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CLIMATE

Glaciers, Ice Sheets, and More: A Primer on the Different Types of Polar Ice

BY GUEST BLOGGER | FEBRUARY 5, 2018

By Lauren Harper

Do you ever catch yourself captivated by photos of the frozen tundra, blankets of fresh powder snow, or icebergs found in the polar regions? Although they're all made of frozen water, each one is a unique type of polar ice that plays a key part of the global climate system.

What Is Polar Ice?

Polar ice develops in the highest latitude points or the poles on the planet. It can come in many sizes and shapes, and can form in various ways. Polar ice helps to keep the polar regions cool, and aids in regulating the global climate.

Due to its white color, ice and glaciers have an albedo or reflectivity of 0.9 on a scale of 0 to 1. Like wearing white clothing on a hot day, it makes them excellent reflectors of incoming sunlight that would normally warm the earth's surface. As a result y, the temperatures in the polar regions hover between -40°F and 32°F, on average.

Polar ice development depends on the climate cycle or climate oscillation. This is when the planet alternates between warm and cool periods that can last thousands of years. In periods of glacial cooling, or "ice ages," there is an increase in the growth of glaciers and polar ice.

Types of Polar Ice

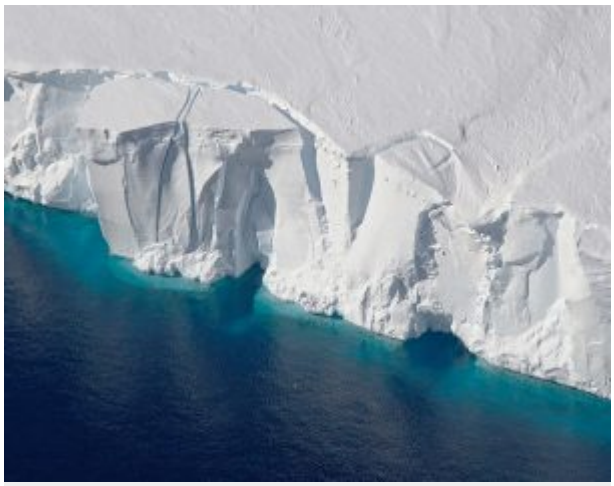
Glaciers

Glaciers form over land in the poles and on mountaintops. They are large ice masses created by snowfall that has transformed into ice and compressed over the course of many years. Glaciers are known for their ability to move, acting as a slow-moving river. Ice sheets, ice streams, and ice shelves are a few types of glaciers.

Ice Sheets

Ice sheets are large masses of glacial ice, also known as continental glaciers, that cover at least 20,000 square miles of land. That's roughly large enough to blanket West Virginia in ice.

Ice sheets form from partially melted snow that has accumulated over thousands of years. Each layer of snow slowly builds a thick and dense ice mass. Because the packed snow traps dust particles and gases, ice sheets contain an excellent historical record of Earth's climate for researchers to analyze.



Two major ice sheets exist today, in Greenland and Antarctica.
Photo: Stuart Rankin Via Flicker

Two major ice sheets exist today, in Greenland and Antarctica. Greenland's ice sheet is about three times the size of Texas, and Antarctica's could cover the surface area of the United States and Mexico combined.

Ice Streams

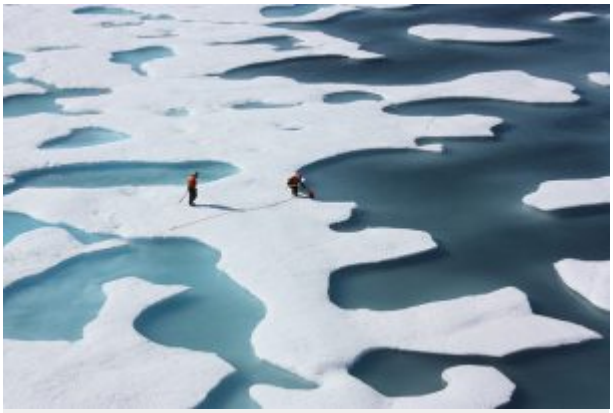
Ice streams are channels of fast-flowing ice sheets and sediment surrounded by slower moving ice. They typically form on sloped valleys that that empty the ice into the sea.

Ice Shelves

Ice shelves are permanent floating ice sheets that extend from icy land masses. They form from ice sheets that slowly flow to the sea after breaking off from glaciers or being carved by ice streams. If they don't melt when they reach the ocean, they can continue to grow into large thick ice masses. They are characteristically flat and featureless. However, they are important because they create a physical barrier around land, slowing the ice sheets' migration into the ocean. Without them, it is likely that sea levels would rise more quickly.

Icebergs

Icebergs are floating pieces that have broken off from larger ice shelves. They can be big enough to sink the *Titanic* or land a helicopter on, or small enough to fit into a glass. They can also come in many colors, depending on the compression of ice crystals and the presence of dirt, rock, and algae. Icebergs can help scientists answer questions about how polar ice influences ocean currents, and how climate affects polar ice. They also provide freshwater and nutrients to the ocean as they melt, helping to sustain plankton, fish and other aquatic life in these regions.



Sea ice is created by sea water freezing. Photo: NASA Goddard Space Flight Via Flickr

Frazil Ice

Frazil ice consists of small, loose ice crystals, resembling snow slush, which accumulate in bodies of water. Unlike the slush familiar to many of us in the northeast US, frazil ice forms in super-cooled turbulent rivers, oceans, or lakes. Frazil ice is the first formation stage of sea ice.

Sea Ice

Sea ice is the free-floating ice that surrounds the polar regions. Unlike icebergs, which break off from land-based ice, sea ice is created by sea water freezing. Because sea ice is less dense than sea water, it floats on the surface.

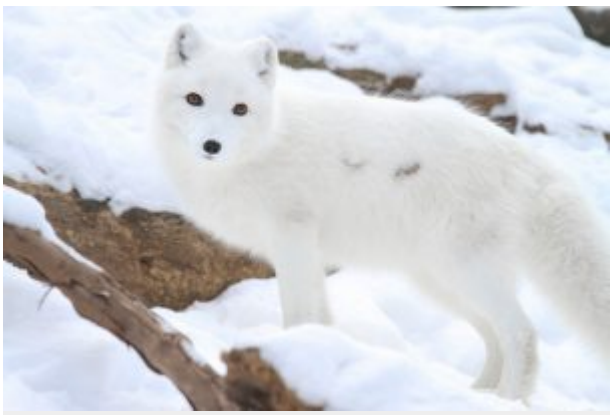
Wildlife in Polar Regions

Animals in the Arctic and Antarctic depend on polar ice. Since the temperatures in these regions are less than ideal for you and me, only a few wildlife species live there.

Because of its geographic isolation, Antarctica is home mostly to penguins, seals, whales, and small invertebrates.

In the Arctic there are polar bears, foxes, puffins, owls, reindeer, narwhal, walrus, seals and more, including many seasonal visitors. Biodiversity is higher in the Arctic because it is connected to the North American, European and Asian continents.

Both ecosystems are able to support these species because polar ice provides nutrients and food for algae, krill, and other invertebrates that form the base of the food chain.



Biodiversity is more abundant in the Arctic because of its continental connections. Photo: Mark Dumont Via Flickr

Effects of Climate Change on Polar Ice

Polar ice levels fluctuate over the year. In the fall and winter, polar ice grows intensely, reaching its full extent in March. Then it partially melts during the spring and summer, reaching its minimum volume in September. This cycle has been taking place for hundreds of thousands of years, but lately there's been more melting than growing.

Over the past decade, scientists have seen a dramatic decrease in the volume of ice that develops in the polar regions, particularly in the Arctic. Climate change is the most significant culprit behind this ice loss.

Shrinking glaciers will reduce the ice that terrestrial animals depend upon for foraging. It will also decrease the amount of nutrients deposited in polar regions. This would shrink fish and other aquatic populations, and affect both polar and ocean biodiversity.

Without ice sheets being replaced in polar regions, Arctic permafrost will continue to melt, releasing previously captured greenhouse gases, including carbon dioxide and methane, back into the atmosphere.

And the effects of melting ice will extend far beyond the poles. As global temperatures climb, melting polar ice will continue to force sea levels to rise around the world. This will cause flooding and erosion in coastal cities where many people reside.

Ocean warming and the influx of less salty water from melting ice could result in the stagnation of ocean circulation patterns, such as the Gulf Stream. The resulting changes in climate patterns could influence temperatures and rainfall around the world, making drought and wildfires more common in some places.

Global Action Plans

The problems that come with rising global temperatures and melting polar ice are not going to resolve themselves. Reducing greenhouse gas emissions and limiting fossil fuel extraction and development are the best ways to slow climate change.

These issues are being addressed through global government participation in environmental protection such as the Paris Climate Agreement, the Antarctic Treaty, and the Arctic Council. With the support of hundreds of world leaders and climate scientists, these international pacts are just the start of global action plans to protect these unique, climate-sensitive regions of the planet.

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