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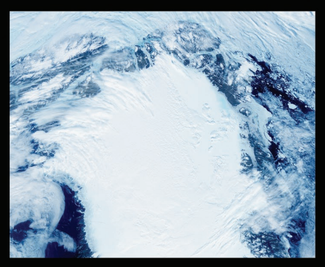
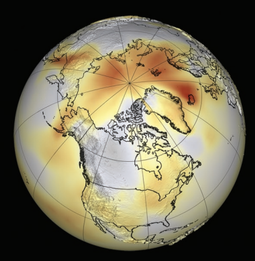
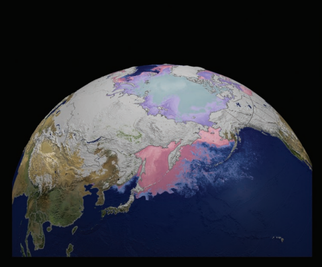
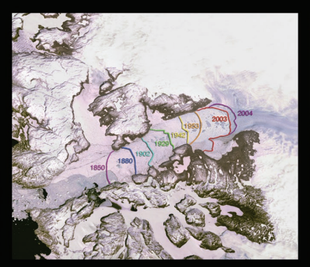
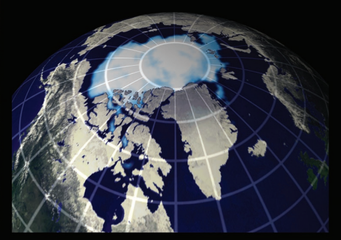
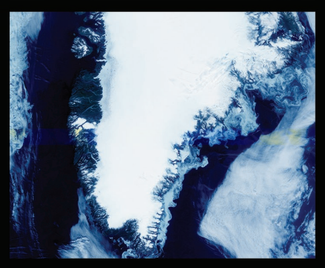
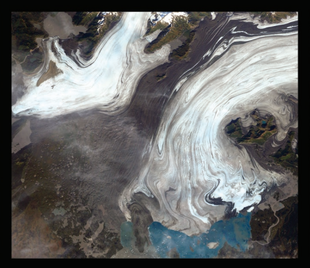
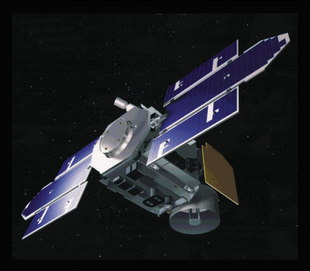




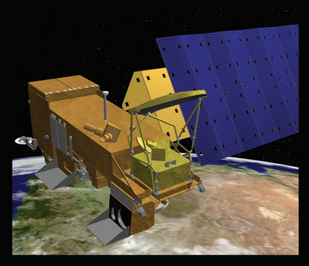



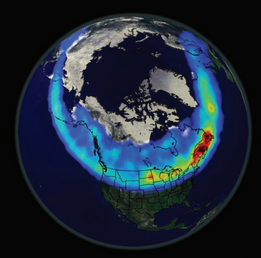
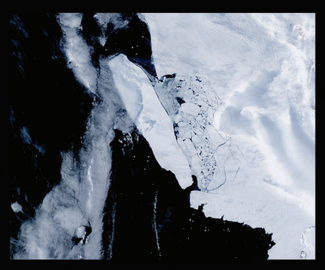


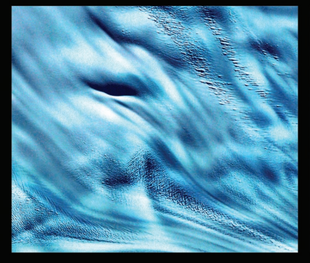


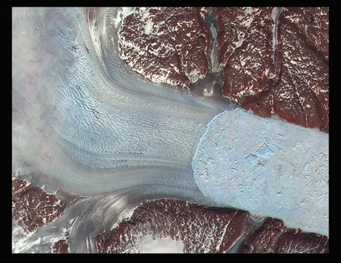
International Polar Year
2007-2009

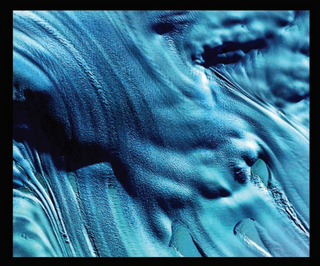
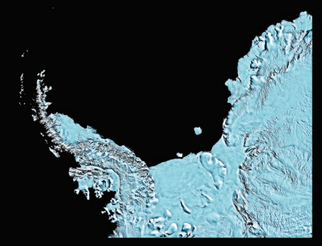
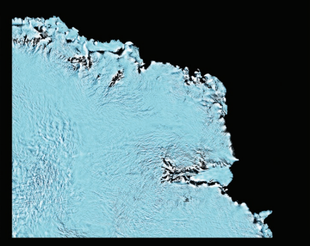


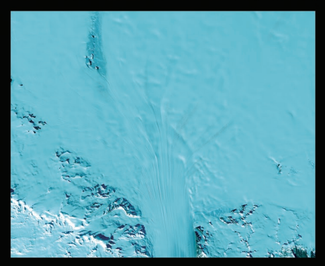
International Polar Year
2007-2009

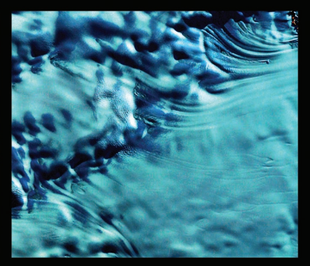
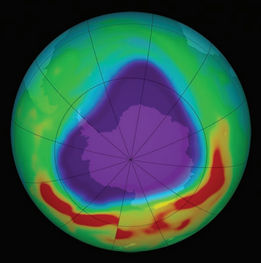
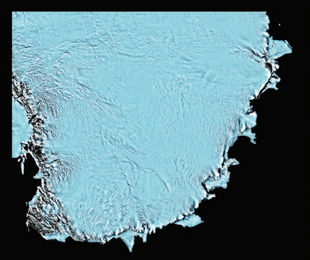



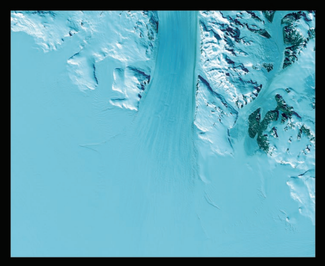


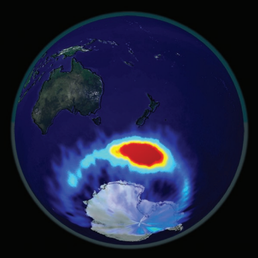


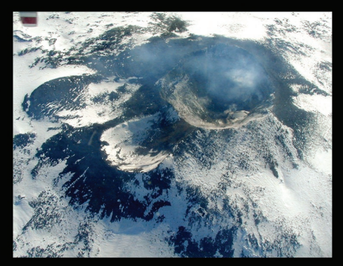
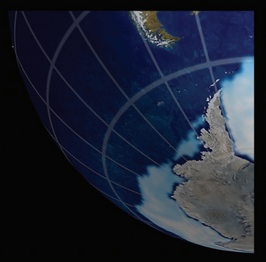
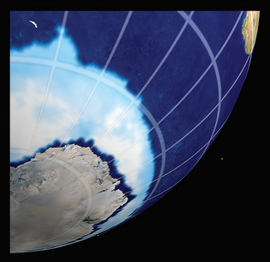
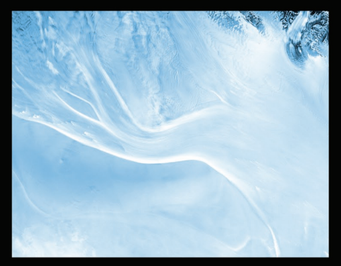










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Greenland ice sheet, July 7, 2002.

Data collected by the Moderate Resolution Imaging Spectroradiometer (MODIS) instrument on the Terra satellite; image Scientific Visualization Studio (SVS)/NASA.

Polar bears, *Ursus maritimus*, live along shores and on sea ice throughout the circumpolar Arctic. The polar bear population could be adversely impacted by changes in the amount of sea ice in the Arctic.

Photo © 2006 Masterfile.

Anomalous temperatures due to tropospheric ozone (industrial pollution) shown here averaged from December through May during 1985-1995 relative to the 1880-1900 average. Substantially warmer temperatures over the Arctic shown in red.

A NASA climate study found that these large increases may have been responsible during recent decades for a significant part of the observed warming trend in the Arctic during winter and spring.

Climate model, Goddard Institute for Space Studies; image SVS/NASA.

The image was taken in 2002, while flying low over the ice fjord toward the floating terminus of the Jakobshavn Glacier in Greenland. The vertical ice wall represents the terminus of the floating ice tongue. The bluish color of the ice wall indicates recent calving of icebergs.

Photo courtesy Konrad Steffen, Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado.

Snow cover and sea ice surface temperature on March 15, 2003.

The coldest sea ice is shown in light blue (-45°C to -30°C), and the warmest is shown in shades of pink (-15°C to 0°C).

Data for snow cover from the MODIS instrument on the Terra satellite. Data for sea ice surface temperature from the MODIS instrument on the Aqua satellite; image SVS/NASA.

Jakobshavn Glacier, Greenland.

This glacier gradually receded after 1850 and stabilized for the second half of the 20th century. However, from 1997 to 2004, the glacier receded again, this time almost doubling in speed. The lines represent ice edge positions as observed from satellite data.

Background image from the Landsat 7 satellite.

Small outlet glacier with medial moraines (debris left behind as it retreats), near Jakobshavn, Greenland.

Photo courtesy Christopher A. Shuman, NASA/GSFC.

Summer Sea Ice, North Pole, August 31, 1990.

Measured perennial sea ice cover in 2001. The sea ice rate of decline averages 8% per decade.

Data from the Special Sensor Microwave Imager (SSMI) instrument on the Defense Meteorological Satellite Program (DMSP) satellite.

Fort Conger Research Station, Ellesmere Island, Canada, just 800 km south of the North Pole and the northernmost point on the first IPY expedition, 1881-1884.

From photo courtesy War Department, 1884, *Proceedings of the Proteus Court of Inquiry on the Greely Relief Expedition of 1883*, Washington: Government Printing Office.

Bering Glacier, terminating in Vitus Lake, Alaska, September 29, 2002.

Higher temperatures and changes in precipitation over the past century have thinned the Bering Glacier by several hundred meters. The glacial retreat has an interesting side effect—an increase in the frequency of earthquakes in the region.

Data from the Enhanced Thematic Mapper Plus (ETM+) on the Landsat 7 satellite.

The *SS Proteus*, exploration vessel on the first IPY Arctic expedition.

Here shown is a photograph of the ship as it was caught in sea ice near Ft. Conger, Ellesmere Island. The ship was destroyed on July 23, 1884 after being crushed by the ice.

Photo courtesy Brainard, D.L., 1884, Brainard Collection of the Lady Franklin Bay Expedition, 1881-1884. College Park, Maryland: National Archives.

ICESat

The Ice, Cloud, and land Elevation Satellite (ICESat) is the benchmark Earth Observing System mission for measuring ice sheet mass balance, cloud and aerosol heights, as well as land topography and vegetation characteristics.

ICESat carries a laser altimeter on board, the first into space for Earth science observations. It is NASA's first and only satellite with a primary mission objective tied to the polar regions.

International Polar Year 2007-2009

Left: Field workers retrieve a surface firn (old snow) core near Kangerlussuaq, Greenland.

Right: Graduate student holds an ice core from the Greenland Ice Core Project 2 at the National Ice Core Laboratory, Denver Federal Center.

Photo courtesy C. A. Shuman, NASA/GSFC.

Aqua

Aqua is a NASA Earth Science satellite mission named for the large amount of information that the mission collects about the Earth's water cycle, including evaporation from the oceans, water vapor in the atmosphere, clouds, precipitation, soil moisture, sea ice, land ice, and snow cover on the land and ice.

International Polar Year 2007-2009

Arctic sea ice on April 23, 2003.

Sea ice is shown in light blue and snow cover on land is shown in white.

Sea ice data from the Advanced Microwave Scanning Radiometer-Earth Observing System (AMSR-E) instrument on the Aqua satellite; daily snow cover data from the MODIS instrument on the Terra satellite; image SVS/NASA.

A Spryte tracked vehicle at Raven Camp, Greenland moving cargo across the ice.

Photo courtesy C. A. Shuman, NASA/GSFC.

Field worker standing above a dry moulin, an almost vertical space, near Kangerlussuaq, Greenland.

Photo courtesy C. A. Shuman, NASA/GSFC.

Polar visible aurora over North America, October 22, 1999.

Data from the Visible Imaging System (VIS) on the Polar satellite; image SVS/NASA.

Iceberg B-15A, Antarctica, January 11, 2005.

This Long-Island-sized iceberg departed the vicinity of McMurdo Station mid-November 2005 and drifted northward at the rate of one mile per day. It is shown here where it paused just before striking the Drygalski Ice Tongue. It later continued north, eventually breaking up into smaller pieces.

Data from the MODIS instrument on the Terra satellite; image SVS/NASA.

View from the "bottom of the Earth."

Image of the Earth highlighting Antarctica and its surrounding sea ice in the southern hemisphere.

Data from the Advanced Very High Resolution Radiometer (AVHRR), NOAA; image SVS/NASA.

A scientist takes snow-sea ice interface temperatures near Barrow, Alaska.

Photo courtesy Donald K. Perovich, USACE/ERDC.

Beluga whale, *Delphinapterus leucas*, a resident of Arctic waters.

Photo © Bryan & Cherry Alexander.

Helheim Glacier, Greenland, May 12, 2001.

The glacier occupies the left part of the images, while large and small icebergs pack the narrow fjord in the right part of the images. In this false-color image and in the image to the right, bare ground appears brown or tan, while vegetation appears in shades of red.

The image to the right shows significant movement after four years.

Helheim Glacier, June 19, 2005.

The position of this glacier's calving front, or margin, has undergone rapid and dramatic change since 2001, and the glacier's flow to the sea has sped up, as well. Scientists believe the retreat of the ice margin plays a large role in the glacier's acceleration.

Data for both images from the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) on the Terra satellite; images SVS/NASA.

HMS Endurance trapped in the sea ice pack of the Weddell Sea in early 1915.

Eventually, the shifting motions of the ice pack ruptured the hull, sinking the ship. This ship carried the exploration party led by Sir Ernest Shackleton on an ill-fated attempt to be the first humans to reach the South Pole.

Photo by Frank Hurley, © Royal Geographical Society.

Edge of iceberg B-15A, Ross Sea, Antarctica.

These floating extensions of the ice sheet are fed by glaciers and ice streams. They move forward under the force of their own weight. Typically, they are about 200 meters thick at their seaward ends, but about 90% of their thickness is below the surface.

Photo courtesy Josh Landis, National Science Foundation (NSF).

The Lambert Glacier, Antarctica, December 2, 2000. (see above, right, and below.)

Lambert Glacier is the world's largest glacier in terms of the area it drains. The focal point of this image is an icefall that feeds into the Lambert glacier from the vast ice sheet covering the Antarctic polar plateau. The long bands indicate the direction of ice flow and are caused by variations in the friction between the base of the ice and the rock over which the ice flows. Ice flows like water, albeit much more slowly.

Data from the ETM+ instrument on the Landsat 7 satellite; image courtesy of U.S. Geological Survey (USGS) National Center for Earth Resources Observation and Science (EROS) and NASA Landsat Project Science Office.

MODIS Mosaic of Antarctica.

Antarctica is the seventh continent, with an area larger than the United States. It is the highest continent, the coldest continent, the windiest continent, and the brightest continent. More than 99% of it is covered in perennial snow and ice.

Image courtesy National Snow and Ice Data Center (NSIDC) using data from the MODIS instrument on the Terra and Aqua satellites.

Portrait of Admiral Richard Evelyn Byrd during the second Byrd Antarctic Expedition, 1933-1935.

Byrd was a pioneering U.S. polar explorer and famous aviator. He attempted to fly over the North Pole in 1926 and undertook five expeditions to Antarctica between 1928-1956.

Photo courtesy The Ohio State University Archives, Papers of Admiral Richard E. Byrd, #7852-3.

Mosaic of the Byrd Glacier, January 11, 2001.

Named after U. S. Antarctic explorer Richard E. Byrd, West Antarctica's Byrd Glacier flows through a deep valley in the Transantarctic Mountains, covering a distance of 180 kilometers and descending more than 1,300 meters as it flows into the Ross Ice Shelf. The fast-moving stream is one of the largest contributors to the shelf's total ice volume.

Data from the ETM+ instrument on the Landsat 7 satellite; image SVS/NASA, U.S. Geological Survey, Byrd Polar Research Center-Ohio State Univ., Canadian Space Agency, RADARSAT International Inc.

Ice from the Ross Sea jams the channel where the B-15A iceberg broke apart in October 2003. The iceberg on the right retains the name B-15A, while the iceberg on the left is now B-15J. Barely visible is iceberg C-16 and Beaufort Island.

The scale in this photo is quite large. The ice cliffs at the edge of these icebergs rise approximately 15 to 20 meters above the water line.

Photo courtesy of Brien Barnett, NSF.

The Antarctic ozone hole, October 1, 2005.

Data from the Ozone Monitoring Instrument (OMI) on the Aura satellite; image SVS/NASA.

Oblique aerial view of the new U.S. Amundsen-Scott South Pole Station near the partly buried dome of the previous station.

Photo courtesy NSF.

The 109th Air National Guard LC-130 transport, carrying scientific cargo, personnel, and medical and food supplies to researchers and support staff working in both polar regions.

It is the only means of transportation between the main U.S. base at McMurdo Station and the rest of the world. This also is the major means of getting scientists deployed from McMurdo to remote field sites.

Photo courtesy C. A. Shuman, NASA/GSFC.

Sign and U.S. flag marking the geographic South Pole near Antarctica's Amundsen-Scott South Pole Station. This marker and sign are moved every year because the ice moves approximately 10 meters per year.

Photo courtesy NSF.

Coronal Mass Ejections from sunspot 10484 sweep by the Earth on November 20, 2003, generating aurora displays worldwide.

Data from the VIS on the Polar satellite.

Four Emperor penguins, *Aptenodytes forsteri,* on the Antarctic ice.

Photo courtesy Josefino Comiso, NASA/GSFC.

Mt. Erebus is a currently active volcano on Ross Island in Antarctica where both McMurdo Station (U.S.) and Scott Base (New Zealand) are located. Instruments on the flanks of the volcano and within the crater monitor the volcano for signs of activity. (elevation: 3794 meters).

Photo courtesy C. A. Shuman, NASA/GSFC.

Wintertime sea ice surrounding Antarctica in the 1990s.

Data from the SSMI instrument on the DMSP satellite; image SVS/NASA.

Whillans Ice Stream, as seen in 1997. It is a major outlet of the West Antarctic ice sheet feeding ice into the Ross Ice Shelf at a rate of 20 km^3 per year. It is approximately 450 km long, 1 km thick, 40 km wide at its narrowest point and has two major branches that join before reaching the ice shelf. The dark area in the upper right is a portion of the Transantarctic Mountains.

Data from the Synthetic Aperture Radar (SAR) instrument on the RADARSAT satellite, Canadian Space Agency.

Designer: Sally J. Bensusen. Editors: Robert A. Bindschadler, Charlotte Griner, Michael D. King, Claire L. Parkinson, Alan B. Ward.

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