A key role for the International Polar Years

The history of polar research has always been intertwined with the great chapters of polar exploration, but looking beyond the national expeditions of the past, polar science is perhaps most indebted to the succession of International Polar Years organised in the last 125 years. Milestones in the history of polar research, it was through these events that today's international and collaborative spirit was established and later strengthened.

Alfred Wegener sends up a weather balloon on June 17 1907 at Danmarks Havn, the base camp of the 'Danmark Expedition', east Greenland.

When Captain Scott drew up his plans for his 1902-1904 and 1911-1912 British Antarctic expeditions, his main motivation was to discover new land and to expand scientific knowledge in fields such as biology, meteorology, geology and glaciology. However, like most other expeditions organised by competing European and world nations in the 19th and early 20th century, Scott's efforts also had deeply nationalistic undertones to do with precedence, territorial claims and international stature.

Nations begin cooperating on polar research

Against this background, the first International Polar Year (IPY) of 1882-1883 focused mainly on the Arctic and was born more out of necessity than from a desire to build diplomatic bridges. Since geophysical phenomena could not be surveyed by one nation alone, twelve countries agreed to collaborate in organising fifteen simultaneous surveying expeditions – thirteen to the Arctic and two to the Antarctic. Whilst these expeditions contributed significant advances in science and geographical exploration, perhaps the most important, and unforeseen, legacy of the first IPY was an early model for international co-operation and co-ordination.

A hundred-plus research stations set up in the 1930s

Half a century later, the International Meteorological Organization initiated the second IPY of 1932-1933, which aimed to investigate the global implications of the newly discovered jet streams. With forty nations taking part, the second IPY heralded advances in meteorology, magnetism, atmospheric science and mapping ionospheric phenomena. This vast co-ordinated effort also resulted in the permanent establishment of 114 observation stations in the Arctic and provided the impetus for the United States' Admiral Byrd to establish the first ever station situated inland from the Antarctic coast.

Nationalistic claims on the Antarctic relinquished after the International Geophysical Year (1957-1958)

Going as far back as Captain Cook, however, there is perhaps no greater milestone in polar research than the International Geophysical Year (IGY) of 1957-58, which involved as many as 61 nations. Realising the potential of radar and other technologies developed during World War II, a handful of American physicists instigated an international programme of research using this technology to gather data from all over the world on subjects as varied as the upper atmosphere, ice mass and the long disputed theory of continental drift.
What was effectively a third IPY paid particular attention to Antarctica with twelve nations collaborating to deploy forty-five bases around the continent and sub-Antarctic islands. This deployment resulted in significant discoveries on the abundance of fresh water held in the form of Antarctic ice, the theoretical analysis of glaciers, seismology and the weather patterns of the southern hemisphere. Indeed, the IGY proved such a success that it paved the way for the Antarctic treaty signed on 1 December 1959 and the designation of Antarctica as an international territory for 'peace and science'.

2007-2008, the fourth IPY, to highlight links to the global climate

Coming at a particularly sensitive moment in the planet's history due to the emergence of global warming, the upcoming IPY of 2007-08 promises to build on these prior milestones. It will also continue to emphasise the central importance of the polar regions as integral and sensitive components of the Earth system.

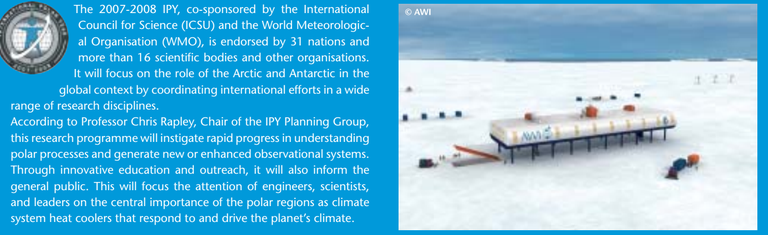
The Transantarctic Expedition, one of the highlights of the International Geophysical Year in 1957-58.

Cover:
- **The Belgica expedition, the first to overwinter in the austral polar night (1897-98).**
- **Artist's view of ESA Cryosat satellite.**

IPY 2007-2008:
a warming world focuses on the polar regions

Remote and inhospitable, the polar regions remain insufficiently studied. At a particularly sensitive time in the history of the Earth due to global climate change, the International Polar Year (IPY) of 2007-2008 will seek to remedy this situation through an intense, internationally coordinated campaign of research. The fourth of its kind, it will build on the work of past Polar and Geophysical Years in an effort to raise awareness of these regions as integral components of the Earth system.

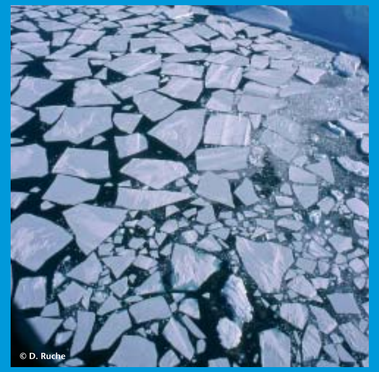
The 2007-2008 IPY, co-sponsored by the International Council for Science (ICSU) and the World Meteorological Organisation (WMO), is endorsed by 31 nations and more than 16 scientific bodies and other organisations. It will focus on the role of the Arctic and Antarctic in the global context by coordinating international efforts in a wide range of research disciplines.
According to Professor Chris Rapley, Chair of the IPY Planning Group, this research programme will instigate rapid progress in understanding polar processes and generate new or enhanced observational systems. Through innovative education and outreach, it will also inform the general public. This will focus the attention of engineers, scientists, and leaders on the central importance of the polar regions as climate system heat coolers that respond to and drive the planet's climate.



Artist's view of the future German Antarctic Neumayer station.

Working together

Because polar processes extend across, and in the case of the Antarctic, beyond national boundaries, the IPY Planning Group expects this coordinated approach to maximise cost-effective outcomes while encouraging researchers from all nations and disciplines to share information and build relationships for present and future programmes.
With the endorsement of international bodies such as the European Polar Board (EPB), the Scientific Committee on Antarctic Research (SCAR), the Committee of Managers of National Antarctic Programmes (COMNAP), the International Arctic Social Sciences Association (IASSA) and the International Arctic Science Committee (IASC), the 2007-2008 IPY initiative benefits from vast expertise in international research programmes. This expertise will be coordinated through an International Programme Office located at the British Antarctic Survey headquarters in Cambridge, and managed with the support of World Meteorological Organisation (WMO) staff.



The IPY will boost programmes observing the evolution of pack ice.

To find out more:
www.ipy.org

Priorities

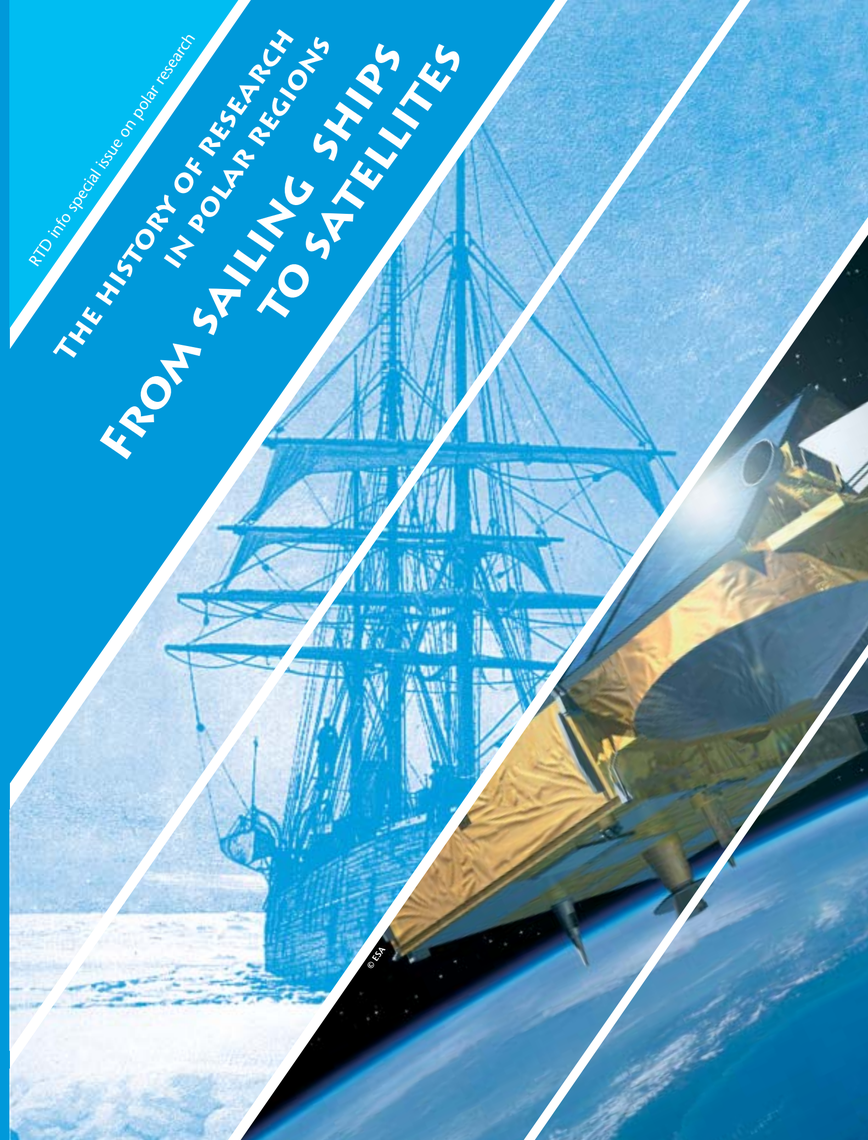
The Planning Group has selected six major themes for the 2007-2008 IPY:

1. Status: to determine the present environmental status of the polar regions.
2. Change: to better quantify and understand past and present natural environmental and social change in the polar regions; and to improve projections of future change.
3. Global Linkages: to advance understanding of the links and interactions between the polar regions and the rest of the globe, and the processes controlling these.
4. New Frontiers: to investigate the frontiers of science in the polar regions.
5. Vantage Point: to use the unique vantage point of the polar regions to develop observatories from the interior of the Earth to the Sun and the cosmos beyond.
6. Human Dimension: to investigate the cultural, historical and social processes that shape the sustainability of circumpolar human societies, and to identify their unique contributions to global cultural diversity and citizenship.

These themes provide guidelines for applicants presenting research proposals and for the IPY Joint Committee selecting projects for endorsement. They set the agenda for the Polar Year; into reaching out to the international public; and into instigating major advances in our knowledge and understanding of the polar regions.

RTD info special issue on polar research

THE HISTORY OF RESEARCH IN POLAR REGIONS FROM SAILING SHIPS TO SATELLITES



POLAR REGIONS RESEARCH MILESTONES 1818-2005

METEOROLOGY
GEOLOGY AND GEOPHYSICS
GLACIOLOGY
OCEANOGRAPHY
BIOLOGY

1818-24: The John Ross and John Franklin expeditions to the Canadian Arctic both return with many **geological specimens**.

1820-23: William Scoresby Jr publishes several books describing **Arctic environments**, whaling and whale biology, and several new Arctic animal species.

1830-33: The first report of **fossil remains** (fragment of carbonised wood) during the first American expedition to Antarctica in 1830.

1831: Sir James Clark Ross is the first to reach the **Magnetic North Pole**.

1840-43: Sir James Clark Ross discovers the **Ross Ice shelf**, source of tabular icebergs.

1840: First official sample of **volcanic rock** collected from Possession Island by theSir James Clark Ross Expedition.

1841: The first active volcano, **Mount Erebus**, is discovered by Sir James Clark Ross.

1843: Publication of "The Zoology of the Antarctic Voyage of HM Ships Erebus and Terror' Includes the first definitive description of the **Emperor penguin**.

1876: H. W. Fielden and H.C. Hart publish **'The Greenland Manual'** which includes the study of plants and their relation to climate.

1882-83: **First International Polar Year**. An international network of scientific stations is established all around the Arctic circle for synchronous meteorological and magnetic observations.

1893-96: F. Nansen's ship, the **Fram becomes imprisoned by pack ice** and drifts to the vicinity of the Pole, demonstrating the drift of the pack ice under the influence of the wind (Ekman drift).

1897: Discovery of small **mites and collembola** abundant among the mosses and lichens in Antarctica.

1897-99: The Belgica – **first purely scientific Antarctic expedition**; important results on plankton biology; bathymetric charting, hydrological soundings' (Drake Passage and Gerlache

1901-04: Geologist Hartley Ferrar maps **sedimentary rocks** known today as the Beacon Supergroup and recognises that the region must have been warmer because of plant traces and animal burrows.

1901-12: Edward Wilson studies the characteristics, life-histories and behaviour of Antarctic **sea birds** both on Captain Scott's Discovery a Terra Nova expeditions.

1908-09: Members of Shackleton's expedition find **important fossils** in the Beardmore Glacier region as well as coal seams indicating a previous wetter and warmer climate.

1910-13: Members of Scott's expedition discovered the **first fossil Glossopteris leaves** indicating an important link with other continents that once formed a supercontinent Gondwana.

1910-13: G.C. Simpson, meteorologist on R.F. Scott's ill-faced expedition, carries out pioneering studies of the **meteorology of the Ross Sea region**, including the first upper-air measurements from Antarctica.

1918-23: Maud tries for North Pole on board a **ship lodged in floating ice**. Amundsen attempt.

1925: Large-scale **circumpolar oceanographic investigations** of Southern Ocean begin (also researching whales' food supply and krill stocks and migration patterns).

1926-62: Alwin Pedersen publishes the first detailed accounts on the **ecology of Arctic birds** and mammals in Northeast Greenland.

1930-31: A British expedition makes the first **weather observations** high inland on Greenland's icecap.

1933-35: Lichens discovered half way up the Scott Glacier by the second Byrd Expedition are the **most southerly plants yet found**.

1949-52: Norwegian-British-Swedish Antarctic Expedition **sets the standard** for seismic shooting for subglacial and ice thickness; snow stratigraphy; ice movement and strain network.

1950: Discovery of **Polar Lows**: Small cyclones forming within Arctic air masses during the cold season.

1951-52: SKIJUMP operation: **anticyclonic surface circulation**, now called the Beaufort Gyre, detected and Lomonosov Ridge, separating the waters of east and west Arctic detected.

1954: W. Dansgaard (University of Copenhagen) shows how seasonal **changes in deposited snow** can be interpreted by isotopic composition, enabling a high precision dating technique.

1955-58: Discoveries of the oldest **Cambrian body fossils** in Spitsbergen (by Norwegian and Polish geologists).

1956: F. K. Ball publishes his theory of the generation of Antarctic **katabatic winds**.

1957-58: Many new meteorological observations established during the **International Geophysical Year**, enabling synoptic studies of Antarctic meteorology for the first time.

1958-60: First modern theory that cold **deep water formation** in the Labrador Sea and the Weddell Sea are key drivers of global ocean circulation.

1960: First studies of sub-ice **topography of Antarctica by radio echo soundings** revealing hidden mountain ranges.

1963: First field test (by M. Walford) in Antarctica of the SPRI MARK I equipment for **radio echo sounding**, developed by Stan Evans at Scott Polar Research Institute.

1964-74: Four programmes of the **International Biological Program** (IBP) are implemented in the Arctic Tundra, providing the first complete overview of the biodiversity and function productivity of these ecosystems.

1966: The **first deep Ice core** to penetrate the total ice thickness (1387 m) at Camp Century, NW Greenland. Opens the door to reconstructing global climatic history from snow sediments.

1971: Launch of **Earth Resources Technology Satellite** and successors allows mapping of untouched terrain and inferring ice surface velocities from sequential imagery.

1972: Laurence Irving publishes the first comprehensive work on the **physiological adaptations of Arctic birds and mammals** (including man).

1979-82: Repeat of **Nansen's 19th century ice drift** experiment advances Arctic research.

1980: Intensive research into the structure and dynamic functioning of the **Antarctic marine ecosystem** under the BIOMASS Programme (34 voyages through to 1985).

1985: First **deep drilling results at Vostok** span a full glacial cycle (150 000years). High correlation between isotope temperature signal and greenhouse gas concentration demonstrated in 1987.

1985: Discovery of the **Antarctic Ozone Hole** by Farman, Gardiner and Shanklin (British Antarctic Survey).

1986: **First dinosaur** from Antarctica discovered on James Ross Island (E. Olivero, R. Scasso and C. Rinaldi).

1989: Discovery of **Dansgaard-Oeschger events**. These intensify thermohaline circulation and destabilise northern ice caps by augmenting snow accumulation on their surface.

1990: Hypothesis that the Southern Ocean productivity is presently limited by **iron availability**. This forms the basis of subsequent iron fertilisation experiments worldwide.

1991: SWEAT hypothesis introduced linking SW North America and Antarctica in a Precambrian supercontinent called **Rodinia**.

1992: The European-funded Greenland ice core project **GRIP reaches bedrock**.

1993-98: SCICEX programme observes **inflow of Atlantic water** to the Arctic has decreased.

1994-95: The First Regional Observing Study of the **Troposphere** (FROST) uses remote sensing data and numerical weather prediction products to advance understanding of Antarctic atmospheric processes.

1997: A geological synthesis of **Svalbard** (by W. B. Harland and co-authors, British).

2000-04: The **Arctic Climate Impact Assessment** (ACIA) report highlights Arctic climate change and its impact on (among many other things) the flora and fauna of the region.

2002-05: Discovery of the **first Cenozoic (Middle Eocene) glaciers** in West Antarctica (on King George Island) by Polish scientists).

2004: **Arctic coring expedition** to the Lomonosov Ridge. Retrieval of the deepest Arctic sediment core ever: 233 km from the North Pole – an archive of the past 55 million years.

2004: **EPICA** (European Project on Ice Coring in Antarctica) reaches a drilling depth of 3 270 m (virtually bedrock) at Dome C (Concordia) and covers around 900 000 years of climate history.

2005-06: The WECCON (Weddell Sea Convection Control) sets out to better understand the **role of the Southern Ocean** in global climate variability through the investigation of atmosphere/ice-ocean interaction processes which occur in the Weddell Sea.

1800 | 1850 | 1900 | 1950 | 2000