INTERNATIONAL POLAR YEAR 2007-2008

An Overview of Research Goals and Activities





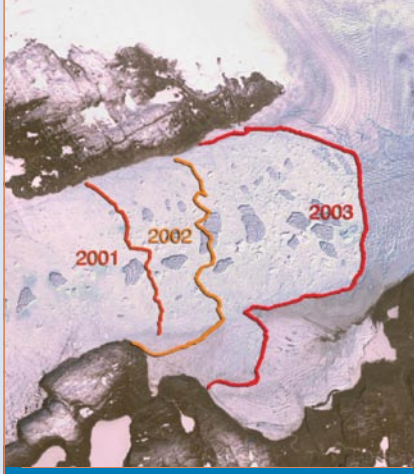
National Academy of Sciences
National Academy of Engineering
Institute of Medicine
National Research Council

THE NATIONAL ACADEMIES
Advisers to the Nation on Science, Engineering, and Medicine


International Polar Year (IPY) 2007-2008 is one of the largest collaborative science programs ever attempted. From March 1, 2007, through March 9, 2009, scientists from across the globe will conduct coordinated research programs in the Arctic and Antarctic. More than 200 projects are planned, involving 50,000 people from more than 60 countries. The ambitious agenda has a distinctly multidisciplinary approach, incorporating physical and biological sciences, social sciences, and a large education component.

IPY 2007-2008 continues a long tradition of scientific collaboration and achievement, dating back to the first IPY 150 years ago in 1882-1883, a second IPY in 1932-1933, and the International Geophysical Year in 1957-1958. The National Science Foundation has already funded the first round of IPY 2007-2008 projects in the United States, and many other nations have put substantial resources behind the collaboration. The National Academies' Polar Research Board developed a vision for IPY 2007-2008 and continues to provide leadership for the United States and to serve as a resource to participants and the general public as IPY gets under way.

Today, the polar regions still represent a vast frontier ripe for scientific discovery. With the support of IPY 2007-2008, scientists will work together to unlock the secrets of the Arctic and Antarctic worlds: How does life persist in these, the coldest, darkest corners of the globe? How will changes in glaciers, ice sheets, snow cover, and sea ice affect the global Earth system? How are traditional ways of life in the polar latitudes facing the challenges of a changing planet? What will be discovered when 21st century technology and new scientific monitoring and observational systems examine this unique frontier? IPY 2007-2008 will help answer these and other questions.



POLAR REGIONS CRITICALLY LINKED TO GLOBAL CLIMATE SYSTEMS

Warmer temperatures are causing sea ice to melt and glaciers to both recede and flow faster into the sea, as illustrated by the Jakobshavn Glacier in Greenland (above). NASA data shows that Arctic perennial sea ice, which normally survives the summer melt season, shrunk by 14 percent between 2004 and 2005. And whatever happens in the polar regions matters here at home—wherever home may be. Melting ice can lead to sea-level rise, threatening coastal communities and ecosystems. It can also alter global ocean circulation, which is closely connected with regional climate conditions.

GLOBAL CHANGES MOST KEENLY FELT IN POLAR REGIONS

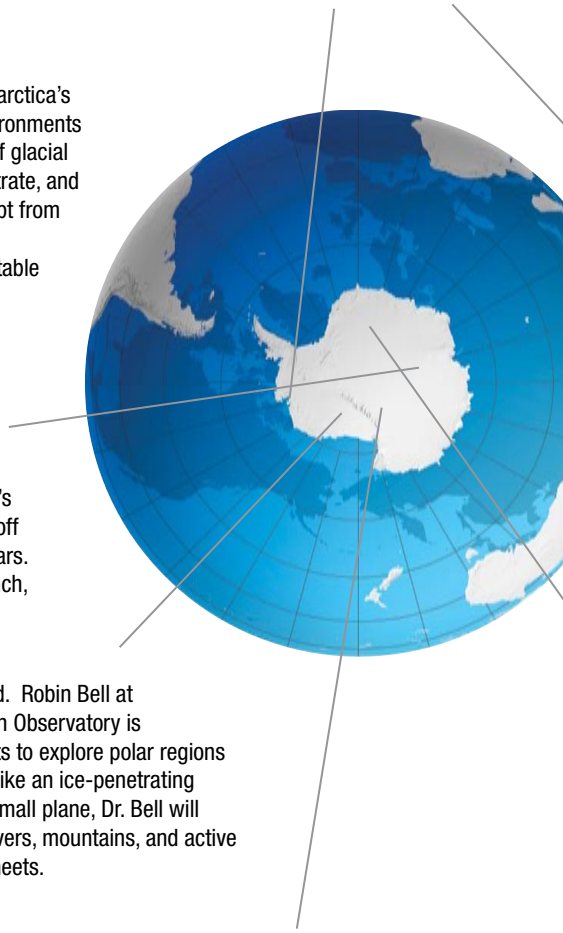
IPY 2007-2008 is accompanied by a powerful sense of urgency. Recent years have brought a flurry of troubling changes in the polar environment—changes that are happening faster than at other latitudes, and faster than scientists had expected. Thawing permafrost is populating the arctic with sinking houses, forests of "drunken trees" that tilt at odd angles, as well as weakened roads, runways, and pipelines.

A SAMPLING OF IPY PROJECTS

Here are just some of the planned IPY research projects within the six key themes shaping the IPY scientific agenda.

GLOBAL LINKAGES: Melting sea ice affects more than just sea levels. When polar ice freezes, it exudes a salty brine that descends to the deep ocean. When polar ice melts, it releases relatively fresh water that remains in the ocean's surface layers. This freeze-melt cycle not only alters the complexion of polar oceans, but it can also alter the circulation of water and heat through oceans around the world, affecting regional climates. Don Perovich and Bruce Elder of the U.S. Army Corps of Engineers Cold Regions Research and Engineering Laboratory and Stephen Ackley of the University of Texas at San Antonio are setting up a system of buoys both in the Arctic Basin and in Antarctica's Amundsen and Bellingshausen Seas. The buoys will take year-long measurements of sea ice that will help scientists understand the changing dynamics of the polar freeze-melt cycle, and what they mean for the future of the world's oceans.

NEW FRONTIERS: Discovered in 1996, Antarctica's Lake Vostok is one of a number of wet environments recently discovered beneath 4 kilometers of glacial ice. The ice is far too thick for light to penetrate, and the lake's water (which is -3^0 Celsius) is kept from freezing only by the immense pressure of the glacier's weight. It's not the most hospitable of habitats, but one that scientists believe may be home to a unique collection of microorganisms. Craig Cary, University of Delaware's Center for Marine Genomics, shown here with Don Cowan, will lead a team of researchers to characterize the "metagenome" (the genomic DNA of an entire community of organisms) of the lake's microbial occupants, which have been cut off from the rest of the world for millions of years. This project is a joint effort of Russian, French, and American researchers.



Not all polar research is done on the ground. Robin Bell at Columbia University's Lamont-Doherty Earth Observatory is developing a system of airborne instruments to explore polar regions that are covered by ice. By mounting tools like an ice-penetrating radar antennae and a laser altimeter on a small plane, Dr. Bell will be able to study an entire world of lakes, rivers, mountains, and active volcanoes buried deep beneath polar ice sheets.

UNIQUE VANTAGE POINT: Planted a mile beneath the Antarctic ice sheet and encompassing a cubic kilometer, IceCube is no ordinary telescope. Instead of light, IceCube's strings of basketball-sized sensors detect collisions of neutrinos with atoms within the ice. Most of these neutrinos are the product of interactions between cosmic rays and the atmosphere. But for every million of these atmospheric neutrinos, a neutrino from deep in the cosmos will reach IceCube after passing through the Earth, including neutrinos that originated in black holes, gamma ray bursts, and supernova remnants. Sensors are already collecting data, and construction on the telescope will be completed in 2011. Scientists hope that this new kind of astronomy will lead to new discoveries about the universe.

HUMAN DIMENSIONS: Astrid Ogilvie, University of Colorado, Boulder, will lead an international team of researchers in an examination of the social dimensions of environmental change in northern regions of Canada, Iceland, and Norway. A variety of methods and projects—interviewing members of the fishing and whale-watching industries, studying how farmers in the mountains of Norway have adapted to changing conditions, and examining diaries dating from as far back as 1725—will help Dr. Ogilvie and her colleagues develop an understanding of how northern societies perceived and were affected by changes in their environment, as well as how they have adapted their lives to those changes.

QUANTIFYING CHANGE: Polar bears may be the most recognized members of the Arctic community, but we might do well to pay more attention to the fungi living underground. How these organisms react to warming temperatures will be key to determining how much of the carbon currently locked up in arctic soils is released to the atmosphere as carbon dioxide, the largest greenhouse gas. Using a range of new molecular techniques, Lee Taylor, University of Alaska Fairbanks, and Chad Nusbaum of the Genome Sequencing and Analysis Program at the Broad Institute, will conduct a community wide analysis of Arctic fungi to find out exactly how these organisms function in their environment and what kinds of changes increasing temperatures may bring.

ENVIRONMENTAL STATUS: To understand how climatic variability and human activities have affected the Antarctic ice, a team of Norwegian and American scientists will work with one eye on the past and one on the future. They'll cross overland from a Norwegian base at to the South Pole in 2007-2008, and make the return trip the following year—3,000 kilometers in 63 days. By retracing some of the steps of scientists who took similar routes in the 1960s, they'll be able to detect changes in the ice during the last 40 years. At the same time, the data they'll be collecting can be used by future scientists to answer similar questions, perhaps during the next IPY.

International Polar Year 2007-2008 is an intense, internationally coordinated campaign of research in the polar regions.

KEY RESEARCH AREAS

- Environmental Status: Assessing environmental status and change in the polar regions
- Quantifying Change: Understanding past change and predicting future change
- Global Linkages: Links between polar and global processes
- New Frontiers: Science exploration in the polar regions
- Unique Vantage Point: Observing Earth and space from the poles
- Human Dimensions: Sustainability of circumpolar societies

IPY LEADERSHIP

The National Academies' Polar Research Board serves as the U.S. National Committee for IPY 2007-2008 and as the liaison to the primary international partners, the International Council for Science (ICSU), and the World Meteorological Organization (WMO). U.S. federal agencies involved in IPY 2007-2008 include the National Science Foundation, the National Aeronautics and Space Administration, National Oceanic and Atmospheric Administration, U.S. Geological Survey, National Institutes of Health, Smithsonian, and many others (for a full listing of U.S. partners, go to **http://www.us-ipy.gov**).

To read more about IPY and find out how you can participate, visit the following websites:

U.S. National Committee: **http://www.us-ipy.org**

U.S. Government: **http://www.us-ipy.gov**

International Programme Office: **http://www.ipy.org**

IPY Youth Committee: **http://www.ipyyouth.org**

ATTENTION EDUCATORS! Visit **http://www.us-ipy.gov** for a list of new classroom resources.

Photo credits: Sinking house and Quantifying Change: Larry Hinzman. New Frontiers (top photo): Craig Cary, University of Delaware; New Frontiers (airplane): Michael Studinger, Lamont-Doherty Earth Observatory of Columbia University; Unique Vantage Point: Gerald Przybylski, Lawrence Berkeley National Laboratory; Human Dimensions: Trond Woxen; Environmental Status: Daniel A. Dixon, University of Maine. Researcher (front cover): University of Washington; Walrus (front cover): NOAA

ABOUT THE POLAR RESEARCH BOARD

The Polar Research Board is a unit of the National Academies dedicated to enhancing understanding of the Arctic, the Antarctic, and the cryosphere and providing guidance to the nation on issues of importance in cold regions. The PRB provides a forum for the polar science community to address research needs and policy issues, conducts program reviews, and facilitates communications on polar issues among academia, industry, and government.

ABOUT THE NATIONAL ACADEMIES

The National Academy of Sciences was established by Congress in 1863 to provide independent scientific advice to the government and nation. Today, the Academy complex includes three honorary societies that elect new members to their ranks each year—the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine—and the National Research Council, the operating arm that conducts the bulk of the institution's science-policy and technical work.

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