gonzalez, Acapela, all rights reserved



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Climbing expedition in South Greenland

Swiss alpine club Montreux Jaman – youth group

With a hint of science

Presented by Maud Galletti

SWISS POLAR
INSTITUTE



① Citizen Science

- Greenfjord project - biology cluster
- 10 eDNA samples taken
- Coastal marine environment
- Now in the lab for analysis



- Looking for marine mammals
- while fishing



② Climbing

- 3 weeks of sun = climbing daily
- 4 routes opened - 6 to 10 pitches
- 2 ridges crossed



③ Basecamp: home for 3 weeks



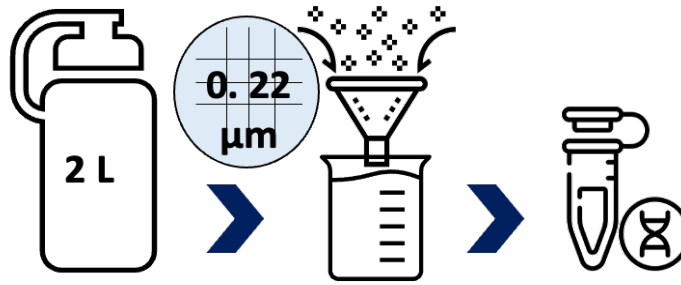
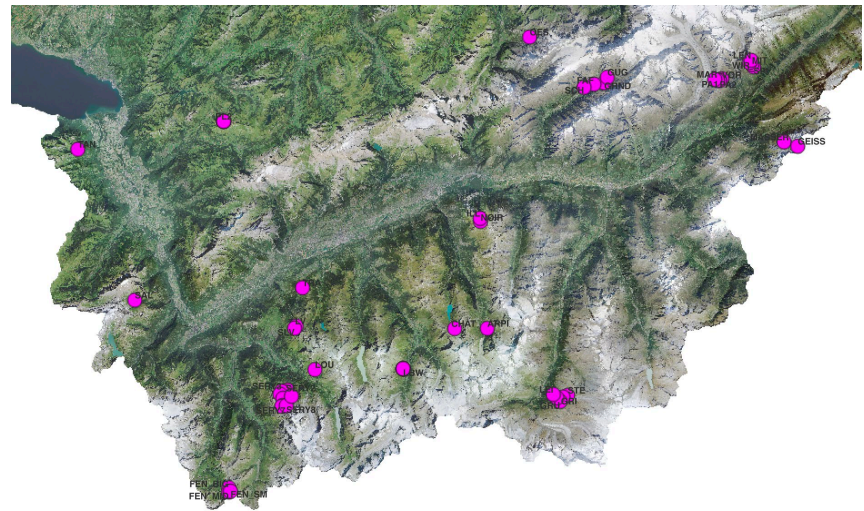
Cataloguing bacteria diversity across alpine and arctic lakes

Anna Carratalà, PhD. Research scientist, Environmental Chemistry Laboratory, EPFL

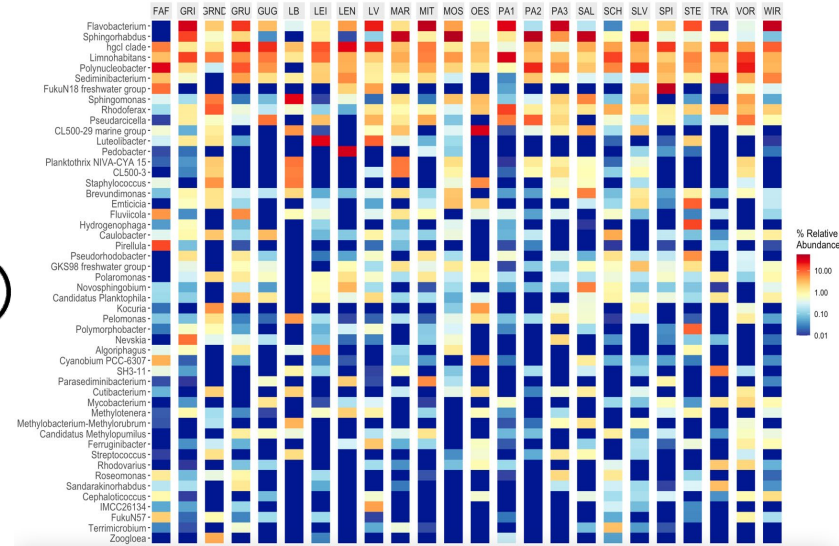


- Goal:** Characterize alpha-, beta- and gamma- diversity of bacteria communities in alpine and arctic lakes and identify environmental factors influencing the diversity estimates in these lakes.

Study sites and methods:

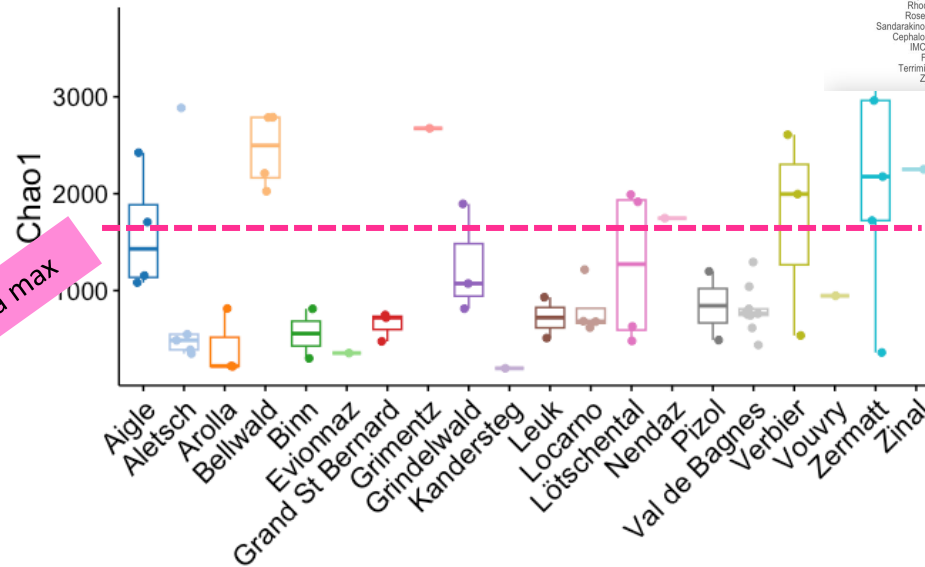


Preliminary results:



n = 12

Lake Geneva max



Take home message

Alpine lakes host high bacteria diversity and very specific communities influenced by very local factors