BAS Science Summaries

2025-2026 Antarctic field season

British Antarctic Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

POLAR SCIENCE
FOR A SUSTAINABLE PLANET

Contents

Cover: *Preparing to launch underwater ocean glider 'Gladys' at Rothera Research Station, Adelaide Island, Antarctic Peninsula*

BAS Science Summaries

2025-2026 Antarctic field season

Introduction

This booklet presents an overview of the field, station, and ship-based science projects that the British Antarctic Survey (BAS) is supporting during the 2025-26 Antarctic field season. Once again, our teams will be delivering ambitious and world-leading research across Antarctica, tackling questions of vital importance to society and the planet.

▲ *Professor Dominic Hodgson*
Interim Director of Science

This work sits at the heart of our new BAS science strategy, *Polar Science for a Sustainable Planet*. From investigating the role of the Polar Regions in regulating global climate, to monitoring biodiversity and long-term environmental change, BAS provides the expertise and infrastructure that enable complex science in one of the harshest environments on Earth. Many of these projects will inform policymakers and are of the highest societal relevance.

The projects for this season span a wide range of scales and disciplines. They include large, multi-partner collaborations – both UK-based and international – as well as sustained long-term observations that provide the essential context for understanding change over decades.

Among the highlights are:

- POLOMINTS – exploring how internal ocean waves generated by glacier calving mix heat and nutrients in the Southern Ocean, with teams working from both Rothera Research Station and RRS *Sir David Attenborough*
- REWIND – a major ice-core drilling project that aims to uncover how past changes in winds and sea ice have influenced the exchange of carbon dioxide between the Southern Ocean and the atmosphere over the last 11,000 years
- THWAITES GLACIER – working with the Korea Polar Research Institute, oceanographers will be deploying from RV *Aaron* to hot-water drill through the main trunk of Thwaites Glacier to investigate how the ocean is melting the bottom of this critical glacier 1,000m beneath the ice surface

continued ▷

Introduction continued

Alongside these headline projects, BAS will continue its vital long-term measurements at Rothera and Halley Research Stations, and other remote locations, including the Larsen C Ice Shelf. These sustained observations remain fundamental for distinguishing natural variability from human-driven environmental change.

The 2025-26 season will, as ever, be both challenging and exciting. This booklet provides a guide to the diverse research efforts under way and acknowledges the contributions of all those working in the field.

On behalf of BAS, I wish everyone involved a safe, productive, and successful field season.

Professor Dominic A Hodgson
Interim Director of Science, BAS

September 2025

List of science projects

Highlight projects

Field-based projects

List of science projects *continued*

Rothera Research Station

Halley VI Research Station

List of science projects *continued*

Bird Island Research Station

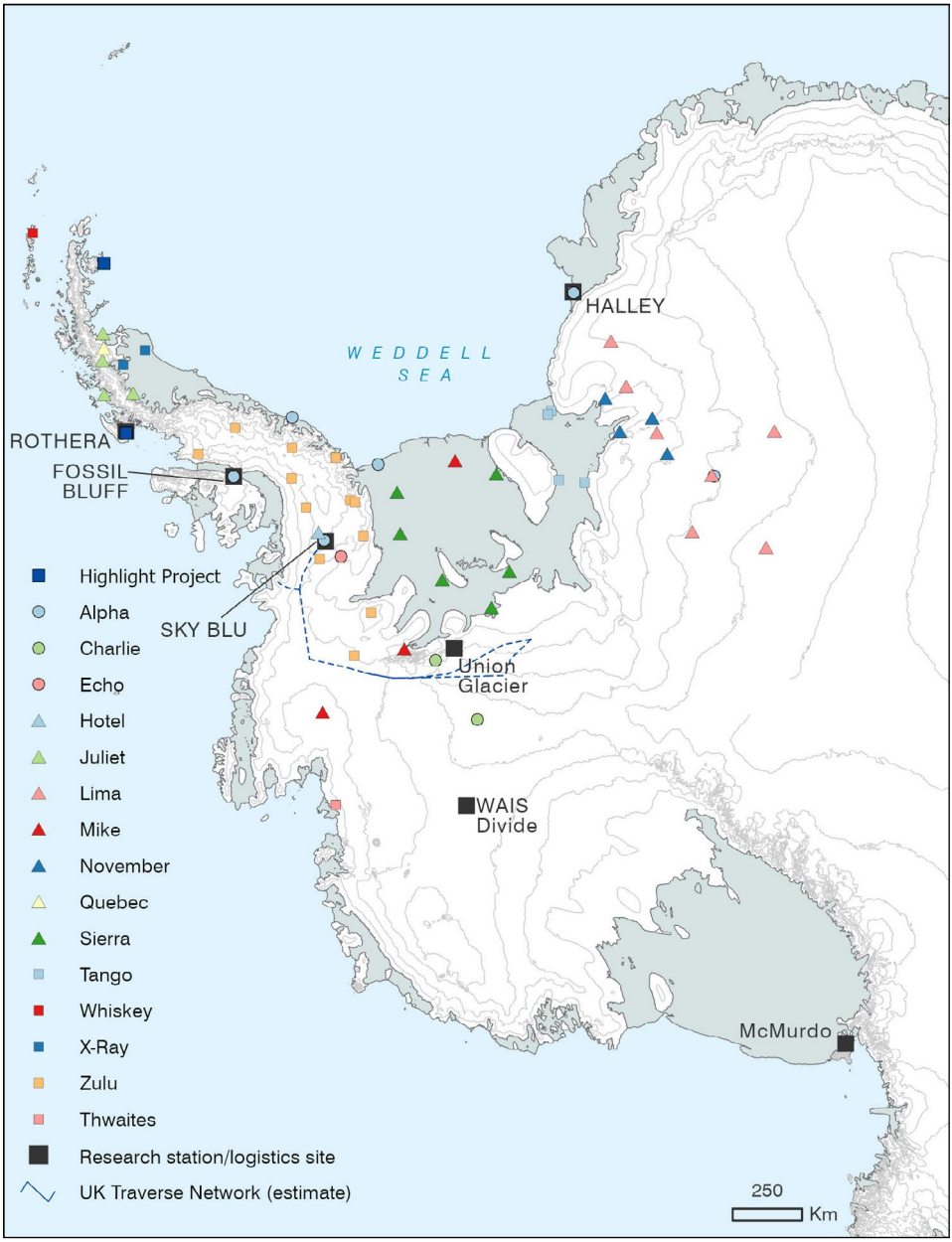
King Edward Point Research Station

Signy Research Station

RRS Sir David Attenborough

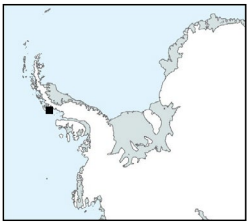
Map of field-based project locations

2025-2026 Antarctic field season



Highlight project

Polar ocean mixing by internal tsunamis (POLOMINTS) – Rothera



Location: Rothera, Ryder Bay and Sheldon Cove

Timing: December 2025 to May 2026

More information: *https://www.polomints.ac.uk*

When marine-terminating glaciers calve into the sea, they will create a big splash at the surface. But they can also create large internal waves, similar to tsunamis, causing large amounts of turbulence below the sea surface as they propagate away from the ice and eventually break. The mixing that occurs affects the physics and biology on the shelf, bringing up nutrients and heat from depth into the surface mixed layer. While small and medium calving events frequently occur, this mechanism has rarely been observed and isn't included in ocean or climate models.

The Polar Ocean Mixing by Internal Tsunamis (POLOMINTS) project, funded by a £3.7m NERC Large Grant, will provide the first systematic observations of this process, using a variety of platforms from sensors on the seabed right up to satellites, and linking the observations to models.

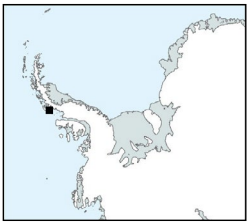
Ryder Bay provides an ideal observatory for this process. Cameras will be set up on Stork Ridge pointing at Sheldon Glacier, and small boats will be used both to measure physical and biogeochemical properties with profiling sensors and water samplers, and to launch autonomous gliders, which will measure from the ice front out into Marguerite Bay.

▲ Observing the front of Sheldon Glacier from the deck of RRS Sir David Attenborough at night

▲ *Small boats from Rothera viewed from RRS Sir David Attenborough during a joint measurement campaign*

Highlight project

Polar ocean mixing by internal tsunamis (POLOMINTS) – RRS Sir David Attenborough



Location: Rothera, Ryder Bay and Sheldon Cove

Timing: January 2026

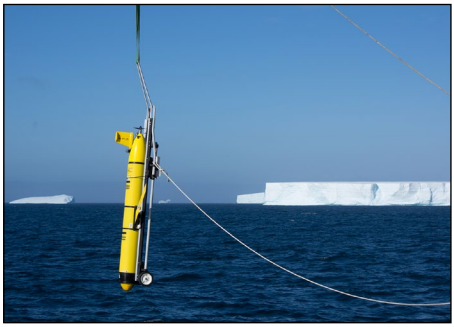
More information: *https://www.polomints.ac.uk*

The Polar Ocean Mixing by Internal Tsunamis (POLOMINTS) project will have a few days on SDA in conjunction with the Iron-Man cruise, SD057. Here we will be deploying oceanographic moorings from the front of Sheldon Glacier out into Marguerite Bay, and surveying the glacier fronts using SDA's workboat *Erebus*.

The moorings will include bottom pressure sensors capable of measuring the passage of waves generated from calving events. In addition, we are installing hydrophones on the moorings nearest the glacier front, which can be used to determine the type and magnitude of calving events from their acoustic signatures. Together with the intense observation campaign from Rothera, the moored instruments will provide time series showing the effect of the waves, continuing year-round.

While SDA is deploying the moorings, *Erebus* will undertake a detailed survey of the ice fronts of the marine-terminating glaciers around Ryder Bay using a sideways-looking multibeam echo sounder.

Overall, the ensemble of measurements made during the POLOMINTS field campaign from SDA and Rothera will enable new insight into a recently-discovered and important process, which needs incorporating into our assessments and models to fully understand and quantify its impacts.

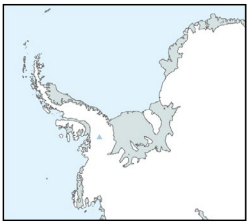


▲ A Slocum glider being deployed near icebergs

▲ *Recovery of a mooring buoy from RRS Discovery*

Highlight project

Sea ice and westerly winds during the Holocene in coastal Antarctica, to better constrain oceanic CO_2 uptake (REWIND)



Location: Near Sky-Blu

Timing: November 2025 to February 2026

The Southern Ocean currently absorbs over 40% of the anthropogenic carbon dioxide (CO_2) from the atmosphere. However, the Southern Ocean can also release CO_2. The extent to which the ocean will act as a source or sink of anthropogenic CO_2 in the future constitutes a major uncertainty facing society today.

The REWIND project aims to drill a deep ice core from the Antarctic Peninsula to explore how westerly winds and sea ice have influenced the uptake or release of CO_2 from the Southern Ocean during the Holocene (~11,000 years). We will measure a suite of chemicals and particulate material, including marine diatoms, to reconstruct winds and sea ice in the Pacific sector at annual resolution. This will be compared with a new high-resolution CO_2 record.

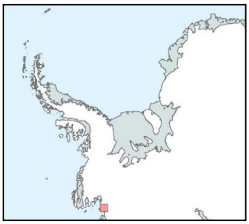
During the 2024-25 season we conducted geophysical surveys and identified a suitable drilling site approximately 35km from Sky-Blu. The deep drilling equipment was deployed, and the first 70m of the core retrieved. This season a larger team (10 people) will return to the site to continue the drilling, hopefully reaching bedrock (~700m).

▲ *The drill site on a rare calm, sunny day*

▲ *Building the base for drilling operations*

Highlight project

Thwaites Glacier



Location: Main Trunk of Thwaites Glacier

Timing: December 2025 to February 2026

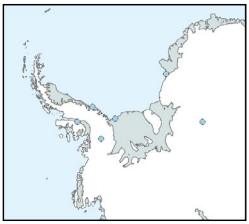
Thwaites Glacier is one of the fastest-changing ice-ocean systems in Antarctica. Much of the ice sheet within its catchment is grounded below sea level on bedrock that deepens inland, making it susceptible to rapid and irreversible ice loss that could raise the global sea level by more than half a metre. Ocean-driven melting beneath Thwaites' floating ice shelf sets the rate of grounded ice loss and therefore its contribution to global sea-level rise. Despite the importance of Thwaites, little is known about the critical ocean processes that drive melt many hundreds of metres beneath its ice shelf. This is especially true for the fastest-flowing portion of Thwaites Glacier – the Main Trunk – where no in-situ observations have ever been taken in the critical grounding line region where the glacier first lifts off the bed and starts floating.

During this season, in collaboration with colleagues from South Korea, we will drill approximately 1,000m through Thwaites Main Trunk, just downstream of the grounding line, using the BAS-designed hot-water drilling system. Through the access hole we create, we will deploy a range of profiling instruments to observe and understand the critical ice-ocean interactions that are driving basal melting. We will deploy a long-term ocean mooring to understand how these interactions evolve in time, and we'll collect sediment samples to shed light on the past evolution of the Main Trunk. We'll also collect water samples to examine the chemical and biological processes occurring beneath West Antarctic ice shelves.

▲ *Hot water drilling on Thwaites Eastern Ice Shelf in 2019*

Field-based project (Sledge Alpha)

Annual Antarctic Automatic Weather Station servicing



Location: Various locations (Sky-Blu, Fossil Bluff, Butler Island, Ronne Ice Shelf, Halley, Baldrick)

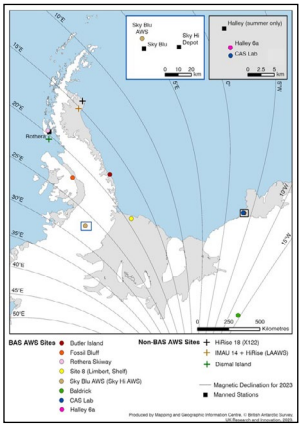
Timing: November 2025 to February 2026

More information: *https://bas.ac.uk/project/meteorology-and-ozone-monitoring/#about*

BAS runs a network of seven Automatic Weather Stations (AWS) on the Antarctic Peninsula and in the Halley region. They are Fossil Bluff, Butler Island, Sky-Blu, Limbert (Site 8), Baldrick, Halley VIa and CASLab. The BAS AWS are part of an international network of over 100 stations covering Antarctica. The BAS Met Team collaborates with scientists from all over the world to ensure the best possible coverage of Antarctica to meet the needs of the scientific and forecasting communities. In addition, BAS services stations for the Universities of Utrecht and Wisconsin. Data is sent via satellite link to meteorological offices around the world so that it can be used immediately for weather forecasting. As well as being vital for forecasting, the data from these stations is the very data that has provided scientists with the incredible climate statistics of the last five decades. It is therefore essential that we visit the stations as regularly as possible to ensure that this invaluable data continues to be recorded.

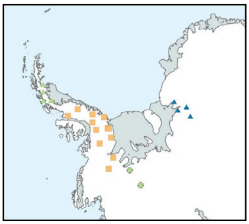
Every year the Rothera Met Team visits the Peninsula sites, while the Halley Met Team visit the Halley sites and Baldrick. A site visit involves collecting high-resolution data from the last year, raising the instruments and power systems above the previous year's snow accumulation, and carrying out necessary repairs and updates. A station service can typically take up to six hours. This project will be supported out of Rothera and Halley, in addition it is planned to install a new AWS at Bird Island alongside the existing met station and also install a cloudbase recorder at Sky-Blu to assist with aircraft operations.

▲ *Servicing Butler Island Automatic Weather Station*



▲ *Map of BAS AWS network*

Field-based project (Sledges Charlie, Juliet, November and Zulu)



Quantifying West Antarctic mantle viscosity via precise GPS measurement of Earth's response to surface mass balance anomalies (UKANET project)

Location: Throughout West Antarctica

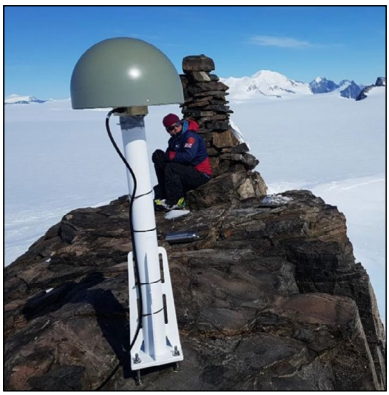
Timing: Opportunistic throughout the season (multi-seasonal)

More information: *https://ukanet.wixsite.com/ukanet*

Satellite measurements of ice-sheet change provide insight into current and future sea-level rise, but they are complicated by a phenomenon known as Glacial Isostatic Adjustment (GIA). GIA is the ongoing response of the solid Earth to past ice-sheet change such as melting of ice. This is the same phenomenon whereby many people are aware that Scotland, for example, is still rising slowly after the ice age.

GIA can be measured wherever we have access to bedrock, but due to the lack of outcrops across much of Antarctica, spatial variations in GIA are poorly known and we are forced to rely on mathematical models to interpret the satellite data. These models are calibrated and validated using precise measurements of Earth deformation made by continuous GPS receivers sited on bedrock. This project is concerned with installing and maintaining those receivers across West Antarctica in a network known as UKANET. These measurements also allow us to work out the rheology of the solid Earth (how it behaves when an ice load is applied). We are pioneering a new approach to determining spatially-variable rheology that involves analysing the GPS-measured response of the solid Earth to natural snowfall variations across Antarctica.

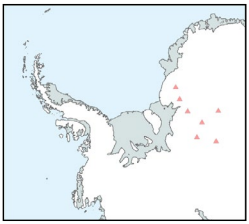
▲ *Preparing to upgrade the instruments and power supply at Welch Mountains, Antarctic Peninsula*



▲ *GPS monument and antenna at Traverse Mountains, Antarctic Peninsula*

Field-based project (Sledge Lima)

Conjugate experiment to investigate the sources of high-latitude magnetic perturbations in the coupled solar wind-magnetosphere-ionosphere-ground system



Location: Various locations

Timing: December 2025 to February 2026

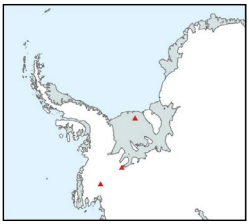
The Low Power Magnetometers (LPMs) operate unmanned all year round, including the long winter, when continuous periods of darkness and temperatures as low as -80°C prohibit human intervention. This has been made possible by new technology which allows the magnetometers to use very little power and survive the winter on solar power stored during the summer. The network measures magnetic fluctuations over a wide area. The data can be used to produce maps of space weather in the region around the Earth where satellites orbit. Information is recorded by the instrument and removed once a year during servicing. This project is expected to be mainly supported out of Halley this season, and two LPM sites will be upgraded to a new system that includes Iridium communications for data transfer.

Space weather causes fluctuations in Earth's magnetic field that create unwanted geomagnetically induced currents (GICs) in power grids, which in extreme cases can cause blackouts. In this project we will improve our understanding and forecasting of space weather and GICs by comparing measurements of geomagnetic field fluctuations at magnetically conjugate locations in the Arctic and Antarctic. 'Magnetically conjugate' means that the Antarctic locations are at equivalent positions with respect to the South Magnetic Pole as the Greenland locations are with respect to the North Magnetic Pole. Magnetically conjugate measurements are scientifically valuable because space weather phenomena are mostly organised by the geomagnetic field and thus should be similar at magnetically conjugate locations. Departures from conjugacy help us understand what other factors influence space weather, and can be compared with model predictions to help improve model accuracy.

▲ *BAS scientist checking the solar power unit for one of the remote Low Power Magnetometers*

Field-based project (Sledge Mike)

Depot digging



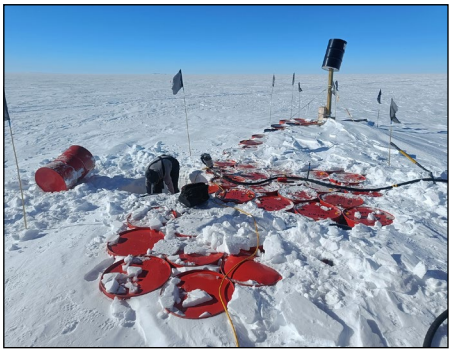
Location: BAS depot network, primarily Ellsworth Land, Ronne Ice Shelf

Timing: November 2025 to January 2026

BAS's area of operations on the Antarctic continent is vast, covering an area which is largely unoccupied and by comparison in excess of most of Europe. Across this area are a series of depots, primarily consisting of Avtur drums, acting as refuelling hubs to allow the Twin Otter aircraft to fly multiple legs across the continent more efficiently.

These drum depots, generally placed on the snow surface, are subject to drifting, snow accumulation and ablation as well as occasionally melting out, especially when in position across multiple seasons. The depot network therefore requires constant maintenance as well as restocking.

This season's priorities are to raise PIG E in Ellsworth Land, Beamish on the Rutford Ice Stream and Edith on the Ronne. A team made up of Field Guides and other station personnel will set up camp at the depot sites and raise the depot sites over several days.

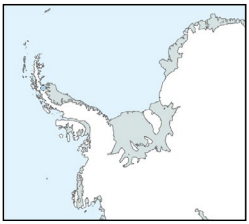


▲ *Depot raising... get the shovels!*

▲ *Newly raised depot with drum marker*

Field-based project (Sledge Quebec)

Direct influence of meltwater on Antarctic Ice Sheet dynamics



Location: Flask Glacier

Timing: November to December 2025

More information: *https://ldeo-glaciology.github.io/AntPen_NSF_NERC*

Ice flows viscously under gravity towards the ocean and the rate of ice flow controls how fast ice sheets and glaciers shrink. Ice flow rates vary in space and time. Recently, members of this project team published the first satellite observations suggesting that meltwater reaches the base of outlet glaciers in the Antarctic Peninsula and causes them to accelerate. This could become more common as air temperature increase around Antarctica this century. Therefore, confirming the team's recent satellite observations, establishing a baseline against which to compare future changes, and improving our understanding of the direct influence of meltwater on Antarctic ice-sheet dynamics is important for improving predictions of sea-level rise.

This is the second year of a three-year US-UK collaboration project, with three deep-field research campaigns on Flask Glacier in the Antarctic Peninsula. We will continue the work of last year, where we deployed instruments and completed UAV surveys to gain insights into both the drivers and implications of short-term changes in ice flow velocity caused by surface melting.

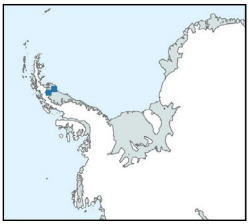
Detailed field measurements of the coupling between surface melt and ice dynamics have been conducted in Greenland, but such measurements are yet to be obtained in Antarctica, where this mechanism is occurring in a newly observed and rapidly changing glacio-hydrodynamic regime.

▲ *An uncrewed aerial vehicle over Flask Glacier used to photograph the surface and create maps of ice elevation and ice flow*

▲ *Pyramid tents at base camp, Flask Glacier*

Field-based project (Sledge X-ray)

A high-resolution approach for ice-shelf instability (HiRISE)



Location: Larsen C Ice Shelf

Timing: November to December 2025

Mass loss from the Antarctic Ice Sheet is the largest uncertainty in current sea-level rise projections and this uncertainty is largely related to its ice shelves. Understanding the viability of these in a future warmer climate is paramount to better predict future sea-level rise. For ice shelves in the coldest ocean waters, such as the Larsen C Ice Shelf, atmospheric warming dominates their climate sensitivity and its location in a critical climate zone makes Larsen C a highly suitable testbed for other ice shelves.

On-ice instrumentation and analysis

Within the HiRISE project and its successor, the new UU/IMAU and BAS collaborative project 'Evolution of the Larsen C firn layer', we have already deployed a detailed Automatic Weather Station, and made snow-surface change and snow-physics measurements at two locations on Larsen C over three years. The 2025-26 season marks the start of the new project. Maintenance visits at both locations are planned by a visiting IMAU scientist together with BAS personnel. It will include raising instruments to the surface, performing instrumentation servicing and replacement of some instruments to ensure their future continuation. In addition, BAS personnel will recover a 10m ice core and install radar equipment at both sites.

▲ *iWS14 on the Larsen C Ice Shelf (Dec 2024)*

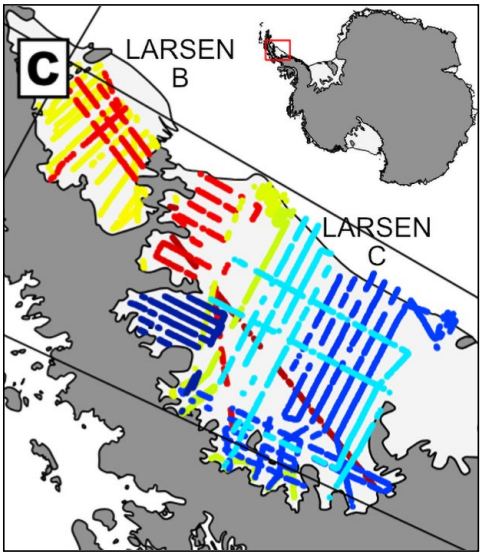
Field-based project (Sledge X-ray)

A high-resolution approach for ice-shelf instability (HiRISE) continued

Aerial survey

The aim is to assess the changing health of the firn on Larsen C Ice Shelf. The composition of the ice-shelf firn layer is important for overall ice-shelf stability. An impermeable firn layer can allow surface melt ponds to form which can result in a process known as hydrofracture in which the entire ice shelf collapses. It is hypothesised that hydrofracture was the cause of the loss of Larsen B Ice Shelf in 2002. We will assess the changing health of the firn on Larsen C Ice Shelf, its larger southerly neighbour.

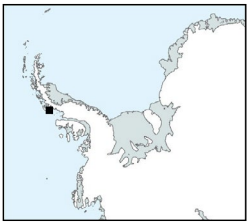
A number of downward-looking radar surveys have previously been flown over the ice shelf, and by comparing the measured ice thickness with its surface elevation, it is possible to calculate the amount of air in the firn – a direct measurement of the firn's health. In the early part of this season we will re-fly some radar lines last flown in 1997 to determine how the health of the ice shelf is changing over time. We will install new ground-based radar systems which will record seasonal firn evolution through the winter and collect shallow ice cores. This data will be combined with a long-term meteorological record from the Automatic Weather Stations on the ice shelf and modelling, to assess the effect of atmospheric variability on the stability of the ice shelf.



▲ *Radar lines flown in 1997 will be reflown this season*

Field-based project

BEA LTMS maintenance and routine sampling



Location: Rothera Research Station (Anchorage Island), Alexander Island (Coal Nunatak, Mars Oasis), Signy Research Station

Timing: Ongoing

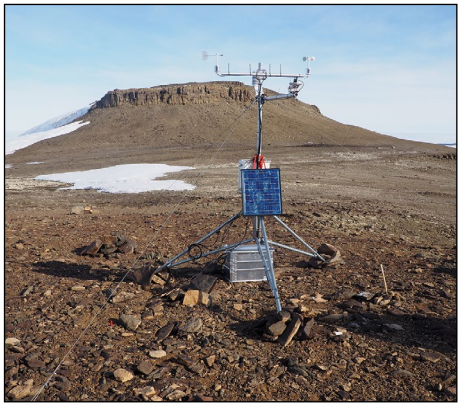
BAS has operated three terrestrial microclimate monitoring stations at sites accessed from Rothera since the mid to late-1990s and one at Signy since the early 1990s. The stations span almost the entire extent of the biological region known as the maritime Antarctic, which has been one of the fastest-warming regions of the planet over recent decades.

Routine site and equipment visits, downloading and maintenance work, and one-off sampling requests, originally the responsibility of the Rothera Terrestrial Assistant, have been carried out by management agreement by the Bonner Lab Manager since the creation of that post. Such visits are typically now carried out within a full 'away-day'.

All three Rothera-accessed stations have had substantial maintenance and upgrading in the last three-to-four seasons, and the Signy station has been replaced and relocated close to the station.

In addition to the maintenance, targeted soil/peat collections supporting an NSF-NERC grant will be carried out at Signy Island, targeting the invasive midge *Eretmoptera*, from standard introduction sites immediately adjacent to station buildings.

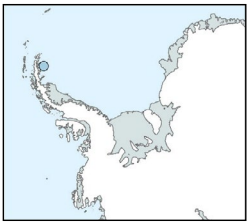
▲ *The AWS on Anchorage Island is easily accessible by boat from Rothera Research Station. Reptile Ridge can be seen here in the background*



▲ *Coal Nunatak is on Alexander Island and only a short flight away from Fossil Bluff. The AWS overlooks King George VI Sound*

Field-based project

The impact of declining sea ice on emperor penguin populations



Location: Snow Hill Island

Timing: November to December 2025

More information: *https://www.bas.ac.uk/project/snow-hill-emperor-penguin-expedition*

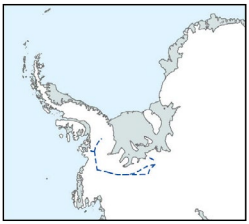
Emperor penguin populations across the Antarctic Peninsula are declining due to climate change. Our monitoring and understanding of the drivers and future population trajectories have been limited by lack of data and the quality of the counts from satellite images. Our field project aims to address these challenges by collecting syncronous UAV survey data to calibrate satellite image counts and to investigate the foraging and moulting areas of the adult birds. These data will feed into planned protection measures and population models to help understand and protect this keystone species.

▲ *Emperor penguins at Snow Hill Island in 2023*

▲ *Drone survey of the colony*

Field-based project

Tractor traverse



Location: Institute Ice Stream and Institute Glacier

Timing: November 2025 to February 2026

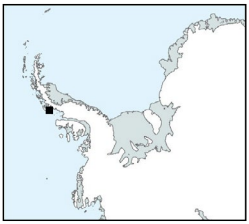
This season the Tractor Traverse will set out from its over-winter depot at Sky-Blu and run two trips out to the English Coast Staging Depot (Harry) and recover the remaining fuel reserves left there following last season's English Coast relief and transport them onwards to SBR. Within this scope will be the recovery of remaining kit from SB9 Depot (The Vibe Truck and associated science cargo), closing this site down for the last time and staging the relocation of the tractor traverse to the Institute Ice Stream (IGIS) some 1,000+km beyond Union Glacier. Future seasons will see the tractor traverse supporting field science for the IGIS project for the next two years.

▲ *PistenBully tractors are used for towing cargo*

▲ *The caboose module provides some level of comfort*

Rothera Research Station

Antarctic Specially Protected Area (ASPA) management visits



Location: Lagotellerie Island, Avian Island, Dion Islands, Leonie Islands, Rothera Point, Moe Island, Powell Island and Lynch Island

Timing: November 2025 to March 2026

More information: *https://www.ats.aq/devph/en/apa-database*

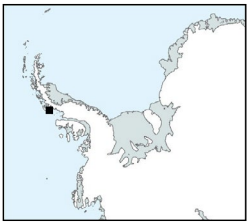
Antarctic Specially Protected Areas (ASPAs) can be designated under the Environmental Protocol to protect sites with outstanding environmental, scientific, historic, wildness or aesthetic values. Each ASPA has a management plan that provides information about the area and the conditions upon which entry is permitted (alongside the appropriate Specialist Activity Permit).

The United Kingdom manages 15 ASPAs on behalf of the Antarctic Treaty Consultative Meeting (the international body where Antarctic governance decisions are made). The BAS Environment Office manages these ASPAs on behalf of the Foreign, Commonwealth & Development Office (FCDO).

For each ASPA, the associated management plan is reviewed and revised (as necessary) every five years. As part of this process, BAS undertakes a site visit to ensure the management plan is likely to remain effective. Several ASPAs are due for review and site visits to ASPAs in the vicinity of Marguerite Bay and the South Orkney Islands are planned for the 2025-26 season.

▲ *ASPA 115 Lagotellerie Island, Marguerite Bay*

Rothera Research Station



Antarctic tourism: developing knowledge and tools to minimise cumulative impacts on biodiversity and wilderness values in Antarctica (ANT-MICI)

Location: Lagoon Island, Anchorage Island, Rothera Research Station, and King George Island

Timing: January to March 2026

More information: *https://lifeonantarctica.com*

Tourist landings in Antarctica have been rapidly increasing in recent years, with accessibility and demand for Antarctic cruises only expected to grow. However, the increased human activity accompanying this trend could pose serious challenges to biodiversity conservation in the region, especially for the sometimes overlooked terrestrial biodiversity of Antarctica. The ANT-MICI project seeks to forecast future tourism trends, improve our understanding of the cumulative impacts of tourism on terrestrial Antarctic biodiversity and wilderness values, and devise and test different strategies for quantifying, monitoring, and mitigating tourist impacts to maintain the unique and pristine character of Antarctic landscapes.

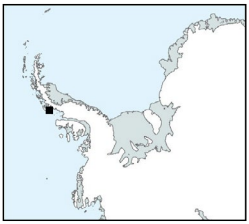
During the 2025-26 field season, we will focus on quantifying the cumulative impacts of trampling and local source pollution on Antarctic groundcover (e.g. mosses and lichens) and terrestrial fauna (e.g. mites, springtails, nematodes, rotifers, and tardigrades) living in the groundcover and soil. In addition, we will test the efficacy of different non-destructive terrestrial biodiversity monitoring techniques that could be used by researchers and operators to prevent biodiversity declines before significant damage is done. We plan to carry out this work at different sites around the Antarctic Peninsula to capture the state of biodiversity across a spectrum, from protected areas to highly-visited tourist areas.

▲ *On the way to sample Antarctic terrestrial biodiversity*

▲ *Small Antarctic moss and lichen community*

Rothera Research Station

ARIES upgrade



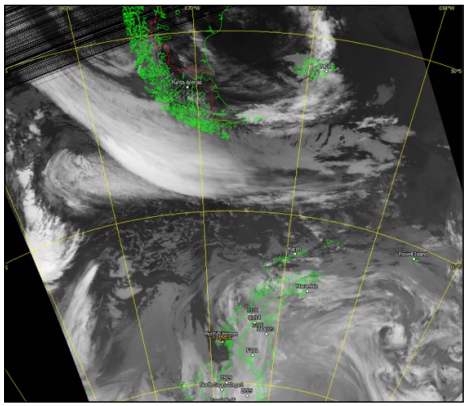
Timing: November to December 2025

More information: *https://cloudsense.ac.uk*

The ARIES dome is the smaller white dome on Rothera Point which houses a satellite dish and receiver system called ARIES (Antarctic Reception of Images for Environmental Science). When a polar-orbiting satellite passes nearby, ARIES captures image data and stores it for use in climate research and local weather forecasting. During the summer months these satellite images are analysed by the Rothera forecaster and used in the daily met brief to show areas of cloud and fog over areas in which BAS aircraft intend to fly. Very often the pilots and forecaster are waiting for that next satellite image over a certain area which will give them a better picture of what's going on and determine whether to go flying or not.

This season BAS engineers, with remote assistance from engineers from Dundee Satellite Station Ltd will finish upgrading the current ARIES system to receive X-band transmission. The new upgrade will allow us to receive data and images from more satellite passes. This data is also used to support other science projects like WIPSY, that uses NOAA satellite passes to calculate upper-level winds.

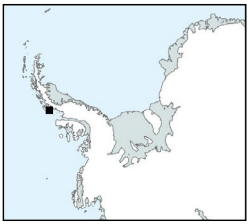
▲ *The ARIES Dome captures satellite image data to help with daily weather forecasting*



▲ *Example of satellite data received by the ARIES system*

Rothera Research Station

BRUV (Baited Remote Underwater Video)



Timing: Ongoing

More information: *https://www.gov.uk/government/publications/the-blue-belt-programme*

https://www.uwa.edu.au/news/article/2021/april/worlds-largest-ocean-monitoring-protects-marine-biodiversity

We are partnering with the UK Government Blue Belt program's Global Ocean Wildlife Analysis Network, deploying BRUVs in the British Antarctic Territory (BAT). We hope that BRUVs will add an additional capacity to our research, allowing us to monitor the animals living in the surface waters. We hope to add this missing information to the monitoring of the near-shore marine environment in Ryder Bay that has been conducted for more than 20 years.

The duration of winter sea-ice cover in Ryder Bay is extremely variable, with the overall warming trend recorded on the Western Antarctic Peninsula since the 1970s affecting winter sea-ice duration. Mid-ocean research cruises have been monitoring krill and fish populations further north in the Southern Ocean for many years and have shown marked reductions in krill numbers. The early life stages of krill rely heavily on algae living on the underside of the sea ice for food and so changes in the winter sea ice are expected to have a marked effect on krill populations. We want to use BRUVs to learn how the annual variation in oceanography and sea ice affects these species.

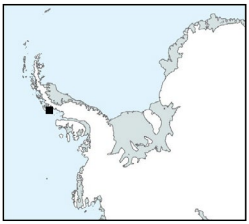
The value of life in the oceans is increasingly being recognised, not just for the intrinsic value of biodiversity, but for the key ecosystem services it provides to human society. One of the emerging questions is to better understand how healthy marine ecosystems capture carbon from the atmosphere and store it into the seafloor. Partnering with Blue Belt and the University of Western Australia will allow us to investigate specific questions about the pelagic marine system in Ryder Bay.

Being part of this global network gives us an excellent opportunity to compare different oceans and understand more about our changing oceans.

▲ *A BRUV (Baited Remote Underwater Video) system being assembled on the boat for deployment*

▲ *View of the bait box underwater. Notice the notothenioid fish in the right bottom corner*

Rothera Research Station



Dynamic live cell imaging at sub-zero temperatures

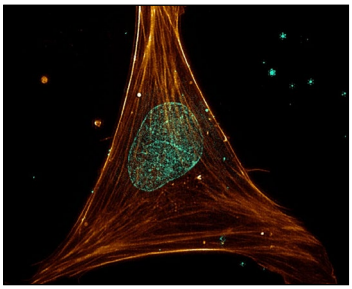
Timing: January 2025 to December 2026

More information: *https://www.bas.ac.uk/media-post/new-project-to-unlock-lifes-secrets-in-extreme-cold/*

https://laser.ceb.cam.ac.uk/research/dynamic-live-cell-super-resolution-imaging-sub-zero-temperatures

How do proteins work in the cold? Life in extreme environments challenges our fundamental understanding of how biological systems work from the molecular to whole organism level. Within cells, proteins are key building blocks for life with functions that are uniquely dependent on their 3D folded state. Whilst much is known about how proteins work at high temperatures, very little knowledge exists about how biology functions in sub-zero conditions where proteins are less stable and oxidative damage is high. Approximately 90% of habitable environments on Earth are permanently below 5°C (i.e. deep sea and polar), therefore this is a huge gap in our knowledge, especially as it is these cold environments that are warming up fastest under climate change.

To start to answer this big question of how life works at 0°C, we have developed cell cultures from the Antarctic plunder fish *Harpagifer antarcticus*, which we get from Rothera (many thanks to the Rothera Dive Team). These cell cultures grow very slowly at 0-2°C, so we, or rather Francesca van Tarwijk, has to be very patient. We can then look at what is going on inside these cells using a variety of dyes and a unique high-resolution microscope system which is being built in-house at the University of Cambridge Department of Chemical Engineering and Biotechnology (CEB). BAS-affiliated Cambridge PhD student Anne-Pia Marty designed portable microscope attachments to enable us to look at these cells at 0°C, but Amir Rahmani (CEB) is now developing a high-resolution microscope unit to go into the BAS cold rooms, which will operate permanently at 0°C and offer greater flexibility in the experiments we can do. This is the first time that any group worldwide has imaged live cells at 0°C, thanks to our unique experimental system and equipment. Initial results are shown in Figure 1.

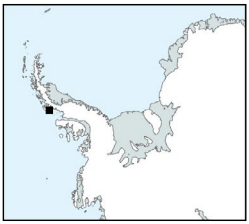


▲ *This super-resolution microscopy image shows a cultured cell derived from an Antarctic fish embryo. The labelled structures are the nucleus (cyan, where the genetic material is stored and read) and the actin cytoskeleton (gold, which gives the cell its shape)*

Rothera Research Station

East Beach Hut atmospheric observatory

Timing: Ongoing



The Southern Ocean slows down climate change. It is one of the few regions of the globe where the deep ocean is in regular contact with the surface, allowing for atmosphere–ocean heat exchange. However, climate models struggle to replicate observed radiation in this region due to inaccuracies in cloud representation, especially at higher latitudes, where observations of aerosols are sparse. Aerosols are small, airborne particles which can influence cloud formation by acting as cloud condensation nuclei (CCN). Model bias in the Southern Ocean region has a fundamental impact on the ability to predict climate globally.

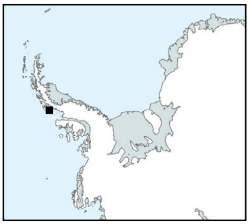
The East Beach Hut atmospheric observatory was established as part of the Southern Ocean Clouds (SOC) project in 2021, with ongoing support for the facility secured via the PRESCIENT programme. The observatory contains a suite of instrumentation which measures the chemical composition and size of aerosol throughout the year. We also gather information on cloud type and on aerosol precursor gases (such as dimethyl sulfide). The observations made at East Beach Hut improve our understanding of aerosol sources, how they might influence cloud formation over the Southern Ocean and ultimately can be used to reduce the climate model cloud bias that exists for the region.

▲ *Working inside East Beach Hut, December 2024*

▲ *East Beach Hut on Rothera Point*

Rothera Research Station

Marine biological research at Rothera Research Station



Timing: Year-round

More information: *https://www. bas.ac.uk/team/science-teams/biodiversity*

The seafloor around Rothera Research Station is characterised by very high natural levels of disturbance but is one of the environments least disturbed by human activity. This high diversity assemblage provides important ecosystem services, including storing carbon from the atmosphere into skeletons and body structures. The dynamics of this ecosystem are changing as human effects on the atmosphere reach the Southern Ocean and impact marine ecosystems.

In their natural state assemblages living on the seafloor are structured by iceberg disturbance, with a depth gradient with higher iceberg scour frequency in the shallows than at depth. When icebergs impact the seafloor, they can kill over 90% of all the animals living there, resetting the community to pioneering species and mobile species that are able to rapidly recolonise these areas of seabed.

The amount of iceberg scour is negatively correlated to the duration of seasonal sea ice, which is the major signal of climate change in the ocean around Rothera. The duration of winter sea ice is reducing and the amount of iceberg scour is increasing. To monitor these changes the iceberg impact study has maintained a grid of markers on the seafloor that measures the number of iceberg impacts per square meter of seafloor, allowing communities of known age to be identified and the frequency of iceberg scours to be followed. The assemblage structure and interactions between species will be recorded and food webs described. This will provide us with important information on the trajectory of seafloor assemblages around Rothera.

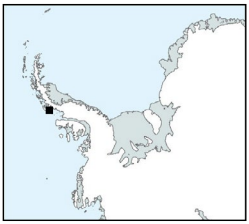
The marine biologist project for 2025-27 is to quantify the carbon in assemblages living in the sediment around Rothera, to build a profile of carbon stored within these assemblages, to compare with identical measurements taken 10 years ago, to look for signals of change.

Seaweed relies on remaining attached to the seafloor in shallow water and are therefore hugely impacted by iceberg scour. Changes in iceberg scour are therefore expected to lead to changes in the biomass and coverage by seaweed around Rothera, which will compete for space with the animals living on the seafloor. Studies will continue to measure seaweed species. Surveys will be continued to monitor ecological change in other species, including anemones. The monitoring of the feeding and reproduction of selected species has been monitored monthly for more than 25 years and has allowed the detection of environmental effects on the amount of energy these species allocate to reproduction.

▲ *Iceberg scour near Rothera Research Station*

▲ *Monitoring ecological change*

Rothera Research Station



Monitoring of skuas and shags at Rothera Point and Ryder Bay

Location: Rothera Point and Anchorage, Mucklescarf, Killingbeck and Skart Islands

Timing: December 2025 to March 2026

More information: *https://www.bas.ac.uk/project/skua-monitoring-at-rothera*

Rothera Point and the islands in Ryder Bay hold 10.3% and 3.5% of the global populations of south polar skuas and Antarctic shags, respectively. The small population of south polar skuas (<30 pairs) at Rothera Point has been studied since the late 1990s. Although the initial intention was to monitor possible impacts of the station, the long-term data are invaluable as indicators of local prey availability at sea and the effects of changes in sea-ice extent and duration, and for helping in the assessment of possible impacts of installation of wind turbines.

Up until summer 2004-05, the monitoring was of population size and breeding success (chicks fledged per pair). Subsequently, the breeding parameters that are collected include laying dates, clutch size, egg dimensions, hatching success, fledging success, chick condition and adult attendance (which provides an index of foraging effort) of each pair. In addition, since 2007-08, monitoring has included resighting of colour-ringed adults, which can be used to estimate adult survival, breeding frequency and divorce rates, and to determine the breeding histories of individuals and the effects of mate change. There is also some monitoring of skuas on nearby Anchorage Island, which act as controls. As well as the skua monitoring, the project includes annual counts of Antarctic shags on Mucklescarf, Killingbeck and Skart Islands.

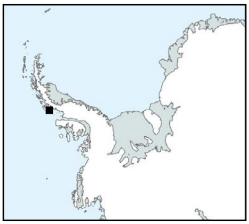
▲ *Antarctic shag and chicks*

▲ *South polar skua*

Rothera Research Station

Rothera biological long-term monitoring – IBIS (IceBerg Impact Study)

Timing: Ongoing

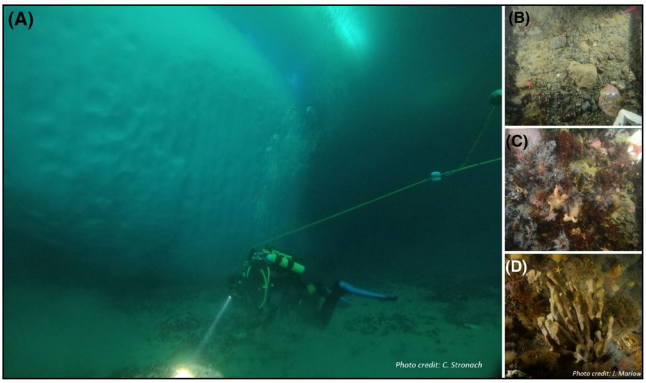


Since the austral summer of 2002-03 BAS has monitored the shallow seabed adjacent to Rothera Research Station. There are three grids of 25 concrete markers at each of 5, 10 and 25m on the seabed of South Cove, which are surveyed annually in December by the Rothera Marine Assistant. Each block that is hit is noted and replaced, so we have a detailed history of disturbance of the seabed for nearly 20 years. Linked to the Rothera oceanographic Time Series (RaTS) this is a powerful tool to investigate climate, ice and biology in the polar shallows.

It is one of the longest, continually-monitored areas for disturbance anywhere in the global ocean. Initially it allowed us to investigate how often the seabed was hit by icebergs and what impact this had on megabenthos. Crucially it was found that the duration of seasonal sea ice (fast ice) cover was related to how often the seabed was pummelled by icebergs. Sea ice is changing drastically in both Polar Regions and Rothera is in the hotspot of sea-ice losses in time and space – what does this mean for life on Antarctica's seabed?

Researchers at the Argentinian research station of Carlini (formerly Jubani) became interested and, collaboratively working with BAS, set up a series of similar iceberg scour monitoring grids at King George Island.

Life in the Polar Regions is thought to be vulnerable to even small changes, and the coastal shallows are the fastest-changing part. Onward monitoring of the Rothera iceberg grid (IBIS) together with that at Carlini should prove to be an important part of the toolset to enable us to understand the wider picture of how the many aspects of climate changes holistically influence life at the far ends of our planet.

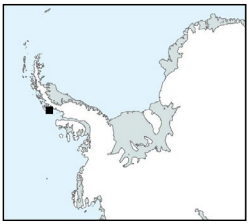


▲ *Impact of icebergs and stages of recovery: Photos show (A) a grounded iceberg frozen immobile in the sea ice and the state of benthic communities (B) immediately after impact, (C) 11 years post-impact and (D) sheltered from ice-scouring impact*

Rothera Research Station

Rothera MF Radar maintenance

Timing: September 2025 to March 2026



The Medium Frequency (MF) radar at Rothera provides measurements of the winds blowing in the mesosphere between 60 and 95km altitude. There has been a radar operating at Rothera since 1997 giving vital information on the middle atmosphere above the Antarctic Peninsula, providing knowledge on how this region responds both to space weather and the long-term change driven by man-made climate impacts. The winds measured by the radar are part of the pole-to-pole circulation and are perturbed by tides in the atmosphere, driven by heating from the Sun (6-24hr periods) and by large planetary waves (periods of days). Data from the radar are used to study the dynamics of the middle-atmosphere and how it couples upwards and downwards in response to changes in the lower atmosphere and variations in space weather coming from above.

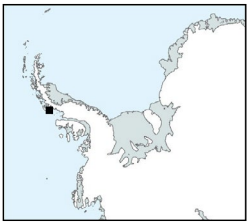
A secondary capability is the monitoring of the electron density in the lower ionosphere and the detection of energetic charged particle precipitation, which affects the chemistry and temperature of our atmosphere. This aspect of the coupling between the Earth's atmosphere and its wider geospace environment is particularly exciting as the radar sits at the magnetic footprint of the radiation belt slot region – a gap in the region of space populated by high energy electrons and protons. During major solar storms the slot regions fills and high energy particles rain into the atmosphere changing the local chemistry and impacting the dynamics. The Rothera MF radar is in a perfect position to observe these events and help us to explore the impact of these particles on local climate variation.

▲ *MF radar array at Rothera Research Station*

Rothera Research Station

Rothera minimum snow cover aerial survey 2025-26

Timing: February 2026



With the rapid pace of development at Rothera there is a significant requirement to collect up-to-date, high-resolution aerial imagery of the station. Due to environmental constraints (minimum snow cover) the data can only be collected between the beginning of February and the middle of March each year. The data will be used for a wide variety of outputs across the organisation including; science, operations, environment and infrastructure.

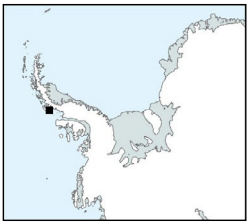
The survey will be conducted from a Twin Otter, using BAS's new Phase One PAS aerial camera. The PAS is made up of twin 150MP metric aerial cameras and is highly modular, allowing the system to be tailored to a specific projects requirements. Along with the aerial survey, a ground survey will be undertaken to establish ground control points using existing features across Rothera Point with a pair of Trimble geodetic GNSS receivers.

▲ *The most recent (2024-25 season) minimum snow cover survey*

Rothera Research Station

Rothera ramp survey

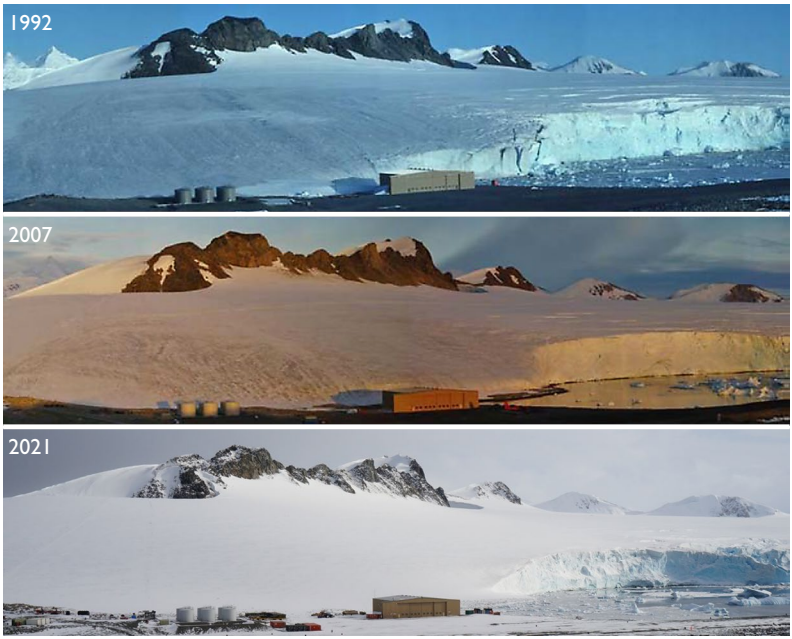
Timing: February 2026



The ice ramp at Rothera is disappearing before our eyes! At the end of every summer the surface profile of the ramp is surveyed to see how much it is changing. This survey is routinely conducted using GPS measurements along a single survey line. Since 2025 we have also started to use a remotely-piloted aircraft to provide additional high-accuracy measurements of the ramp surface elevation.

This long-term co-location of ice measurements and met records is unique and is a valuable data set for studying actual ice changes under a changing climate. Over the past 30 years the bottom has gone back well over 100m, and has lowered by almost 20m. The top hasn't changed much, which means that the ramp is slowly getting steeper.

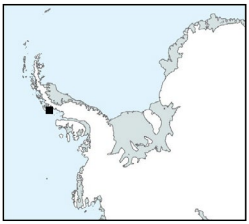
The ramp is affected by the Antarctic Peninsula's regional climate. We can compare the amount of ice that melts each year with the Rothera Met data and it correlates well with air temperature. More ice is lost in warmer years, but occasionally there'll be a cooler year and the ramp thickens slightly. The photographs taken between 1992 and 2021 below illustrate the changes. The survey line is located well to the left of the fuel farm, but the most striking change seen in the photographs is behind and right of the hangar; high ice cliffs in 1992 had become a nice gentle slope by 2021.



▲ *The changing face of The Ramp at Rothera from 1992 (top), to 2007 (middle) and 2021 (bottom). The bottom of the ice has retreated well over 100m*

Rothera Research Station

Rothera Time Series (RaTS)



Location: Ryder Bay

Timing: 1998 to present (ongoing)

More information: *https://bas.ac.uk/project/rats*

The glaciers, sea ice, ocean physics and biology along the Antarctic Peninsula are very closely linked, with strong feedbacks between ice and ocean through winter mixing and summer melting. These changes then strongly affect the growth of phytoplankton, which underpins both the food web and carbon uptake. There are also changes between years, from variable local weather patterns and wider scale processes such as El Niño and the ozone hole. It is therefore extremely important to monitor the system throughout the annual cycle and on decadal timescales. The sinking organic detritus from phytoplankton, and the zooplankton that graze on it, feeds the benthic ecosystem and leads to the sequestering of carbon in the sediments.

The Rothera Time Series is unique in covering winter sampling. The sample site is 4km from the station, accessed by small boat or a sled. There have been many interesting feedbacks found, with less sea ice leading to more heat and carbon loss in winter, followed in summer by more heat uptake (which, unexpectedly, exceeds the original loss) but reduced phytoplankton growth and so less carbon uptake. With a potential shift to less sea ice across a wider region, including a wide scale absence of sea ice in the winter of 2022, it is important to continue the sampling to assess the oceanographic processes driving these changes, and the consequences of the surface waters being exposed to wind-driven mixing and heat loss through the winter when there is no sea ice.

CTD casts are taken once or twice a week to monitor the temperature, salinity, chlorophyll and turbidity together with a variety of water samples to understand the ice melt and biological processes. In addition, an ocean glider is deployed for month-long missions to measure similar parameters, including close to the glacier front and further away from station, following the route warm water needs to follow to reach the glaciers to study how it mixes and cools en route to the melting ice.

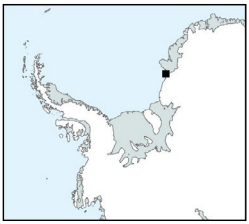
▲ *Ocean glider ready to be deployed for a month*

▲ *Deploying a CTD on the ice*

Halley VI Research Station

Airglow spectrometer (Agspec)

Timing: 2024-ongoing

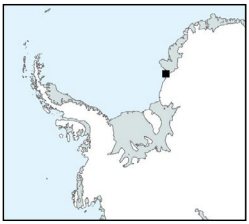


The airglow spectrometer measures the spectra of faint airglow emissions in the middle atmosphere. These spectra can be used to measure the temperature of the middle atmosphere but also can be used to measure atmospheric waves (e.g. tides and gravity waves). By combining long-term temperature records across Antarctica we can see the effect of climate change (increased temperatures at surface) on the middle atmosphere temperature.

▲ *Airglow spectrometer instrument*

Halley VI Research Station

All-sky camera

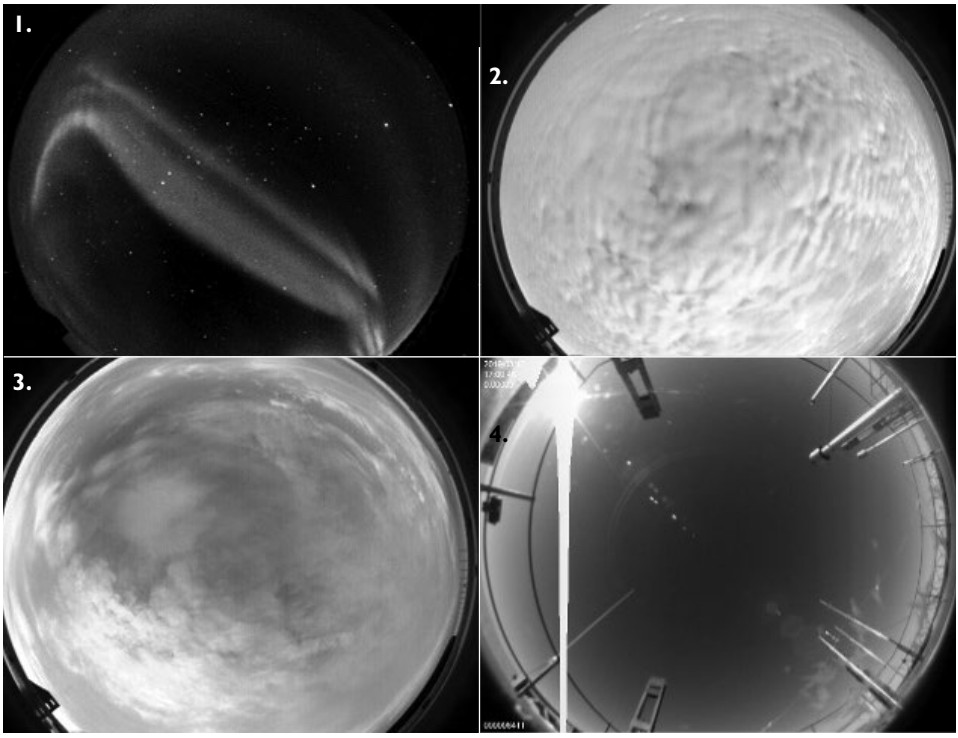


Timing: 2018-ongoing

More information: *https://bas.ac.uk/polar-operations/sites-and-facilities/facility/all-sky-camera-black-and-white*

This instrument takes regular, visible light images of the sky using a fisheye lens. This data is used to determine the cloud cover levels at a given site. It is normally used to aid the analysis of mesopause (upper middle atmosphere, 87km) airglow spectra measurements (cloud equals poor airglow spectra) which are used to calculate mesopause temperatures. It also can be used to observe aurora.

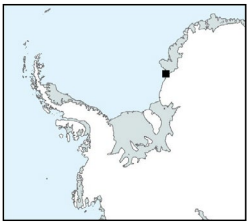
This instrument has been engineered to run autonomously over the unmanned Halley winter period.



▲ *Figures (1-3) are from Halley in previous years, one of the aurora, two of cloud cover. Fig 4 is an image taken by the camera during its unmanned operation in March 2019*

Halley VI Research Station

Auroral cameras – conjugate measurements of isolated proton auroras, red aurora, and pulsating auroras at subauroral latitudes



Timing: 2020-ongoing

We have three small auroral cameras at the Halley Research station that have run autonomously. These cameras are used to observe:

Proton auroras

Energetic protons striking the upper atmosphere can cause isolated bursts of light from the upper atmosphere known as proton auroras. One curious aspect is that the bursts of light occur in the northern and southern hemisphere but not at the same time. One theory suggest that the bursts of light are due to an ultra-low frequency wave packet that travels along the geomagnetic field and bounces between the northern and southern hemisphere. Theory suggests that each time the wave packet crosses the equator it causes a burst of energetic protons that travel along the magnetic field into the atmosphere – so causing the burst of light. However, satellite observations provide inconclusive support for this idea. The optical instrument at Halley is designed to measure these bursts of light and compare the timing with signals at Nain in the northern hemisphere. The intention is to combine the optical measurements with measurements of the wave packets using the search coil magnetometer at Halley and Nain and hence test the theory more carefully.

Red aurora

Red aurora are sometimes observed at Halley after a large geomagnetic storm. They can last for hours but the chain of events leading to the red aurora is very complicated and not well understood. Satellite data suggest that ions trapped in the geomagnetic field are the ultimate source of energy for the red aurora. The ions are heated and then somehow transfer this heat to electrons which travel down into the atmosphere and collide with oxygen atoms which emit the light we see as the red aurora.

continued ▷

▲ *Red aurora (Image: Kazuo Shiokawa)*

Halley VI Research Station

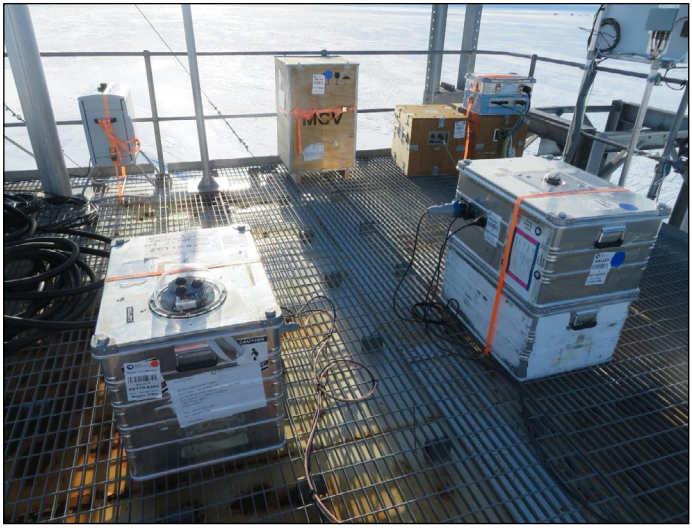
Auroral cameras continued

The object of this project is to deploy a special type of camera that can measure the red aurora across the whole sky so we can understand this energy transfer process. The camera has been built by our Japanese colleagues at Kanazawa University in Japan as part of a new and longer-term collaboration with BAS.

This project is important since high-energy ions which power the red aurora also cause damage to satellites in orbit. By understanding the red aurora and measuring how long it lasts we can help determine how long satellites may be at risk of damage.

Pulsating auroras

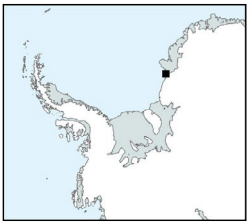
Observations show that the intensity of the aurora can vary as if there is a switch turning it on and off every second or so. As energetic electrons striking the atmosphere cause the bright auroral patches, the suggestion is that wave-particle interactions modulate the flow electrons coming down the field line into the atmosphere. It is thought that the waves responsible are very low frequency plasma waves, which originate in space but which also travel along the geomagnetic field and can be detected at Halley. The intention is to combine the optical observations with measurements of very low frequency waves at Halley to test some of the theories.



▲ *The auroral camera system (left) on the roof of the CASLab, adjacent to the All-Sky Camera system (right)*

Halley VI Research Station

Clean Air Sector Laboratory (CASLab)



Timing: 2012-ongoing

More information: *https://bas.ac.uk/polar-operations/sites-and-facilities/facility/halley/clean-air-sector-laboratory-caslab/#about*

Tropospheric ozone

The laboratory-based TEi 49i ozone monitor currently runs continuously in the CASLab. These measurements not only help us to understand the mechanisms of reactive chemistry in the seasonal sea-ice zone, but also contribute to our commitments of being a background monitoring station for the WMO's Global Atmospheric Watch programme.

Aerosol loading

The Automated Condensation Particle Counter (CPC) instrument measures the concentration of particles (>0.01µm) in the atmosphere. These particles are produced from a variety of processes relating to the production of reactive halogen oxides and sulphur compounds from the seasonal sea-ice zone and contribute to local aerosol loading. These measurements therefore make a complimentary addition to those made by the TEI 49i ozone monitor.

▲ *The Clean Air Sector Laboratory (CASLab) at Halley Research Station*

▲ *The CASLab is located away from the main station*

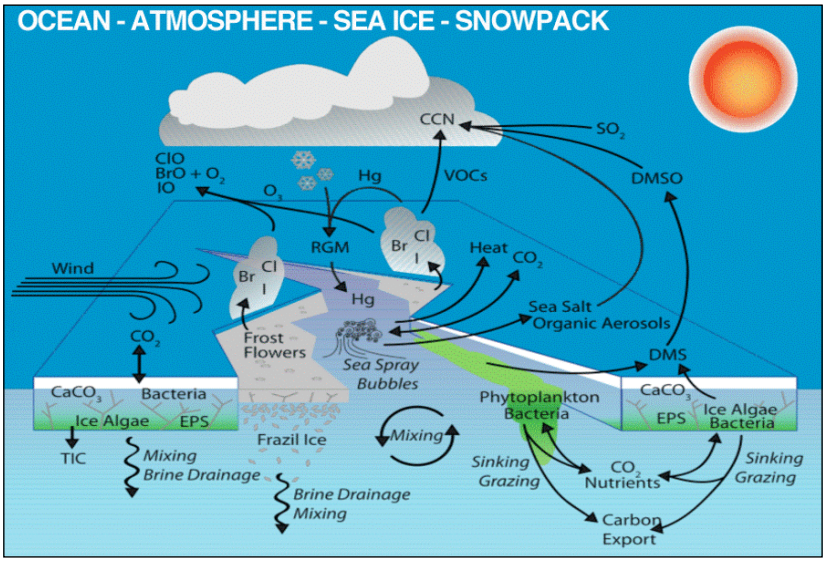
continued ▷

Halley VI Research Station

Clean Air Sector Laboratory (CASLab) continued

Greenhouse gas observations of CH_4 and CO_2

We have developed two autonomous systems centred on the Picarro instrument, which measure the atmospheric methane (CH_4) and carbon dioxide (CO_2) mole fraction. We are currently running one of these systems with our international colleagues at the Alfred Wenger Institute's (AWI) Neumayer Station III. Measurements of CH_4 and CO_2 contribute to two NERC-funded projects; the SONATA-RoSES programme, the aim of which is to assess the current state of the Southern Ocean carbon cycle, and also the MOYA project, aimed at improving quantification the global budget of atmospheric methane.

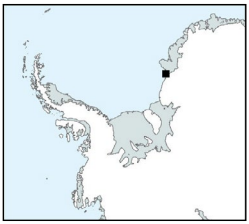


▲ *Schematic showing the physical, chemical and biological interactions in the sea-ice zone*

Halley VI Research Station

Discovering reasons for atmospheric methane growth using deuterium isotopes (MethaneDH)

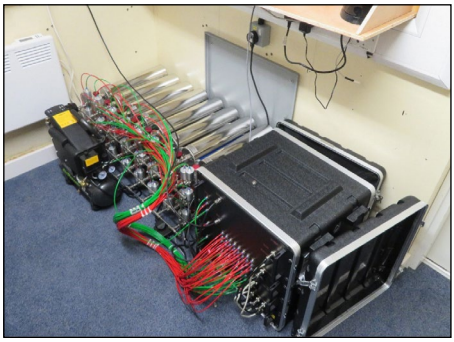
Timing: 2021-ongoing



Atmospheric methane levels are growing rapidly with a 70ppb (an extra ~4% of total atmospheric methane) rise in atmospheric methane mole fraction observed over the last decade. The reasons behind the growth since 2007 are not well known. The changing 13C/12C isotopic signature of atmospheric methane can give us some insight into the reasons for the change because, concurrent with the atmospheric methane rise, it has become depleted in 13C. There have been several proposed reasons for the increase and corresponding isotopic shift and we need additional tracers of the sources to explain it. This proposed work will use measurements of the deuterium/hydrogen (D/H) isotope ratio of methane to constrain the source distribution of methane globally.

New instrumentation for high-precision multiple-sample measurement of D/H isotopes in methane in ambient air has recently been developed and this will be used to analyse air samples collected close to sources. The isotopic signatures of the major sources will hence be characterised, including wetland, waste, biomass burning, fossil fuel, ruminants and rice agriculture. A focus of the field campaigns will be on tropical Africa and East Asia, parts of the world with high emissions of methane, but with very few measurements of methane isotopic signatures. Measurements at remote locations, such as Halley, will act as baseline information, and latitudinal transects will inform on global distributions. The results will then be used to identify regional source signatures for the main source categories. Understanding the causes of the current rise in methane is critical to driving policy for greenhouse gas reduction globally and the desire to remain within the 2°C temperature change outlined in the Paris Agreement.

The engineering teams at BAS have built an automated flask sampler that will run unattended through the Halley winter collecting air samples that will be shipped out for analysis the following season.

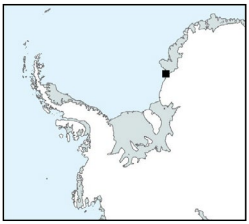


▲ *The automated methane flask sampler in the CASLab*

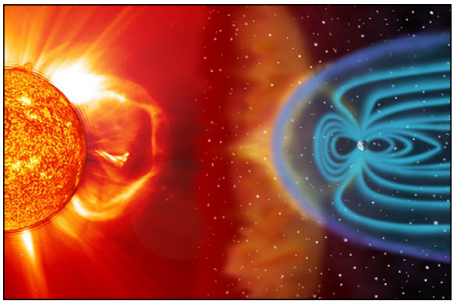
Halley VI Research Station

Electro-Magnetic Quiet Area (EMQA)

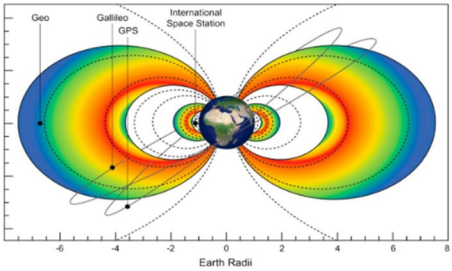
Timing: 2012-ongoing



The Electro-Magnetic Quiet Area (EMQA) at Halley is a region of the station that is packed with very sensitive instrumentation that detects very slight disturbances in the Earth's magnetic field and variations in one of the upper most layers of our atmosphere – the ionosphere. These instruments run automatically throughout the year without the need for human intervention. This season we will be carrying out some minor maintenance on some of the equipment.



▲ *The solar wind pushing on Earth's magnetic field (Image: NASA)*



▲ *Earth's Van Allen radiation belts*

Search coil magnetometer

This instrument is designed to measure ultra-low frequency waves. These waves are generated in space by natural processes during geomagnetic storms and other active periods driven by solar disturbances. Some of the waves are guided along the geomagnetic field and are able to penetrate the atmosphere and reach the ground. We want to find out more about these waves since we think they cause a depletion in the Earth's radiation belts – i.e. we think they remove high-energy charged particles that circulate around the Earth and which cause damage to satellites. The Halley and Rothera search coil magnetometers are part of an international network of magnetometers called MICA-S (Magnetic Induction Coil Array – South). By making measurements over a network of instruments at different locations we can get a better information on where the waves originate, where they propagate to, and thus gain a better understanding on the region in space where they deplete the Earth's radiation belts.

Fluxgate magnetometer

This instrument measures perturbations in the Earth's magnetic field caused by electrical currents in the ionosphere and beyond. Periods of particularly large and variable magnetic perturbations are known as magnetic storms during which electrical power distribution networks across the globe, such as the National Grid, can be disrupted or damaged.

continued ▷

Halley VI Research Station

Electro-Magnetic Quiet Area continued

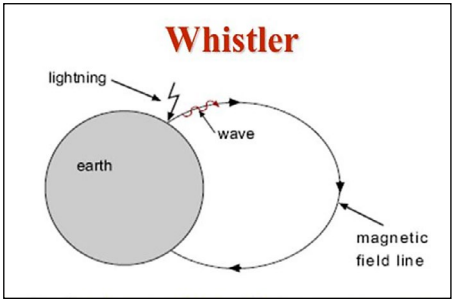
Very Low Frequency (VLF) receiver

The Halley VLF receiver listens to very low frequency radio waves as part of several networks of receivers located all over the Polar Regions. The data gathered by these networks are used by more than 35 institutions around the world to:

- Record and map, in real-time, lightning strikes around the world (WWLLN instrument – University of Washington, Seattle, USA)
- Listen to powerful VLF communication transmitters located in mainland USA, Hawaii, Europe (including the Lake District). This technique uses the upper atmosphere as a gigantic energetic particle detector to find out about interactions between our atmosphere and solar flares, solar eclipses, explosions on other stars, and particles effects from the solar wind – the aurora (AARDDVARK instrument – University of Otago, New Zealand)
- Record electromagnetic waves from space – these waves are responsible for the harsh conditions for satellites as they orbit through the Van Allen Belts (VELOX instrument – BAS, Space Weather Observatory)
- Record and analyse whistling tones originating from lightning in America – this inputs into space weather models used to protect satellites from the harsh radiation environment of space (AWDA instrument – University of Eotvos, Budapest, Hungary).

As part of the Halley Automation Project we also run one Low Power Very Low Frequency (VLF) wave receiver. These instruments provide back up to two of our higher power experiments, known as AARDDVARK and VELOX.

▲ *The Halley VLF receiver*



▲ *Schematic showing the generation and detection of a 'whistler' from a lightning strike at the WWLLN instrument*

MOSAIC

The Mesospheric 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 joint collaboration between the Massachusetts Institute of Technology, Lancaster University, the South African National Space Agency, and the British Antarctic Survey. This experiment will map the concentration of high altitude ozone from pole to pole and identify the changes caused by space weather. The instrument

continued ▷

Halley VI Research Station

Electro-Magnetic Quiet Area continued

is a passive, low-cost spectrometer for detecting ozone at altitudes of ~100km (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 11.072GHz generated by ozone. By fitting the shape of the ozone line radiation very accurately we can determine the concentration of ozone with altitude, especially from 50-100km altitude. At these high altitudes the concentration of ozone is affected by chemistry reactions induced by energetic particle impacts on the atmosphere, such as those that cause the aurora.

Riometer

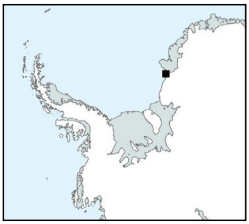
This instrument looks straight up and measures the noise coming from the galaxy at frequencies between 15-50MHz. The galactic noise is almost constant, with just small variations occurring as the stars rotate across the sky each day. Space weather events cause changes in the transmission of the galactic noise signal through the Earth's ionosphere around 50-100km up. We can measure these changes in radiowave opacity using the riometer, and calculate what is happening to the levels of ionization. This information tells us about the geophysical processes going on during solar storms, it indicates the presence of the aurora directly over Halley (even during daylight hours), and indicates the levels by which local radiowave propagation conditions could be affected – like polar radio blackouts. A new version of the instrument will be deployed in 2024, so while there is no photo of it at Halley yet, the pre-deployment version is pictured below.

▲ *The Halley MOSAIC spectrophotometer is located on top of a container*

▲ *A new riometer was deployed in 2024*

Halley VI Research Station

Glaciological monitoring of the Brunt Ice Shelf

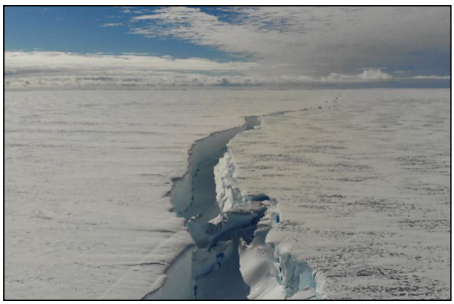


Timing: 2011-ongoing

More information: *https://bas.ac.uk/project/brunt-ice-shelf-movement*

The project uses data from a variety of in situ instruments on the ice shelf, satellite data, and numerical modelling to understand the changing risk to our operations and infrastructure on the Brunt Ice Shelf. In 2016-17, the Halley technical, vehicle, science and operational teams successfully moved the Halley VI station to a new, safer location on the ice shelf.

In February 2021, the first of several large icebergs (now called A74) calved from the northern part of the ice shelf. In January 2023, a second large iceberg (now called A81) calved from the western part of the ice shelf. In May 2024 a third large iceberg calved from north of Halloween Crack (now called A83). As a result of the project, the Brunt Ice Shelf is the most closely and thoroughly observed ice shelf on Earth. A network of 11 GPS instruments measures the deformation of the ice shelf around Halley VI while six additional GPS track the movement of icebergs, sending data to Cambridge every day. Satellite imagery from ESA, NASA and the German Aerospace Agency along with ground penetrating radar and on-site drone footage provide additional information on any growth of cracks to inform operations during the summer season.



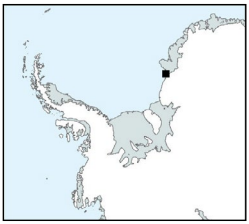
▲ *Chasm 1 on the Brunt Ice Shelf*

▲ *Maintaining a GPS station on the Brunt Ice Shelf*

Halley VI Research Station

Meteorology and ozone monitoring

Timing: 2012-ongoing



Stratospheric ozone measurements

Stratospheric ozone shields the Earth's surface from more than 90% of harmful solar ultraviolet radiation. The 'Ozone Hole' was discovered in 1985 by BAS scientists using Halley's unique data set of Dobson spectrophotometer observations which now spans 60 years. Maintaining these observations, at Halley and elsewhere, is crucial to monitoring the slow recovery of stratospheric ozone following the banning of CFCs.

The destruction of ozone by CFCs in the stratosphere requires extremely cold temperatures, and energy from sunlight. Antarctic ozone therefore begins to decrease in the spring with the end of polar night and recovers during the dark winter months when ozone is replenished by atmospheric mixing.

The automated Dobson is being returned to the UK this summer season for repair and calibration; we still have the SAOZ instrument (Système D'Analyse par Observations Zénithales) running at Halley. This is another instrument that measures stratospheric ozone, as well as Nitrogen Dioxide, which plays a key role in the global ozone distribution.

The discovery of the Ozone Hole is a prime example of the importance of investing in long-term observational science.

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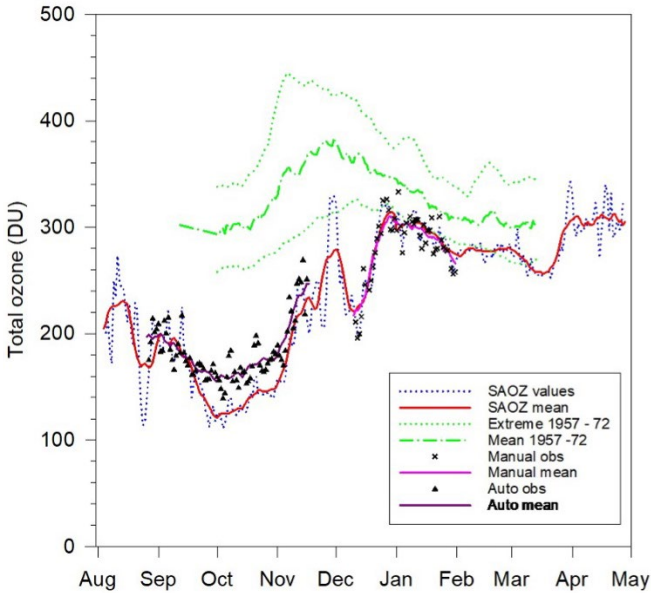


▲ *Ozone measurements at Halley in 2023-2024 (AutoDobson, Manual Dobson and SAOZ data)*

Halley VI Research Station

Meteorology and ozone monitoring continued

Radiosonde launches

This year, we will resume our launch of radiosonde balloons six days a week as soon as personnel return to Halley in late November. These radiosondes measure temperature, humidity, wind speed and wind direction from the Earth's surface, through the troposphere (10km) and high up into the stratosphere (~25km). Each set of measurements provide a snapshot of the state of the atmosphere above Halley at the time of the launch. This information is then fed into global weather forecasting models.

Automated air sampling

We have an automated system for collecting air samples throughout the unmanned winter months. These air samples are collected monthly and sent to the U.S. National Oceanic and Atmospheric Administration (NOAA) in the following summer. They will measure a range of greenhouse gases and atmospheric pollutant, thus maintaining these important global data sets that were first established at Halley in 1983.

Snow sampling campaign

Snow samples are collected that are then melted down for water samples. These are sent to the IAEA-WMO Global Network for Isotopes in Precipitation (GNIP) which has been in operation since the 1960's and is comprised of hundreds of observation stations located around the world.

SPN1 solar radiation sensor

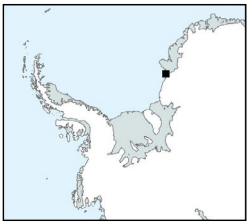
The SPN1 sunshine pyranometer provides measurements of total radiation, diffuse radiation, direct radiation and sunshine duration.

▲ *Automated air sampling system running in the CASLab*

▲ *Radiosonde launch at Halley*

Halley VI Research Station

Skiymet meteor radar

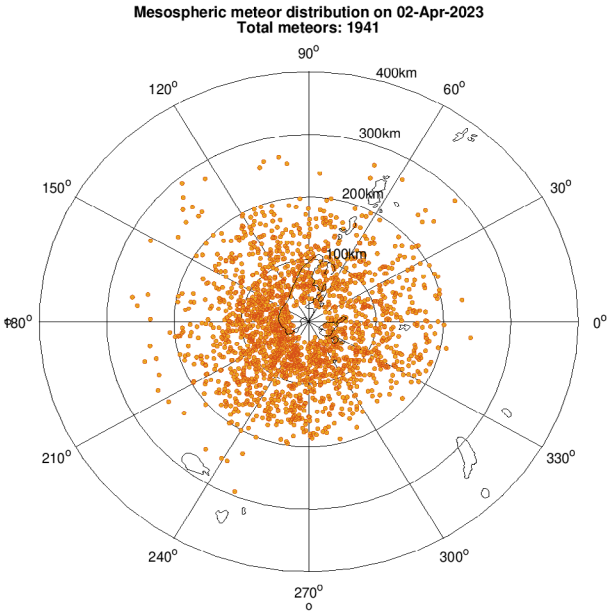


Timing: 2024-ongoing

More information: *https://www.bas.ac.uk/polar-operations/sites-and-facilities/facility/skiymet*

The meteor radar detects the ionised trails of meteors drifting with the winds of the upper mesosphere in a region ~300km in diameter centred over each radar. The radars use these drifts to determine zonal and meridional winds at heights of 80-100km with height and time resolutions of ~2km and 1 hour. Both the radars can make continuous measurements over periods of many years and so are ideally suited to studies of winds, tides and waves. Statistical techniques applied to the individual meteor drifts allow us to determine the parameters of atmospheric tides and the variances and momentum fluxes of gravity waves.

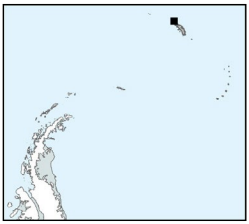
Work includes installing six antenna on telegraph poles and connecting antenna to electronics located in a caboose at Halley. A similar system already exists at Rothera.



▲ *Example output from the Skiymet already in place at Rothera Research Station showing a dot plot of the distribution of mesospheric meteors on 2 April 2023*

Bird Island Research Station

Bird Island marine predators long-term monitoring programme



Timing: Ongoing

More information: *https://www.bas.ac.uk/project/higher-predators-long-term-science*

Each year, BAS undertakes long-term ecological research at Bird Island under the CONSEC programme (Research, Conservation and Leadership in Southern Ocean Ecosystems), supported by NC-ALI. The goal is to track and understand changes in Antarctic ecosystems, particularly through the lens of marine predators. These species respond to both natural drivers like climate variability and human impacts such as fisheries.

Ongoing resighting studies of ringed and tagged animals provide vital data on survival across life stages (juvenile, immature, adult), recruitment age, breeding frequency, and success. These insights are central to a wide range of ecological and life history research. The focus species at Bird Island include wandering, black-browed, and grey-headed albatrosses; northern and southern giant petrels; white-chinned petrels; macaroni penguins; and both Antarctic fur and leopard seals. The programme also conducts population and breeding monitoring for light-mantled albatrosses, gentoo penguins, and many others! Additional data collected each season – such as chick and pup growth rates, foraging trip durations, breeding phenology, and dietary composition – reflect fluctuations in food availability across the wider marine environment. These findings contribute to regional conservation efforts, informing the management of Southern Ocean fisheries through CCAMLR, and supporting ACAP's objectives to improve the conservation status of listed seabird species.

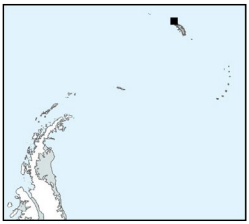
▲ *A leopard seal on Bird Island being measured for body size*

▲ *The team on Bird Island looking for new sightings*

Bird Island Research Station

The movement and behaviour of snowy sheathbills

Timing: Ongoing



A new colour-ringing study of snowy sheathbills is underway at Bird Island, aiming to improve our understanding of this unique and understudied species. The project focuses on fitting snowy sheathbills with individually identifiable colour rings and conducting systematic resighting efforts to track individuals over time.

The key objectives of the study are to estimate the population size of sheathbills on Bird Island, investigate their behaviour through detailed observations of individual time budgets, and assess migratory movements by recording sightings of ringed birds at other locations.

Findings from this work will contribute important new knowledge about a species for which relatively little is known and will inform the Government of South Georgia & the South Sandwich Islands' Terrestrial Protected Area Management Plan.

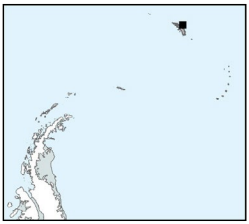
We encourage all visitors and researchers to keep an eye out for colour-ringed sheathbills and report any sightings. Please contact Ash Bennison directly or email sheathbill@bas.ac.uk with details of where and when any ringed individuals are seen (and pictures are always welcome!)

▲ *A ringed snowy sheathbill*

▲ *Please report any sheathbill sightings!*

King Edward Point Research Station

Creating a sustainable framework for monitoring whales at South Georgia

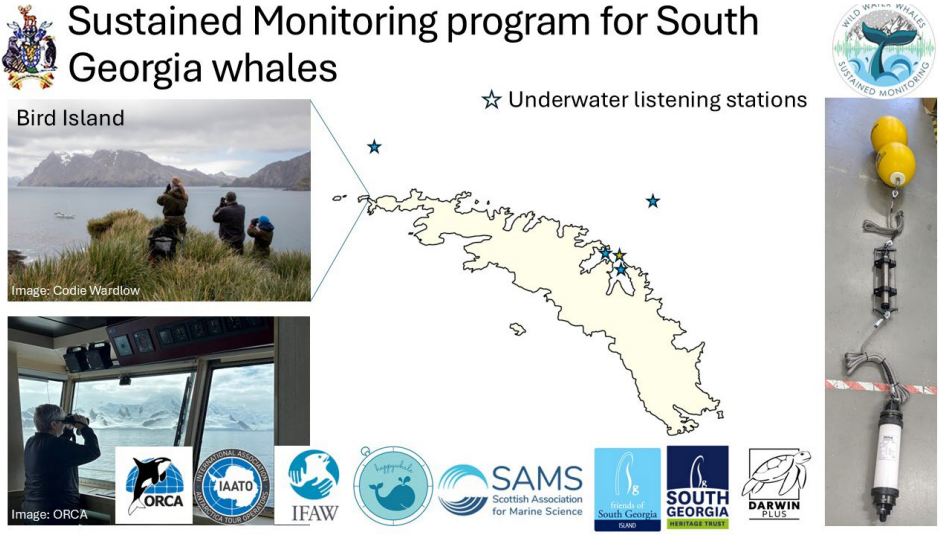


Timing: October 2024 to March 2027

More information: *https://www.bas.ac.uk/project/sustained-monitoring-of-whales-at-south-georgia*

This project helps the Government of South Georgia and the South Sandwich Islands (GSGSSI) take management actions to improve environmental quality for recovering whales in South Georgia (SG) waters. The project will build a sustainable framework for long-term monitoring of whales at South Georgia (focused in high vessel-traffic areas) using acoustic detections and data-gathering partnerships to measure inter-annual whale density patterns.

The project aims to deploy three acoustic moorings to record whale vocalisations and vessel noise. The two KEP marine biologists and the crew of the GSGSSI are key project partners for the deployment and turnaround of these acoustic moorings. Whale observations from Bird Island and observers from the ORCA whale sightings networks will be complied and compared to acoustic data collected in Cumberland Bay. All of this data will contribute and provide management guidance to minimise impacts from vessels (collision risk and underwater noise) in key whale habitats and identify environmental drivers influencing whale densities.

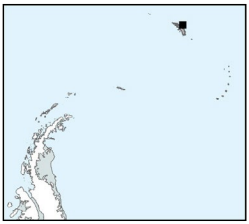


▲ *Summary slide showing acoustic mooring and whale observers*

King Edward Point Research Station

Disentangling drivers of Antarctic fur seal populations and the impact of Avian Influenza

Timing: November 2025 to April 2026



Antarctic fur seals are one of South Georgia's top predators, with approximately 95% of the world's population breeding on the island. This project aims to use a small UAV (drone) to update population counts at three breeding beaches on South Georgia. Two beaches were severely affected by Highly Pathogenic Avian Influenza (HPAI) during the 2024-25 season, with high levels of male and pup mortality, while the third is a long-term study beach. Counts of males, females and pups will be compared to long-term photo-point monitoring and historic aerial counts to detect any significant changes linked to HPAI or other population drivers such as oceanographic conditions. Blood samples will also be collected to assess HPAI seroprevalence (the proportion of animals with antibodies indicating past exposure) and immunity in the breeding population.

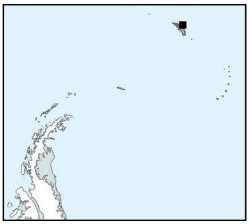
▲ *Antarctic fur seals on the coastline of South Georgia*

▲ *Maiviken is a long-term fur seal study site on South Georgia*

King Edward Point Research Station

Higher predator monitoring at Cumberland Bay

Timing: September 2025 to April 2026



King Edward Point Research Station (KEP) conducts applied science, focused on the sustainable management of the three fisheries within the South Georgia Marine Protected Area; toothfish, krill and icefish. Since 2008 Antarctic fur seals and gentoo penguins, both krill predators, have been monitored at Maiviken in Cumberland Bay. Maiviken is an important study site due to its proximity to the northern shelf and shelf-break of South Georgia, where the krill fishery operates. The number of these animals and their breeding success is a good indicator of krill abundance in the ecosystem

Each summer, seal and penguin populations are surveyed by ground and drone counts. Breeding success is monitored through the number of successfully reared offspring and their average weights and fur seal scats are collected to study diet. Southern elephant seals are also monitored during the summer breeding season, with recent work showing juveniles to be krill consumers.

Data from KEP is reported back to CCAMLR (Convention for the Conservation of Antarctic Marine Living Resources) annually. CCAMLR are responsible for setting the annual krill fishery quota. The Government of South Georgia then apply additional measures to the fishery, such as seasonal closures and No Take Zones.

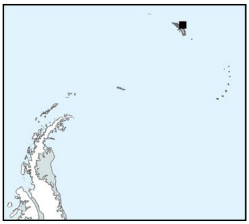
▲ *Gentoo penguins at the Maiviken breeding colony*

▲ *Southern elephant seals surveyed by drone, with males, females and pups clearly distinguishable*

King Edward Point Research Station

Synchronised swimming: tracking penguins and krill swarms on the South Georgia Shelf

Timing: Summer 2025 to 2026



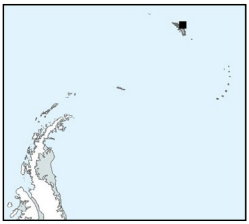
This project investigates how breeding gentoo penguins at Maiviken, South Georgia, locate and exploit krill swarms during their foraging trips. By simultaneously tracking penguin movements in three dimensions and surveying prey with ship-based acoustics, we aim to link penguin diving behavior to krill distribution and swarm structure. We will deploy 41 GPS depth loggers on breeding adults during the guard period, recovering them as chicks enter crèche. Six tags will enable remote data downloads, helping guide targeted acoustic surveys of krill hotspots. Nest monitoring with time-lapse cameras will connect parental foraging behavior to breeding success, while diet will be assessed via DNA analysis of collected scats. This integrated approach will improve understanding of predator-prey dynamics on the South Georgia shelf, informing conservation and management of both penguin populations and their critical krill prey.

▲ *Gentoo penguin adult and chick at Maiviken, South Georgia*

King Edward Point Research Station

The ECHO surveys: long-term monitoring of plankton communities in South Georgia waters

Timing: Year-round



The South Georgia marine ecosystem is subject to natural variability, regional climate change, and impacts from commercial fisheries. Plankton and micronekton communities, especially krill, form the foundation of this productive environment, supporting vast numbers of marine mammals and seabirds. The ECHO surveys, named for the primary acoustic instrument (the echosounder), are conducted year-round to track seasonal and annual changes in these communities. They integrate monthly plankton trawls in eastern Cumberland Bay with bimonthly Eastern Core Box (ECB) surveys off northeast South Georgia. Data collected include acoustic readings, oceanographic measurements, predator observations, zooplankton net samples, and optical plankton data.

Monthly trawls from the FPV *Pharos* SG, ongoing since 2006, monitor seasonal changes in plankton and fish larvae, including mackerel icefish. The bimonthly ECB surveys, begun in 2022, use four 60km transects with continuous EK80 echosounder data, daytime marine mammal observations, evening plankton trawls targeting krill swarms, CTD casts, twin miniBongo nets for smaller zooplankton, and an underwater vision profiler for detailed optical sampling.

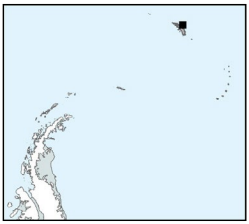
These integrated surveys enhance understanding of krill abundance and variability, key factors for interpreting penguin and seal breeding success and whale distribution, and support ecosystem-based management of the South Georgia and South Sandwich Islands Marine Protected Area and the region's winter krill fishery.

▲ *Humpback whale seen during the ECHO survey*

▲ *Deploying the Conductivity, Temperature and Depth sensor off the north-east coast of South Georgia during the ECHO survey*

King Edward Point Research Station

Transmission, spread, and population impacts of Avian Influenza on South Georgia wildlife



Location: King Edward Point and Bird Island

Timing: Summer 2025 to 2026

Highly Pathogenic Avian Influenza (HPAI) was first detected in South Georgia in October 2023. The initial cases involved dead brown skuas on Bird Island, but the outbreak rapidly spread across the region, affecting a wider range of species, including mammals. Among the most severely impacted were elephant seals, brown skuas, and wandering albatrosses. Although the current situation remains uncertain, there is a recognised risk of a third outbreak during the 2025-26 summer season.

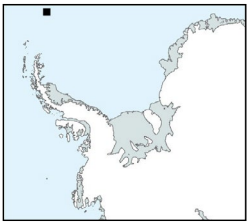
This project aims to continue coordinated, systematic sampling across South Georgia to strengthen outbreak monitoring and improve understanding of transmission dynamics. This season's priorities include early detection of new strains, particularly through scavenger species such as giant petrels, and tracking viral evolution by focusing on fur seal immunity late in the season. Additionally, the project will examine the relationship between pathogen spread and population-level impacts by integrating pathogen sequence data, host exposure and survival inferred from immunological analyses, and long-term monitoring of marine predator populations around South Georgia.

▲ *Sampling a gentoo penguin at Maiviken during the 2023-24 Avian Influenza outbreak at South Georgia*

Signy Research Station

Aerial surveys of wildlife and habitats on Signy Island

Timing: November 2025 to February 2026



This project will trial the use of a DJI Dock 1 to perform aerial surveys of wildlife and habitats on Signy Island. The equipment offers the ability to perform pre-programmed flights over the internet, allowing operations to be conducted on the island from a base anywhere in the world. Missions can be flown immediately or scheduled to be performed regularly, as soon as the inbuilt weather station confirms conditions are suitable. This technology frees dependency of such survey work upon having a trained pilot at the station, and indeed any personnel at all if reliable power and internet can be provided during periods that the station is closed. The project will start with summer-only trials when the station is open and the drone can be maintained and overseen by personnel, flying an increasingly ambitious set of surveys over moss banks, seabird colonies and seal haul-out sites. We will trial its use for infrastructure surveys and search and rescue operations at the same time. The aircraft will be monitored by a trained pilot who can take command with a remote controller in the event of a problem. Should the trials prove successful we will move to a deployment during the winter period once an appropriate power supply and internet access are available outside the periods of normal station operation. This has potential to allow surveys of early-nesting penguin species whose breeding begins before the station opens in spring. The trial will serve as a wider proof of concept for automated drone operations on stations and deep-field sites.

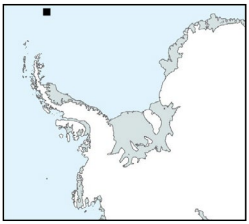
This project aims to conduct summer-only trials of DJI Dock while the station is open, allowing supervision of operations by a qualified pilot. These will initially be around the station and backslope before extending to Cemetery Flats and Gourlay Peninsula. During these flights image data will be collected for census and mapping of terrestrial vegetation communities, seals and breeding seabirds, providing a range of examples of applications that will be of interest to biologists across BAS. This work will also serve as a proof of concept for the equipment for wider use across BAS, where aerial surveys of remote locations are required at times when personnel are absent.

The unit will be packed up for the winter, given that currently renewable power is not available to power it outside station operation periods. The rebuild of Signy promises to be net zero, meaning the power requirements of the Dock can be hard-baked into the design.

▲ *Elephant seals at Cemetery Flats beach on Signy Island*

Signy Research Station

Signy Island marine predators long-term monitoring programme



Timing: December 2025 to April 2026

More information: *https://www.bas.ac.uk/project/higher-predators-long-term-science/higher-predators-signy-island-penguin-monitoring*

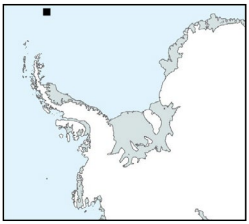
BAS carries out long-term science at Signy as part of the CONSEC (Research, Conservation and Leadership in Southern Ocean Ecosystems) programme funded by NC-ALI to understand changes in Antarctic ecosystems. Marine predators are sensitive to processes that are natural (such as climate variability), or brought about by humans (such as fishing). The data collected annually include population size, reproductive success, timing of breeding and diet composition of predators.

Analyses show that modes of climate variability, e.g. the Southern Annular Mode and the El Niño-Southern Oscillation, affect upper-trophic-level predators, including seals and penguins. The Antarctic is unusual in that scientists and policy-makers from many nations have adopted an ecosystem approach for managing fisheries. One of the programme objectives is to help inform the regional conservation and management authority for Southern Ocean fisheries, the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR). BAS data on southern giant petrels at Signy are also submitted to the Agreement on the Conservation of Albatrosses and Petrels (ACAP), which seeks to achieve a favourable conservation status for albatrosses and petrels, primarily by coordinating and undertaking international activity to mitigate known threats to their populations.

▲ *The South Georgia shag breeds at the South Orkney Islands, South Georgia and the South Sandwich Islands, and is now recognised by taxonomists as a separate species within the blue-eyed shag complex*

▲ *The gentoo penguin is one of three penguin species (Adélie, chinstrap and gentoo) monitored annually at Signy for population trends and breeding success*

Signy Research Station



Spatial and temporal patterns of climate change impacts on vegetation and permafrost across the Antarctic Peninsula and Scotia Arc macroregion

Location: Signy and Rothera Research Stations

Timing: January to March 2026

Since 2000 the warming of the Antarctic Peninsula (AP) paused although it is predicted to resume, as suggested by the extreme events in early 2020. The AP macroregion includes different climatic and biogeographic regions with likely different responses to climate change (CC), highlighting the need for long-term and multidisciplinary studies. This multidisciplinary proposal aims achieve a better understanding of CC impacts on terrestrial ecosystems analysing cryosphere (permafrost, snow), biosphere (vegetation, soils), hydrosphere (permafrost hydrology). Since late 1990s, despite the recent pause in warming, both abiotic (permafrost) and biotic (vegetation) responses are not homogeneus across the AP. Since 2009 the two native vascular plants exhibited striking expansions on Signy Island, increasing >100%. Their success could be due to their capability competing for nutrients and the occurrence of fungal root symbionts. Soil fungi and microbiota have pivotal ecological roles and their potential alterations arising from CC could have substantial effects on ecosystems. Vascular plants expansion could also facilitate invasive plants' establishment.

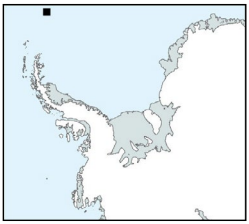
We aim assess whether the climatic and environmental changes occurred since the early 2000s are producing measurable impacts at different spatial and temporal scales on vegetation, permafrost, and soils across the AP macroregion from the South Orkney Islands to Marguerite Bay through a multidisciplinary and international consortium. We will assess the sensitivity of vegetation, soil chemistry and microbiota through long-term manipulative experiments on Signy Island. We will use *Deschampsia antarctica* as a target of major ecosystem changes involving vegetation and assess whether its expansion is associated with changes in its rhizosphere and associated root and soil microbiota and quantify permafrost degradation and Active Layer Thickening (ALT) through long-term monitoring and ALT impacts on the hydrology and hydrochemistry of surface freshwaters.

BAS staff will support this project by downloading the ongoing experiments and conduct maintenance of the long-term monitoring network.

▲ *Signy Research Station*

Signy Research Station

Summer-monthly collections of the intertidal bivalve Lissarca miliaris at Shallow Bay, Signy Island



Timing: November 2025 to March 2026

Lissarca miliaris is a small, up to 5mm-long, reddish-brown bivalve that lives on red and brown seaweed in the intertidal of Signy Island. Specimens previously collected between 1972 and 2011 were analysed for growth and reproduction and showed changes in growth performance correlating with a 40-year warming event of air temperatures, suggesting local adaptation to increasing temperatures. They also showed changes in reproductive efforts with more but smaller juveniles being brooded and released. Since 2011 we continued the summer-monthly bivalve collections to monitor further growth and reproductive changes and since 2014 we monitor the annual intertidal, subtidal and terrestrial temperatures, a key environmental factor, with TinyTag temperature loggers. In our annual dataset until 2021, we can see that times with broken winter sea-ice increase, intertidal bivalves are experiencing colder winter temperatures and variation growth rate is linked with variation in temperature.

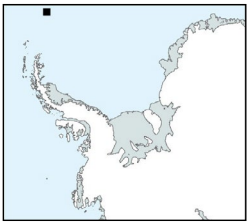
For the bivalve collections a handful of seaweeds is picked at monthly intervals during the summer season from the stepping stones in 'Shallow Bay' and checked for the presence of the small bivalves. The bivalves (~50 individuals) will be removed either in the field or in the lab from the seaweed and fixed in ~70% ethanol.

The measurements from the TinyTag loggers, deployed at one intertidal, one subtidal and four terrestrial sites, will be downloaded once per year and at the same time have their batteries replaced.

▲ *Lissarca miliaris on seaweed*

Signy Research Station

Trial of remote UAS operations on Signy using DJI Dock



Timing: November 2025 to February 2026

Understanding animal migration patterns is important due to its links with population processes. The conditions experienced along migration routes and in the wintering areas can affect overwinter survival of animals, or their body condition upon return to the breeding grounds which goes on to affect their reproductive success. The degree to which discrete breeding populations of animals share wintering areas can therefore have profound effects on how their population trends are coupled, and identifying these wintering areas can assist with diagnosis of factors driving population change.

Chinstrap penguins are found across the Scotia Arc and Antarctic Peninsula, including the South Orkney and South Shetland Islands. Tracking of migrations using geolocator tags has shown that birds from the South Shetlands tend to migrate to the Pacific Ocean or remain locally, while those from the South Orkneys move to the NE of the South Sandwich Islands. The consistency of these migratory strategies, both at the population and individual level, are poorly understood. This project aims to track chinstrap penguins from multiple colonies across the South Shetland Islands and Signy Island on the South Orkneys over three consecutive migrations to better understand migration paths and the degree of individual and population fidelity to wintering areas.

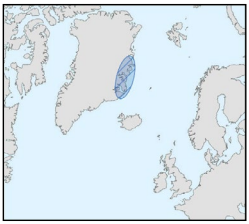
In 2022-23, at Gourlay Peninsula at the south-east of Signy Island, 22 chinstrap penguins were fitted with a small (3g) geolocator tag mounted on a leg ring, then released. Tagged birds were recaptured the following year, their tags removed and replaced with a fresh one, allowing recovery of data from the previous migration and equipping of the bird for the following one during a single encounter occasion. An additional four birds were marked to increase the sample size. Devices were swapped for a second time.

In the final year (2025-26) all devices will be recovered and the project fieldwork will end. We estimate this sampling strategy will produce ~36 bird-year migrations, 14 pairs of migrations within individuals and five individuals tracked over three years. This sampling will be replicated at four sites in the South Shetland Islands by other institutions.

▲ *A chinstrap penguin nesting at Signy*

RRS *Sir David Attenborough*

Greenland Ice Sheet to Atlantic tipping points from ice loss (GIANT)



Location: East Greenland fjords

Timing: July to August 2026

More information: *https://www.bas.ac.uk/project/giant*

The overarching goal of GIANT is to include Greenland fjords in the UK's Earth System Model (UKESM). Right now, the UKESM predicts that North Atlantic Sub-Polar Gyre currents (convection) could collapse in the 2040s if capped by enough freshwater from the Arctic, with major knock-on effects for ecosystems, fisheries and weather in the region.

Led by BAS, GIANT focuses on the key uncertainty in the Arctic freshwater budget – melting and calving at Greenland's marine glaciers. We aim to capture the complex physical processes involved in transporting oceanic heat to glacier faces and how this promotes melting and iceberg calving. We will achieve this by:

1. Developing a fleet of enhanced technologies to measure key physical processes including airborne and marine autonomous vehicles, on-ice instruments and instruments drilled into ice faces.
2. Deploying instruments at two field locations in East Greenland fjords (30-day SDA cruise plus helicopter) and NW Greenland (Petermann Glestjer, terrestrial teams).
3. Feeding observational data into multiple models for iceberg calving, ocean turbulence, ice fracture, and ice-face melting and eventually into a reduced physics fjord model and the UKESM.

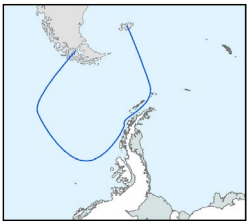
The GIANT team comprises nearly 50 scientists from 14 UK institutions and collaborators from the USA and Denmark.

▲ *MeltStake instrument operating at the ice face*

▲ *Air Greenland helicopter on the RRS Sir David Attenborough helideck*

RRS *Sir David Attenborough*

Iron and manganese impacts on the future of Southern Ocean ecosystems (Iron-Man)



Location: Southern Ocean

Timing: January 2026

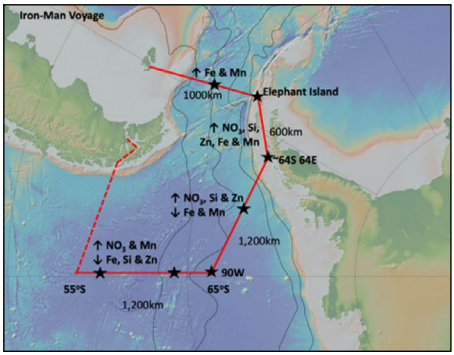
This project will deliver improved understanding of how key resources, mainly iron and manganese, regulate primary production and photosynthesis, across the Southern Ocean. This will help predict future impacts in this critical region for global biodiversity and carbon cycling. This will be achieved by combining chemical and biological observations and experiments.

This project will investigate how the relative supply and abiotic recycling, biological recycling and removal of iron and manganese to the upper ocean varies through different regimes, using ship-based and autonomous platforms.

Primary production in the Southern Ocean is considered to be dominantly regulated by iron. Climate models project increasing future primary production. However, climate models neglect the role of the micronutrient manganese, which has been shown to also be important in limiting Southern Ocean primary production.

Iron and manganese are both predominantly associated with photosynthesis and the relative demand primary producers have for one resource over the other is critical. Unfortunately, the role of different iron and manganese supply and cycling pathways in the Southern Ocean is poorly understood.

Confidence in projections of future Southern Ocean net primary production underpins regional biodiversity, ecosystem structure and carbon cycling – critical information for those seeking to manage and mitigate climate change impacts, including the development of marine protected areas.

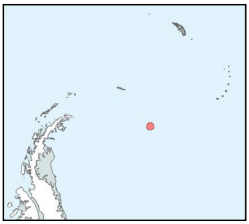


▲ *Iron-Man voyage tracks*

▲ *RRS Sir David Attenborough*

RRS *Sir David Attenborough*

Polar ocean ecosystem time-series (POETS) Western core box (WCB)



Location: Scotia Sea

Timing: February to March 2026

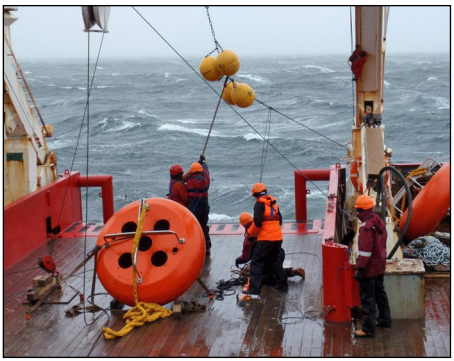
More information: *https://www.bas.ac.uk/project/poets-wcb*

South Georgia is an isolated island in the Atlantic sector of the Southern Ocean. Located south of the Polar Front, the region is bisected by the Antarctic Circumpolar Current, which transports nutrients and organisms from the Antarctic Peninsula across the Scotia Sea to the region.

South Georgia has been identified as a key source of regional biodiversity, potentially supporting anomalously high levels of endemic and range-edge species. Its pelagic ecosystem is extremely productive and intense phytoplankton blooms support a rich food web that includes zooplankton, in particular Antarctic krill, and vertebrate predators (penguins, seals and whales).

Antarctic krill play a central role in the Southern Ocean food web as effective grazers on phytoplankton as well as a key prey item of a wide range of higher trophic predators. Inter-annual fluctuations in krill abundance at South Georgia are significant and have been linked to environmental forcing and reduced predator foraging and breeding performance.

The WCB undertakes an acoustic survey for krill, net and environmental (CTD) sampling and deploys and recovers several moorings for all-year round monitoring. These data are required to understand the long-term variability in krill biomass at South Georgia and the influences from climate variability, fishing pressure and predation.

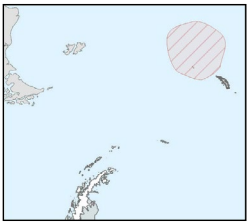


▲ *Mooring deployment*

▲ *Adult female Antarctic krill (Euphausia superba)*

RRS *Sir David Attenborough*

Scotia Sea open ocean laboratories (SCOOBIES)



Location: North-west Scotia Sea

Timing: March to April 2026

The Scotia Sea open ocean laboratories (SCOOBIES) is a long-term ocean observatory located in the northern Scotia Sea, near South Georgia, an area of exceptionally high primary productivity and atmospheric CO_2 drawdown. The observatory is designed to quantify the biological carbon pump (BCP) by measuring the flux of biologically fixed carbon to the deep ocean, thereby contributing to understanding global carbon sequestration processes.

At the core of SCOOBIES is a 3,600m-deep mooring at the P3 site, equipped with advanced biogeochemical sensors and autonomous platforms. This infrastructure enables high-resolution, year-round monitoring of carbon fluxes, plankton community dynamics, and their seasonal to interannual variability. It also provides critical insight into how anthropogenic stressors (such as plastic pollution and ocean acidification) interfere with these mechanisms. These measurements address knowledge gaps in biologically mediated carbon export, which are often underrepresented in climate models.

SCOOBIES is supported by the Polar ocean ecosystem time-series (POETS) and maintained under the National Capability Single Centre (NCSS). Its data contribute to international programs including IOCCP, GOA-ON, CCAMLR, and SOOS. As the only sustained time series of carbon flux in the Atlantic sector of the Southern Ocean, SCOOBIES plays a critical role in detecting environmental variability, informing climate projections, and supporting marine policy and conservation efforts.

▲ *Retrieving a sampling net during a science cruise*

▲ *Recovering a mooring from the Southern Ocean*

Feedback and further information

We welcome your feedback and comments on this document. These should be addressed to:

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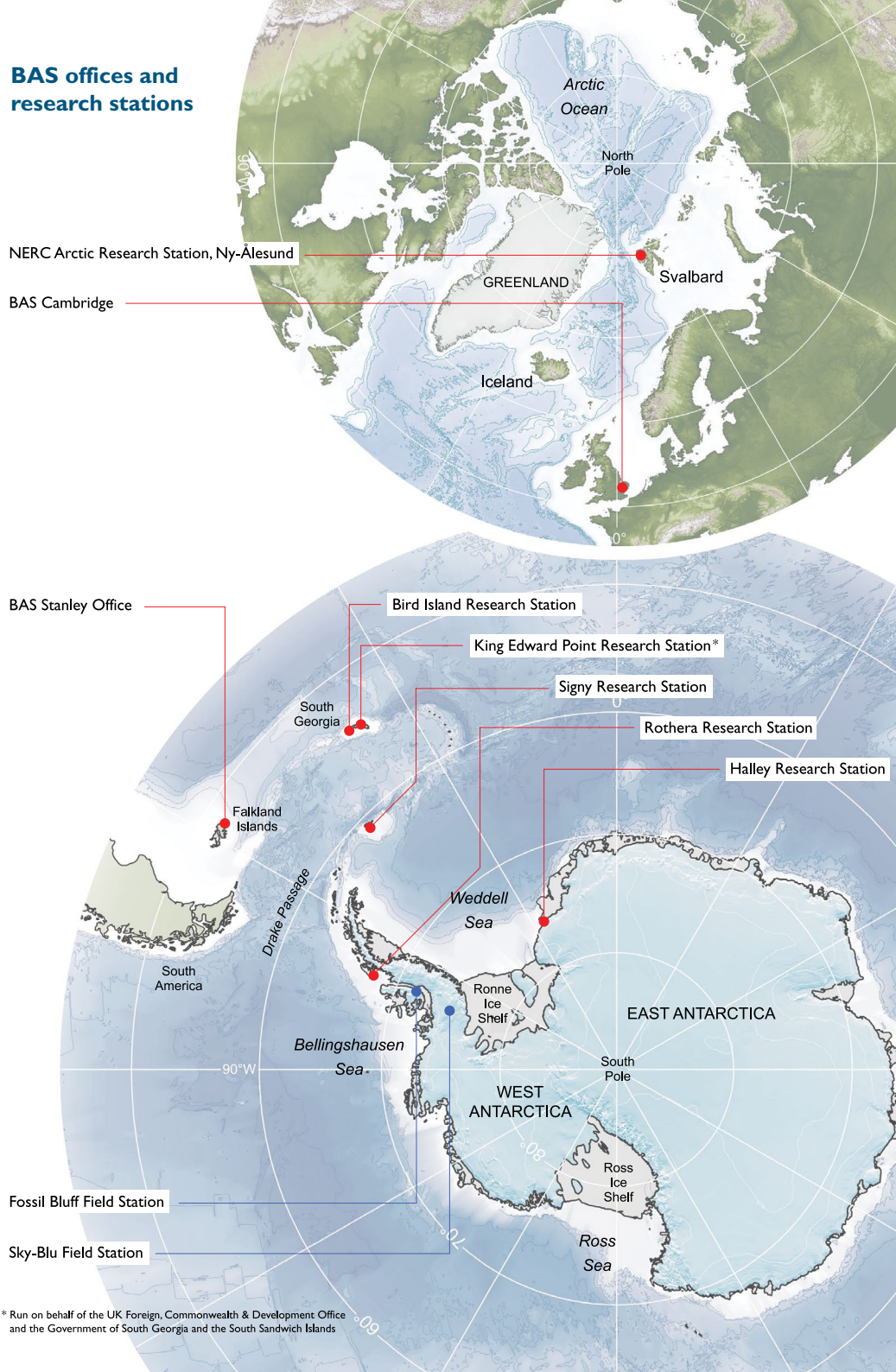
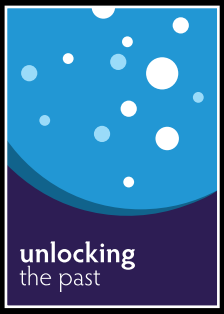
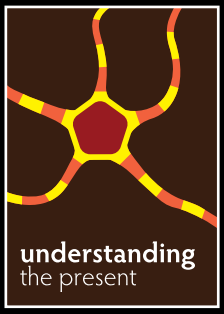


* Run on behalf of the UK Foreign, Commonwealth & Development Office and the Government of South Georgia and the South Sandwich Islands





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