SWISS POLAR INSTITUTE

Updates by SPI Flagship Initiatives
GreenFjord & PAMIR

Julia Schmale, GreenFjord

Martin Hölzle, PAMIR

GreenFjord

Greenlandic Fjord ecosystems in a changing climate: Socio-cultural and environmental interactions

Funded Partners

EPFL

ETH zürich

WSL

Universität Zürich[UZH]

UNIL | Université de Lausanne

Further Partners

SCRIPPS INSTITUTION OF OCEANOGRAPHY

AARHUS UNIVERSITY

HELMHOLTZ GEMEINSCHAFT

INSTITUT POLAIRE FRANÇAIS

GIOS

NiPR National Institute of Polar Research

PAUL SCHERRER INSTITUT PSI

GREEN FJORD

Prof. Julia Schmale - **PI**
EPFL

ATMOSPHERE

Prof. Samuel Jaccard – **co-I,** UNIL

OCEAN

Prof. Kristy Deiner – **co-I**
ETHZ

BIODIVERSITY

Prof. Loic Pellisier – **co-I**
ETHZ / WSL

Prof. Andreas Vieli – **co-I**
UZH

CRYOSPHERE

Prof. Laine Chanteloup – **co-I,** UNIL

HUMAN

Dr. Lisa Bröder – **co-I**
ETHZ

LAND

- **40 Scientists**
- **1/3 ECR**
- **15 institutions**
- **7 countries**

Advisory Board

Søren Rysgaard
(Denmark, Greenland Integrated Observing System)

Yvon Csonka
(CH, Humanities)

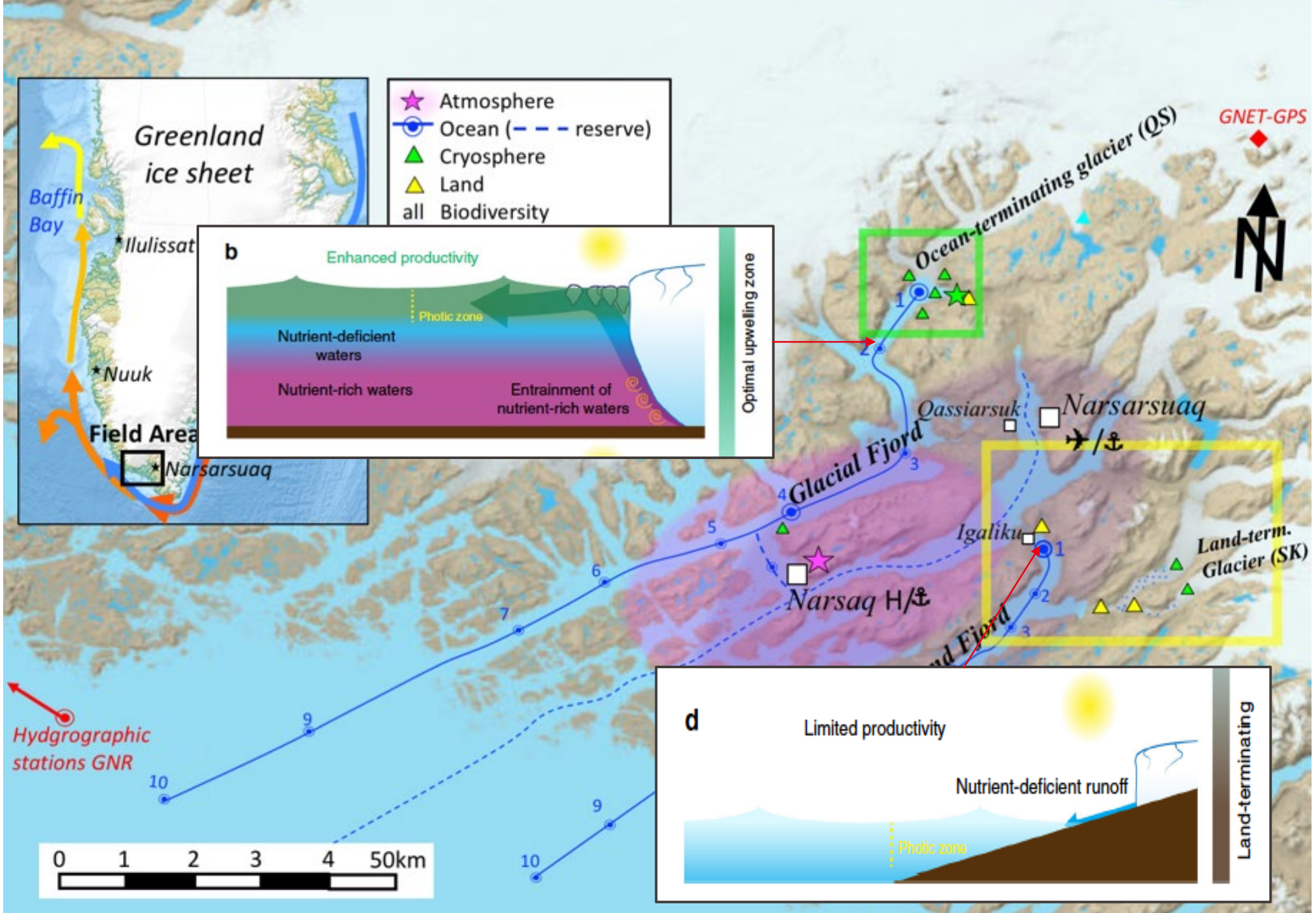
Josephine Nymand
(Greenland, National Research Council)

GREEN FJORD

What are the consquences of retreating ice on the fjord ecosystem?

- Marine productivity
- Carbon cycle
- Local climate / weather
- Livelihoods

after Hopwood et al., 2018



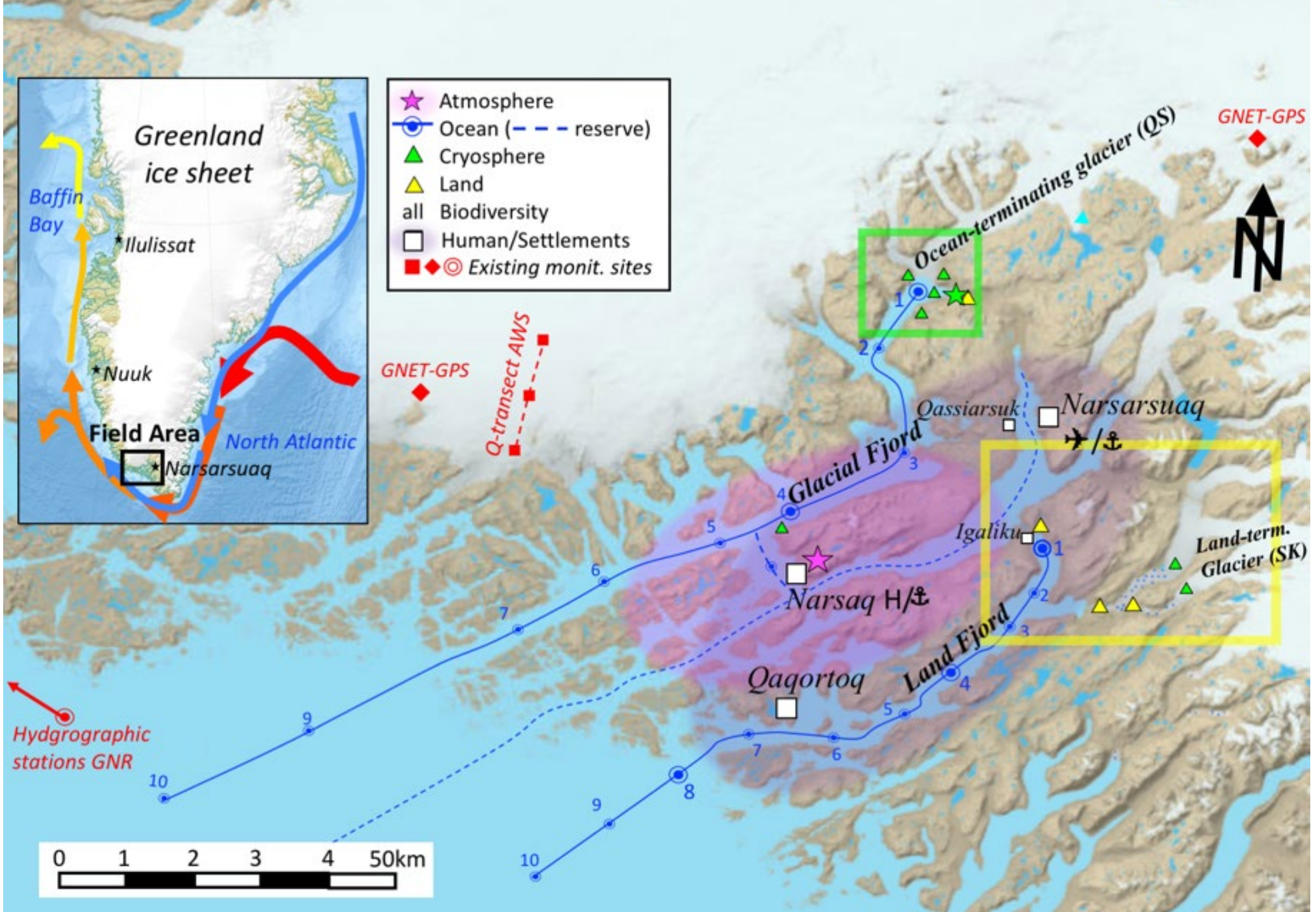
GREEN FJORD

2022
scouting & setting up

2023 – 2024
intensive observation periods

2023 – 1000 person days in the field

2025
phase out



UNIL | Université de Lausanne

Human Cluster

With the aim of getting local residents deeply engaged in the project, here's what was achieved on the field between **August 2022, April and August 2023** :

- **27** semi-conducted interviews with local residents from a variety of professions
- **1** commented path on the ice cap with a local resident
- **1** photo exhibition in the community centre of Narsaq
- **1** photo book with the exhibition's pictures is in preparation for the local community

Interview of a local fisherman, April 2023. ©photo credit: Thora Herrmann

Two local residents discussing at the exhibition, August 2023. ©photo credit: Anita Feierabend

Land cluster

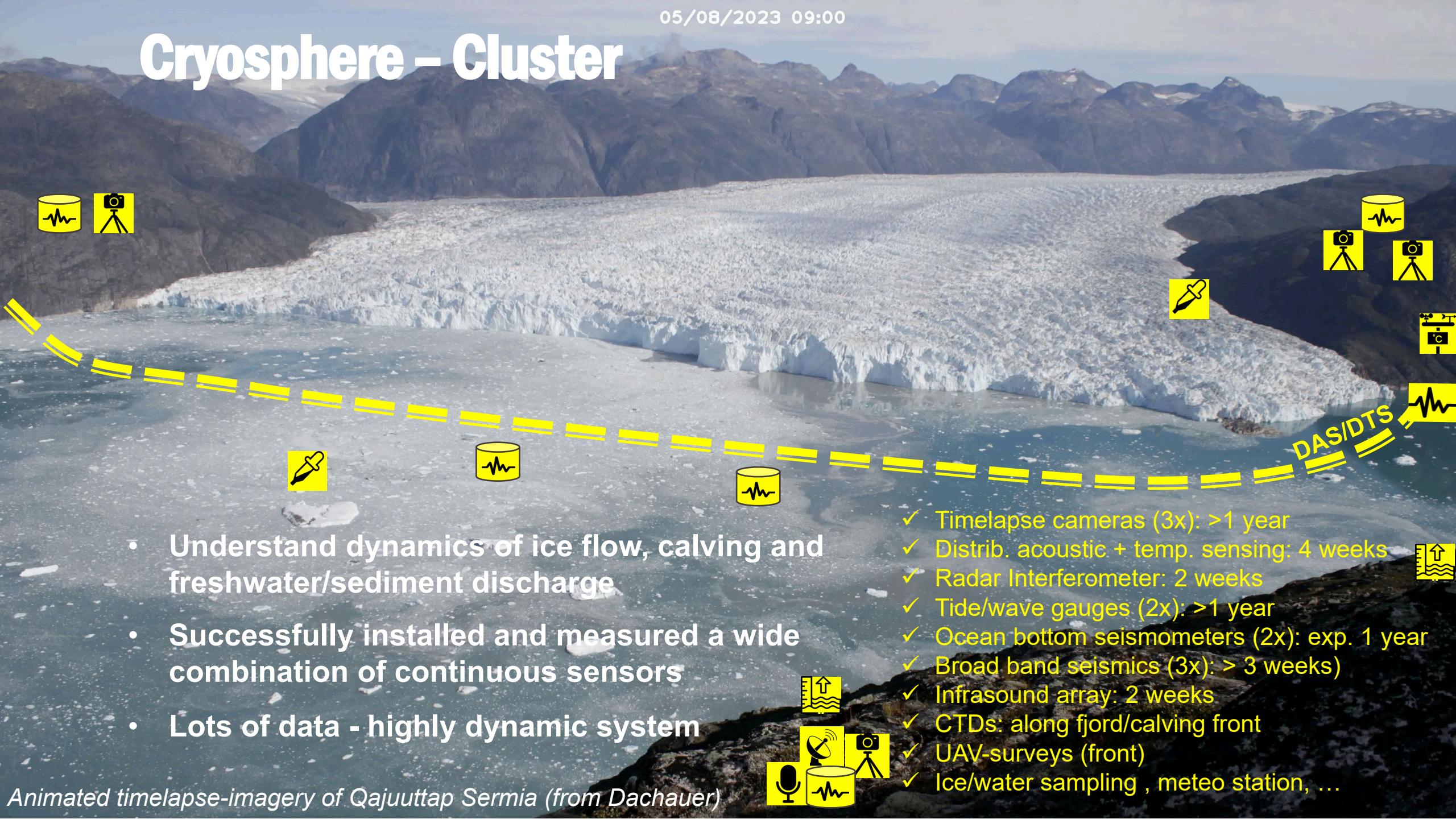
May-June 2023: erosion and export of land-derived organic matter and sediments by glacial meltwater

- Installation of in-stream sensors to monitor water level, temperature, conductivity, pH, dissolved oxygen, turbidity
- Collection of soil, sediment, glacial ice and water samples for mineral and organic matter characterization, eDNA

August 2023: soil sampling campaign
with S. Dötterl's "Soil Resources" group at ETHZ

Focus on chronosequence above Narsaq: plots of different ages thus representing different stages of soil formation

Cryosphere – Cluster



- **Understand dynamics of ice flow, calving and freshwater/sediment discharge**
- **Successfully installed and measured a wide combination of continuous sensors**
- **Lots of data - highly dynamic system**

- ✓ Timelapse cameras (3x): >1 year
- ✓ Distrib. acoustic + temp. sensing: 4 weeks
- ✓ Radar Interferometer: 2 weeks
- ✓ Tide/wave gauges (2x): >1 year
- ✓ Ocean bottom seismometers (2x): exp. 1 year
- ✓ Broad band seismics (3x): > 3 weeks)
- ✓ Infrasound array: 2 weeks
- ✓ CTDs: along fjord/calving front
- ✓ UAV-surveys (front)
- ✓ Ice/water sampling , meteo station, …

Animated timelapse-imagery of Qajuuttap Sermia (from Dachauer)

UNIL | Université de Lausanne

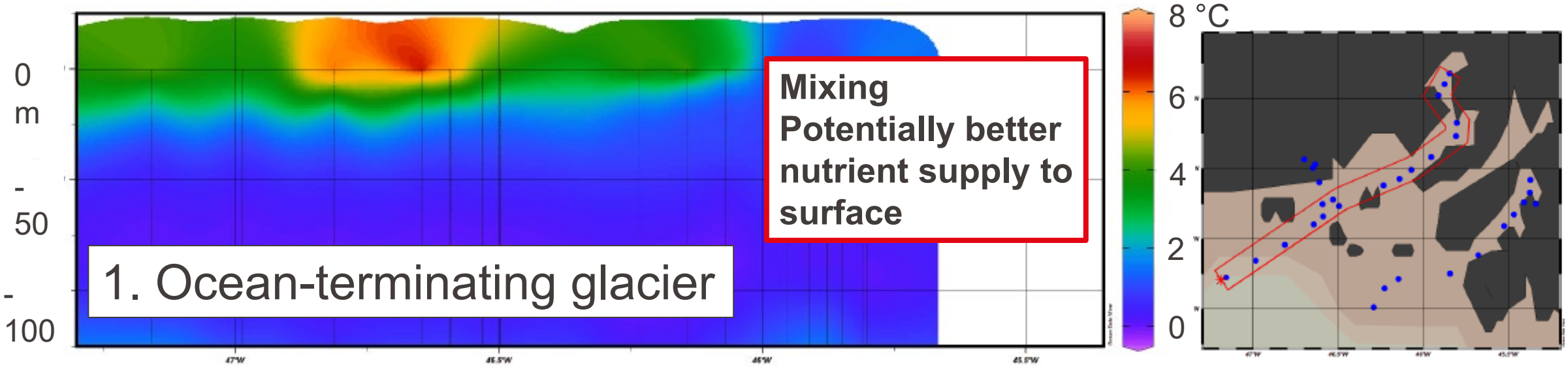
Ocean cluster

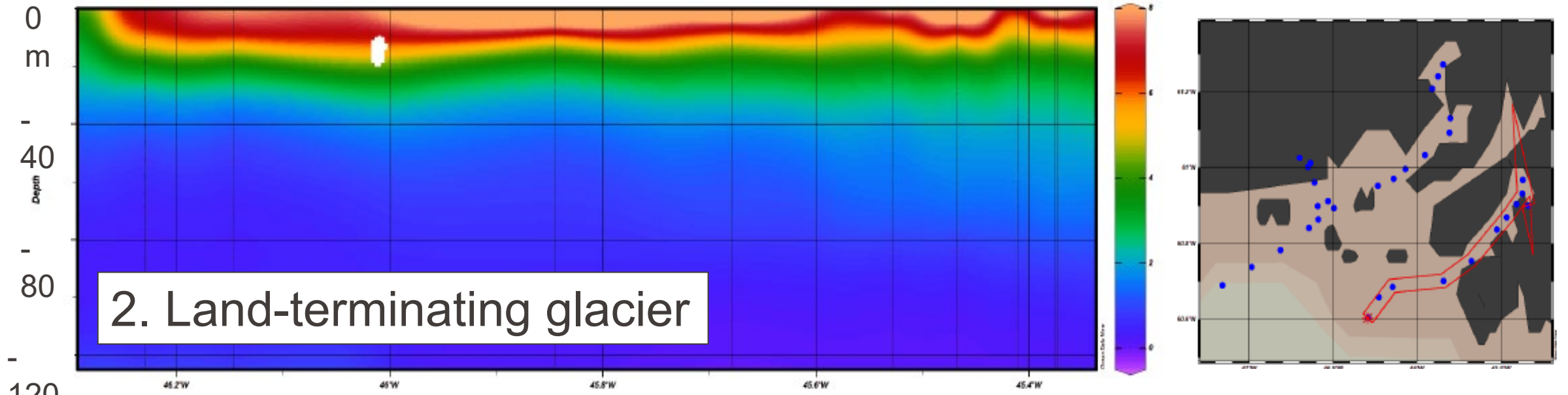
23.08-05.09.2023
10 scientists
16 stations
> 1500 samples
32 CTD profiles

UNIL | Université de Lausanne

Ocean cluster

Both fjords are highly stratified.



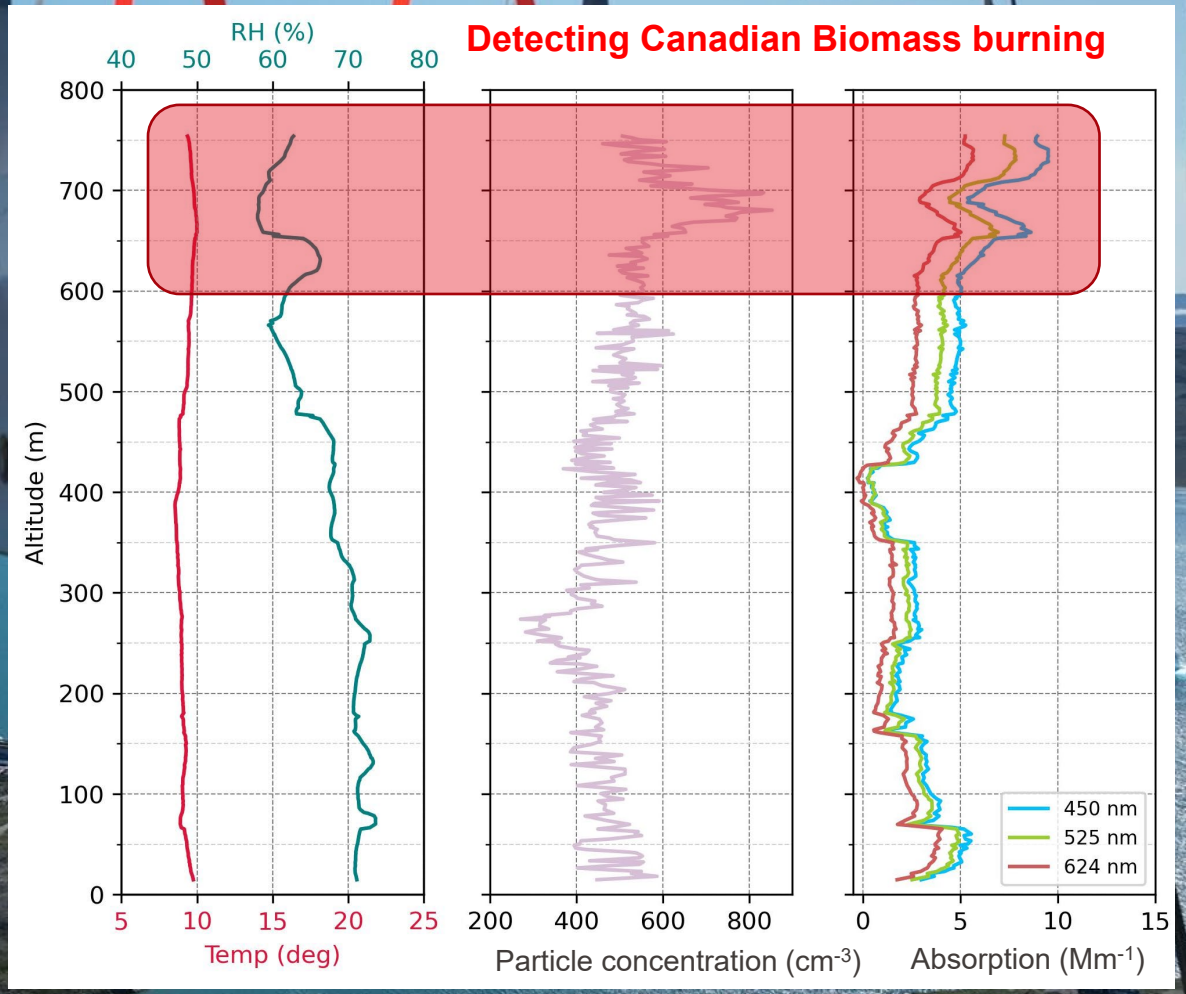


Atmosphere Cluster

Understanding natural and anthropogenic sources of aerosols and their climate impacts.
Focus on glacial dust through EPFL ECO-Plains project.

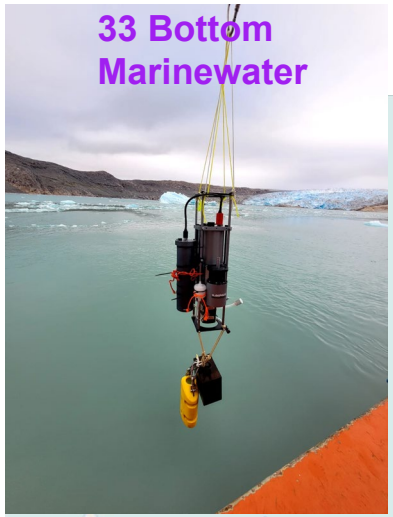
Preliminary data

30 flights
> 170 filters
20 real-time instruments



Measuring Biodiversity across the fjordic landscape

Total eDNA samples collected (2022-2023):



Lowest sample: -640 m
Highest sample: +514 m

Current total: **198 eDNA samples** (176 in 2023)

Plan to sequence **microbial**, **plant** and **animal** diversity

Outreach

GREEN FJORD

ABOUT RESEARCH CLUSTER NEWS BLOG INTERNAL WI

CONTACT

Scan for an awesome video!

GreenFjord 9+

GreenFjord

We are a Swiss scientific project team and interested in Southern Greenlandic Fjord systems.

SWISS POLAR Class

Schweitzimiut ilisimatusarnut Narsap qulaanut ballonimik 600 meterimik qussissuilimmut ulluc tamaasa qullerlussarput.

De schweitziske forskere sender dagligt en ballon op i 600 meters højde over Narsaq.

2 pages in national newspaper

Balloner over Narsaq

Spektakulært forskningsprojekt skal undersøge luftforureningen i Sydgrønland

KLIMAFORANDRINGER

Jesper Hansen
jesper@sermitsiaq.gl

Et stort forskerhold fra Schweitz opholder sig i øjeblikket i Narsaq, hvor de undersøger luftens partikelindhold for at blive klogere på, hvordan klimaændringerne måske påvirker udbredelsen af luftforurening.

Undersøgelserne foregår blandt andet ved at opsende nogle særlige meteorologiske balloner i luften over Narsaq.

– Luften i Narsaq er ren og ganske uforurenet, så det er et godt sted for at undersøge, hvordan partikler spredes i luften, forklarer miljøforskeren og professoren Julia Schmale fra det schweiziske tekniske universitet Ecole Polytechnique Federale de Lausanne til Sermitsiaq. Julia Schmale er leder af det store forskningsprojekt.

– Vi måler luftens kemiske sammensætning, især de fine partikler. Fine partikler kan være tegn på forurening, og det kan påvirke klimaændringer. Luftforurening er ikke et problem i Narsaq, hvor luften er meget ren. Derfor er effekten af de fine partikler på klimaet, som er med til at danne skyer, meget vigtig.

Data med sekunders mellemrum

– Vi ved ikke meget om, hvordan partiklerne kommer til Sydgrønland: fra havet, landet, isen? Så vi samler data i realtid med få sekunders mellemrum for at besvare disse spørgsmål. Vi opsender også balloner for at se, om partiklerne er anderledes højere oppe i atmosfæren i forhold til jorden.

Ballonerne er med til at gøre forskningsprojektet meget synligt i Narsaq, hvor indbyggerne kan følge med i de daglige opsendelser.

– Ballonen har et rumfang på 64 kubikmeter og fyldes med helium. Den kan bære 30 kilo instrumenter og nå en højde på 600 meter, siger Julia Schmale.

Stort projekt

Luftmålingerne er en del af et større forskningsprojekt, som kaldes GreenFjord. Udover meteorologer og luftforskerne medvirker også forskere inden for marinbiologi, kryosfæren (frosset vand som sne og is, red), biodiversitet, land og mennesker. I alt kommer der omkring 20 forskere fra alle hold til Narsaq i sommerens løb. Udover forskere fra Schweitz er der også forskere fra Japan og Storbritannien.

Fra 4.-8. august benytter kryosfæreholdet skibet Adolf Jensen. I slutningen af august skal marinbiologerne på togt med Naturinstituttets forskningsskib »Sanna«.

GreenFjord-projektet er finansieret af the Swiss Polar Institute, the Swiss National Sciences Foundation, Ecole Polytechnique Federale de Lausanne, Federal Institute of Technology Zurich, University of Zurich og University of Lausanne.

Under opholdet i Narsaq bor forskerne på Narsaq International Research Station, som er en uafhængig facilitet drevet på non-profitbasis – og som skal understøtte forskning i Sydgrønland inden for en bred vifte af forskningsprojekter.

De schweiziske forskere pointerer over for Sermitsiaq, at deres projekt intet har at gøre mineindustrien og en eventuel råstofudvinding på Kvanefjeldet at gøre.

Ballonitut teknikerip Lionel Favrap Schweitzimeersup paasissutissat Narsap qulaani ballonimeersut sjungnnersut takuai.

Ballonteknikeren Lionel Favre fra Schweitz tjekker data fra ballonen over Narsaq.

www.greenfjord-project.ch, https://www.facebook.com/GreenFjord/

GREEN FJORD

Qujanaq
Tak
Thank you

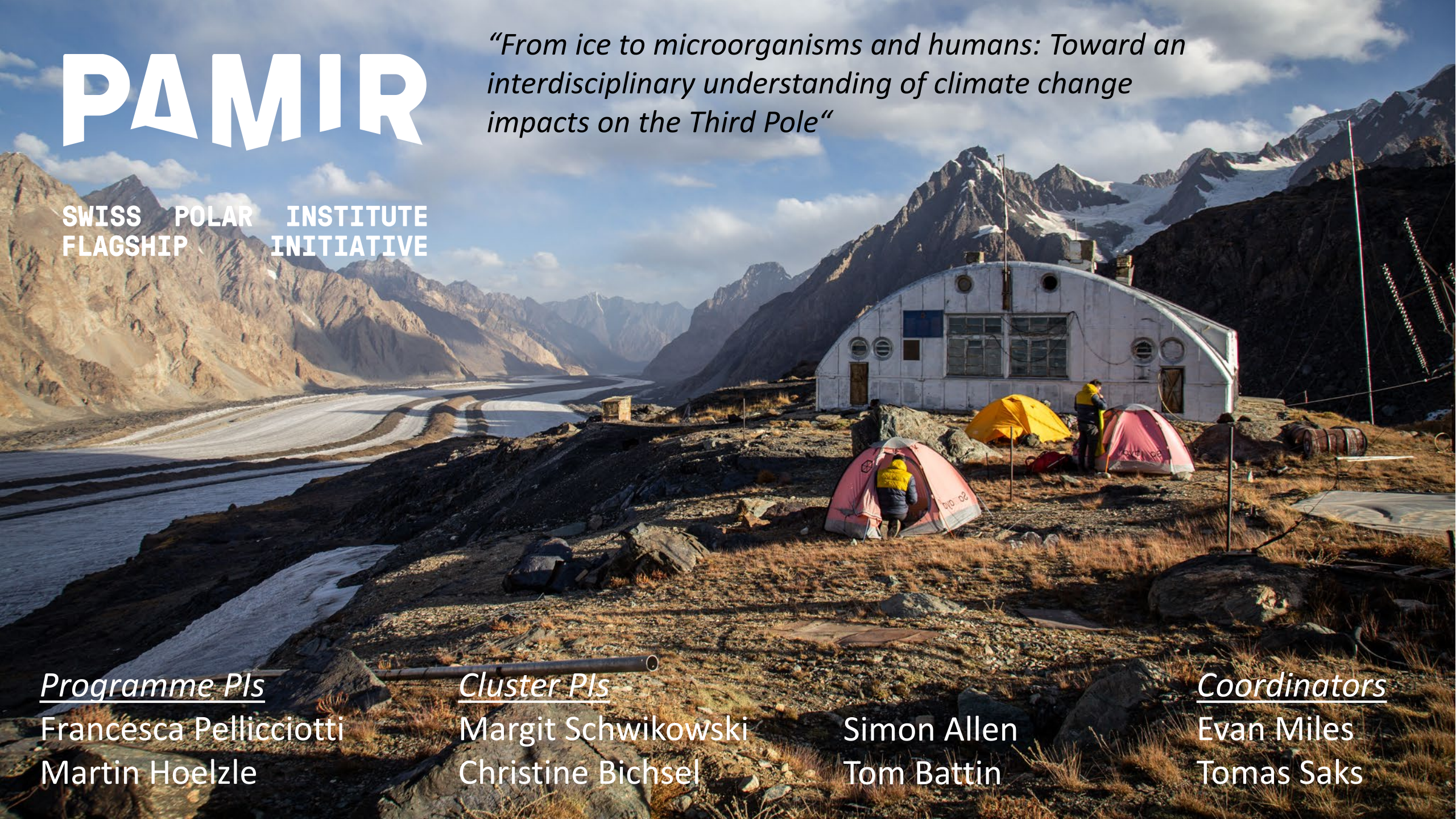
Credit: B. Heutte, EERL, Canadian biomass burning

Funding from: SPI, SNSF, EPFL, UNIL, ETHZ, UZH

PAMIR

SWISS POLAR INSTITUTE
FLAGSHIP INITIATIVE

"From ice to microorganisms and humans: Toward an interdisciplinary understanding of climate change impacts on the Third Pole"



Programme PIs
Francesca Pellicciotti
Martin Hoelzle

Cluster PIs
Margit Schwikowski
Christine Bichsel
Simon Allen
Tom Battin

Coordinators
Evan Miles
Tomas Saks

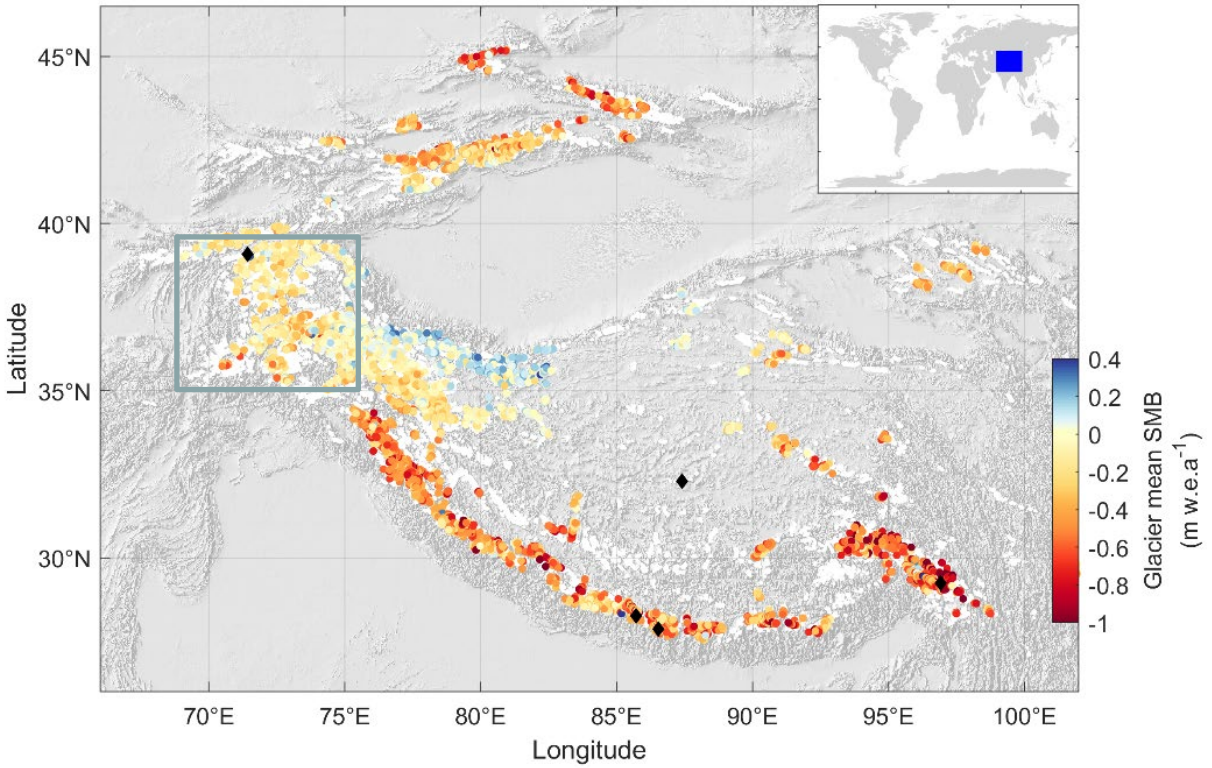
Unique region

PAMIR

1 A region with ‘stable’ glaciers: "Karakoram Pamir Anomaly"

2 The most vulnerable mountain ‘water tower’ in the world

2000-2016 glacier health



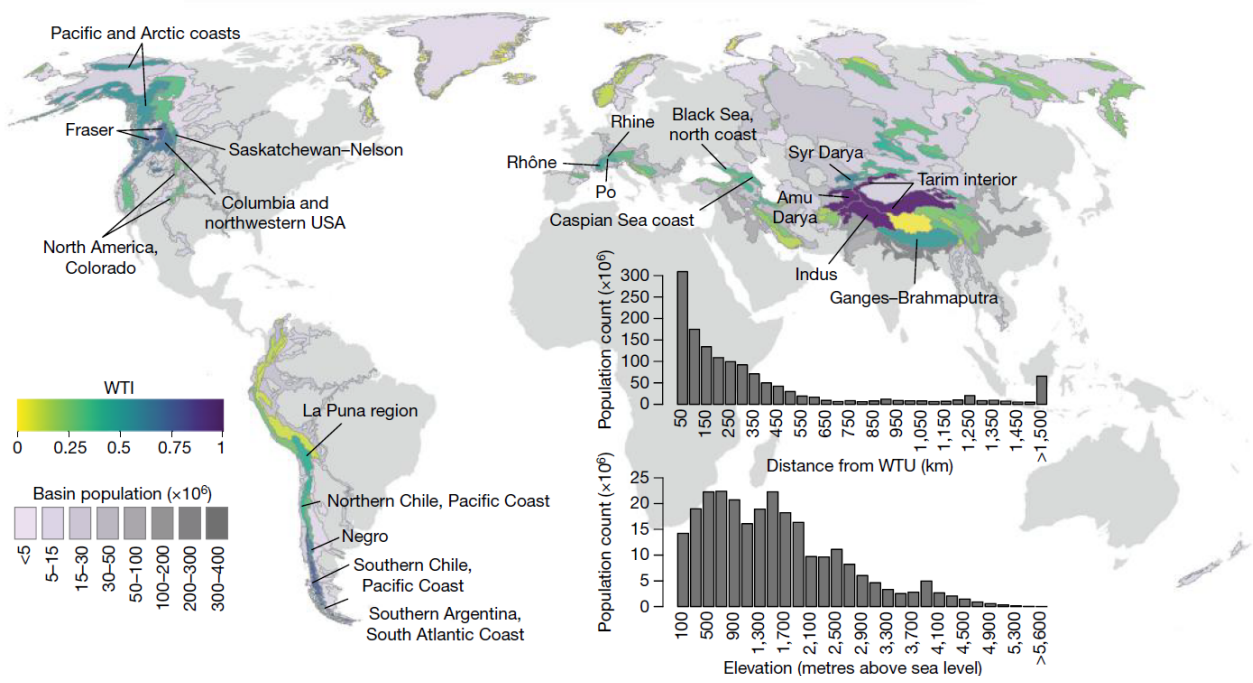
Miles, ….and Pellicciotti, 2021, *Nature Communications*

Unique region

PAMIR

1 A region with ‘stable’ glaciers:
"Karakoram Pamir Anomaly"

2 The most vulnerable mountain ‘water tower’ in the world



What is the current state of the Pamir cryosphere?

- Causes, character, future of the Anomaly?
- Impacts on ecosystems, hazards and water resources?
- History of cryospheric research, understanding?

Immerzeel et al., 2020, *Nature*

Where are we?

PAMIR Flagship Initiative

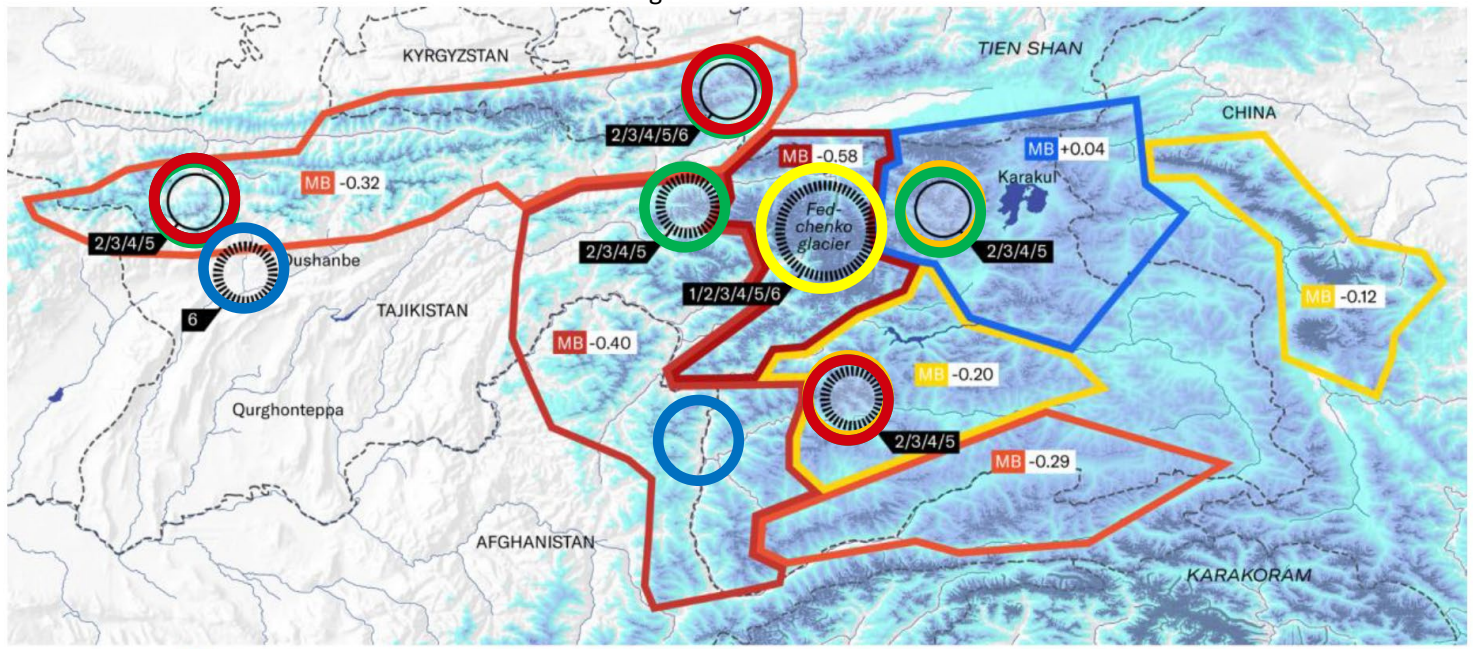
- All clusters on fieldwork, all sites visited
- Field person-days:
  498 in 2022
  1127+ in 2023
- MoUs with major partners
- New opportunities

- Major challenges remain
  - Helicopters
  - Geopolitics
  - Internal politics

Tashkent
Bishkek

Munich

Cambridge



C1 C2 C3 C4 C5 C6

Highlights, 2022-2023

PAMIR Flagship Initiative

The war in Ukraine and sanctions on Russia threatened Cluster 6 plans

Instead… C6 pivoted:

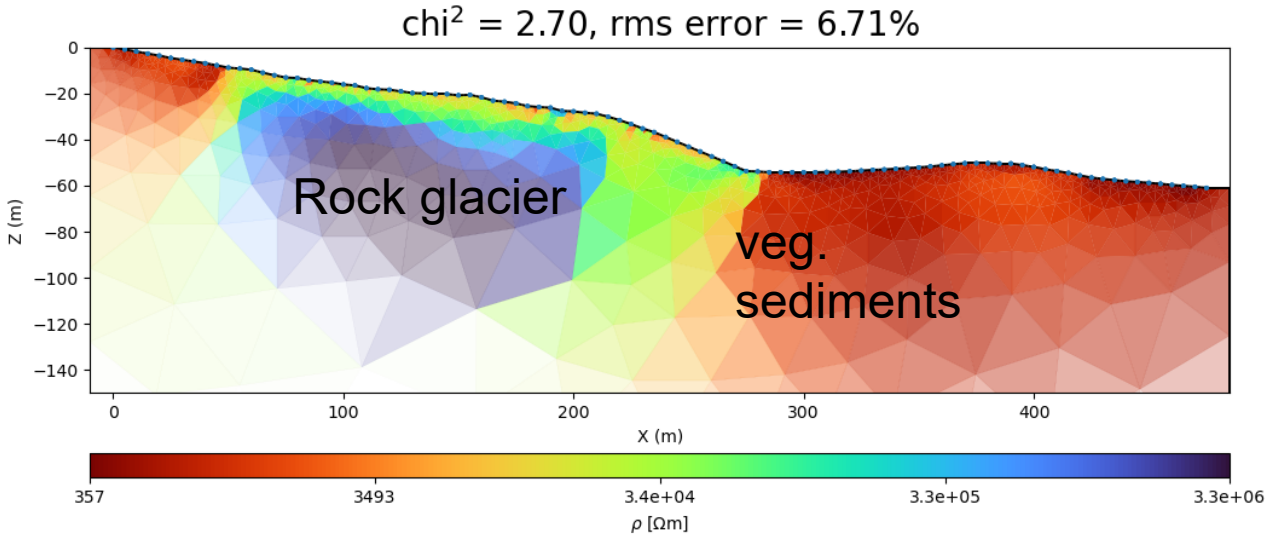
- New local, international partnerships
- Unprecedented archival access
- New ideas and grants

C6, *History of glacier science*: opening new partnerships for old records

Highlights, 2022-2023

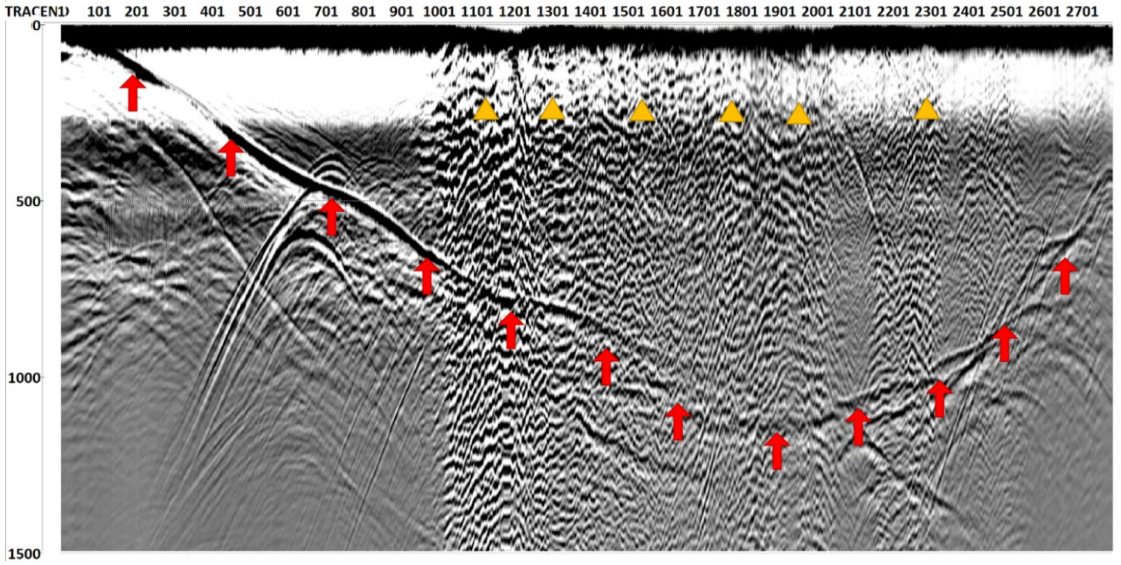
PAMIR Flagship Initiative

Where & how is the permafrost?



C2, *Permafrost*:
Multi-method geophysical surveys conducted at 4 sites (so far)

How much ice is there?



C3, *Glaciers, snow, and hydrology*:
Increased *n glaciers* with ice thickness measurements from 2 to 6 in 2023

Highlights, 2022-2023

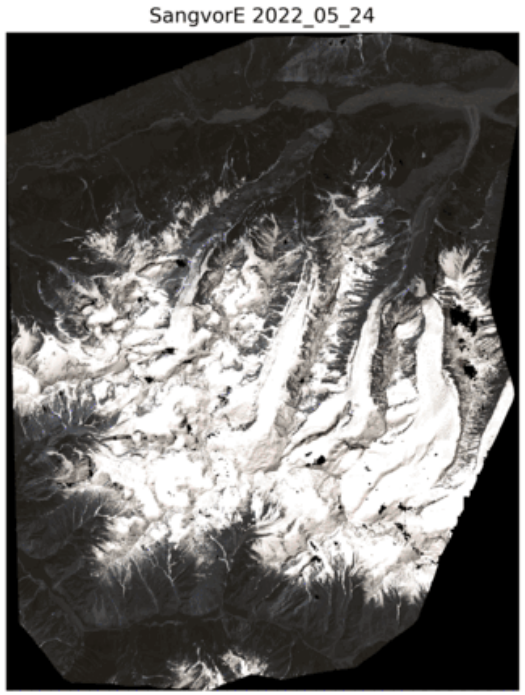
PAMIR Flagship Initiative

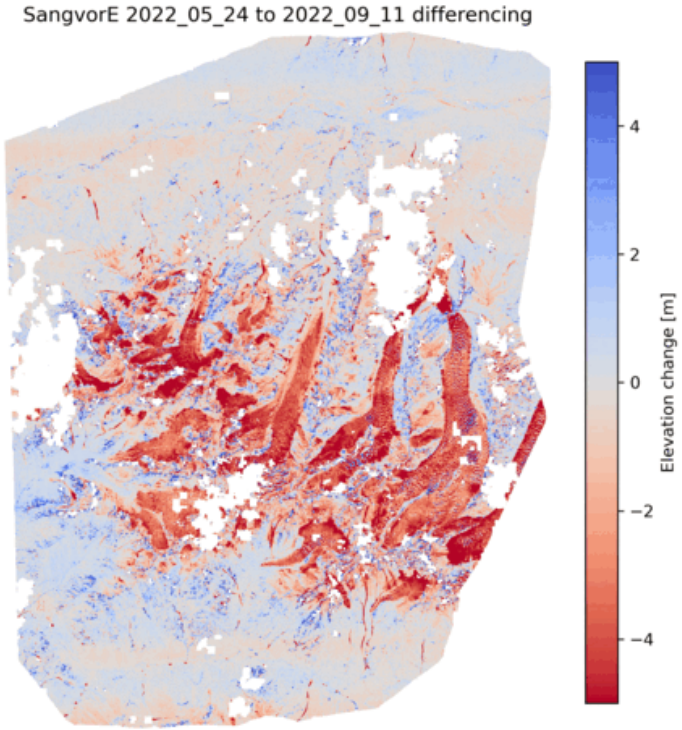
Multi-institutional systematic monitoring sites across the Pamirs

- Meteorology
- Glacier mass balance
- Ground temperatures
- Hydrology

Seasonal Plèiades stereoimages/DEMs

- 4 acq. x 7 sites x 500km2





C2/3/4/5: High-quality datasets for characterizing cryospheric state, function and changes during 2022-2025

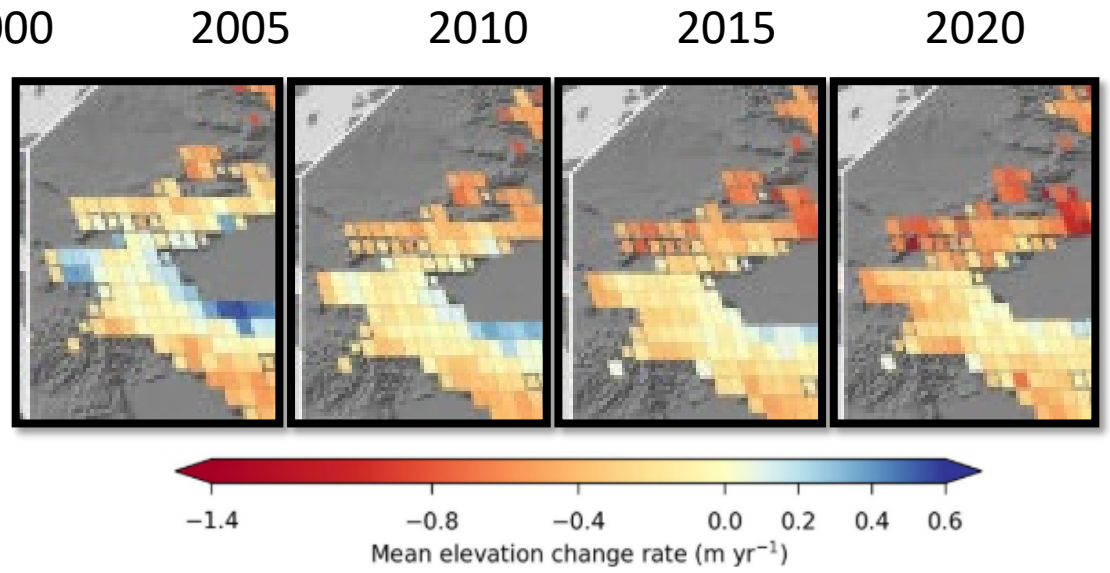
Many other highlights…

PAMIR Flagship Initiative

- Workshops and training (Swiss, partners)
- Genetic samples of mountain fluvial ecosystems (C4)
- Essential lake surveys and landscape assessments (C5)
- Establishment of hazard monitoring sites (C5)
- Opening the doors to historic Soviet aerial surveys (C3)
- Continuous ablation measurements at 5 sites (C3)
- Rock glacier vegetation assessment (C5)
- Opening doors to the Gorbunov station (C1/3/6)
- Great launches in CH and TJ
- Outreach activities begin, SCO links
- Strengthening local ties and building new ones
- Cross-cluster fieldwork, progressive integration
- Cross-discipline constructive discussions

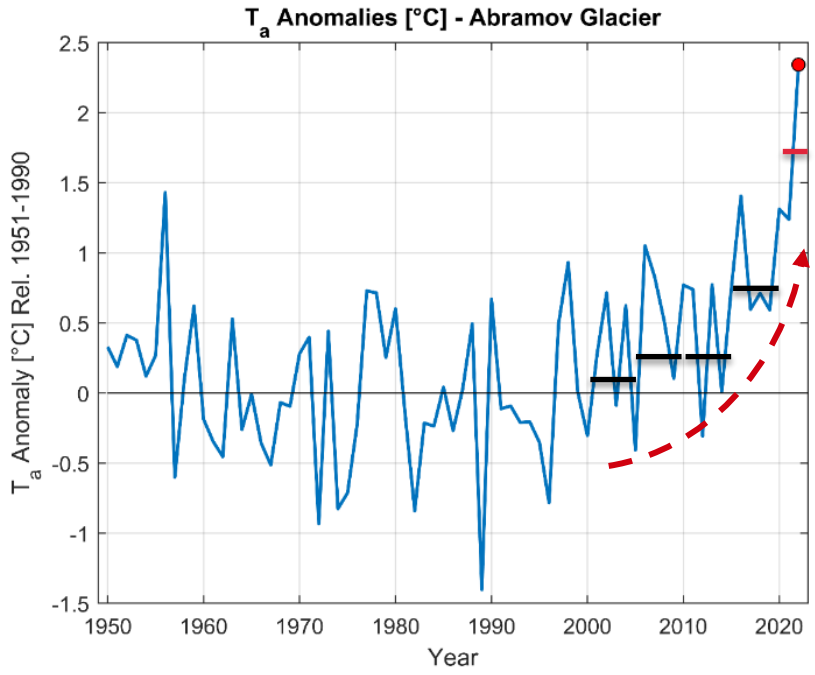
Are we too late for the Anomaly?

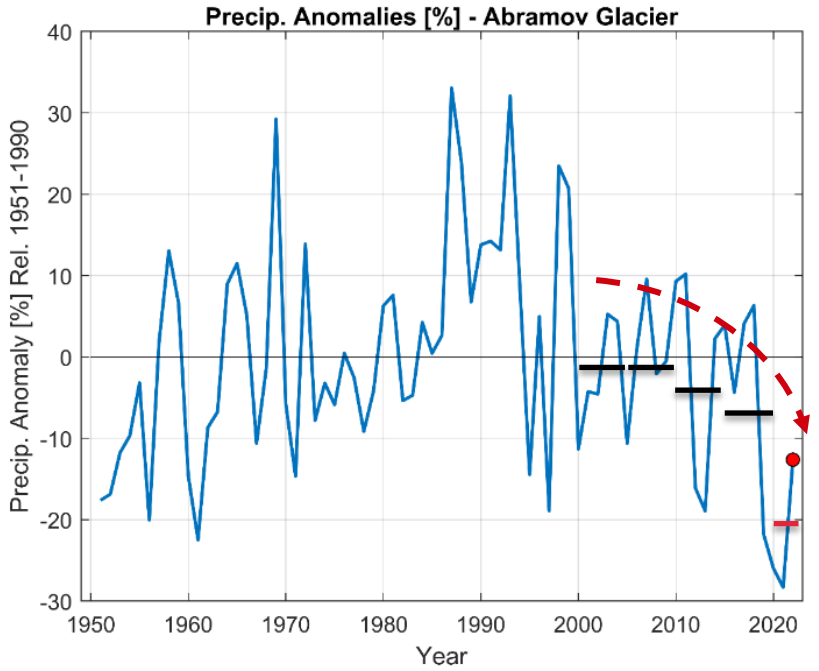
ASTER Elevation Change



Hugonnet et al, 2021

ERA5-Land Reanalysis



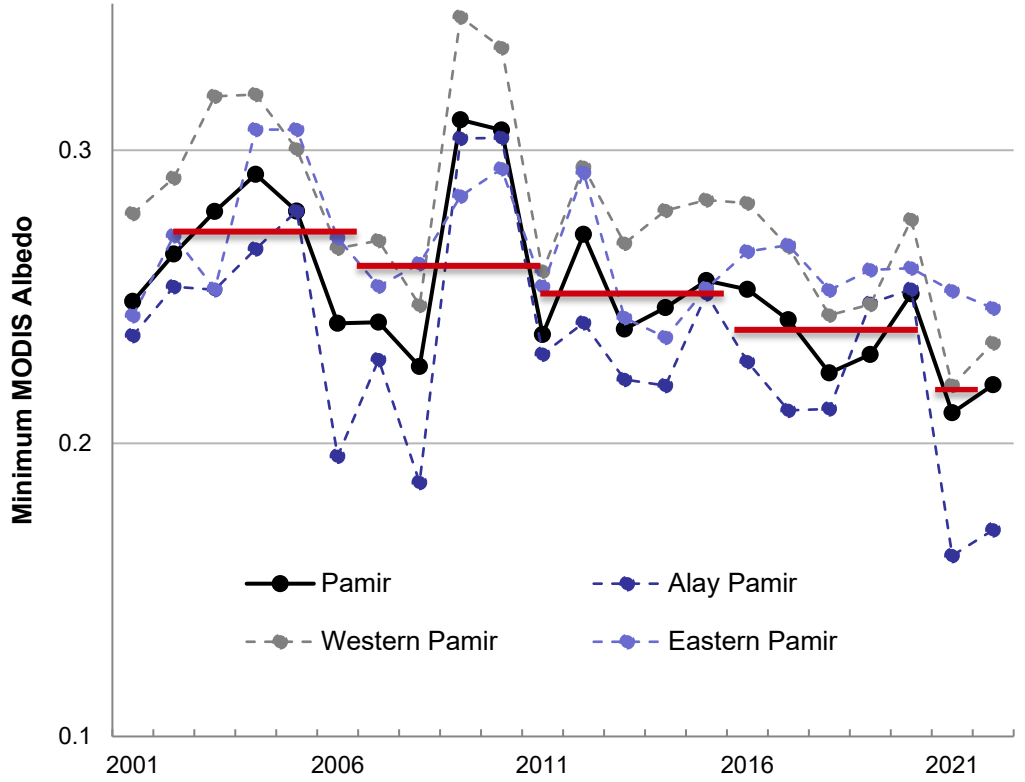


PAMIR Flagship Initiative

Are we too late for the Anomaly?

PAMIR Flagship Initiative

Field observations: total negation of many accumulation areas in 2022



Ren et al, in review

Progressive albedo reduction due to precipitation decrease and temperature increases

Where are we going?

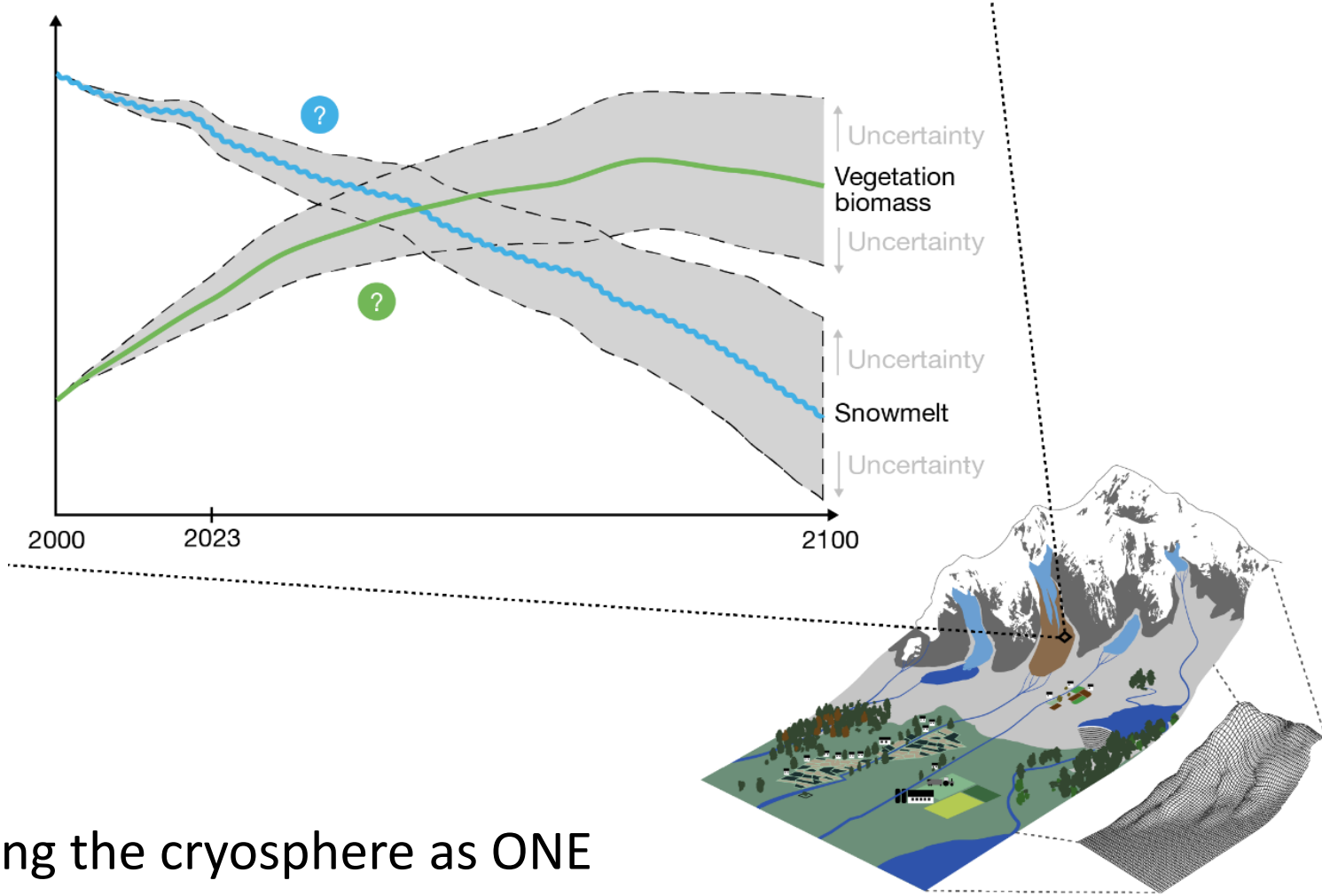
PAMIR Flagship Initiative

Current state adds **urgency**:

observations → understanding → society

Projections of the *integrated* PAMIR mountain system:

- water in the rivers
- soil moisture
- glacier melt
- permafrost thaw
- vegetation and crop dynamics



What do we learn by considering the cryosphere as ONE element in a water tower, not THE element?

Thank you very much for your attention

PAMIR

SWISS POLAR INSTITUTE
FLAGSHIP INITIATIVE

Francesca Pellicciotti
Martin Hoelzle
The PAMIR Consortium