Understanding Antarctica

Fifty years of British scientific monitoring (1959-2009)

Above: *Release of a meteorological balloon at the UK base at Admiralty Bay, King George Island, in 1959.*

Cover: *Release of a meteorological balloon with attached radiosonde at the UK's Halley Research Station, in 2009.*

Understanding Antarctica is of vital importance to the future of the planet. Although geographically remote, Antarctica is a pivotal component of the Earth System and a sensitive indicator of accelerating global environmental change.

The UK undertakes a wide range of long-term research and monitoring activities in Antarctica. These activities underpin government and international policies. The UK and our many international collaborators are building on a legacy of more than 50 years of observations and measurements.

Much of Antarctica remains unexplored, especially under the ice and in the deep sea, and will continue to inspire and challenge scientists for the next 50 years.

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Plain Language Commission
Clear English Standard
Winning Document

The Antarctic ozone hole was discovered in 1985 and formed in less than a decade

Atmospheric levels of the greenhouse gas CO_2 are now greater than at any time in the past 800,000 years

The Antarctic Peninsula has warmed by approximately 3°C in the last 50 years

87% of glaciers on the Antarctic Peninsula have retreated in the last 50 years

Stations, field camps and depots are more widely distributed across Antarctica than ever before

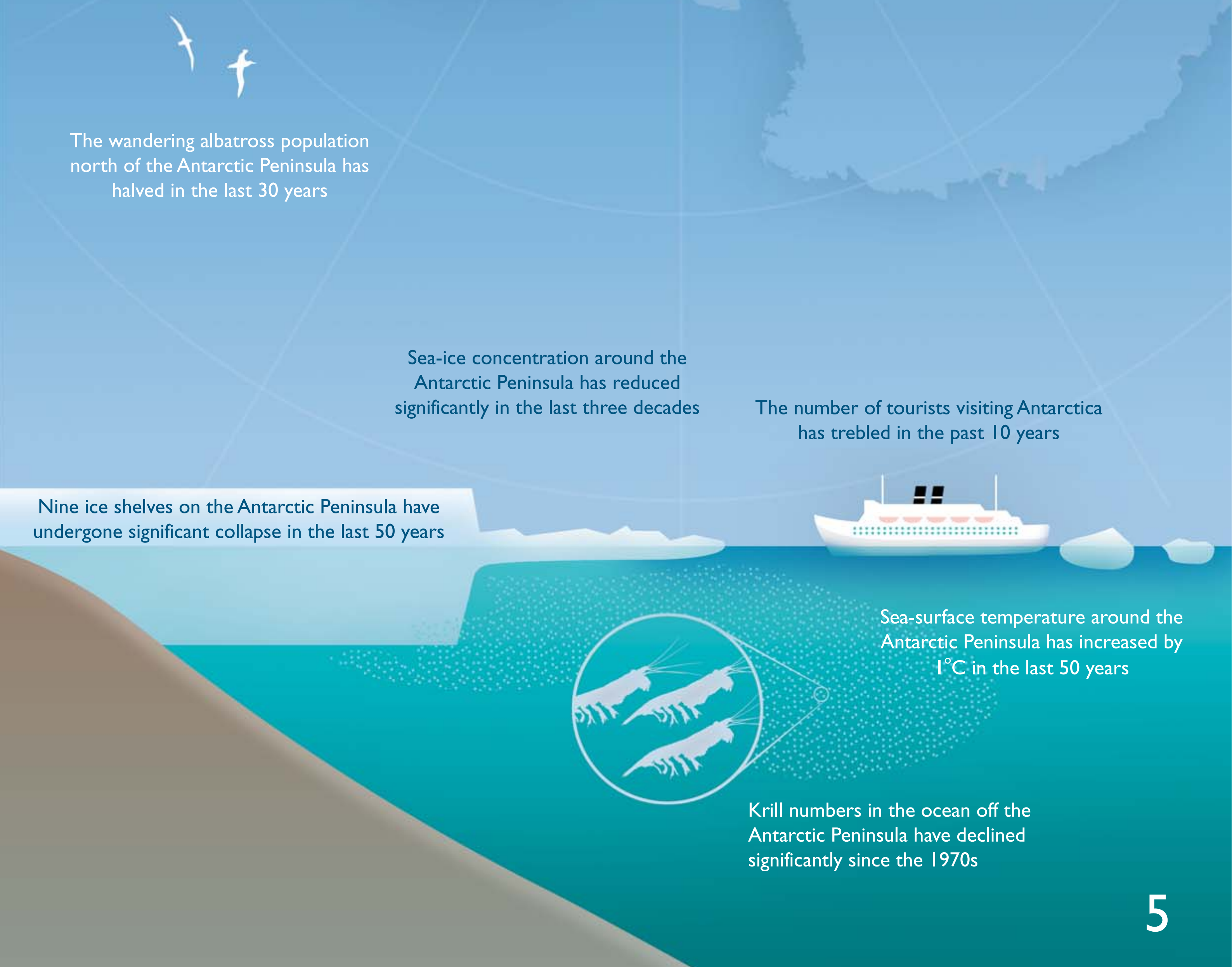
SUMMARY

Science has always been at the centre of human endeavour in Antarctica. It is just over 50 years since the International Geophysical Year (1957-58) established many of the long-term research and monitoring programmes now undertaken there. On the 50th anniversary of the signing of the Antarctic Treaty, and on completion of International Polar Year (2007-08), it is timely to reflect on the importance of Antarctic monitoring and look to its future.

Over the past 50 years, long-term environmental monitoring by the British Antarctic Survey, part of the Natural Environment Research Council, and UK universities has resulted in many important discoveries, such as the hole in the ozone layer and the rapid melting of glaciers on the Antarctic Peninsula. Research on areas such as climate change and ice-sheet-linked sea-level rise clearly demonstrate the global importance of Antarctic science. As an active collaborator working with scientists from other Antarctic Treaty nations, the UK has achieved more than would have been possible working alone.

It is essential to continue to monitor the Antarctic environment, parts of which are warming faster than anywhere else on the planet. There are also areas of science about which we have little understanding and which require new long-term research. These include surveying the deep sea, understanding the causes and effects of ocean acidification in the Southern Ocean and predicting the future of Antarctica's ice sheets, which play a key role in determining global sea level.

This publication presents examples of discoveries by UK scientists that have resulted from long-term environmental monitoring.



ATMOSPHERE

The Antarctic atmosphere is highly complex and its elements connect over vast ranges of space and time. Our knowledge of the workings of the climate system is far from complete. However, long-term monitoring has shown that temperatures have been rising for the past 50 years. Continued data collection is essential to help refine complex climate models and improve predictions of future change.

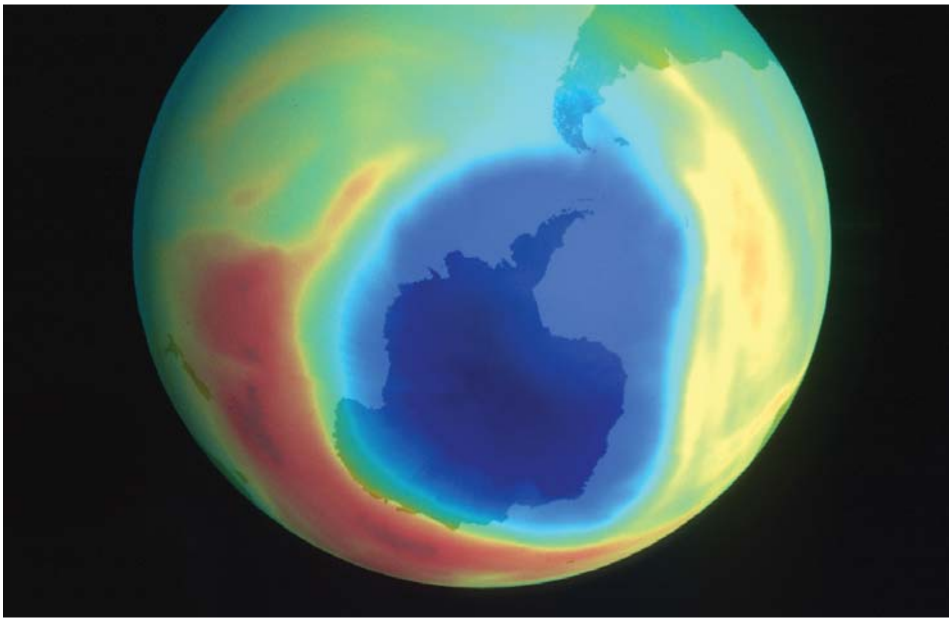
Ozone layer

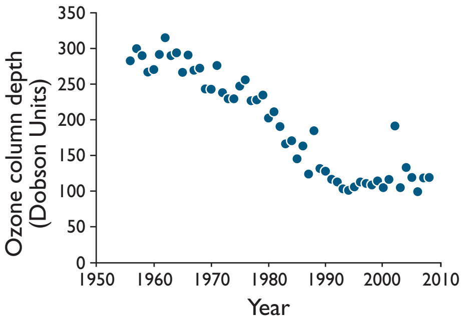
Dataset: **53 years**

The ozone layer is the Earth's natural sun-screen, which protects plants, humans and other animals from harmful UV-B radiation. In 1985, long-term monitoring of ozone above Antarctica, at the UK's Halley and Faraday research stations, led British scientists to discover a serious thinning of the ozone layer. The rapid formation of the 'ozone hole' was caused by emissions of man-made gases called chlorofluorocarbons (CFCs), released primarily in the northern hemisphere.

The international community responded rapidly and agreed the Montreal Protocol (1987), which banned the production and use of CFCs and other ozone-depleting chemicals. The Protocol has been very successful and the amount of ozone-depleting substances in the atmosphere is now decreasing by 1% per year. However, these substances are long-lived and predictions suggest that the ozone hole will not have recovered until around 2060.

The long series of careful ozone measurements undertaken in Antarctica, which began during the International Geophysical Year of 1957-58, shows the importance of having high-quality data records from which to measure change. The paper reporting depletion of the ozone layer, written by Farman *et al*. and published in *Nature* in 1985, is the most cited article in Antarctic science.





Above: *Amount of ozone over the UK's Halley Research Station between 1956 and 2008 (blue circles represent the lowest ozone column depth recorded each October).*

Left: *A satellite image showing the ozone hole over Antarctica (low ozone levels are denoted in blue) (Image: NASA).*

Relevant publication

Farman, J. C., Gardiner, B. G., and Shanklin, J. D. (1985). Large losses of total ozone in Antarctica reveal seasonal ClOx/NOx interaction. *Nature* **315**: 207-10.

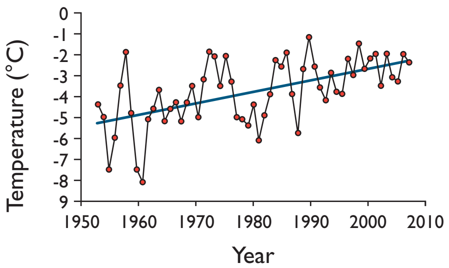
Climate change in the Antarctic Peninsula region

Dataset: **56 years**

Antarctica and the surrounding Southern Ocean play a key role in the global climate system. They exert important controls on sea level, atmospheric carbon dioxide concentrations and the transport of heat around the globe. Monitoring and understanding the causes of change in the Antarctic climate is of great importance.

The Antarctic Peninsula is one of the most rapidly warming regions on Earth. In only five decades, winter temperatures on the west coast of the Peninsula have risen by over 3°C, while the north-east Peninsula has warmed by about 2°C in summer. This summer warming has caused the thinning of glaciers and rapid retreat of ice shelves in this region. Human activity has contributed to this.

Further warming threatens important marine ecosystems and will increase the loss of grounded ice from the Peninsula, contributing to global sea-level rise.



Above: *Annual mean temperatures at the Ukrainian Vernadsky Research Station, formerly the UK's Faraday Research Station, on the west coast of the Antarctic Peninsula. The blue line shows the upward trend in temperature.*

Above: *The Ukrainian Vernadsky Research Station, formerly the UK's Faraday Research Station, where temperature measurements show a warming of 3°C in the last 56 years.*

Relevant publications

Turner, J., Colwell, S. R., Marshall, G. J., Lachlan-Cope, T. A., Carleton, A. M., Jones, P. D., Lagun, V., Reid, P. A., and Iagovkina, S. (2005). Antarctic climate change during the last 50 years. *International Journal of Climatology* **25**: 279-294.

Gillett, N.P., Stone, D.A., Stott, P.A., Nozawa, T., Karpechko, A., Hegerl, G.C., Wehner, M.F., and Jones, P.D. (2008). Attribution of polar warming to human influence. *Nature Geoscience* **1**: 750 – 754.

ICE

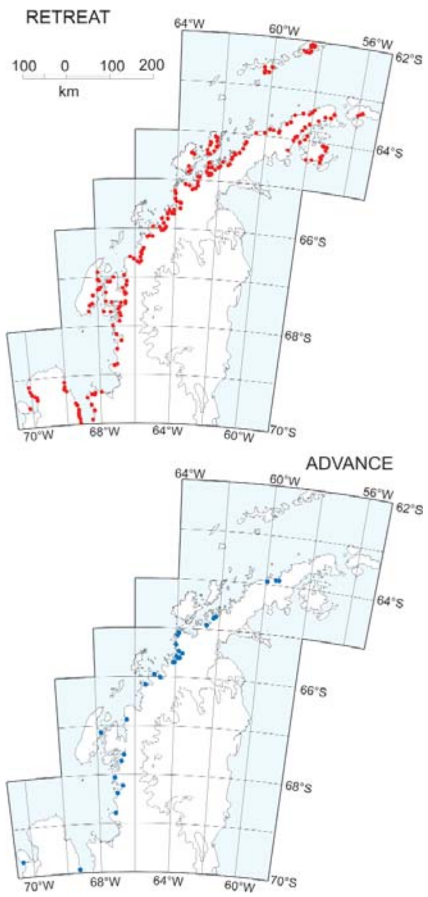
Antarctica contains 90% of the ice found on the planet. UK scientists are increasing our understanding of the role of Antarctic ice in sea-level change. However, the Intergovernmental Panel on Climate Change (IPCC) has highlighted the need for more detailed scientific knowledge about the world's ice sheets, as we cannot yet confidently estimate the contribution they will make to future sea-level rise.

Glaciers

Dataset: **60 years**

Glaciers at the edge of Antarctica's ice sheets drain into the sea or into floating ice shelves. Warming of the atmosphere and oceans around the Antarctic Peninsula has dramatically affected the region's ice. The glaciers on the Antarctic Peninsula are now in widespread retreat. Researchers at the British Antarctic Survey and US Geological Survey analysed more than 2,000 aerial photographs dating from the 1940s and over 100 satellite images from the 1960s onwards to calculate the position of glacier fronts along the Antarctic Peninsula. The results show that of the 244 glaciers that flow into the sea, 212 (87%) have retreated in the last 60 years.

The retreat began at the northern tip of the Antarctic Peninsula and, over time, has moved southwards as temperatures have risen. On average, the glaciers studied retreated 50 metres per year in the last five years, faster than at any other time in the last 60 years. The contribution of these glaciers to sea-level rise is a few centimetres per century.



Above: *Overall change observed in glacier fronts on the Antarctic Peninsula over the last 60 years.*

Ice shelves

Dataset: **150+ years**

Antarctica's vast ice shelves, formed where glacial ice flows off the land and floats on the sea, are highly sensitive to change as they are exposed to both the ocean and the atmosphere. Nine ice shelves along the Antarctic Peninsula have retreated or been lost completely in recent decades. This is attributed mainly to atmospheric warming. Because these ice shelves were already floating, their loss did not contribute to sea-level rise.

As the ice shelves were lost, the glaciers feeding into them have accelerated dramatically, draining and thinning the ice sheets behind them.

There is widespread concern about how increases in ocean temperature may threaten the ice shelves further south of the Peninsula and influence the stability of the West Antarctic Ice Sheet. To investigate this, UK scientists developed a satellite laser technique to monitor changes in ice sheet thickness. Results show that glaciers in the Amundsen Sea Embayment region of the West Antarctic Ice Sheet are accelerating and the ice is thinning rapidly – by more than one metre per year. If this ice sheet collapses, it will cause a significant rise in global sea level.

Relevant publications

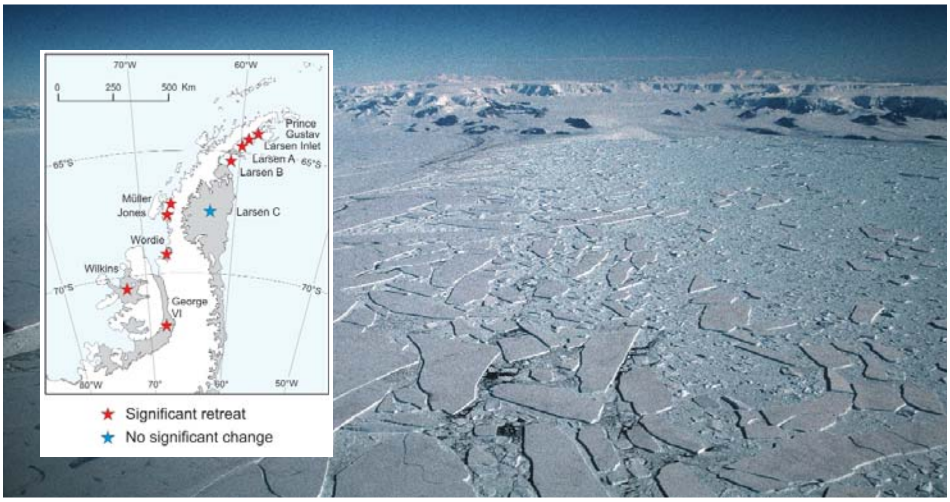
Cook, A. J., Fox, A. J., Vaughan, D. G., and Ferrigno, J. G. (2005). Retreating glacier fronts on the Antarctic Peninsula over the past half-century. *Science* **308**: 541 – 544.

Vaughan, D. G., and Doake, C. S. M. (1996). Recent atmospheric warming and retreat of ice shelves on the Antarctic Peninsula. *Nature* **379**: 328-331.

Thoma, M., Jenkins, A., Holland, D., and Jacobs, S. (2008). Modelling Circumpolar Deep Water intrusions on the Amundsen Sea continental shelf, Antarctica. *Geophysical Research Letters* **35**: L18602, DOI:10.1029/2008GL034939.

Right: *Part of the Larsen B Ice Shelf, following its rapid collapse in 1995.*

Inset: *Overall change observed in ice shelves on the Antarctic Peninsula over the last 150 years.*

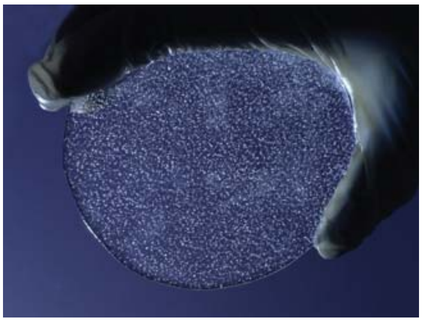


Ice cores

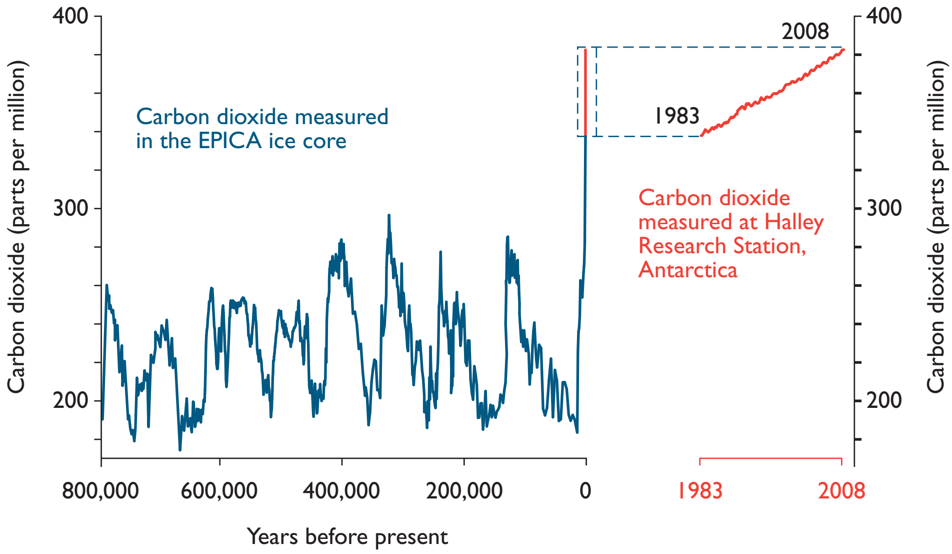
Dataset: **26 years**

The tiny bubbles of ancient air trapped in Antarctic ice hold a unique record of Earth's past climate. International science programmes, such as the European Programme for Ice Coring in Antarctica (EPICA), have drilled ice cores deep into the East Antarctic Ice Sheet. Analysis of the trapped air shows that the concentration of greenhouse gases in the atmosphere, such as carbon dioxide, is closely related to climate – as greenhouse gas levels increase, so does air temperature.

Ongoing air measurements at the UK's Halley Research Station show that greenhouse gas levels are substantially higher now than at any time in the past 800,000 years. Man-made activities are directly affecting the composition of the Earth's atmosphere, with carbon dioxide emissions increasing year on year.



Above: *Slice of Antarctic ice core showing trapped air bubbles, an archive of past atmosphere.*



Right: *Concentration of the atmospheric greenhouse gas carbon dioxide, over the past 800,000 years, as measured in air trapped in the EPICA ice core (—) and from 1983-2008 at the UK's Halley Research Station (—).*

Relevant publication

EPICA Community Members. (2004). Eight glacial cycles from an Antarctic ice core. *Nature* **429**: 623-628.

OCEANS

The Southern Ocean encircles Antarctica and its cold waters support thousands of marine species. The ocean interacts with Antarctica's ice and atmosphere, with changes in one often causing changes in others. How marine life in the Southern Ocean adjusts to environmental change is of major concern and many species may be at risk.

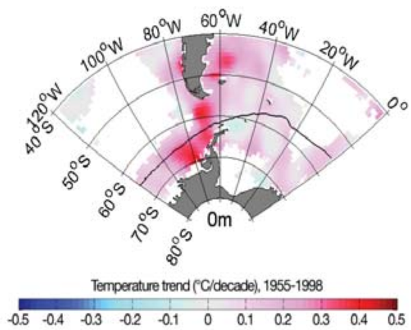
Rapid temperature change in the ocean

Dataset: **43 years**

By analysing oceanographic data collected by researchers from many nations, British scientists have shown that the surface waters to the west of the Antarctic Peninsula have increased in temperature by more than 1°C since the 1950s.

The warming is strongest at the surface and can be attributed to atmospheric changes and a dramatic reduction in sea-ice cover. Higher sea-surface temperatures, coupled with saltier surface waters in summer, may further reduce the formation of sea ice. This will have adverse effects on many marine species in the region.

Sea temperatures around Antarctica are remarkably stable, varying by just 3°C throughout the year. Cold-blooded animals, living on the seabed, are well-evolved to cope with stable low temperatures, but do not cope well with higher temperatures. A change of just 2°C could make it difficult for many species to feed and move. This puts their survival into question, and makes them some of the most vulnerable species on Earth to environmental change.



Above: *Sea-surface temperature trend (1955-1998) around the Antarctic Peninsula. Pinks and reds denote warming, blues denote cooling (areas with no data are left white). Note in particular the strong warming to the west of the Peninsula.*

Left: *Ocean warming threatens the survival of many marine species, such as this brittle star* (Ophionotus victoriae).

Relevant publications

Meredith, M. P., and King, J. C. (2005). Rapid climate change in the ocean west of the Antarctic Peninsula during the second half of the 20th century. *Geophysical Research Letters* **32**: L19604, 1-5.

Peck, L. S., Clark, M. S., Morley, S. A., Massey, A., and Rossetti, H. (2009). Animal temperature limits and ecological relevance: effects of size, activity and rates of change. *Functional Ecology* **DOI**: 10.1111/j.1365-2435.2008.01537.

Sea ice

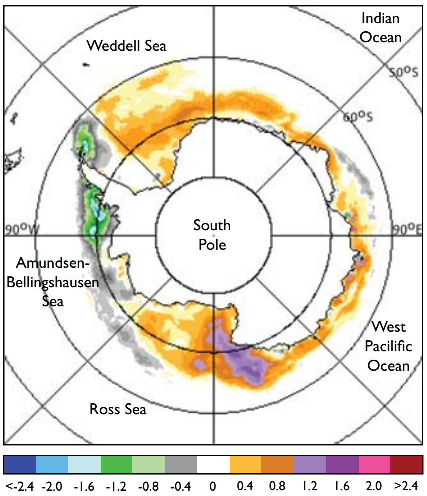
Dataset: **28 years**

Antarctic sea ice has a large effect on Antarctic coastal climates, the ocean and marine ecosystems.

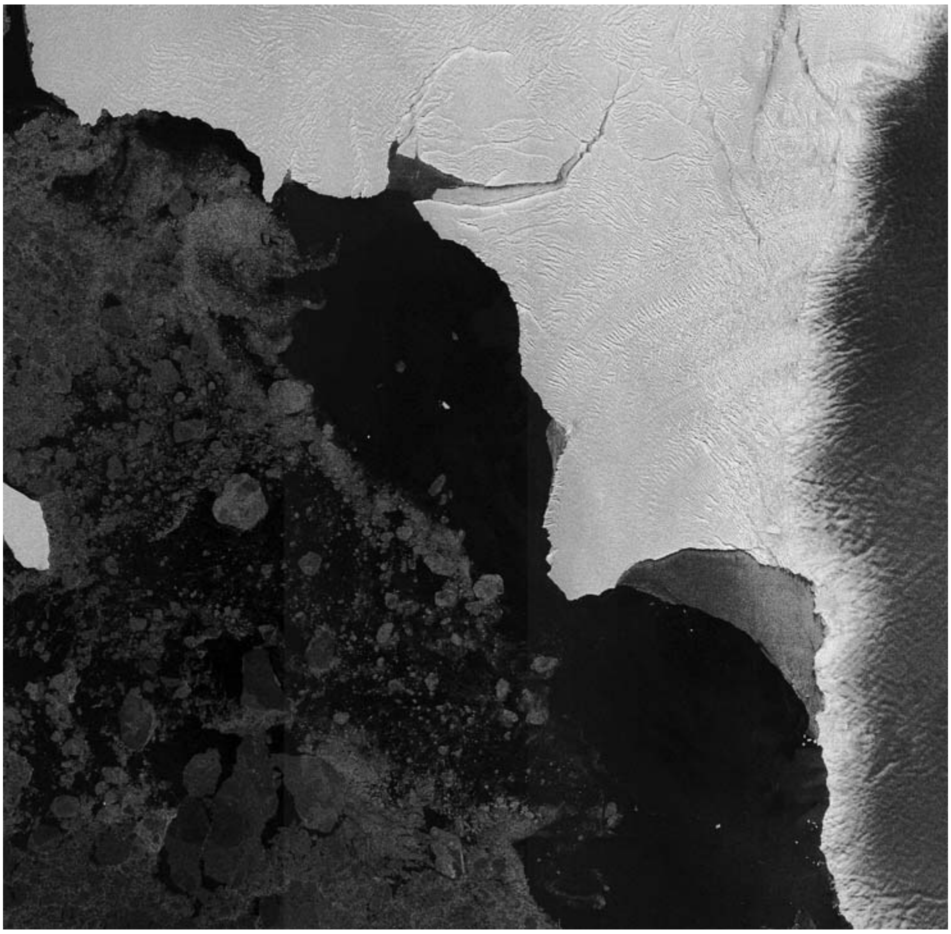
At the interface between the atmosphere and ocean, sea ice affects how much the relatively warm ocean heats the cold Antarctic atmosphere. Sea ice also provides an important habitat for krill and other marine species that make up part of the Southern Ocean food web. At the moment, however, the mechanisms controlling sea-ice extent are not fully understood, most notably why it can vary so much from year to year.

Satellites have been able to monitor sea ice since 1979 and the changes in autumn ice extent are shown in the figure (left). This shows that, unlike in the Arctic, sea-ice concentrations have actually increased by a small amount around most of the continent. This may initially seem surprising in a warming world. However, it is consistent with a slight surface cooling that has been observed at the stations around East Antarctica. This has been attributed to the development of the ozone hole, which has further isolated the continent from the air above the surrounding oceans.

The largest loss of ice has been in the Amundsen-Bellingshausen Sea, where more storm activity has driven stronger northerly winds to the west of the Antarctic Peninsula, limiting sea-ice growth. This reduction in ice extent has also been linked to the marked warming observed at the coastal stations in this area over the last few decades.



Above: *The spatial pattern of autumn sea-ice concentration changes around Antarctica from 1979-2007. This shows a clear trend of decreasing sea ice to the west and north-east of the Antarctic Peninsula and an area of increase in the Ross Sea region (Image: NASA).*



Right: *The Polar View project in the Antarctic supplies near real-time satellite images to ensure safe and efficient ship navigation in hazardous sea ice. This example shows ice near the Brunt Ice Shelf. Further information can be found at* www.polarview.aq

Relevant publication

Turner, J., and Overland, J. E. (2009). Contrasting climate change in the two polar regions. *Polar Research*. In Press.

LIFE

Life in the Antarctic Peninsula region is under pressure. Plants and animals face the dual challenge of climate change and environmental impact by human activities in the region. Terrestrial life must respond to changes in UV radiation, water availability and temperature. Marine life faces increasing ocean temperatures, acidification, changes in salinity and fishing activities. Research shows that Antarctic life may struggle to adapt to the rapidly changing environment.

Albatrosses

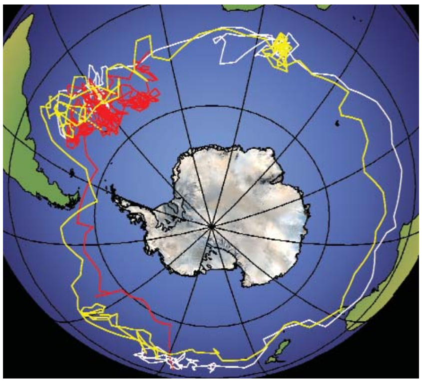
Dataset: **48 years**

The albatross is an iconic symbol of the Southern Ocean. These huge birds forage over vast areas and can live for more than 60 years. UK scientists have monitored albatross numbers since the early 1960s. They have found a large decrease in black-browed, grey-headed and wandering albatross numbers, with populations halving in only 30 years.

Satellite tracking studies by UK scientists gave the first real evidence that some albatrosses spend a great deal of time foraging behind commercial fishing vessels. Each year, thousands of albatrosses drown as they swallow baited hooks released by long-line fishing vessels.

Working with the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), which regulates fishing in the Southern Ocean, scientists used their expertise to find practical ways to protect the albatrosses in the north Scotia Sea region. As a result, the number of albatrosses killed by legal fishing fell from almost 6,000 birds in 1997 to nil in 2006 and 2007.

This outstanding success sets an example for all other regional fisheries organisations to follow. Tracking studies reveal that albatrosses are still being killed in illegal, unregulated and unreported fishing in the Southern Ocean and in fisheries outside the CCAMLR area.



Above: *Plot of wandering albatross foraging tracks revealing, in some cases, the birds' circumnavigation of Antarctica.*

Left: *Wandering albatross (*Diomedea exulans*) in flight.*

Relevant publication

Croxall, J.P., Silk, J.R.D., Phillips, R.A., Afanasyev, V., and Briggs, D.R. (2005). Global circumnavigations: tracking year-round ranges of non-breeding albatrosses. *Science* **307**, 249-250.

Decline in Antarctic krill stocks

Dataset: **78 years**

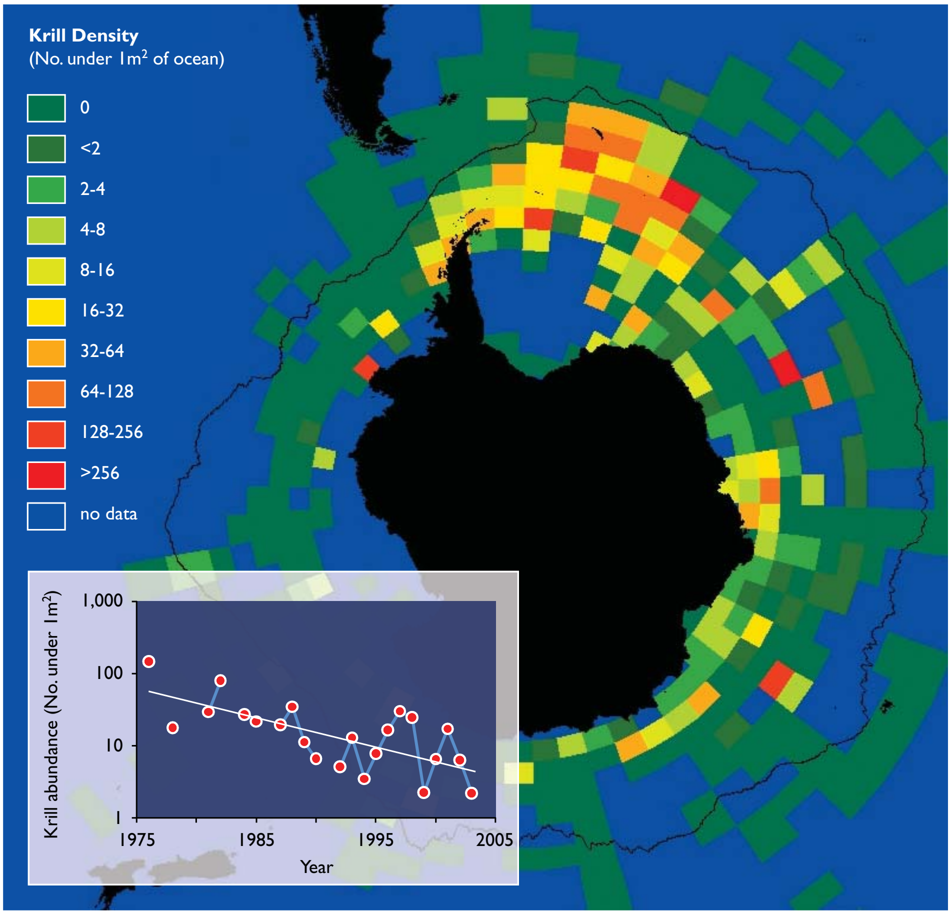
The Antarctic krill (*Euphausia superba*) is a six-centimetre-long, shrimp-like crustacean at the heart of the Southern Ocean food web. In 2004, nine nations, including the UK, pooled their scientific information on krill into one large database. Results for krill abundance, dating back to 1926, showed that in the Scotia Sea area, krill numbers have declined significantly since the 1970s. This region holds about two-thirds of all Antarctic krill, is their main breeding ground and is the centre of the commercial krill fishery.

This krill decline affects species that depend on it as a food source. Seals, whales and penguins may all forage and breed less successfully. The decline also poses management issues for the krill fishery.

Winter sea ice acts as a nursery for young krill and the loss of winter sea ice leads to a fall in krill numbers during the following summer. Further ocean warming and reduction in sea ice could result in the collapse of krill stocks in this area.

Right: *Abundance of krill across the Southern Ocean. Each box is a composite of multiple years of data and represents the mean number of krill under 1m² of ocean.*

The inset graph shows the recent decline in krill numbers monitored in the Scotia Sea region to the north-east of the Antarctic Peninsula.



Above: *Antarctic krill (*Euphausia superba*).*

Relevant publication

Atkinson, A., Siegel, V., Pakhomov, E., and Rothery, P. (2004). Long-term decline in krill stock and increase in salps within the Southern Ocean. *Nature* **432**, 100-103.

HUMAN IMPACT

Antarctica is vulnerable to local environmental impact by human activities. The wider distribution of science infrastructure across the continent and the increasing number of tourists visiting the region both require careful management to ensure that they do not adversely impact the Antarctic environment.

Antarctic infrastructure

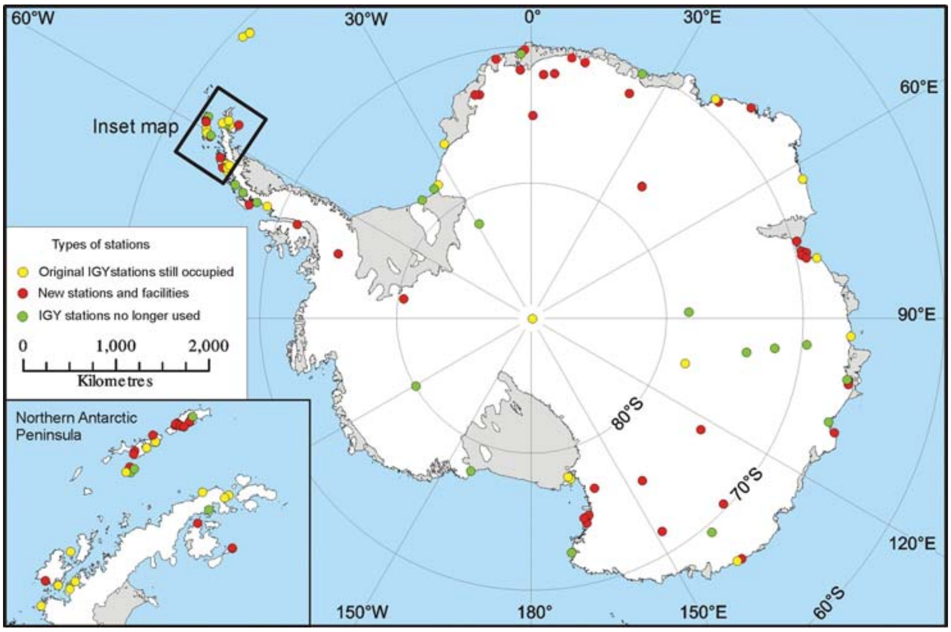
The first major phase of Antarctic station construction occurred to support the scientific work of the International Geophysical Year (IGY) of 1957-58. In the last 50 years scientific requirements have changed. As a result, some stations were no longer needed and only around 25 of the 47 stations used during the IGY are still in use today.

Antarctic science is becoming increasingly international – currently 27 nations operate Antarctic research stations, compared with only 13 in 1958. Today there are over 75 stations and major facilities supporting over 4,000 science and support staff.

Environmental impacts of Antarctic stations include loss of habitat, chemical and sewage pollution, disturbance to local wildlife and the introduction of non-native species that may threaten vulnerable Antarctic ecosystems.

To reduce greenhouse gas emissions, many Antarctic Treaty nations are, where possible, using renewable energy technology, such as solar heating and wind turbines, to power their Antarctic facilities.

Above: *The first completed module of the UK's Halley VI Research Station stands on the Brunt Ice Shelf in Antarctica.*



Left: *Sites of Antarctic stations which have been used since the IGY (1957-58) (**I**), stations founded since 1958 (**I**) and IGY stations no longer used (**I**). Stations founded after the IGY and then abandoned are not shown.*

Relevant publication

Tin, T., Fleming, Z. L., Hughes, K. A., Ainley, D. G., Convey, P., Moreno, C. A., Pfeiffer, S., Scott, J., and Snape, I. (2009). Impacts of local human activities on the Antarctic environment. *Antarctic Science* **21**: 3-33.

Above: *Tourists at Port Lockroy Historic Site on Goudier Island.*

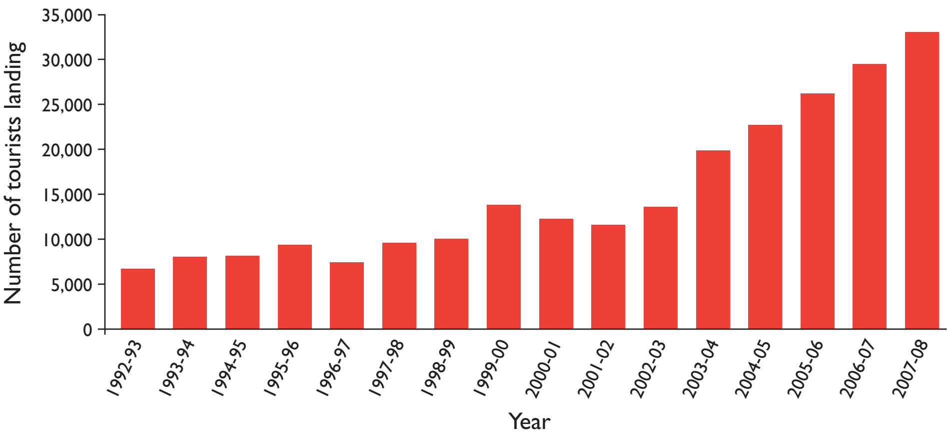
Tourism

Dataset: **12 years**

In the past decade tourism has expanded greatly, mostly in the Antarctic Peninsula region. Visitor numbers have trebled, with more than 33,000 tourists landing at over 200 Antarctic sites during the 2007-08 season.

The Port Lockroy historic British base and gentoo penguin colony on Goudier Island received 18,265 visitors in 2007-08 making it the most visited site in Antarctica. This is one of the few locations in Antarctica for long-term monitoring of how tourist visits affect wildlife. Results show that impacts are minimal. More co-ordinated research is needed to help us understand better what effects tourism might have on the Antarctic environment.

Right: *Number of tourists landing in Antarctica (1992-93 to 2007-08). For further details see:* http://www.iaato.org/tourism_stats.html



Relevant publication

Trathan, P.N., Forcada, J., Atkinson, R., Downie, R.H., and Shears, J. R. (2008). Population assessments of gentoo penguins (*Pygoscelis papua*) breeding at an important Antarctic tourist site, Goudier Island, Port Lockroy, Palmer Archipelago, Antarctica. *Biological Conservation* **141**: 3019-3028.

THE FUTURE

Antarctica is a pivotal component of the Earth System and has a profound effect on the world's climate and ocean systems. It provides a unique natural laboratory for the study of global processes, including climate change. The 50th anniversary of the Antarctic Treaty gives us an opportunity to consider future science and long-term monitoring requirements.

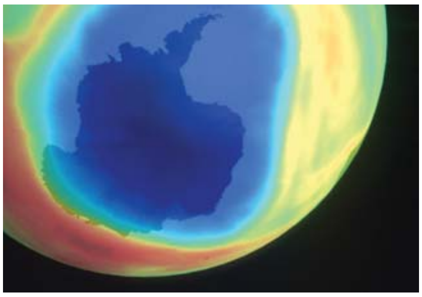
Since the International Geophysical Year (1957-58) and the signing of the Antarctic Treaty in 1959, science has been at the heart of human activity and endeavour in Antarctica. This report shows that the science carried out is wide-ranging and consists of an integrated set of inter-disciplinary research, monitoring and survey activities. These scientific programmes are highly interconnected and involve significant national and international collaborations.

Antarctic science and monitoring underpin government and international policies and benefit society. For example, within the Antarctic Treaty System, the Protocol on Environmental Protection covers the Antarctic environment and its flora and fauna. The Protocol depends on science and monitoring to function effectively and inform environmental management. Antarctic science also contributes important data and results to global research programmes, such as the Intergovernmental Panel on Climate Change (IPCC).

It is essential to continue to study and monitor the Antarctic environment, some parts of which are among the most rapidly warming regions on the planet. The Antarctic Treaty System provides a highly successful framework through which science can be internationally co-ordinated.

The latest science has linked human activity to the retreat of glaciers and the collapse of ice shelves in the northern Antarctic Peninsula. In West Antarctica, the ice sheet is thinning rapidly around the Amundsen Sea Embayment. The challenge now is to predict what will happen next to the West Antarctic Ice Sheet and its effect on global sea level.

There are also scientific areas about which we know very little, and which require new long-term research and monitoring. These include surveying the unknown deep-sea life in the Southern Ocean, understanding the causes and impact of ocean acidification, and determining the effects of climate change on Antarctic ecosystems. Antarctica still has much to tell us about our future.

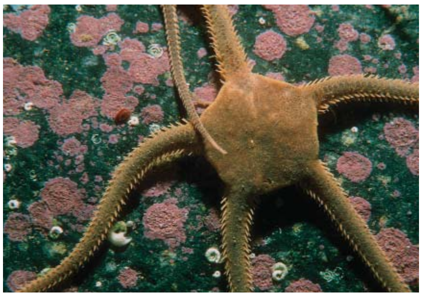


ATMOSPHERE

The ozone hole formed in less than a decade, showing how rapidly the Earth's atmosphere can respond to human activities. The combination of the effects of increasing carbon dioxide and reduced ozone levels are affecting the climate system. The ozone hole is expected to recover by about 2060 but continual monitoring of both ozone and carbon dioxide is critical for accurate projections of future climate.

ICE

In 2007, the Intergovernmental Panel on Climate Change identified the rate of glacier and ice-sheet melting as the largest uncertainty in future sea-level predictions. Sea ice is of enormous importance climatically because it reflects most of the solar radiation that falls on it, and reduces the transfer of heat and moisture between the ocean and the atmosphere. Continued long-term monitoring of the ice caps and sea ice is essential for predicting future climate change.



OCEANS

The Southern Ocean, especially the deep ocean, is the least-known part of our planet. The surface waters around parts of Antarctica are already warming. An equally serious threat to marine life is increasing ocean acidification. International effort is needed to monitor the spatial and temporal variations of the physical, chemical and biological changes in the Southern Ocean.

LIFE

Human activities such as sealing, whaling and fishing have significantly affected the Southern Ocean and Antarctic ecosystems. Climate change now poses a new threat, causing changes to the number and distribution of many species. It is important to develop a set of internationally-agreed biodiversity indicators for the marine and terrestrial environments.

HUMAN IMPACT

Sustainable use of the Southern Ocean and maintenance of the highest standards of environmental management must be key objectives of the Antarctic Treaty System for the next 50 years. The Committee for Environmental Protection to the Antarctic Treaty and the Commission for the Conservation of Antarctic Marine Living Resources play critical roles in ensuring that Antarctica remains a natural reserve devoted to peace and science.

Useful websites

UK Foreign and Commonwealth Office Polar Regions Unit
www.fco.gov.uk/en/fco-in-action/global-network/antarctica

British Antarctic Survey
www.antarctica.ac.uk

Natural Environment Research Council
www.nerc.ac.uk

Antarctic Treaty Secretariat
www.ats.aq

Commission for the Conservation of Antarctic Marine Living Resources
www.ccamlr.org

Scientific Committee on Antarctic Research
www.scar.org

The Council of Managers of National Antarctic Programs
www.comnap.aq

International Association of Antarctica Tour Operators
www.iaato.org

International Polar Year
www.ipy.org

Intergovernmental Panel on Climate Change
www.ipcc.ch

Below: *A glaciology field camp on Pine Island Glacier, West Antarctica.*

Greencoat Plus Velvet contains 80% post-consumer recycled fibre, 10% TCF (Totally Chlorine Free) and 10% ECF (Elemental Chlorine Free) pulp. All pulp is fully recyclable and sourced from carefully managed and renewable commercial forests. In recognition of its recycled content, Greencoat Plus Velvet has also been awarded the NAPM recycled mark.

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