

sea lane — A commonly used route for travel by sea.

sea smoke — A haze of quickly crystallized water vapor.

shipping lane — See "sea lane."

South Pole — The place on Earth where its southern rotational axis intersects its surface. On this land, embedded in ice, temperatures can plunge to -128 degrees.

Synthetic aperture radar — An imaging system that can detect not only where ice is, but just how old and hard it has become.

Things to think about

* Why does sea water freeze at a lower temperature than fresh water?

* Over the years, there have been various attempts to eliminate the threat of icebergs. These include trying to melt them, lassoing them to tow them out of the way, dropping bombs on them and painting them black so they would melt in the sun. Why has none of these attempts been successful?

* When the temperature is 35 or 40 degrees below 0 Fahrenheit, a glass of hot water tossed into the air will crystallize, or freeze before it hits the ground. Why is this?

* During the Northern Hemisphere winter, the North Pole receives little light during the day, yet during the summer the sun never sets. The same is true at the South Pole during the opposite six months of the year. What is happening during the Earth's rotation around the sun to cause these extremes?

* In the last 30 years, the ice shelves around Antarctica have been getting smaller, disappearing at a rate of more than one percent every 10 years. Why?

A Disorientation So Profound . . .

Robert Greenler, a physicist who has made two research trips to the Antarctica, writes in his book *Chasing the Rainbow: Recurrences in the Life of a Scientist* about the warning he received during his orientation prior to the trip:

We were acquainted with the danger of being caught, even a few hundred feet from the base, in a whiteout, where all traces of horizon, sky, and snow structure dissolve into a featureless white, leaving not only no visual clue to the direction of the base but also no clues to the direction of up or down. The resulting disorientation is reported to be so profound that some people are unable even to remain standing.

Internet Resources

<http://school.discovery.com/homeworkhelp/worldbook/atozgeography/a/023740.html> --

Comprehensive article on Antarctica.

<http://www.dynamicearth.co.uk/education/edupolar.html>

Easy-to-understand site that briefly explains climatic and environmental conditions around the poles.

<http://www.grida.no/geo2000/pacha/polar/index.htm>

A quick overview of the polar climates and their influences in a world climate context.

<http://www.discovery.com/exp/antarctica/chillout.html>

Illustration of the how the Antarctic glaciers and ice fields affect the polar climate.

<http://www.infoplease.com/ipa/A0873721.html>

Facts about both poles like mass, area, geography, etc.

<http://www-bprc.mps.ohio-state.edu/polarpointers/PolarPointers.html>

An extensive list of Web links related to the Arctic and Antarctic regions, listed under several different categories.

<http://www.usatoday.com/weather/antarc/acoldsci.htm>

News, weather, and information on polar weather and mechanics of the polar climates.

Other Resources

For students:

Ferris, Jeri. *Arctic Explorer: The Story of Matthew Henson*. Carolrhoda Books, 1989.

George, Michael. *Antarctica*. Creative Education, 1994.

Hackwell, W. John. *Desert of Ice: Life and Work in Antarctica*. Charles Scribner's Sons, 1991.

Lambert, David. *Our World: Polar Regions*. Silver Burdett Press, 1987.

Markle, Sandra. *Pioneering Frozen Worlds*.

Atheneum Books for Young Readers, 1996.

McDonald, Kellie. *Antarctica*. Heinemann Library, 1997.

Taylor, Barbara. *Arctic & Antarctic*. Eyewitness Books, 1995.

For adults:

Alexander, Caroline. *The Endurance: Shackleton's Legendary Antarctic Expedition*. Knopf, 1998.

Greenler, Robert. *Chasing the Rainbow: Recurrences in the Life of a Scientist*. Elton-Wolf Publishing, 2000.

Lye, Keith. *The World's Climates*.

Raintree Steck-Vaughn Publishers, 1999

Svonn, Orvig and H.E. Lansberg (Editors). *Climates of the Polar Region*. Elsevier Science, 1970.

Taylor, Barbara. *Arctic & Antarctic. Photographed by Geoff Brightling*. Random House, 1995

Weller, Dave and Mick Hart. *Arctic and Antarctic*.

Thunder Bay Press, 1996

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EXTREME WEATHER

Although "you can't do anything about the weather," as the old saying goes, people are fascinated with it. Extreme climates, such as the frigid, desolate plains of Antarctica, attract adventurers who pit their stamina against the unrelentingly harsh environment. Armchair weather-watchers are curious about the oddities: the hottest place on Earth, the driest, the rainiest. Episodes of violent weather—tornadoes, hurricanes, blizzards, turbulent thunderstorms—remind us that much in the natural world is still outside of human control. This series explores many types of extreme weather, from inhospitable locations such as the completely arid Atacama Desert in northern Chile to killer storms that can destroy a town in minutes. It also discusses how meteorologists use increasingly sophisticated technology to track approaching storms and issue life-saving warnings before "nature takes its course."

POLAR WEATHER

The North Pole and the South Pole are desolate regions with some of the most unforgiving weather on Earth—polar weather. The North Pole is surrounded by the Arctic ice cap, a huge, frozen ocean 5.5 million miles square, the largest expanse of sea ice on Earth. The South Pole, or Antarctica, is a land embedded in ice, where temperatures can plunge to -128° Fahrenheit. Combined, the polar ice sheets of the Arctic and Antarctic cover one-seventh of the Earth's surface. Learn about the killer environments at both of the poles, where an unprotected diver would die within minutes. Follow the journey of a cargo ship and its escort icebreaker through 400 miles of frozen ocean—and discover the ingenious method used to free the ship when it becomes stuck in heavy ice. Learn more about the "ends of the Earth," our last remaining regions of true, unspoiled wilderness.



The North Pole

A great sea of churning, grinding ice surrounds the North Pole. But there are a few gaps in the ice, where brave adventurers have explored the frigid, twilight world. Early polar explorers battled through the ice in wooden ships, suffering appalling hardship. Many lost their lives to the lethal combination of winds and temperature, or when their ships were crushed by ice. Even today, this heaving, frozen ocean can trap and sink a reinforced, steel-plated ship.

The vast island of Greenland extends south from the Arctic Ocean. The ice on Greenland is piled up 2 miles thick, and massive glaciers squeeze and flow between its mountains like gigantic frozen tongues. When the glaciers reach the ocean, they shed icebergs from their tips—some 15,000 icebergs each year.

The air at both poles is very dry. At -40 degrees Fahrenheit, it can hold only one-tenth of the water it could at normal temperatures. In fact, there is not enough water in the cold polar air to create a complete snowflake, but there is just enough to make tiny, flat hexagons of ice called "diamond dust." Over millions of years, enough diamond dust has accumulated in Antarctica to create an ice cap nearly 3 miles thick.

The South Pole

Antarctica is a land of savage extremes. It is the coldest place on Earth, with an average winter temperature of -76 degrees Fahrenheit. It is also the windiest place on Earth, with cold air pouring down the valleys like a never-ending avalanche.

Antarctica is immensely high, with mountains over 13,000 feet—as tall as the Rockies. There is so much ice that the average height of Antarctica is 7,500 feet, which is three times higher than any other continent. But only the mountain peaks project through the thick mantle of ice that fills the deep valleys. Ninety percent of the world's ice is here, and two-thirds of the world's fresh water. If all the ice on Antarctica melted, world sea levels would rise 200 feet.

The forbidding ice shelves of Antarctica rise 100 feet straight out of the sea, supported below the water by a further 400 feet of ice. One floating mass of ice, for example, covers 3,000 square miles, twice as big as Japan. Many icebergs are so large that they can be tracked by satellites for years before they melt.

Antarctica is populated by a few thousand scientists, who are there to study life in these extreme conditions, and to help find out whether we're under threat from global warming or from another ice age. They are scattered around the continent on a few remote bases, many of which are almost impossible to reach except by air.

Antarctica — The "Colder" Pole

Both the North Pole and the South Pole receive almost the same amount of sunlight during the year, and the South Pole even receives a little more solar energy because the Earth is closest to the sun in December, when the sun shines there for 24 hours a day. Yet the South Pole is considerably colder.

Timeline

1910 — British Naval Captain Robert Falcon Scott sets out for the South Pole in a converted whaling ship. He is racing against his rival, Norwegian explorer Roald Amundsen, to be the first to reach the Pole. His team uses tractors; when they break down, he turns to Siberian ponies.

December 1911 — Amundsen, using dogs, first for transport and later as food, reaches the Pole first.

January 1912 — Scott's team reaches the Pole and is bitterly disappointed to find it already marked by the Norwegian flag. On the grueling haul back, Scott and his crew of four all eventually perish from cold and hunger.

April 14, 1912 — British shipbuilders have launched the great ocean liner Titanic, which they believe is unsinkable. But on its maiden voyage, the ship's steel hull is ripped open by an iceberg. There are not enough lifeboats for all the passengers, and of more than 2,200 passengers and crew, only 705 are rescued. The rest drown.

1920s — As a result of the Titanic tragedy, the U.S. Coast Guard sets up an international ice patrol that still scours the Atlantic for rogue icebergs. Beginning every January, they fly out over the Atlantic shipping lanes to assess the danger and then relay their warnings back to any ship in jeopardy.

1991 — American tourists are transported to the North Pole on a Russian ship, the first icebreaker to cut a path through the Arctic ice all the way to the North Pole.

1992 — Sir Ranulph Fiennes and Dr. Michael Stroud attempt to be the first to walk unaided all the way across Antarctica. They succeed in 10 weeks, although they succumb to the loss of 50 pounds in body weight and to severe frostbite.

January 1996 — Freezing polar air spills far down into the U.S., bringing one of the worst winter storms the East Coast has ever seen. Thirty-one inches of snow are dumped on some of the most populous areas in just 30 hours, bringing businesses and transportation to a halt. In the Northeastern states alone, 60 people lose their lives.

This is because the Arctic is an ocean almost completely surrounded by continents and Greenland, while Antarctica is a continent surrounded by an ocean. Ice in the Arctic is only a few feet thick, with 30 degree Fahrenheit water underneath, so some of this "heat" reaches through the ice into the air. Even in winter, there are openings in the ice, allowing more ocean heat into the air. The Arctic also receives some relatively warm water from the Pacific and Atlantic oceans.

Antarctica, however, is covered by a few thousand feet of ice, and even though there is some geothermal heat at the bottom of the ice, it can't get through to warm the air. Also, winds from the strong storms in the Southern Ocean, which surrounds Antarctica, create an ocean current that reduces the amount of warm water that reaches the continent.

Vocabulary

Antarctica — The South Pole

Arctic ice cap — A huge, frozen ocean of 5.5 million square miles that surrounds the North Pole. It is the largest expanse of sea ice on Earth.

axis — The imaginary straight line through the center of the Earth, around which the planet rotates.

crystal ice — Solid form of water in which the molecules are arranged in a definite pattern that is repeated regularly in three dimensions.

diamond dust — Tiny, flat, hexagonal crystals of ice.

frostbite — Tissue damage caused by exposing a part of the body to intense cold.

gangrene — Decay of tissue in a part of the body to which the blood supply is obstructed by injury, such as frostbite.

glacier — A large mass of ice and snow that moves slowly outward from its center or down a mountain until it melts or breaks away.

Greenland — A vast island extending south from the Arctic Ocean. Here the ice is piled up 2 miles thick.

iceberg — A great mass of ice broken off from a glacier and floating in the sea. A much larger portion of the iceberg lurks unseen beneath the waves—up to seven times more ice under the water than above. Because icebergs melt mostly from beneath, they become unstable and keel over.

icebreaker — A sturdy, powerful vessel designed to cut channels through heavy ice.

jet stream — A high-altitude current of air that circles the globe. As the Earth spins, the air masses break up into separate, swirling bands of weather. The boundary between the two northernmost bands is marked by the jet stream.

multi-year ice — Layers of ice that do not melt in the summer months. Hitting this ice is like trying to break through concrete.

North Pole — The place on Earth where its northern rotational axis intersects its surface.

Northwest Passage — Water route from the Atlantic to the Pacific through the arctic islands of Canada.