NERC ARCTIC STATION SO YEARS RESEARCH STATION SCIENCE SUMMARIES

2022 SEASON





British Antarctic Survey





Natural Environment Research Council

THE NERC ARCTIC RESEARCH STATION



Established in 1991, the United Kingdom's Arctic Research Station in Svalbard is funded by the Natural Environment Research Council (NERC) as part of a broad network of research facilities 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 provides an extremely effective and safe platform for Arctic field research. Comprising 440m² 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. The Station's Polarcirkel workboat provides access to field locations throughout the fjord coastline. 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 WiFi access anywhere in the community.

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.

New science equipment

In recent years, the Station has been the fortunate recipient of additional funding provided by NERC to better equip the station, both for scientific purposes and to improve the safety and comfort of fieldwork. A suite of new marine equipment including a CTD array, an EcoSub, submersible ROV, and plankton nets can be deployed directly from the Station's new Polarcirkel boat. There is also a comprehensive film and editing setup to allow scientists to document their work and prepare material for outreach and other communication purposes. From a comfort perspective, the Station is also

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: <u>www.ar</u>ctic.ac.uk

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 Station provides and incurs no extra cost.

NERC Arctic Station Laboratory

During the early part of the 2019 season, the Station laboratory underwent a major upgrade. This multipurpose facility comprises four separate laboratory spaces:

- Large main laboratory with wide benching and double sink. Suitable for use as laboratory or electronics workshop
- Annex chemical laboratory with recirculating fume hood, Class II biological safety cabinet and oven
- 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





- Spark free laboratory fridges and chest freezers
- Balances (2 d.p. and 4 d.p.)
- Vacuum pumps
- Oven and vacuum concentrator
- Microscopes (multiple light field, including blue light)
- BioSpectrometer (200-830nm; with µCuvette)
- pH meter
- Centrifuges, heat block mixer and vortex (for 1.5ml, 15ml & 50ml tubes)
- Autoclave, steriliser, and microwave
- Web ports available in the laboratory

Further information is available from the Station pages on the Arctic Office website:









THE NY-ÅLESUND INTERNATIONAL RESEARCH COMMUNITY

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 a number of other affiliated organisations including the University of Svalbard (UNIS). The Ny-Ålesund Science Managers Committee (NySMAC) includes representatives from each station. The NERC Station Manager, Dr Iain Rudkin, is the Vice-Chair of the Committee. They 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: G. Evatt University of Manchester

- rapidly shrinking glaciers the north side of the local glacier Kronebreen has retreated by 2.6km since the Station was established;
 - 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.

74°- 81° North and 10°- 35° East. Discovered in 1596 by the Dutch explorer Willhem 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 46.

The Svalbard archipelago lies between

Svalbard has a land area of 61,000 km², 60 per cent of which is 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 temperatues in Svalbard have increased by at least 4°C in the last 50 years with the local area and its wildlife experiencing rapid changes. Some of these changes include:

STATION 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 has proudly supported the annual education and outreach initiative Arctic Live, connecting researchers at the Station to thousands of students across the globe. The Station also provides an excellent training ground for United Kingdom-based students to gain experience of working in a remote polar environment.

Due to COVID-19, the Station was closed during the years 2020 and 2021, however, it was able to open again in February 2022 and the Station has been pleased to welcome a range of projects and their national and international teams.

NERC Arctic Research Station Projects 2022							
RiS #	Project Pl / Leader	Institute	Email Address	Project Title	Dates	Location	Funding source
11462	Dr James Bradley	Queen Mary University of London	jbradley.earth@ gmail.com	SUNSPEARS	February – March 2022 May 2022 September 2022	Midtre Lovénbreen Forefield	Leverhulme Trust
11185	Jamie Buchanan- Dunlop	Encounter EDU	j <u>amie@</u> encounteredu. com	Arctic Live 2022	April 2022	Ny-Ålesund, Kongsfjord	XL Group plc
11966	Dr Nicolas Cassar	Duke University, USA	<u>Nicolas.</u> <u>Cassar@duke.</u> <u>edu</u>	N2Fix	July 2022	Blomstrandhalvøya	H2020 EU Funded – INTERACT III - Transnational Access Programme
6921	Dr Kevin Newsham	British Antarctic Survey	<u>kne@bas.ac.uk</u>	REMUS - Soil Warming Project	July 2022	Kongsfjordneset	British Antarctic Survey core funds and British Ecological Society
11885	Dr James Bradley	Queen Mary University of London	j <u>bradley.earth@</u> gmail.com	IMPACT	September – October 2022	Bayelva Area	Arctic Access Scheme 2022
10785	Professor Michael Kosch	University of Lancaster	<u>m.kosch@</u> <u>lancaster.ac.uk</u>	MOSAIC – Mesopheric Ozone Spectral Analysis Instrument Chain	Ongoing project: 2017–2028	Ny-Ålesund	BAS research grant (Royal Soc Newton International Exchanges project
	Dr Mark Clilverd	British Antarctic Survey	<u>macl@bas.</u> ac.uk				

SUNSPEARS

Research in Svalbard database number: 11462

Date of visit: 25 February to 11 March, 2 to 12 May and 23 September to 7 October 2022

Principal investigator: Dr James Bradley, Queen Mary University of London

Field team: Zhou Lyu, Queen Mary University of London, Steve Schmidt, University of Colorado Boulder, Pacifica Summers, University of Colorado Boulder, Mihai Cimpoiasu, British Geological Survey, Harry Harrison, British Geological Society, Trevor Irons, Montana Tech, Carlos Oroza, University of Utah, Dane Liljestrand, University of Utah

Email: jbradley.earth@gmail.com

The main objective of this permafrost project is to understand how seasonal processes contribute to the longer-term development of Arctic soils. The objectives 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 fieldwork is expected to be completed in summer 2023.



AXA XL Arctic Live 2022

Research in Svalbard database number: 11185

Date of visit: 21 April to 5 May 2022 Principal investigator: Jamie Buchanan-Dunlop, Encounter Edu Field team: Ellie Mackay, Encounter Edu Email: jamie@encounteredu.com

Arctic Live 2022 builds on the Arctic Live events that took place from the NERC Arctic Research Station in Ny-Ålesund from 2014-19 and the virtual iterations in 2020/21 during lockdown. It is the most northerly education programme delivering polar education for schools following research conducted from the NERC Arctic Research Station. The objectives of Arctic Live 2022 were to:

- develop students' knowledge about the Arctic and Arctic science
- enhance students' science skills through joint online investigations
- inspire students to consider STEM careers
- engender environmental empathy and awareness

Arctic Live 2022 delivered 19 live broadcasts which were accessible to all schools around the world, using the Encounter Edu platform. In total, 865 schools participated from 25 countries reaching 52.3K students. Further information is available at <u>https://encounteredu.com/live-lessons/</u> courses/axa-arctic-live-2022.



Response of Nitrogen Fixation in Lichens and Mosses to a Rapidly Changing Arctic Environment (N2Fix)

Research in Svalbard database number: 11966 Date of visit: 4 to 11 July Principal investigator: Nicolas Cassar, Duke University Field team: Perrin Hagge, Duke University Email:Nicolas.Cassar@duke.edu

Funded through the EU INTERACT Transnational Access Scheme, the N2 Fix project aims to address the response of nitrogen fixation in lichens and mosses (cryptogams) to a rapidly changing Arctic environment. This field season, the team had two main objectives: collect the diversity, including replicates, of cryptogams found in the Arctic tundra regions and to opportunistically collect glacial ice samples. During their visit to the



Station, the team were able to successfully collect a variety of lichen and moss samples which will now be tested in the lab at Duke University in a series of experiments to determine the drivers of terrestrial biological nitrogen fixation. The team hope to revisit the Station in 2023.



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

Research in Svalbard database number: 6921 Date of visit: 4 to 18 July Principal investigator: Dr Kevin Newsham, British Antarctic Survey (BAS) Field team: Claudia Colesie, University of Edinburgh and Guy Hillyard, BAS

Email: kne@bas.ac.uk

In September 2014, REMUS, a long-term soil warming experiment, was set up at Kongsfjordneset on the Brøggerhalvøya Peninsula. Forty-eight plots in three blocks were established over frost boils. The boils were colonised by *Salix polaris, Bistorta vivipara* and *Saxifraga oppositifolia*, and by microbial soil crusts. Twenty-four ITEX chambers (1.2 m basal diameter, 0.75 m aperture diameter, 400 mm height, each held down with ropes) were deployed over frost boils to increase mean annual soil surface temperatures by c. 1 degrees Celsius.

The REMUS team visit the site every year. In 2022, the main objectives of the fieldwork were to carry out any necessary repairs to the open top chambers (OTCs) in the soil warming experiment at Kongsfjordneset and to water 24 plots. In addition, the team conducted gas exchange analyses on biological soil crusts (BSCs) at the experiment and sample BSCs for laboratory analyses in Harland-Cox Huset.



IMPACT: Impact of permafrost thaw on ecosystem functioning and biogeochemical fluxes

Research in Svalbard database number: 11885

Date of visit: 29 September to 7 October 2022

Principal investigator: Dr James Bradley, Queen Mary University of London Field team: Margaret Cramm, Queen Mary University of London, Carlo Cardellini, University of Perugia, Francesco Montemagno, University of Naples Federico II Email: jbradley.earth@gmail.com

The Arctic is warming at three times the global average, and while warming trends in the next decade are well understood, their impact on terrestrial and marine biogeochemical cycling is less clear. Summer melting events release previously sequestered organic carbon and nutrients, which can be directly respired by the soil microbial community in situ or exported through meltwaters to the marine ecosystem.

The relative contribution of these processes can significantly impact the total amount of carbon dioxide and other greenhouse gases (such as microbially produced methane) released to the atmosphere.

The main objective of this project was to study the impact of permafrost thaw on ecosystem functioning and biogeochemical fluxes, focusing on terrestrial sites around Ny-Ålesund (various sites near Bayelva and Midtre Lovenbreen). The team were able to complete the fieldwork during their visit which included biological and chemical sampling, in situ soil C flux chamber measurements. This data will be combined with data from previous monitoring of these sites during February 2022 and June 2022, as well as geophysical data from the Bayelva permafrost observatory. This project is part of an ongoing collaboration between Dr James Bradley, Prof. Donato Giovanelli at University of Naples "Federico II" (Italy), Prof. Karen Lloyd at the University of Tennessee Knoxville (USA), and Prof. Julia Boike of the Alfred Wegener Institute (Germany).





MOSAIC – Mesopheric Ozone Spectral Analysis Instrument Chain

Research in Svalbard database number: 10785

Date of visit: Ongoing project -2017 to 2028

Principal investigators:

Prof Michael Kosch, Lancaster University and Dr Mark Clilverd, BAS

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.

30TH ANNIVERSARY CELEBRATIONS



ARCTIC 2021-2022 saw two **STATION** important milestones for the Station: 30 years since the establishment of the Station in Ny-Ålesund in 1991, and 50 years of United Kingdom science

presence in Svalbard since 1972. As part of the 30th Anniversary celebrations, the Station Team put together a short video with messages from previous and current users of the Station and included a special message from Sir Michael Palin who visited the Station back in 1992

The videos are available here and include a copy of the press release issued to mark the occasion: www.arctic. ac.uk/resources/films/



NEW STATION BUILDING NAME

In 2022, the Station building was renamed 'Harland-Cox Huset', in recognition of Nicholas Cox, the Station Manager from 1991 until his retirement in 2022. Nick's dedication to supporting the hundreds of researchers who have worked from the Station over the years has been exceptional. His leadership, professionalism, positivity, humour and kindness will be remembered for many years to come. Thank you to colleagues in the Norwegian Polar Institute, Kings Bay, UKRI and NERC for their support in marking this important occasion. Thank you Nick and all very best wishes for a long and happy retirement. We look forward to seeing you in Svalbard again before too long!





NERC Arctic Research Station

lain Rudkin, Station Manager Email: <u>iadk@bas.ac.uk</u>



NERC Arctic Office

Henry Burgess Email: <u>Henry.Burgess@bas.ac.uk</u> Tel: 01223 221426

> Nicola Munro Email: <u>nalm@bas.ac.uk</u> Tel: 01223 221468

Website: <u>www.arctic.ac.uk</u> Twitter: @ArcticStationUK; @Arctic_Office





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