

Partners

UNIVPM, UNIVE, CNR-IRBIM, NTNU, NCU

Project name: Mosses as Biomonitors of Atmospheric Deposition:
From Analytical Approach to the Evaluation of Long-Range
Transport Pollution in Spitsbergen.

Project Acronym: POLAR-MOSS

Polarin Application: 188



Background

Atmospheric pollution can travel far beyond its source

The Arctic is often considered one of the most remote and pristine environments on Earth. However, atmospheric pollutants can be transported over long distances and reach even the most isolated polar ecosystems.

Mosses are particularly valuable for studying atmospheric deposition because they absorb nutrients and contaminants directly from the atmosphere and can accumulate substances over time.

However, information on the spatial distribution and sources of atmospheric pollutants across the Arctic landscape remains limited, especially in remote areas of Svalbard.

In October 2025, we designed a field study to investigate these knowledge gaps:

Mosses as Biomonitor of Atmospheric Deposition: From Analytical Approach to the Evaluation of Long-Range Transport Pollution in Spitsbergen.

The project focuses on the Kaffiøyra region of western Spitsbergen, where mosses were collected along a spatial gradient to investigate the distribution of trace elements and persistent organic pollutants (PAHs).

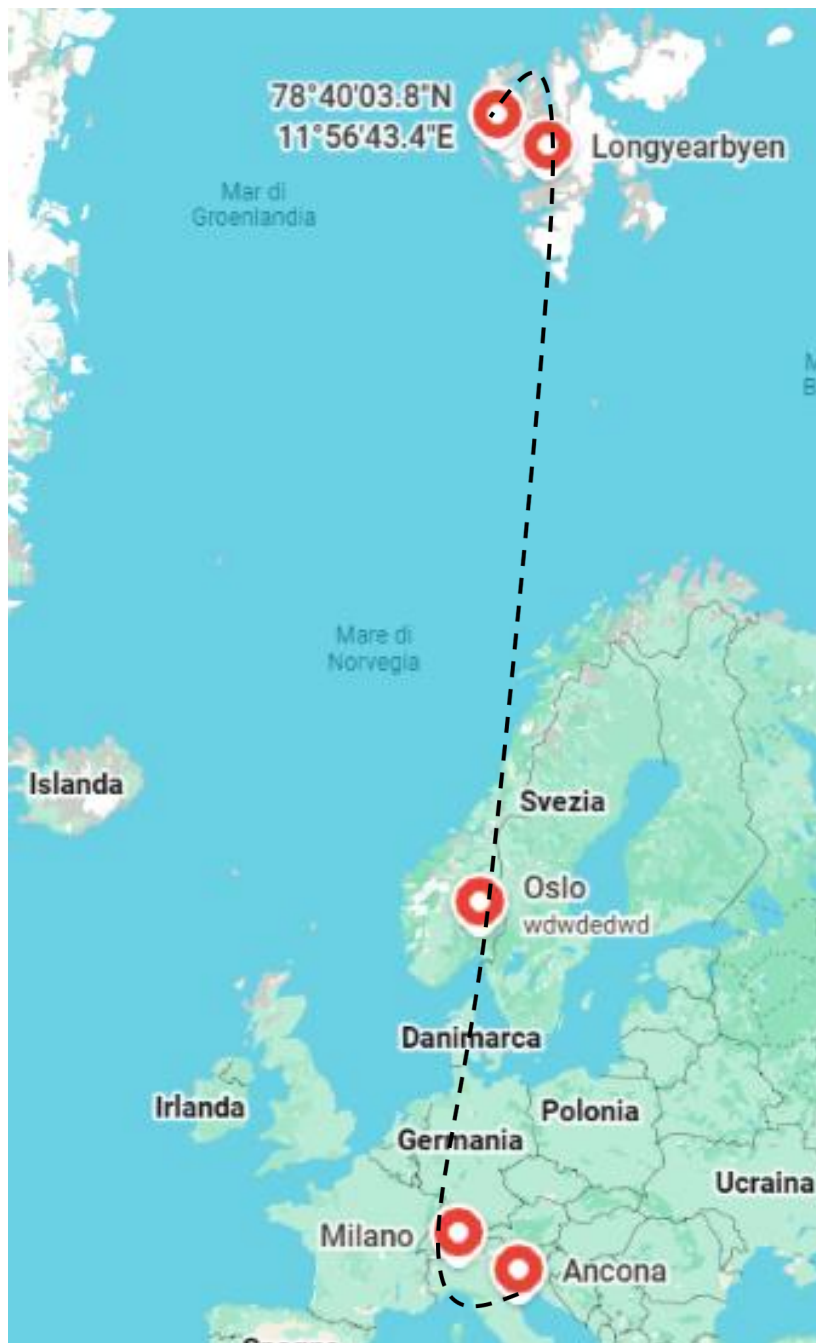
Next step:

Collect moss and soil samples across the Arctic landscape and use their chemical composition to trace atmospheric deposition and investigate potential pollution sources.

POLAR-MOSS gotfunded!

In August 2026, the field campaign was carried out in collaboration with the Nicolaus Copernicus Polar Station. .

During the campaign, we successfully collected samples from 28 stations across the Kaffiøyra region, together with additional samples from Longyearbyen



Over 3,000 km from Ancona to the Arctic.

The long journey to reach the North

Our journey to the Arctic began in Ancona, Italy, at our university, Università Politecnica delle Marche.

From Ancona, we travelled by train to Milan, where we boarded a flight to Longyearbyen, Svalbard.

Once in Longyearbyen, we continued our journey by ship, sailing along the coast of Spitsbergen towards our field site.

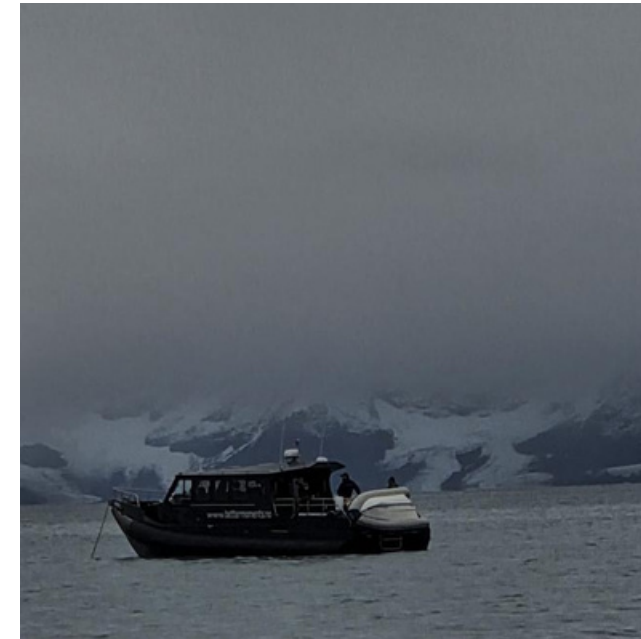
Finally, we reached the Nicolaus Copernicus Polar Station, ourbase for the POLAR-MOSS campaign.

From Ancona to the heart of the Arctic - the POLAR-MOSS journey had begun.

*15–29 AUGUST 2026
14 days in the Arctic*



Svalbard Island from the plane

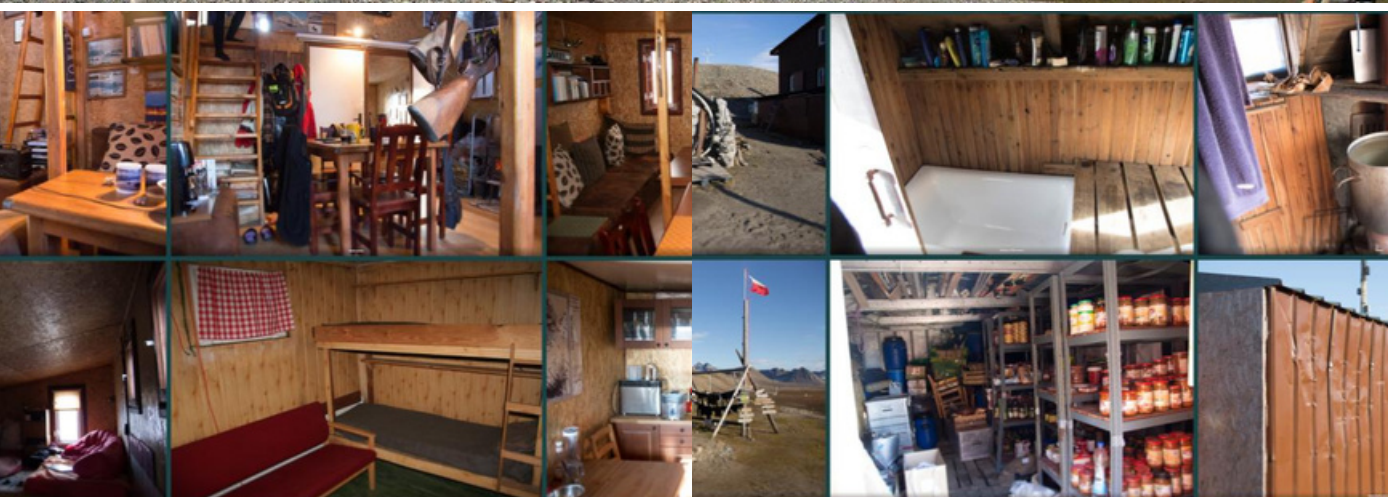
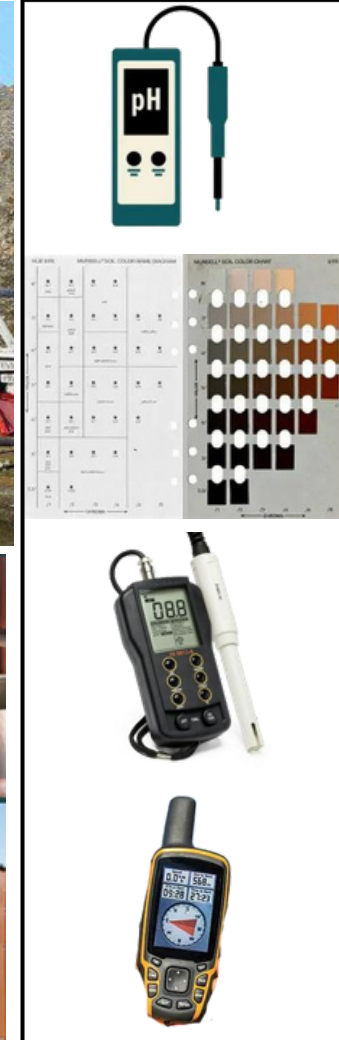


The boat used to reach the Kaffiøyra Region

Nicolaus Copernicus Station

For ten days, the Nicolaus Copernicus Polar Station was the home, laboratory and starting point for every field mission. From here, we explored the Arctic landscape, collected samples and adapting activities and timelines to ensure data quality and the security of operations. Using the facilities at the station, we carried out preliminary measurements and prepared all the equipment and materials needed for our field expeditions.

Photo Lorenzo Massi





Fieldsite: Kaffiora Region

Over five days of fieldwork, we covered approximately 60 km across the Kaffiøyra region, collecting moss and soil samples at different locations. These samples were carefully stored and prepared for laboratory analyses aimed at investigating metalloids and trace metals, as well as polycyclic aromatic hydrocarbons (PAHs)

Sampling Campaign and Main difficulties encountered

17–27 August 2026 | Kaffiøyra, Svalbard

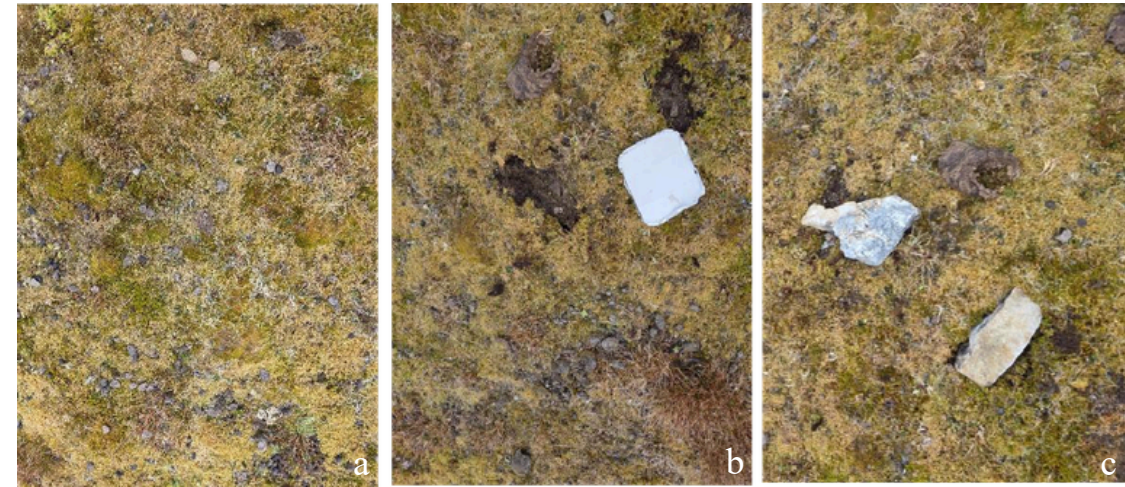
Despite the extensive sampling activities, all procedures were carried out with minimal impact, preserving the natural conditions of the sampling sites.

Samples collected

Despite extensive searches, *Hylocomium Splendens* was not identified in the study area or around Longyearbyen. The campaign continued successfully by collecting different mosses species along with topsoil samples (0–3 cm).

Geomorphological constraints — including **glacial moraines and meltwater pathways** — required on-site adjustments, but allowed us to achieve a broad spatial coverage of approximately 21 km².

Photo Lorenzo Massi



Picture 1 Samples collected on Kaffiøyra. Before (a); During (b); After (c).



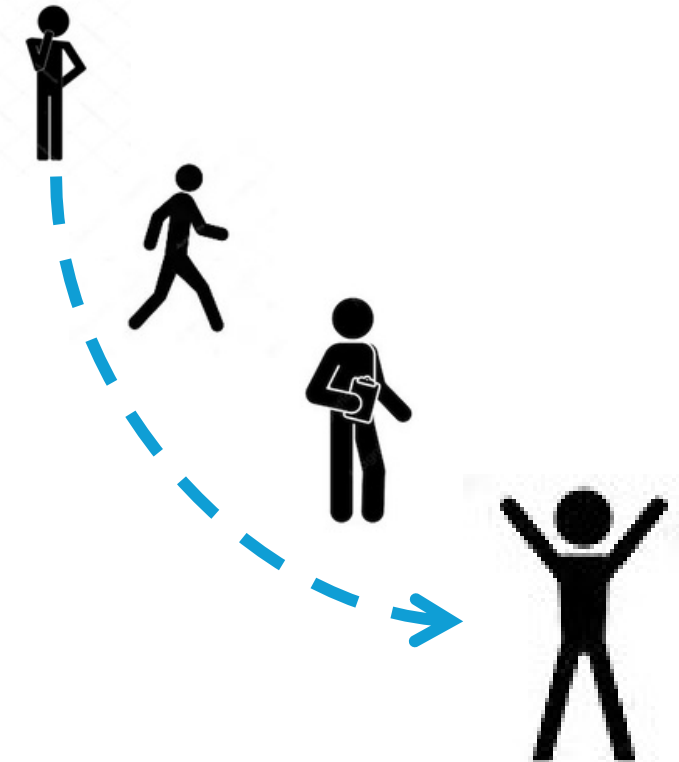
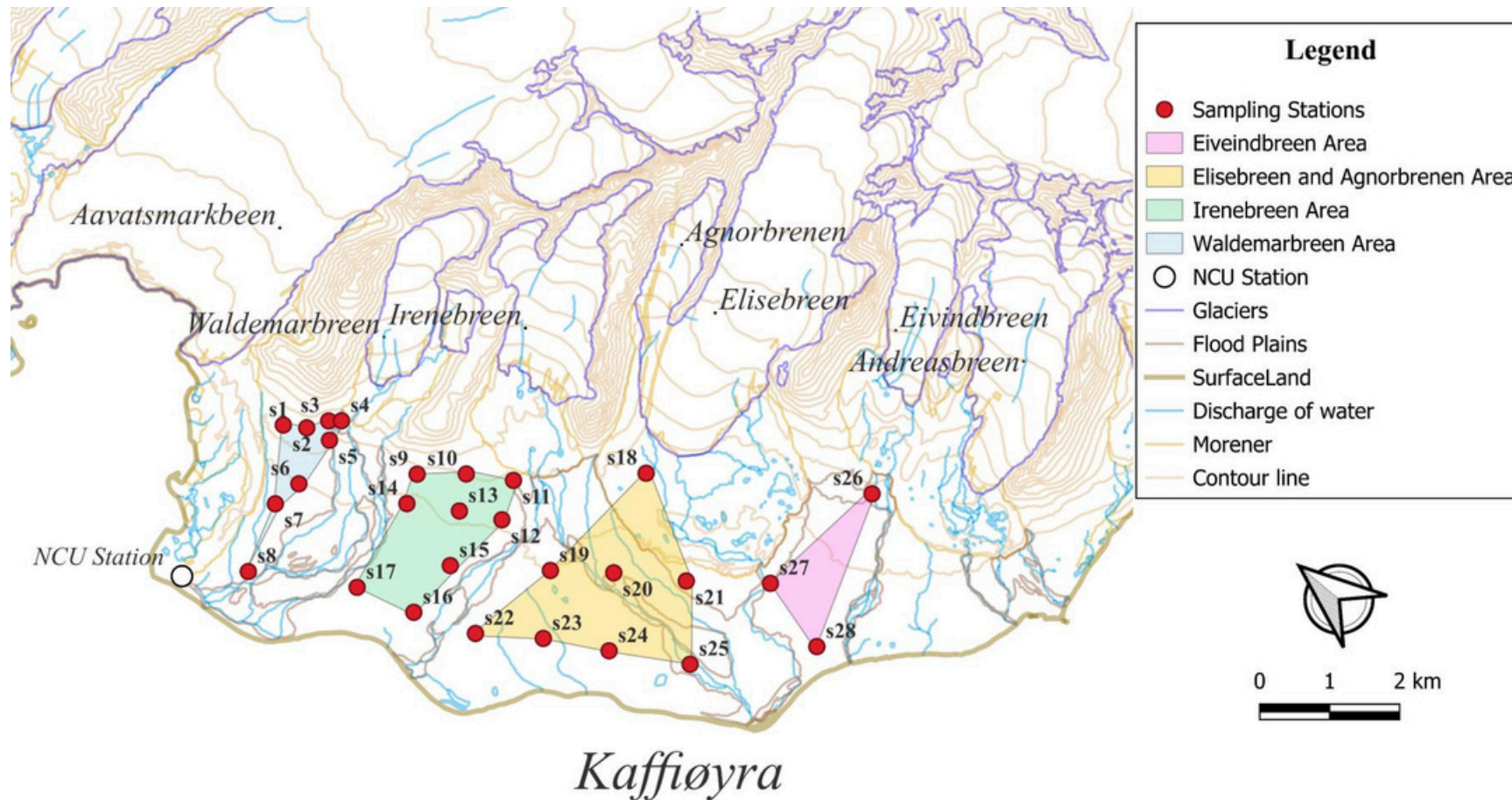
Picture 2 Samples collected: topsoil (a); moss (b; c; d)

POLAR – MOSS Project

28 STATIONS | 21 km² | 56 SAMPLES | 70% AREA

The 2026 NCU Polar Expedition allowed us to carry out an extensive sampling campaign across the Kaffiøyra region, mapping the wide plain in front of **four glaciers: Waldemarbreen, Irebreen, Elisebreen and Eivindbreen.**

The sampling campaign covered an extensive spatial and altitudinal gradient. The most distant station was located approximately 10 km from the Nicolaus Copernicus University (NCU) Station, while the highest-elevation site - Station s3 - was positioned at around 205 m a.s.l



Meteorological Conditions

Favourable conditions during the first days

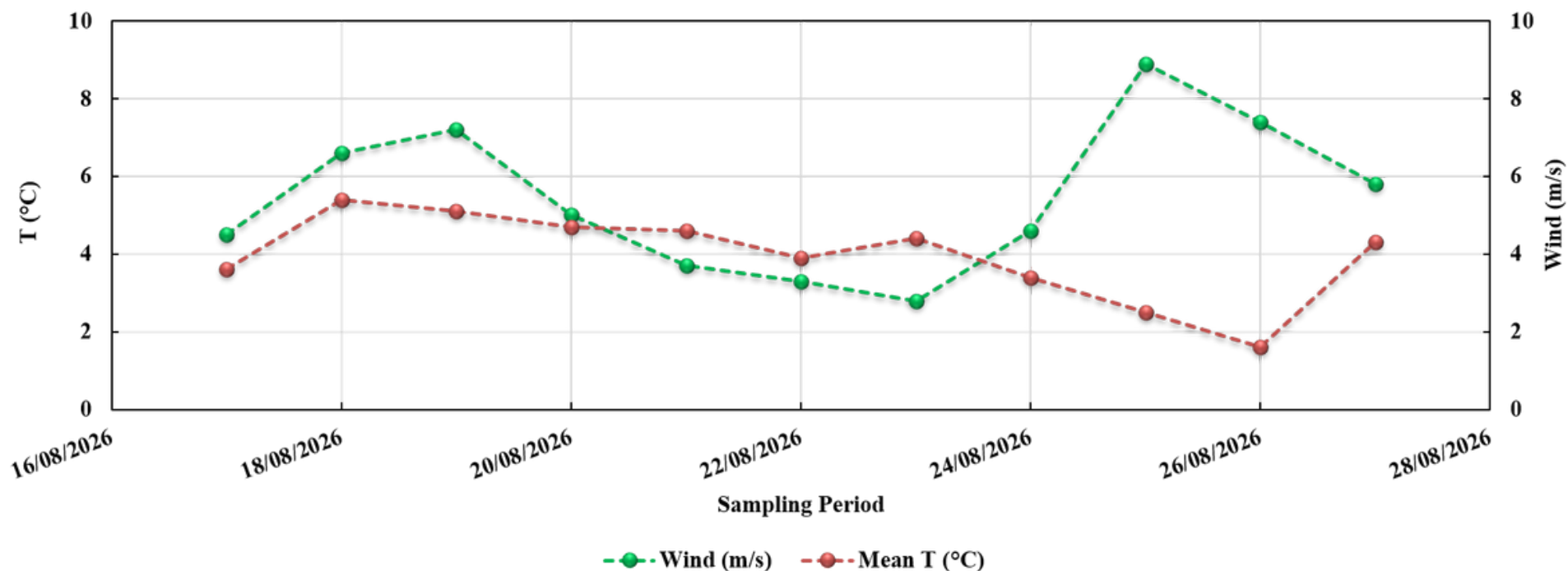
During the first part of the campaign, weather conditions were generally stable, with only rare and brief precipitation events that facilitated moss sampling

A shift towards harsher conditions

From 25–26 August, temperatures gradually decreased while wind speeds increased, marking a transition towards more dynamic late-August Arctic conditions.

Weather was part of the expedition

The changing Arctic weather shaped our daily activities and provided an additional environmental context for the sampling campaign.



Arctic Wildlife

The Arctic landscape was not only our field laboratory, but also a living ecosystem, where we encountered a diverse range of wildlife throughout the expedition.

During this experience, we also had the opportunity to encounter the incredible wildlife of the Arctic. During our fieldwork, we observed a remarkable variety of life, reminding us that even in one of the most extreme environments on Earth.



Arctic Landscape

An extreme environment shaped by ice, wind and life

*In addition to the work project, this experience gave us the opportunity to admire extraordinary landscapes,
which made our journey even more significant.*



POLARIN PARTNERS

