NERC ARCTIC RESEARCH STATION SCIENCE SUMMARIES

ARCTIC STATION

2024 SEASON

Photo: P Samways, BAS

British Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Arctic Office
NATURAL ENVIRONMENT RESEARCH COUNCIL

UKRI Natural Environment Research Council

THE NERC ARCTIC RESEARCH STATION


Photo: BAS

Established in 1991, the UK's Arctic Research Station in Svalbard is funded by the Natural Environment Research Council (NERC) as part of a broad network of research facilities in Ny-Ålesund to support excellent environmental science. It is managed and operated by the British Antarctic Survey.

The Station is available to support United Kingdom-based researchers and international collaborators across a wide range of fields, including ecology, glacial/periglacial geomorphology, atmospheric chemistry, and marine research.

Priority use of the Station is given to researchers funded by United Kingdom Research and Innovation (UKRI). The Station also welcomes those supported directly by universities and research centres or funded from other routes, such as the Leverhulme Trust, the European Union and similar sources. The Station is also a part of the EU Horizon Europe project POLARIN (Polar Research and Infrastructure Network - https://eu-polarin.eu/), providing transnational access.

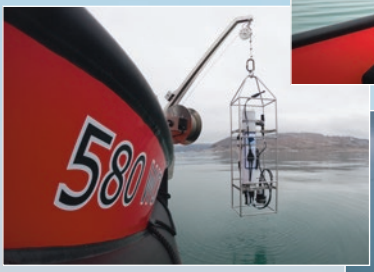
The Station provides an extremely effective and safe platform for Arctic field research. Comprising 440m^2 of laboratory, office, workshop, storage, garage, sitting room and bedroom space. All users of the Station receive comprehensive briefings and appropriate training. Safety support is provided during their stay. There is also access to snowmobiles and a wide range of field support equipment. The Station is extremely well-connected via a fibre optic web link and telephone system. However, to prevent interference with sensitive instruments at a Geodetic Earth Observatory in Ny-Ålesund there is currently no mobile telephone network or Wi-Fi access anywhere in the community. However, as of 2024, there is now 4G mobile coverage.

The Station is normally open to support researchers from early March through to early September, although there is potential to open the Station at other times of the year. Expressions of interest in using the Station are welcome at any time but it is best to apply as early as possible.

For further information about the Station, the application process and who to contact, as well as detail on Ny-Ålesund itself, please visit the NERC Arctic Office website: www.arctic.ac.uk
You can also access as virtual tour of the Station here: https://virtual.arctic.ac.uk/

Science equipment

Use of the Station includes a range of cutting-edge science kit, including ice corers, water samplers and CTD, and a Polarcirkel workboat which is available for use in the nearby Kongsfjorden, extending the reach and range of activities for the next generation of Arctic scientists.
There is also a comprehensive film and editing setup to allow scientists visiting the Station to document their work and prepare material for outreach and other communication purposes. From a comfort perspective, the Station is also well stocked with outdoor clothing to loan to visitors during the colder spring season as well as providing a backup in case of lost luggage. The use of any of this equipment is included in the service the facility provides and incurs no extra cost.



Photos: Iain Rudkin, BAS

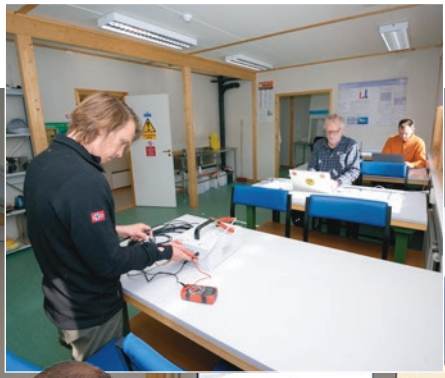
NERC Arctic Station Laboratory

This multipurpose facility comprises the following laboratory spaces:

- Large main laboratory with wide benching and double sink. Suitable for use as laboratory or electronics workshop
- Wet laboratory with ultra-pure water system, sink and benching
- Dry laboratory with benching, balances and microscopes
- As well as associated office space and store of general laboratory consumables

Users are also able to apply to use the Kings Bay Terrestrial Laboratory for any work involving chemicals and will be guided by the Station Manager when applying to access the NERC Station.

Further information about the lab space in the Station is available from the Station pages on the Arctic Office website: www.arctic.ac.uk or by contacting Guy Hillyard, Arctic Labs Manager - ghil@bas.ac.uk



Photos: BAS

THE NY-ÅLESUND INTERNATIONAL RESEARCH COMMUNITY


Photo: Iain Rudkin, BAS

Scientific research in Ny-Ålesund began in 1966. The Norwegian Polar Institute established a research station in 1968. The Cambridge Arctic Shelf Programme operated a busy summer field base from 1972 – 1992 overlapping with the NERC Arctic Research Station, which opened in 1991. There are now 14 research stations operated by 10 nations: Norway, United Kingdom, Germany, France, Japan, Italy, China, Netherlands, Korea and India. There is strong collaboration between the various international partners within the Ny-Ålesund research community.

There are also several other affiliated organisations including the University of Svalbard (UNIS). The Ny-Ålesund Science Managers Committee (NySMAC) includes representatives from each station. The BAS Arctic Operations Manager, Dr Iain Rudkin, is the Vice-Chair of the Committee. NySMAC discuss project details, promote international collaboration, science quality and help ensure protection of the local natural environment. The Committee also organises research seminars held in the countries represented in the community.

AN INTRODUCTION TO SVALBARD


Photo: Iain Rudkin, BAS

The Svalbard archipelago lies between 74°- 81° North and 10°- 35° East. Discovered in 1596 by the Dutch explorer Willem Barentz the archipelago was initially named Spitsbergen ('the land of pointed peaks'). It remained a "No Man's Land" until 1920 when the Spitsbergen Treaty was signed in Paris. Now known as the Svalbard Treaty, it recognised the islands as part of the Kingdom of Norway. There were 14 original signatory nations, including the United Kingdom; today that number has risen to 48.

Svalbard has a land area of 61,000 km^2, 56 per cent of which is currently glaciated. The sun is permanently in the sky from mid-April to late August and lies below the horizon mid-October to late February, showing above the mountains near Ny-Ålesund (79°North), in early March. The west coasts of Svalbard experience the last remnants of the North Atlantic Drift. From mid-June to early September the coastline is largely snow free with areas of alluvial plain and tundra, which support plant life.

The Arctic is experiencing climatic warming three times faster than the rate of the rest of the world. Average temperatures in Svalbard have increased by 4°C in the last 50 years with the local area and its wildlife experiencing rapid changes. Some of these changes include:

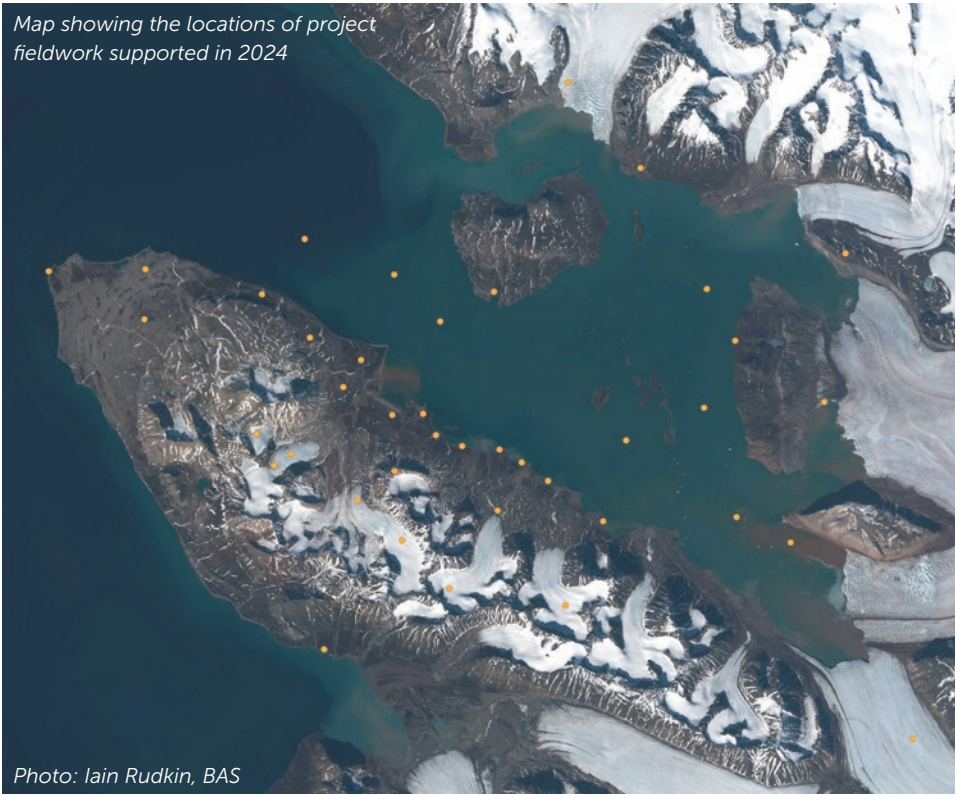
- rapidly shrinking glaciers;
- warming air and seas bringing new bird and fish species, including Mackerel;
- alterations to plant life and growth cycles; and
- increasing marine microplastic pollution.

The Ny-Ålesund area is home to the polar bear, reindeer, arctic fox, ringed, harbour and bearded seals, walrus and whales including beluga, humpback and minke. Blue and fin whales are becoming quite common. Birds make use of the perpetual summer sunlight to nest. They include puffins, Brunnich's guillemots, phalaropes, fulmars, ivory gulls, little auks and ptarmigan. Barnacle geese return in the summer having spent the winter on the shores of the Solway Firth. Terns rear their young before returning to Antarctica in the autumn.

Image: BAS

PROJECT SUMMARIES

The NERC Arctic Research Station has supported over 100 projects in the last 10 years, with up to 40 scientists regularly visiting each year. The location is particularly suitable for ecological research, glacial/periglacial geomorphology, hydrology and atmospheric chemistry and marine research. The Station also provides an excellent training ground for United Kingdom-based students to gain experience of working in a remote polar environment. 2024 was another busy season for the Station, supporting thirteen science projects, one VIP visit and one media team visit.



Map showing the locations of project fieldwork supported in 2024

Photo: Iain Rudkin, BAS

NERC Arctic Station Projects 2024

RiS #	Project PI / Leader	Institute	Project Title	Location	Funding source
12304	Dr James Bradley	Mediterranean Institute of Oceanography, France/ Queen Mary University of London	The atmospheric ecosystem over the High Arctic (ARCTIC-AIR)	Midtre Lovénbreen, Austre Brøggerbreen, Vestre Brøggerbreen	NERC Arctic Station Access Scheme
12404	Dr Liam Kelleher	University of Birmingham	Microplastics in the Arctic region measured on-site by Rama Spectroscopy (MARS)	Vestre Brøggerbreen, Midtre Lovénbreen, Austre Lovénbreen, Austre Brøggerbreen.	NERC Arctic Station Access Scheme
12412	Dr Cath Waller	University of Hull	Plastic in Arctic Nearshore Systems (PLANS)	Brøggerhalvøya and Kongsfjord	NERC Arctic Station Access Scheme
12044	Dr Arwyn Edwards	Aberystwyth University	CRYO365	Austre Brøggerbreen, Vestre Brøggerbreen, Vestre Lovénbreen, Midre Lovénbreen	NERC
6921	Dr Kevin Newsham	British Antarctic Survey	REMUS - Soil Warming Project	Kongsfjordneset	NERC and Universities of Ghent and Edinburgh
12382	Dr Claudia Colesie	Edinburgh University	Plant phenology change as a driver of Arctic greening trends (TundraTime)	Brandal, Daerten, Zeppelin tower, Geopol, Ny-London	NERC
12248	Ligia Coelho	Cornell University, USA	COOLER – Color Catalog of Extremophile Communities in Ice	Midtre Lovénbreen, Austre Brøggerbreen, Blomstrandsbreen	INTERACT
12248	Dr James Bradley	Mediterranean Institute of Oceanography, France/ Queen Mary University of London	Quantifying the role of Fungi in carbon cycling in the cryosphere (QCARBON)	Midtre Lovénbreen outflow stream, Blomstrandbreen, Kvadehuken.	NERC and DFG (German national funding agency)
12395	Prof Kate Hendry	British Antarctic Survey	Silicon Cycling IN Glaciated Environments (SiCLING)	Kongsfjord	NERC
11462	Dr Mihai Cimpoiasu	British Geological Survey	SUNSPEARS	Midtre Lovénbreen	NERC/NSF
12207	Prof Bjorn Tytgat	Ghent University, Belgium	Climate Change impacts on Arctic soil and lake microbiomes (CLIMARCTIC)	Knudsenheia & Kongsfjordneset	Belgian Science Policy Office ExPoSoils
12252	Dr Mark Clilverd	British Antarctic Survey	Antarctic-Arctic Radiation-belt Dynamic Deposition VLF Atmospheric Research Konsortia - AARDDVARK	NERC Station, Ny-Ålesund	BAS National Capability-SS funding
10785	Prof Mike Kosch	Lancaster University	The Mesospheric Ozone System	NERC Station, Ny-Ålesund	BAS research grant (Royal Society Newton International Exchanges

The atmospheric ecosystem over the High Arctic (ARCTIC-AIR)

Research in Svalbard database number: 12304

Date of visit: 23 February – 8 March 2024

Principal investigator: Dr James Bradley, Mediterranean Institute of Oceanography, France/ Queen Mary University of London

Field team: Laura Morales Moncayo, Queen Mary University of London

Email: jbradley.earth@gmail.com

The atmosphere is the Earth's largest potential habitat, yet the least understood. Microscopic organisms (microbes) are transported between land and water through the atmosphere in a process that shapes global biodiversity and influences disease transmission. Yet little is known about the nature and extent of the atmospheric microbiome, including the rates of airborne input, and the structure and function of resident microbial communities. This project aims to assess whether Arctic atmospheric communities are structured and adapted to the atmosphere and investigate the relationship of airborne communities to adjacent marine and cryospheric habitats. This project integrates ecosystem ecology, biogeochemistry, and climate to address two major objectives:

1. Characterize the diversity of High Arctic atmosphere-dwelling and adjacent microbial communities using state-of-the-art molecular techniques.
2. Determine the metabolic capabilities and ecological processes influencing the structure and function of the High-Arctic atmospheric community.

Whilst up in Ny-Ålesund, the ARCTIC-AIR team performed a survey of atmospheric microbial communities to understand the community composition, physiological capabilities, and ecological controls of High-Arctic atmosphere-dwelling microbial communities. They also compared the atmospheric communities to underlying and adjacent cryosphere (snow, ice) communities and sampled atmospheric microbes using a portable air sampler in the vicinity of Ny-Ålesund and from various glacier and tundra locations. They also sampled snow and ice from the adjacent habitats. Filters retrieved from the air sampler were frozen and returned to home laboratories for further analyses. Snow and ice samples were filtered in the laboratory at the NERC Station and have been returned to the home labs for processing. This will yield genomic data that the team will use to tackle their main hypothesis - that atmospheric microbial communities are strongly structured due to selection for metabolic traits and resistance to atmospheric stressors.

If the atmosphere is found to be ecologically structured, it would result in the discovery of the largest biosphere on Earth, and could broaden how (and where) we may search for life on other planets.

Photo: James Bradley, Mediterranean Institute of Oceanography, France/Queen Mary University of London

Microplastics in the Arctic region measured on-site by Rama Spectroscopy (MARS)

Research in Svalbard database number: 12404

Date of visit: 23 February – 11 March 2024

Principal investigator: Dr Liam Kelleher, University of Birmingham

Field team: Alice Phillips, University of Birmingham

Email: l.kelleher@bham.ac.uk

Microplastics (MP) are an emerging concern worldwide, with studies detecting their presence from within human blood to the more remote Arctic environment. Recently Arctic and MP literature call for increased studies and tools to develop knowledge of MP presence and transport mechanisms (Bergmann et al.) Combining this with the 2020 SESS report section 5, the study of MP is noted to be developing but still lacking knowledge. From the following 3-objectives the MARS team aim to build upon their own research developments to increase and contribute to the progress of Arctic research on MP.

The teams' objectives are as follows:

Obj1. collection of snow scoop and atmospheric deposition samples

Obj2. validation of our open-source benchtop Raman spectrometer

Obj3. post visit analysis of rubber and nanoplastics (NP)

To meet the objectives, the team's proposed fieldwork included carrying out snow, ice and airborne sample collection for microplastic analysis. The other part of this was analysing these with a portal Raman spectrometer. However, the spectrometer unfortunately was not working and as a result more time was spent collecting a range of ice core, bulk snow, snow transects, and a variety of airborne samples. The samples collected are now back at the lab at the University of Birmingham and the team are focusing on getting the glacier samples analysed. We expect to complete the lab work shortly.

Highlights from the fieldwork included:

- obtaining the first glacier samples for microplastic analysis in the Arctic (to the team's knowledge). This has mainly been focused on obtaining ice cores from icebergs.
- carrying out very low temperature airborne sample collection with their custom nanotank systems. These had previously only been used in the summer to collect samples at a different station.

From the work the team expect to generate 2-3 papers that will act as pilot and proof of principle data to return for further research in the Arctic region.

Photo: Iain Rudkin, BAS

Plastic in Arctic Nearshore Systems (PLANS)

Research in Svalbard database number: 12412

Date of visit: 26 February – 11 March 2024

Principal investigator: Dr Cath Waller, Hull University

Field team: Charlotte Hopkins, Hull University

Email: C.L.Waller@hull.ac.uk

To date there are no published studies in the Arctic looking at microplastics contamination across environmental and biological components of local foodwebs, from samples taken at the same locations and times. There is very limited data on microplastics levels in Arctic marine species or more importantly its effects on biologically important functions of these species (e.g. ingestion and excretion of microplastics). Nor are there any studies looking at microplastic deposition in snow during the winter months, which may represent a major vector for introducing microplastic pollution from elsewhere. New data are needed to map spatial and temporal patterns of microplastics and overlap with marine biota to predict where contamination is likely to occur.

Given its extreme northern location and environmental importance for both endangered megafauna and the broader marine ecosystem, Svalbard is a critical location for understanding the impacts of microplastic pollution in the Arctic. Samples from Svalbard would provide a further spatial location in our extensive dataset, strengthening our understanding of microplastic distribution across the Arctic.

The aims of this project are to evaluate macro- and microplastic levels in a range of environments and if possible taxa. The current lack of fundamental knowledge about plastics in the Svalbard archipelago means important questions about the threats it poses to both endangered megafauna and the broader marine and terrestrial ecosystems cannot be assessed. Therefore, understanding and quantifying plastic contamination in Svalbard is critically important.

The aim of this project is to gain a baseline quantification of macro- and microplastics in the areas around Ny Ålesund across a range of environments (water, snow, ice, air and sediments) and to ascertain whether ecologically important biological components of the ecosystem are under threat from microplastics. We also aim to understand the perceptions of plastic pollution and engage with stakeholders. This fieldwork enabled a proof-of-concept information gathering opportunity which will help the team to develop a citizen science project monitoring and reporting plastics around the archipelago (in collaboration with cruise ship operators and other stakeholders in Svalbard).

The team had a successful visit and were able to collect all samples required for the microplastic analysis. All the samples have been processed and the team are currently working through the FTIR identification of these.

Photo: Iain Rudkin, BAS

CRYO365

Research in Svalbard database number: 12044

Date of visit: 8 March – 18 March 2024, 13 June – 24 June 2024 and 1 August – 8 August 2024

Principal investigator: Dr Arwyn Edwards, Aberystwyth University

Field team: Karen Cameron, Glasgow University, Andy Mitchell, Aberystwyth University

Email: aye@aber.ac.uk

Glaciers host microbial ecosystems which exhibit surprising levels of biodiversity and activity despite the seemingly austere conditions for life on ice. In the light of the rapid climate change affecting the High Arctic there is an urgent need to understand the spatial and temporal constraints on these ecosystems, as well as their metabolic processes. The projects key goals relate to the stated aims and objectives of NERC Standard Grant NE/V012991/1 and help the delivery of the project by accessing a diverse range of glacier surfaces to collect samples of microbiota associated with debris on bare ice surfaces. This will enable a comparative approach to be taken for constraining the spatial and temporal variability in supraglacial microbiota and cognate metabolic processes.

The CRYO365 project's overall hypothesis is that glacier surfaces host light-independent microbial metabolic activities, thus allowing microbial activities in unexpected conditions with neglected contributions to nutrient cycles and greenhouse gas production. The team are using the High Arctic glaciers of Svalbard in every season to compare their microbial communities in the depths of polar night, the cold of the winter, the spring thaw and the height of summer. At each glacier the team have collected samples for molecular analyses and measure microbial activities.

Photo: Iain Rudkin, BAS

Following field campaigns hosted by UNIS in Longyearbyen in 2022 and 2023, the team successfully conducted sampling in summer 2023 with the assistance of the NERC Station and the Norwegian Polar Institute. During 2024, three campaigns were mounted, in March, June, and August. These collected ice surface samples, cryoconite and debris material from a range of glaciers around Kongsfjorden. The team are currently working on molecular analyses of DNA and RNA from these samples and conducting experimental incubations in cold laboratory facilities at Aberystwyth University. While the CRYO365 project is focused on the changing microbial ecology of glacier surfaces in different seasons, a new NERC Arctic Office supported project by the team, in cooperation with a team of Japanese researchers is exploring the transitions between seasons, with fieldwork conducted at the National Institute of Polar Research (NIPR) facility in Ny-Ålesund in September 2024 with the assistance of the NERC Arctic Research Station team, and planned for February 2025 for deployment from the NERC Arctic Research Station.

REMUS: Responses of Microbes in Upper Soil Horizons to Environmental Manipulations

Research in Svalbard database number: 6921

Date of visit: 27 June – 11 July 2024 and 22 August – 11 September 2024

Principal investigator: Dr Kevin Newsham, British Antarctic Survey

Email: kne@bas.ac.uk

The REMUS experiment, which measured the effects of warming and irrigation on High Arctic plants, lichens and soil microbes, was set up in September 2014 at Kongsfjordneset on Brøggerhalvøya, Svalbard. 48 plots were established in three blocks over frost boils colonised by soil crusts and the vascular plant species *Salix polaris, Bistorta vivipara and Saxifraga oppositifolia*. Warming was applied using hexagonal ITEX chambers of 1.2 m basal diameter, which elevated annual mean and summertime soil temperatures by 0.6 °C and 1 °C, respectively, and the frost boils were irrigated twice each summer with deionised water. Warming and irrigation were applied in factorial combination to the boils, resulting in four treatment groups. Loggers buried in soil recorded temperatures every hour.

Photo: Iain Rudkin, BAS

After four years of treatment, warming increased the flux of carbon dioxide emitted from soil by microbes by 44%, but also increased the consumption of methane by soil methanotrophic bacteria by 78%. Higher cover of *S. polaris* was apparent in warmed plots after several years of treatment, with warming also leading to increased numbers and biomass of *B. vivipara* individuals. In a collaboration with the Universities of Ghent, Bangor and Edinburgh, *B. vivipara* plants were sampled in September 2024 in order to determine whether microbes forming symbioses with roots are responsible for the improved growth of the plant species. Staff at Edinburgh University have also shown warming to cause bleaching and physiological deterioration of the lichen *Cetrariella delisei*, and those at the University of Ghent and the Swiss Federal Research Institute are currently investigating the relationships between greenhouse gas fluxes and the abundance and gene expression of soil microbes.

Congruent with long-term measurements elsewhere on Brøggerhalvøya, mean soil temperature in unchambered plots in the REMUS experiment rose by ~1 °C between 2014 and 2024. Given this rapid increase in temperature, substantial changes to High Arctic soils, including altered greenhouse gas fluxes, plant biomass, lichen physiology and microbial activity, can be anticipated in the natural environment by the mid 2030s.

From 2025, the REMUS experiment will be managed by Dr Emanuele Pallozzi at the Research Institute on Terrestrial Ecosystems of the Italian National Research Council.

Plant phenology change as a driver of Arctic greening trends (TundraTime)

Research in Svalbard database number: 12382

Date of visit: 27 June – 11 July and 22 August – 12 September 2024

Principal investigator: Dr Claudia Colesie, Edinburgh University

Field team: Lisa Pilkinton, Karsten Knerr, Mariana Garcia Criado and Rowan Paterson

Email: claudia.colesie@ed.ac.uk

The NERC-funded TundraTime project addresses climate change impacts in tundra ecosystems including how warming is shifting tundra plant phenology – the timing of life events such as bud burst or flowering – and productivity – the increase in plant growth and biomass over time. The team will answer the fundamental research question of whether climate warming is leading to longer tundra growing seasons and thus increasing plant productivity in the Arctic, with important implications for carbon cycling and wildlife. This project relies on various fieldwork around Ny-Ålesund supported by the NERC Arctic Station.

One big task was a detailed survey of the local flora including lichens and mosses. For this part of the project, the team travelled to various sites on foot and by boat and counted species occurrences. The data will be compared with previous visits from ten years ago and allow the team to detect if the highly specialised local plant communities are changing their distribution patterns.

Another part of the project involved the measurement of the photosynthetic activity of the local lichen and moss communities. This is an important measure to understand how productive this tundra ecosystem is, with direct consequences for the local food webs. To complete this research, we have installed a monitoring system, outside the station, which measures activity on an hourly basis. This will generate a unique dataset, allowing us for the first time to understand tundra ecosystem functionality even under snow.

Photos: Claudia Colesie, Edinburgh University

Finally, in this project, the team are also investigating the relationship between fungi and plants in the tundra. This is important because these organisms facilitate each other, increasing biodiversity and productivity. For this work, the team have revisited fertilised plots near Ny-Ålesund to study vegetation change and they have applied new fertiliser in 2024. Next year the team will come back to see what effect this fertilisation has caused.

Colour Catalog of Extremophile Communities in Ice (COOLER)

Research in Svalbard database number: 12248

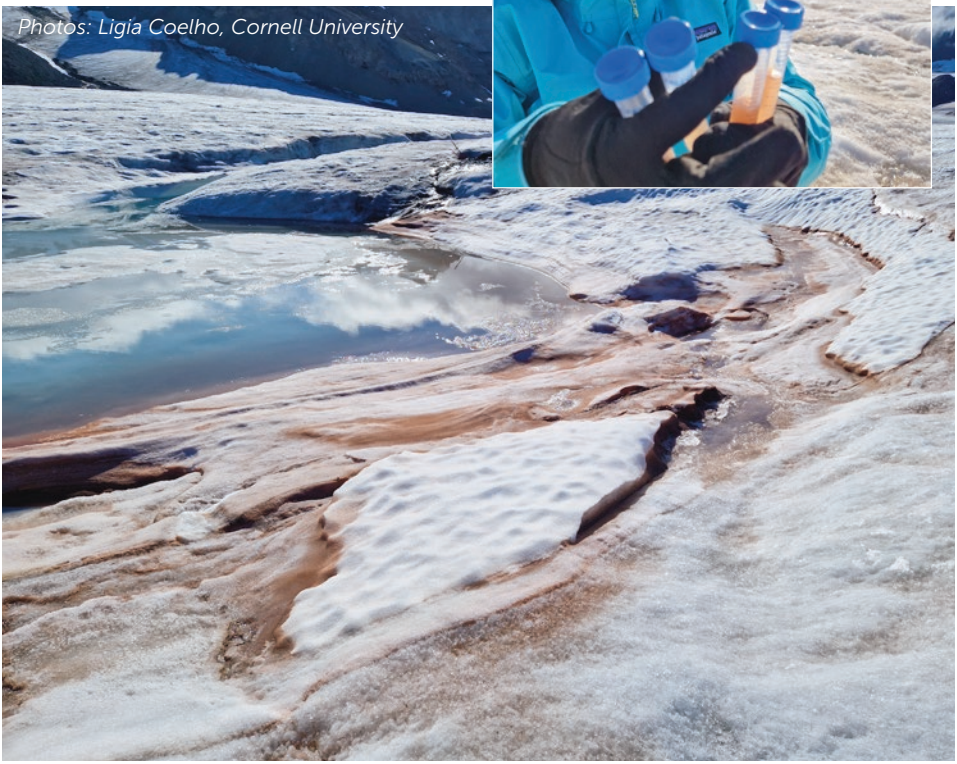
Date of visit: 11–25 July 2024

Principal investigators: Ligia Coelho, Cornell University, USA

Field team: James Bradley, Queen Mary University of London/ Mediterranean Institute of Oceanography, France

Email: lc992@cornell.edu

The COOLER project focuses on understanding the critical role of biopigments in polar ecosystems, which are vital for life on Earth and potentially beyond. These pigments help organisms survive environmental stressors and influence ice surfaces and surrounding ecosystems. Pigmented microorganisms are involved in phenomena like algae blooms and "watermelon snow," and serve as biomarkers for climate-induced changes. Additionally, biopigments are used to monitor environmental health, detecting pollution and ice melt. The project aims to create a catalog of *in situ* biopigment measurements, which can support both Earth-based environmental studies and extraterrestrial life exploration by space agencies like ESA and NASA.



Photos: Ligia Coelho, Cornell University

Quantifying the role of fungi in carbon cycling in the cryosphere (QCARBON)

Research in Svalbard database number: 12248

Date of visit: 11 July – 5 August 2024

Principal investigator:
Dr James Bradley, Queen Mary University of London/ Mediterranean Institute of Oceanography, France

Field team: Laura Molares Moncayo, Scott Ledford, Juan Carlos Trejos and William Orsi

Email: jbradley.earth@gmail.com

The overarching aim is to quantify the role of Fungi in the marine carbon cycle, in a rapidly changing Arctic environment. During the QCARBON project in summer 2023, the team successfully sampled beach sediments, shallow marine sediments, and fjord water, and set up DNA-SIP incubations to measure organic carbon and nitrogen assimilation processes, and remineralization rates, among fungi that are delivered from glaciers to the fjord. Preliminary data from the team's work shows evidence for heterotrophic production via continuous measurements of oxygen in incubation vials, and they also saw enrichment of 13C in the CO_2 of the incubations, indicating processing of labelled substrates. During their fieldwork in 2024, the team enhanced their preliminary study by re-sampling from previously visited sites, and setting up parallel incubations with 13C labelled amino acids and 13C labelled cellulose to understand the relative bioavailability of carbon produced by bacterial turnover (i.e. necromass) versus plant-derived sources to fungi, and assess assimilation rates and efficiency of the different carbon sources. The team also took the opportunity to carry out sampling of bioaerosols using their portable air sampler, to serve as a summer comparison to data collected as part of the ARCTIC-AIR project in February 2024.

Photos: Iain Rudkin, BAS

Silicon Cycling IN Glaciated Environments (SiCLING)

Research in Svalbard database number: 12395

Date of visit: 15 July – 29 July 2024

Principal investigator: Prof Kate Hendry, British Antarctic Survey

Field team: Nathan Callaghan and Kathryn Howe

Email: kathen@bas.ac.uk

Glaciers – vast rivers of ice that flow from ice caps and ice sheets – were once thought to be inert environments, too cold for biology or for chemical reactions to occur. It's only in the last two decades that we've discovered that glacial environments are home to a diverse range of micro-organisms and are "hot spots for biogeochemical weathering", chemical processes that release biologically important elements. As glaciers flow, they crush the underlying rock into very fine "flour", and the unusual chemistry of waters underneath ice sheets and glaciers allows new, solid material to form. These very fine particles are highly reactive and can release elements and compounds into the environment. Glacial flour is an important source of precious nutrients for coastal marine environments and has attracted interest as a potential fertiliser for crops, but also has the potential to harbour toxic metals. However, we're only just beginning to disentangle the complexity of glacial biogeochemistry.

Photo: Paul Samways, BAS

In the project, Silicon Cycling in Glaciated Environments (SiCLING, joint between BAS and the University of Cambridge), the team are beginning to peel away some of the complexity linked to one key nutrient: silicon. Silicon is needed in small quantities by every living thing, including us, but is needed in larger amounts by creatures that silicify (i.e., make their skeletons from glassy silica). This includes plants, which form small blebs of silica in their leaves called phytoliths, and an important type of algae called diatoms, which make their cell walls out of silica. Glacial flour contains a lot of reactive detritus that dissolves to release biologically available silicon. SiCLING is investigating glacial flour and fjord sediments to understand how silicon is released, how it interacts with other important elements – such as iron – and organic matter, and how these processes might change in the future with global warming and accelerated ice melting.

The first step is to collect water, flour and sediment samples from polar environments. We started out in Ny-Ålesund, in the land of the polar bear in northern Svalbard, sampling in Kongsfjorden near the UK Arctic Research Station. The team had a successful field season in Ny-Ålesund collecting river and fjord waters and marine sediments for geochemical analyses, to investigate the interaction between silicon and other nutrients and trace metals in glaciated environments. The samples will be shipped back for analysis to the UK and USA, with project partners from the Dauphin Island Sea Laboratory. Together with all the data that is generated, the team will be using new modelling methods to calculate how much silicon is being released by glaciers in Svalbard.

SUNSPEARS

Research in Svalbard database number: 11462

Date of visit: 5 August – 22 August 2024

Principal investigator: Dr Mihai Cimpoiasu, British Geological Survey

Field team: Harry Harrison, Rachel Rubin, Trevor Irons, Steve Schmidt and Adam Solon

Email:mcim@bgs.ac.uk

The Arctic has experienced a massive reduction in glacier cover over the recent decades. This however, allowed new terrestrial habitats to develop, which are becoming more and more important for the world's carbon budget. Our understanding of year-round variability experienced by Arctic soils and its effect on geophysical and biogeochemical processes are impaired because of a lack of year-round data. The SUNSPEARS project, which stands for "Sensors under snow – Seasonal processes in the evolution of Arctic soils", has the ambition to capture this year-round variability by installing a series of sensors on the forefield of Midtre Lovénbreen glacier, a few miles South-East of Ny-Ålesund. The sensor measurements will be complimented by a microbiological analysis of soil samples from across the forefield, which will tell us a bit more about the existent microbial species and their activity.

The objectives for SUNSPEARS include sampling and analyses for biological and chemical characteristics of the soil at various times of year and establishing continuous monitoring of the physical properties of the soils via geophysical instrumentation. Maintenance of sensors, data collection, and sampling is still ongoing, and the project is expected to be completed in 2025.

The team have also published a paper on Midtre Lovénbreen forefield characterization and a review paper on how state of the art soil biogeochemical models capture seasonal dynamic in Arctic soils:

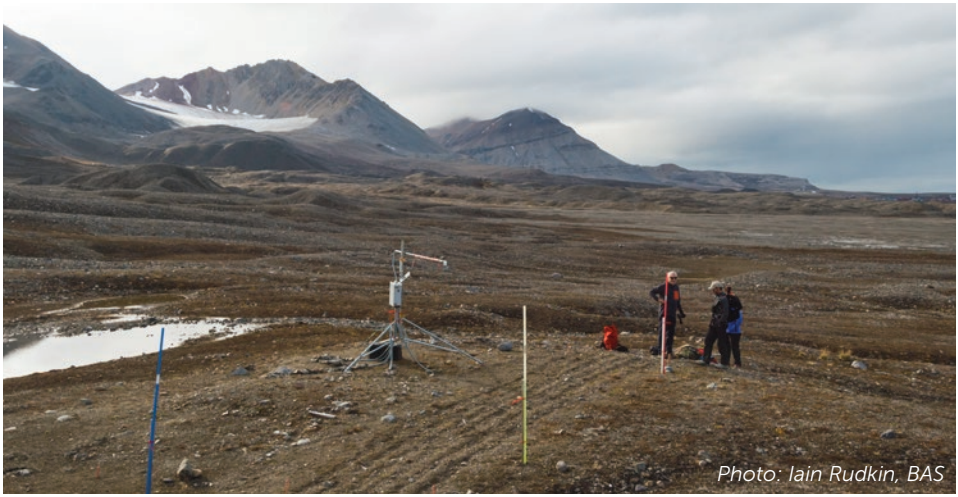


Photo: Iain Rudkin, BAS

Climate change Impacts on Arctic soil and lake microbiomes (CLIMARCTIC)

Research in Svalbard database number: 12207

Date of visit: 22 August – 12 September 2024

Principal investigator: Prof. Dr. Elie Verleyen, Ghent University

Field team: Bjorn Tytgat, Xingguo Han and Ruben Van Daele

Email: Bjorn.tytgat@ugent.be

The ExPoSoils project (Climate change experiments in Arctic and Antarctic polar desert soils) aims to follow up and compare the effects of climate change experiments initiated six to ten years ago. Snowfences were installed in Knudsenheia (Ny-Ålesund) and the Sør Rondane Mountains (SRM, East Antarctica) during, respectively, the CLIMARCTIC and MICROBIAN projects (PI Elie Verleyen and Wim Vyverman, UGent). Snowfences affect water availability, photosynthetic period and soil temperature. Open Top Chambers (OTCs) were installed in Kongsfjordneset (Ny-Ålesund) by Dr. Kevin Newsham (project REMUS) and the SRM (project MICROBIAN) to artificially warm soil.

During the 2024 field campaign, soil samples were collected in the snowfence and OTC plots at different depths. Using both amplicon sequencing as well as a metatranscriptomics approach, the team will look at the responses of the microbial communities (bacteria, protists, fungi) in both composition and functioning to these climate change experiments. Gas measurements were performed by Dr. Xingguo Han (WSL, Switzerland) to track greenhouse gas (CH_4, CO_2 and N_2O) emissions, which will be linked to the sequencing data. Lastly, data from our time-lapse cameras installed in July 2023 were collected. These data provide us insights in the intra annual dynamics in snow cover and differences between control and snowfence plots.

Samples from identical experiments were taken in the Antarctic and will allow us to investigate differences and similarities in responses between both polar regions.

Photos: Bjorn Tytgat, UGent

Antarctic-Arctic Radiation-belt Dynamic Deposition VLF Atmospheric Research Konsortia - AARDDVARK

Research in Svalbard database number: 12252

Date of visit: 2005–2030

Principal investigator:
Dr Mark Clilverd, British Antarctic Survey

Field team: Neil Cobbett,
British Antarctic Survey

Email: macl@bas.ac.uk

The Antarctic-Arctic Radiation-belt (Dynamic) Deposition - VLF Atmospheric Research Konsortium (AARDDVARK) provides continuous long-range observations of the lower-ionosphere. The Konsortia sensors detect changes in ionisation levels from ~30-85 km altitude, with the goal of increasing the understanding of energy coupling between the Earth's atmosphere, Sun, and Space. The team use the upper atmosphere as a gigantic energetic particle detector to observe and understand changing energy flows; this Science area impacts our knowledge of global change, communications, and navigation. The joint NZ-UK Antarctic-Arctic Radiation-belt (Dynamic) Deposition - VLF Atmospheric Research Konsortia (AARDDVARK) is a new extension of a well-establish experimental technique, allowing long-range probing of ionisation changes at comparatively low altitudes.

This long-term project started in 2005 and currently set to run until 2030. It is one of two remotely run projects supported by the Station. In June 2024, Mark Clilverd and Neil Cobbett from BAS were supported by the Station to replace the VLF Space weather instrument. Further information is available here: https://space.physics.otago.ac.nz/aarddvark/

Photo: Iain Rudkin, BAS

Mesopheric ozone radiometer (MOSAIC)

Research in Svalbard database number: 12252

Date of visit: 2017–2028

Principal investigators: Prof Michael Kosch, Lancaster University and Dr Mark Clilverd, British Antarctic Survey

Email: macl@bas.ac.uk

The Mesopheric Ozone Spectral Analysis Instrument Chain (MOSAIC) is a chain of spectrometers running from pole to pole at about the longitude of Europe/Africa. The chain is a collaboration between the Massachusetts Institute of Technology, Lancaster University, the South African National Space Agency, and the British Antarctic Survey. The instrument is a passive, low-cost spectrometer for detecting ozone at altitudes of ~100 km (about the same height as the aurora). The instrument uses a satellite TV dish and a low noise block converter (LNB) to monitor the line radiation at 11.072 GHz generated by ozone in the mesosphere.

This experiment will map the concentration of high-altitude ozone from pole to pole, and identify the changes caused by space weather. Ultimately, it will lead to greater understanding of the role of space weather within the Earth's climate system, and in our ability to forecast seasonal weather patterns more reliably in the future.

ARCTIC STATION

MEET THE NERC ARCTIC STATION TEAM FOR 2024

Iain Rudkin

Iain began working for BAS in 2009 overwintering as a Field Guide at Rothera three times and taking part in numerous summer projects from the polar plateau north to the sub-Antarctic islands. After a period guiding in the tourism sector, Iain returned to BAS in 2021 as the Deputy Arctic Station Manager. In 2023 he became the Arctic Operations Manager, and a large part of his remit is overseeing the running of the station in Ny-Ålesund.

Paul Samways

Paul joined BAS in 2012 as Boating Officer based at Rothera Research Station. He completed 2 wintering contracts in this role before becoming Winter Station Leader, also at Rothera.

Paul left BAS in 2018 to become a helicopter pilot, then joined his local ambulance service during the pandemic, then retrained as an electrician for the renewables energy sector.

In that time Paul has completed several short contracts for BAS including Rothera Station Leader, Traverse Leader and Arctic Station Leader in Ny-Ålesund.

He resides in the south of England with his wife, dog and 2 cats.

MEDIA VISIT

In late August, members of the BAS Comms Team, along with Henry Burgess (NERC Arctic Office) and Dorothea Moser (BAS), accompanied a small team of journalists from ITV News, The Times and Carbon Brief to the NERC Arctic Research Station. The trip was very successful and gave the journalists the opportunity to visit land- and marine-terminating glaciers, see some science in action and to meet several UK and international teams working from Ny-Ålesund. ITV did three live broadcasts from the Station and Carbon Brief held a live webinar with Dorothea Moser and Henry Burgess, engaging hundreds of participants. The links to the programmes and webinar are as follows:

ITV News: https://www.itv.com/news/2024-09-16/summer-in-svalbard-ice-scientists-fighting-against-warmest-season-on-record

Carbon Brief webinar: https://www.carbonbrief.org/webinar-carbon-brief-joins-scientists-live-at-the-uks-arctic-research-station/

Fran Pothecary

Fran started work with BAS in 2013 as a Base General Assistant at Rothera. Truly bitten by the Antarctic bug she continued to work south as a Field Guide at Rothera, overwintering in 2015, then took up contracts as Station Leader at KEP and Signy. By further combining work as a guide in the cruise ship tourism industry, she gained experience working in the Arctic particularly Svalbard and the combination of skills and knowledge gained here, put her a good position to action as relief Station Leader at Ny-Ålesund during 2024, a position she hopes to reprise in future years.

Guy Hillyard

Guy has worked for BAS since 2005 starting in the biology labs at Cambridge HQ moving to a lab management role as Biology lab manager in 2015 with oversite of the Arctic Station.

He has been working from the Arctic Station in a science/Station support role most seasons since 2008.

Henry Burgess

Henry is the Head of the United Kingdom's Natural Environment Research Council Arctic Office. The Office is hosted by the British Antarctic Survey in Cambridge. It supports researchers based in the UK in the High North; provides advice to policy makers; and develops international scientific cooperation across all aspects of Arctic research. The Office also helps deliver the operation and planning for the NERC Arctic Station in Svalbard. Henry is also the President of the International Arctic Science Committee (IASC) from 2022-26.

Nicola Munro

Nicola is the NERC Arctic Office Manager and is based at BAS in Cambridge. Her remit includes management of Arctic research projects and programmes such as the Canada – Inuit Nunangat – United Kingdom Arctic Research Programme and manages BAS's involvement as a partner in the EU funded Polar Research and Infrastructure Network (POLARIN) transnational access project. She also provides support to users of the Station, working closely with the Arctic Station Manager.

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British Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

UKRI Natural Environment Research Council