

# Innovation for Planet Earth

Making a difference to economy and society



**British  
Antarctic Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL

**POLAR SCIENCE  
FOR PLANET EARTH**

# Pushing the boundaries of knowledge...

## ...under some of the most extreme and hostile conditions on Earth

This requires an innovative spirit in all areas of work.

Our scientific, engineering and operations staff constantly invent ingenious solutions to help us:

- Unlock the past
- Understand the present
- Predict the future

## ...beyond the Polar Regions

We strive to make our expertise available wherever it can be applied – not only in the Polar Regions, but also in:

- Cold mountainous areas
- Remote and inhospitable places

Many of our technologies are transferable. Prominent examples include:

- *Remote sensing*: Detection of animals from space. Satellite and airborne assessment of sea ice and icebergs
- *In situ sensing*: Instruments and techniques developed for polar fieldwork can be applied in other contexts, such as groundwater monitoring or location tracking

Our research addresses issues of global relevance, including climate change, space weather risks and development of bio-renewable resources.

We support the UK Government's Industrial Strategy and are keen to build partnerships where our expertise or assets can contribute to clean growth.



# Engineering based on ‘frugal innovation’

## Environmental technologies that don't cost the Earth

Engineering work at BAS is underpinned by the principles of ‘frugal innovation’: full functionality without unnecessary complication, with optimised power consumption and minimal need for maintenance. Designs and controls are robust and intuitive so that non-technical staff can easily operate equipment under challenging conditions, thousands of miles from support.

- *Drilling into ice and rock:* Novel designs for drills provide access to ancient atmospheres locked up in ice, and cross-fertilise with space technologies for exploration of planets
- *Probing structure and depth of ice and water:* Our radars help determine how much freshwater is locked up in glaciers. This underpins sea-level rise predictions and water management strategies in the Himalayas. Phase-sensitive radars measure melt rates of ice shelves and monitor groundwater levels in arid soils

## Testbed under extreme conditions

Our research infrastructure in the Polar Regions provides an ideal and demanding test ground for innovations and technologies developed by others.

Our experts can monitor how inventions fare when exposed to real-life extremes of UV, temperature, wind, humidity, biodiversity and pressure. Polar environments are a powerful testbed for autonomy and artificial intelligence.

- *Algorithms for autonomous image collection:* We trial software that uses Artificial Intelligence to optimise wildlife surveys
- *Prevention of biofouling:* Together with partners, we test surfaces designed to minimise marine biofouling
- *Safety for lone workers:* We are exploring new opportunities to test remote biomedical devices to increase safety for lone workers

*Extreme engineering: deep-field automated data capture*



# Data for decision making

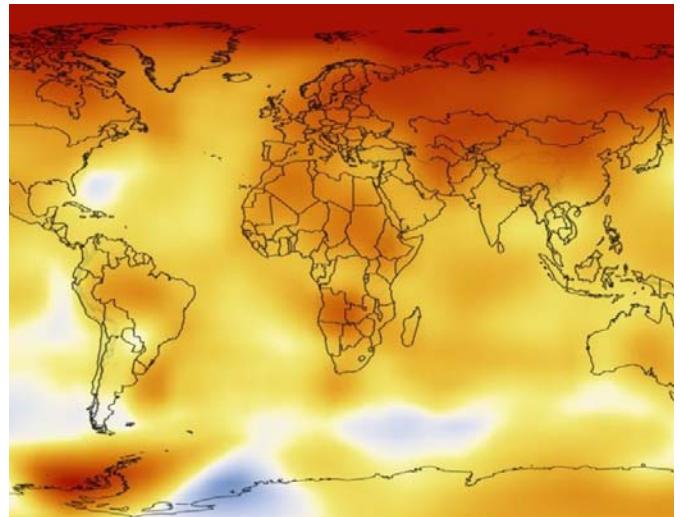
*We collect environmental data and develop models that enable improved decision-making for business and governments*

## Underpinning risk assessment and mitigation

- *Space weather is listed on the UK's National Risk Register of Civil Emergencies:* A severe space weather event could cause blackouts, disrupt essential services and disturb global navigation satellites. Our research provides early warning of extreme events for infrastructure operators and helps satellite designers increase resilience against space weather
- *Climate modelling:* We collect data to improve weather forecasting and climate predictions. We employ regional climate models where high resolution is essential for investment decisions, such as in complex mountain ranges
- *Sea-level rise:* Our research decreases uncertainty around the rate at which polar ice sheets contribute to global sea-level rise. This informs the IPCC and underpins planning decisions for coastal infrastructure

## Strengthening ecosystem sustainability

- *Fisheries management:* Our research provides vital information to set sustainable catch limits. The information helps shape government regulation and provides evidence to industry for sustainability certification
- *Marine plastic pollution:* We are increasing our understanding of degradation of plastic and its effect on the marine environment. Such evidence underpins decisions on prevention and mitigation



*Big data: improving global climate models and weather forecasts*

# Learning from nature

Wildlife in the Polar Regions display a multitude of novel traits and functionalities. We research how these organisms can thrive under extreme conditions, and what we can learn from them to build a sustainable bio-economy.

- *Cold-active bio-catalysts:* We are investigating if enzymes from polar invertebrates can lower energy use in domestic cleaning products and in the biotechnology industry
- *Crop protection:* Our research explores the potential use of a polar fungus as a winter-active bio-pesticide
- *Bio-remediation:* We are studying the potential of polar micro-organisms to mop up pollutants in cold waste water
- *Active ingredients for functional foods, cosmetics and healthcare:* We are exploring if anti-oxidants, UV-protectants, anti-microbials or other functional molecules derived from polar organisms could help us live healthier lives



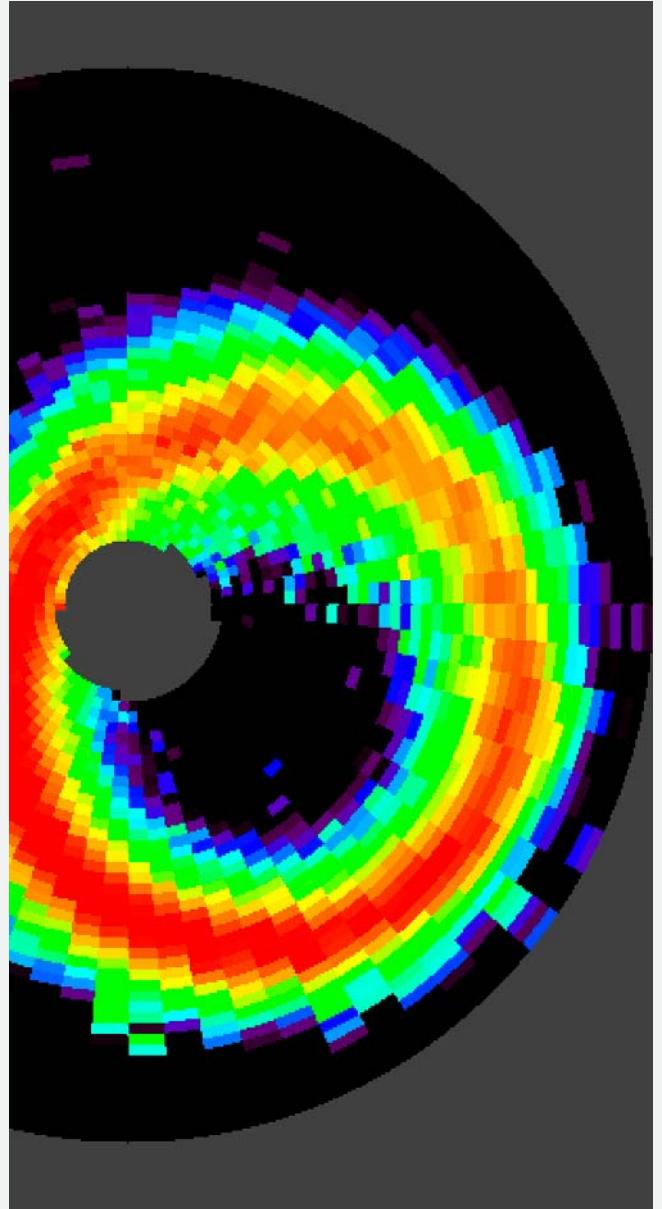
*Naturally fluorescing biomolecules could be used in sensors and medical research*

# Connecting science and art

Creativity and out-of-the-box thinking lie at the heart of both innovative science and engaging art.

By encouraging dialogue between British Antarctic Survey staff and artists, we challenge each other's assumptions and unlock new ways of thinking. Artwork that arises from these collaborations brings the significance of our science to new audiences, taps into emotions and values, and encourages action.

- *Data as Art:* Scientific data often have innate beauty when visualised. A series of artworks based on our own data is displayed in the Aurora Innovation Centre at BAS, and on our website ([www.bas.ac.uk/project/data-as-art](http://www.bas.ac.uk/project/data-as-art))
- *Data into Art:* We are fostering a series of collaborations between artists and BAS scientists, creating art to be displayed and performed at our Aurora Innovation Centre and other exhibitions
- *Science, Art and Entrepreneurship:* We encourage entrepreneurial approaches to the creative outputs of our art-science collaboration. Contact [aurora@bas.ac.uk](mailto:aurora@bas.ac.uk) to learn more



Artistic visualisation of electron precipitation from solar storms over the magnetic South Pole

# Innovation through partnership

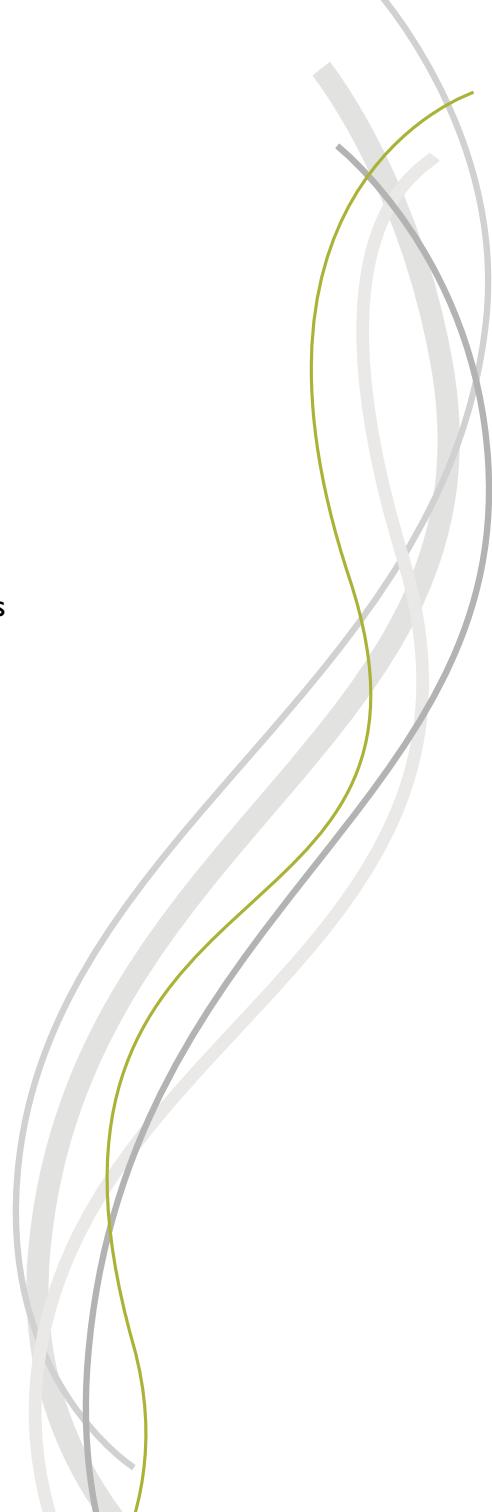
Collaboration is central to all we do. We aim to make our technologies and expertise visible and accessible to all who could benefit from them, and strive to co-develop novel applications that bring value to society.

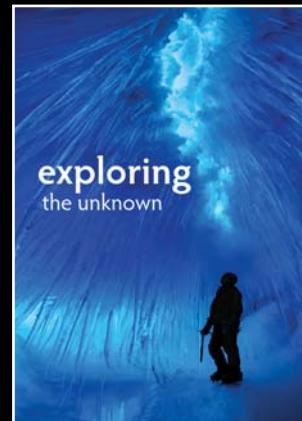
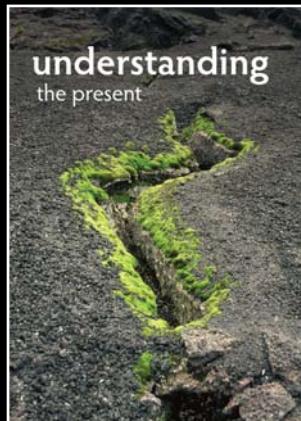
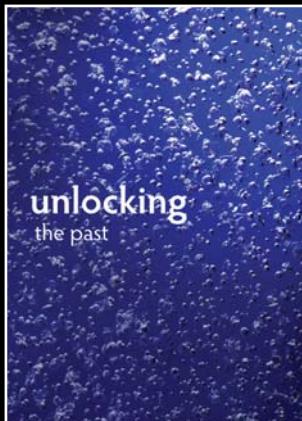
To achieve this, we seek partnerships with interdisciplinary collaborators from industry, policy, academia and the third sector whose expertise complements ours. We are also keen to learn from others about how to innovate in our work.

A valuable tool for building partnerships is our Aurora Innovation Centre – a networking, conference and co-working space that enables direct collaboration with BAS at our Cambridge headquarters.

To find out more, visit our website [aurora.bas.ac.uk](http://aurora.bas.ac.uk).

**AURORA**  
CAMBRIDGE





**British Antarctic Survey (BAS)**, an institute of the Natural Environment Research Council (NERC), delivers and enables world-leading interdisciplinary research in the Polar Regions. Its skilled science and support staff based in Cambridge, Antarctica and the Arctic, work together to deliver research that uses the Polar Regions to advance our understanding of Earth as a sustainable planet. Through its extensive logistic capability and know-how BAS facilitates access for the British and international science community to the UK polar research operation. Numerous national and international collaborations, combined with an excellent infrastructure help sustain a world-leading position for the UK in Antarctic affairs.

NERC is part of UK Research and Innovation [www.ukri.org](http://www.ukri.org)

[www.bas.ac.uk](http://www.bas.ac.uk)



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