NERC ARCTIC RESEARCH STATION SCIENCE SUMMARIES

2018 SEASON

British Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Arctic Office
NATURAL ENVIRONMENT RESEARCH COUNCIL

NERC SCIENCE OF THE ENVIRONMENT

UK Research and Innovation

THE NERC ARCTIC RESEARCH STATION

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 to support excellent environmental science. It is managed and operated by the British Antarctic Survey.

The Station is available to support researchers based in the United Kingdom across a wide range of fields, including: ecological, glacial/periglacial geomorphology, hydrology, atmospheric chemistry, marine research and beyond.

Researchers in receipt of funding from within the United Kingdom Research and Innovation network are eligible to use the Station, where their proposed science is appropriate and can be practically supported. In addition a wide range of others who have received funding through competitive funding processes, such as the Leverhulme Trust, can also be supported.

Researchers based outside the United Kingdom can apply for funding to use the Station through the INTERACT EU transnational access programme: eu-interact.org

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 those who use the Station receive comprehensive briefings and appropriate training. Safety support is provided during their stay. There is strong collaboration between all the different international partners within the Ny-Ålesund community.

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 state of the art fibre optic web link and telephone system. There is no mobile coverage.

The Station is usually open to support researchers from early March through to the end of August. Expressions of interest in using the Station are welcome at any time and the earlier the better.

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

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 at the inception of the international research community.

There are now 14 research stations operated by 10 nations: Norway, UK, Germany, France, Japan, Italy, China, Netherlands, South Korea and India. There are a number of other affiliated organisations including the University of Svalbard (UNIS).

The Ny-Ålesund Science Managers Committee (NySMAC) includes representatives from each station. 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.

Photo: Linda Baaken

AN INTRODUCTION TO SVALBARD

The Svalbard archipelago lies between 74°- 81° North and 10°- 35°East. Discovered by the Dutch explorer Willhem Barentz in 1596 the archipelago was initially named Spitsbergen (the land of pointed peaks). It remained a "No Mans Land" until 1920 when the Svalbard Treaty (originally the Spitsbergen Treaty) was signed in Paris. The Treaty recognised the islands as part of the Kingdom of Norway. There were 14 original signatory nations, including the UK, and today that number has risen to 46.

Svalbard has a land area of 61,000 km^2, 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 from mid-October, showing again in Ny-Ålesund (79°North), in early March.

The west coasts of Svalbard are warmed by 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 archipelago is at the forefront of Arctic climate change, with annual average temperatures having risen by 4°C in the last 50 years, with even more pronounced changes in the winter (7°C since 1971).

Svalbard is home to the polar bear, reindeer, arctic fox, ringed, harbour and bearded seals, walrus and beluga whales. Blue and finn whales are becoming quite common. Birds make use of the perpetual summer sunlight to nest. They include Barnacle geese, who winter on the shores of the Solway Firth; terns, who leave in the autumn to fly to Antarctica; puffins; Brunnich's guillemots; phalaropes; fulmars; ivory gulls; little auks and others.

STATION SUMMARIES

NERC Arctic Research Station Projects 2018						
	Project PI / Leader	Institute	Email Address	Project Title	Dates	Funding source
1	Dr Geoffrey Evatt	Manchester	Geoffrey.Evatt@manchester.ac.uk	Antarctic Meteorites	19 - 28 March	Leverhulme Trust
2	Dr Hamish Pritchard	BAS	hprit@bas.ac.uk	Bedmap	26 April – 7 May	NERC Funded
3	Jamie Buchanan-Dunlop, Dr Helen Findlay and Dr Ceri Lewis	Digital Explorer, Plymouth Marine Laboratory and University of Exeter	jamie@digitalexplorer.com hefi@pml.ac.uk C.N.Lewis@exeter.ac.uk	Arctic Live 2018	30 April – 11 May	XL Group plc
4	Dr Kevin Newsham	BAS	kne@bas.ac.uk	REMUS Soil Warming Project	25 June – 5 July	British Antarctic Survey – core funds
5	Dr Arwyn Edwards	Aberystwyth	aye@aber.ac.uk	Ice and Snow Microbes	2 – 12 July	H2020
6	Dr Alistair Crame	BAS	jacr@bas.ac.uk	PhD Student Course. Safe & Effective Fieldwork in the Polar Regions	27 August – 2 September	Funded by course participants and British Antarctic Survey

The Lost Meteorites of Antarctica

Research in Svalbard database number: 10883

Dates of visit: 19 – 28 March 2018

Principal Investigator: Dr Geoffrey Evatt, University of Manchester
Email: Geoffrey.evatt@manchester.ac.uk

In March 2019, our 'Lost Meteorites of Antarctica' team are heading back to Ny-Ålesund, to continue the development of an englacial meteorite detection system (alas there are no such things to buy off the shelf). The purpose being to locate the 'missing' iron meteorites of Antarctica, which we have hypothesised to have melted a short way into the ice surface, just out of reach of previous collection missions. Being out in Ny-Ålesund in March 2018 proved extremely useful in the development of our meteorite detection system. And not just in terms of the help offered by the close proximity of glaciers, but also the radio-free environment which allowed us unrivalled tuning of the equipment.

In the next mission (March 2019), we shall take back our improved detection system for final field trials, before full Antarctic deployment in late 2019. Should we find the missing layer of Antarctic meteorites, then much credit will be due to the work we conducted up on Svalbard.

As this all alludes to, amongst its abundant qualities the NERC Arctic station allows for relatively easy testing of equipment that will eventually be heading South. It also allows for personnel to acclimatise (as far as this is possible) to polar environments and become accustomed to skidoos. The support we received from NERC and Kings Bay was immense, and we very much look forward to returning this season.

Bedmap Himalayas: Helicopter Radar Field Trial

Research in Svalbard database number: 10988

Dates: 26 April – 7 May 2018

Principal Investigator: Dr Hamish Pritchard, British Antarctic Survey
Email: hprit@bas.ac.uk

A team from the British Antarctic Survey travelled to Ny-Ålesund, Svalbard in April/May 2018 for trials of a helicopter-borne, low-frequency radar system. The system is intended for deployment to High Mountain Asia as part of the BEDMAP Himalayas project.

Little is known about the volume of ice in High Mountain Asia because it is so difficult to measure the thickness of the generally heavily-crevassed glaciers there. The best way to overcome this is to use a helicopter-borne radar. Helicopter radar systems have been used before but not at the sort of frequencies that will be required to penetrate up to 1000m of ice that is heavily crevassed and covered in rock debris. Low frequencies require a long antennas of the order of 10-20m and this represents a major structural, electronic and operational challenge.

Two radar sets were available: an older, lower specification one that had been used on the ground at Ny-Ålesund in the past and a new system using an innovative transmit/receive mode designed to allow the maximum antenna length on the carrying frame. Ground tests were conducted to test and compare the systems. The result of the tests was that the new radar was found to be not yet fully operational so the older radar with 4 m half-dipole antennas was chosen to be fitted to the carrying frame for the flight trials.

The carrying frame had been test-flown in the UK with very good results. It performed just as well in polar conditions. It had the right compromise between flexibility and rigidity, was well-balanced and oriented itself to the flight direction correctly. It is robust, simple and adaptable.

Flights were conducted over four different glaciers with different thicknesses, flow speeds and crevasse intensity. The radar data were excellent, with bed returns visible beneath 450 m of ice in the presence of heavy surface crevassing.

The trial was a success because the ability to sound >400 m of ice on an otherwise inaccessible glacier was proven; the frame was demonstrated as air-worthy in polar conditions; and the issues that need to be addressed to make the new radar operational were identified and solutions planned.

Arctic Live 2018

Research in Svalbard database number: 11039

Dates of visit: 30 April – 11 May 2018

Principal Investigators:
Jamie Buchanan-Dunlop, Encounter Edu
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Dr Helen Findlay, Plymouth Marine Laboratory
Email: hefi@pml.ac.uk

For the fifth year, an education outreach team from Encounter Edu (formerly Digital Explorer) has worked with researchers at the NERC Arctic Research Station in Ny-Ålesund to bring polar life and science to life for thousands of young people around the world.

The Encounter Edu team set up a 'broadcast studio' in the station garage / store room and live streamed 30 broadcasts to schools. These ranged from live investigations, experiments that students watching could follow, to expert interviews with resident field researchers and station manager. Students are always amazed with the view from behind the station stretching over 30km on a clear day to the Tre Kroner, the pyramidal peaks at the head of the fjord.

In addition to the education outreach work, Arctic Live 2018 saw the beginning of a long-term marine monitoring programme, investigating the abundance and partitioning of marine microplastics in Kongsfjorden and the impact of ocean acidification on marine invertebrate settlement. This being the first year of sampling, results will be available in future years. This data will help build a picture of how human activity is impacting the marine environment around the NERC Arctic Station.

AXA Arctic Live is supported by AXA XL, BAS, University of Exeter and PML and implemented by Encounter Edu. Further information is available at https://encounteredu.com/live/arctic-live-2018.

Jamie and team broadcast live to schools across the globe. Typically 14 classes per day starting in Australia, then Singapore followed by European countries and in the evening Canada and the USA.

All photos: Digital Explorer

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

Research in Svalbard database number: 6921

Dates of visit in 2018: 25 June – 5 July and 23 – 30 August 2018

Principal Investigator:
Dr Kevin Newsham,
British Antarctic Survey
Email: kne@bas.ac.uk

In September 2014, REMUS, a long-term soil warming experiment, was set up at Kvadehuken on the Brøggerhalvøya Peninsula. 48 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 (Fig. 1). Twice each summer, one litre of deionised water is applied factorially to 24 of the boils, resulting in four treatments (-OTC/-water, -OTC/+water, +OTC/-water and +OTC/+water). Initial observations with collaborators at the Universities of Copenhagen and Malaya indicate that the watering treatment influences soil microbial diversity and that OTCs affect greenhouse gas fluxes to and from soil.

Photo: M Misiak

Further analyses, including plant cover estimates and probing for specific taxa of soil bacteria, are planned for 2019.

ITEX Chambers. Photo: Elise Biersma

Functional Diversity of High Arctic Microbiomes

Research in Svalbard database number: RiS 10798.

Dates of visit: 2 – 12 July 2018

Principal Investigator: Dr Arwyn Edwards, University of Aberystwyth

Email: aye@aber.ac.uk

With the support of the Leverhulme Trust and the European Union Horizon 2020 Innovative Training Network MicroArctic, PhD students Aliyah Debbonaire and Melanie Hay returned to Ny-Ålesund under the supervision of Dr Arwyn Edwards in July 2018. The team's objectives focused on the development of a detailed local-scale biogeography of glacier-associated microbiomes. This entailed sample collection on many of the glaciers local to Ny-Ålesund, and the team enjoyed (largely) good weather allowing a productive collection season.

At present the team are developing molecular data (rRNA gene amplicon sequencing, shotgun metagenomics), metabolomics analyses and culture collections to provide insights into the community structure-function relationships of microbiomes associated with discrete glacier catchments.

Working on the Midtre Lovenbreen Glacier in mid-summer. Easily accessible, it takes 1.5 hours to reach the glacier snout on foot. Photo: Functional Dynamics of High Arctic Microbiomes Team

NERC Advanced Training Short Course: Safe & Effective Fieldwork in the Polar Regions

Research in Svalbard database number: 10344

Dates of visit: 27 August – 2 September 2018

Principal Investigator: Dr Alistair Crame, British Antarctic Survey
Email: jacr@bas.ac.uk

BAS is a full Host Partner in five NERC Doctoral Training Partnerships (DTPs) and one Centre for Doctoral Training (CDT), and students assigned to these partnerships form the core of our current 100+ student register. The accent within these consortia is very much on providing state of the art training facilities and to help do this we run an Advanced Training Short Course (ATSC) every year entitled "Safe and effective fieldwork in the polar regions". The course lasts for some ten days and is designed to give PhD students and Early Career Researchers a thorough introduction to planning and organising fieldwork in both polar regions; everything is catered for, from small, two-person parties right up to large, multinational expeditions into the deep field.

We begin with three days intensive lecture and practical work in BAS Cambridge before transferring up to Ny-Ålesund for a full week of fieldwork. Working from the NERC station every day we start with some basic familiarisation to the polar environment, route planning, and field safety. For some students this will be their very first experience of living and working in an extreme environment but both the Station Manager and an experienced BAS Field Assistant are on hand to make sure that everybody is fully kitted out and aware of all the basic field safety procedures. We then go straight into the scientific activities, concentrating on a geophysical survey of a small glacier, and a marine biological survey of Kongsfjord.

You do not have to be either a geophysicist or a marine biologist to really enjoy the course! The emphasis is not so much on getting specific results as to how we go about the field surveys. We ask the students to put all that they have learnt so far into practice and, as much as possible, to run the field days. How would they plan a day's survey, what kit would they take, and what are the essential safety steps? Of course, the experts are on hand to help out, but working in small teams and groups the students get some invaluable first-hand experience of decision making in a potentially hostile environment.

We generally work with small parties of 8 to 12 students towards the end of the summer season. A group of this size fits perfectly with life on the NERC station and is also a great opportunity for the students to interact with researchers from some 10 other nations. Our week there usually goes in a flash and at the end of the course the students nearly always ask if they can come back next year!

Photo credit: Jonathan Rosser

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