



“Polar Meltdown” That’s the Truth Episode #6 Backgrounder

Fact: The Polar ice caps are melting

CURRICULUM CONNECTIONS

Grade 1-6 Science “Attitudes”

Gr 1-2: Students will show growth in acquiring a sense of responsibility for actions taken

Gr 3-4: Personal and group actions, Gr 5-6: Personal and shared responsibility for actions taken

Grade 2 Science Topic D: Hot and Cold Temperatures

Grade 4 Science Topic A: Waste and Our World

Grade 5 Science Topic D: Weather Watch

Quick Facts

- Data shows that the polar ice caps are melting due to both natural and human factors.
- The ice caps are melting because the earth’s average temperature is rising (global warming). This means the cold needed to keep the ice frozen isn’t sustained for long enough to do its job. This can and does happen naturally, but according to sources like NASA, the current average temperature increase can’t be explained by natural cycles alone.
- Ice acts like a protective cover over the Earth and our oceans.

- Rapid **glacial** melt in Antarctica and Greenland also influences ocean currents, as massive amounts of very cold glacial-melt water entering warmer ocean waters is slowing ocean currents. And as ice on land melts, sea levels will continue to rise.
- Specifically, since the industrial revolution, carbon dioxide and other greenhouse gas emissions have raised temperatures, even higher in the poles, and as a result, glaciers are rapidly melting, calving off into the sea and retreating on land.
- The good news is that individuals can play a big part on both fronts with just a few simple changes to your daily routine to reduce emissions to lower your carbon footprint.
- Melting sea ice and glaciers affect weather patterns
- In the Arctic, as sea ice melts, wildlife like walrus are losing their home and polar bears are spending more time on land, causing higher rates of conflict between people and bears.

Discussion Questions

- Oinkie suggests it's no big deal if sea ice melts because that's what ice does. Do you think it matters if sea ice and polar ice caps are melting? Why?
- What natural factors contribute to sea ice melting?
- What human factors contribute?
- How are animals affected? Humans?
- What can we do to help the situation?

(Stay tuned for Episodes 7-9 for more climate change content)

Activities

- This is a very simple activity for kids to demonstrate how melting ice caps and sheets lead to sea levels rising.
<https://www.science-sparks.com/melting-polar-ice-caps/>
- Check out this interview with a polar scientist. Is there someone at a local university or other organization you could reach out to in order find out more about this topic?
<http://owlconnected.com/archives/project-planet-can-we-stop-the-ice-caps-from-melting>

- Try your hand at Polar Poetry! Write a poem about how the melting of sea ice/polar ice caps can affect people and/or animals
<https://www.poetry4kids.com/lessons/poetry-writing-lessons/>
- For an extensive list of climate education resources and activities, check out ACEE's weblink here: <https://www.abcee.org/climate-education>

Reference Source Articles & Links

Why are Glaciers and Polar Ice Caps Melting

Why are glaciers important?

Ice acts like a protective cover over the Earth and our oceans. These bright white spots reflect excess heat back into space and keep the planet cooler. In theory, the Arctic remains colder than the equator because more of the heat from the sun is reflected off the ice, back into space.

Glaciers around the world can range from ice that is several hundred to several thousand years old and provide a scientific record of how climate has changed over time. Through their study, we gain valuable information about the extent to which the planet is rapidly warming. They provide scientists a record of how climate has changed over time. Today, about 10% of land area on Earth is covered with glacial ice. Almost 90% is in Antarctica, while the remaining 10% is in the Greenland ice cap.

Rapid **glacial** melt in Antarctica and Greenland also influences ocean currents, as massive amounts of very cold glacial-melt water entering warmer ocean waters is slowing ocean currents. And as ice on land melts, sea levels will continue to rise.

What is the difference between sea ice and glaciers?

Sea ice forms and melts strictly in the ocean whereas glaciers are formed on land. Icebergs are chunks of glacial ice that break off glaciers and fall into the ocean.

When **glaciers** melt, because that water is stored on land, the runoff significantly increases the amount of water in the ocean, contributing to global sea level rise.

Sea ice, on the other hand, is often compared to ice cubes in a glass of water: when it melts, it does not directly change the level of water in the glass. Instead, depleting Arctic sea ice triggers a host of other devastating consequences—from depleting available ice on which walrus can

haul out or polar bears hunt to changing weather systems around the world by altering the pattern of the Jet stream.

Why are glaciers melting?

Since the early 1900s, many glaciers around the world have been rapidly melting. Human activities are at the root of this phenomenon. Specifically, since the industrial revolution, carbon dioxide and other greenhouse gas emissions have raised temperatures, even higher in the poles, and as a result, glaciers are rapidly melting, calving off into the sea and retreating on land.

Even if we significantly curb emissions in the coming decades, more than a third of the world's remaining glaciers will melt before the year 2100. When it comes to **sea ice**, [95% of the oldest and thickest ice in the Arctic is](#) already gone.

Scientists project that if emissions continue to rise unchecked, the Arctic could be ice free in the summer as soon as the year 2040 as ocean and air temperatures continue to rise rapidly.

What can I do to help?

Strong action on climate change means preparing communities for impacts that are happening **now**. But it also means looking to the future, focused on reducing the heat-trapping gases in our atmosphere that will bring damaging consequences as our planet warms.

The good news is that individuals can play a big part on both fronts with just a few simple changes.

First, reach out to your local elected officials to find out if your city has a disaster response plan for right now. Keeping communities' safe starts by having a strong plan in place that leverages some of the best, but underutilized tools we have to protect our communities: nature.

And when it comes to **reducing emissions**, you can make a few simple changes to your daily routine to lower your carbon footprint.

What are the effects of melting glaciers on sea level rise?

Melting glaciers add to rising sea levels, which in turn increases coastal erosion and elevates storm surge as warming air and ocean temperatures create more frequent and intense coastal storms like hurricanes and typhoons. Specifically, the Greenland and Antarctic ice sheets are the largest contributors of global sea level rise. Right now, the Greenland ice sheet is disappearing four times faster than in 2003 and already contributes 20% of current sea level rise.

How much and how quickly these Greenland and Antarctic ice sheets melt in the future will largely determine how much ocean levels rise in the future. If emissions continue to rise, the current rate of melting on the Greenland ice sheet is expected to double by the end of the century. Alarmingly, if all the ice on Greenland melted, it would raise global sea levels by 20 feet.

How do melting sea ice and glaciers affect weather patterns?

Today, the Arctic is warming twice as fast as anywhere on earth, and the **sea ice** there is declining by more than 10% every 10 years. As this ice melts, darker patches of ocean start to emerge, eliminating the effect that previously cooled the poles, creating warmer air temperatures and in turn disrupting normal patterns of ocean circulation. Research shows the polar vortex is appearing outside of the Arctic more frequently because of changes to the jet stream, caused by a combination of warming air and ocean temperatures in the Arctic and the tropics.

The **glacial** melt we are witnessing today in Antarctic and Greenland is changing the circulation of the Atlantic Ocean and has been linked to collapse of fisheries in the Gulf of Maine and more destructive storms and hurricanes around the planet.

What are the effects of melting glaciers and sea ice loss on humans and wildlife?

What happens in these places has consequences across the entire globe. As sea ice and glaciers melt and oceans warm, ocean currents will continue to disrupt weather patterns worldwide. Industries that thrive on vibrant fisheries will be affected as warmer waters change where and when fish spawn. Coastal communities will continue to face billion-dollar disaster recovery bills as flooding becomes more frequent and storms become more intense. People are not the only ones impacted. In the Arctic, as sea ice melts, wildlife like walrus are losing their home and polar bears are spending more time on land, causing higher rates of conflict between people and bears.

Author: Lorin Hancock

<https://www.worldwildlife.org/pages/why-are-glaciers-and-sea-ice-melting>

The Polar Ice Caps Melting are Melting

Data shows that the polar ice caps are melting due to [both natural and human factors](#). Data comes from NASA satellites and is accepted by skeptics and climate change advocates alike. ^{[1][2]}

This isn't to say that every blip of data on sea ice and land ice spells catastrophe, but it does indicate that when we aggregate the data we see trends of polar ice caps melting at accelerated rates (on average over time, especially since the 1970s; not each year). ^{[3][4]}

This melting is at least in part due to an increase in the earth's average temperature AKA "[global warming](#)," which is thought to be [impacted by human Carbon Dioxide production](#) (and the release of other greenhouses gasses into the atmosphere from both human activity and natural occurrences).

The process can be confusing as [data from both the Arctic and the Antarctic shows the effects playing out in different ways](#), but the data is generally confirmable (see the citations below for details, or see the videos below for some basics).^{[5][6][7]}

[NASA Releases Time-Lapse Video Of Depleting Arctic Ice Cap.](#)

FACT: The ice caps are like a “canary in a coal mine” regarding letting us know if [global](#) warming (natural or manmade) is a problem.

[NASA | The Arctic and the Antarctic Respond in Opposite Ways.](#)

Largest Areas of Agreement and Disagreement About Polar Ice Caps and Global Warming

All sides of this debate focus on the impact of climate change.

Many [people](#) believe that the ice caps are melting and that melting ice caps have negative effects. Most also agree that humans are contributing to the problem via [global warming](#) (the greenhouse effect that makes the earth’s average temperature rise).

The fact that we are coming to the end of a geological ice age should also be taken into account.

The greatest disagreement isn’t over whether or not climate change is real or if sea ice is melting, it is [over whether this is a major problem or a modest one](#), and how much control we have over it.

Ultimately, all sides of the argument are based on data [NASA satellite data](#) collected since 1979 (and ice chunks studied since the 50’s), which show a long-term decline of global sea ice and land ice. Polar ice naturally recedes and grows in cycles, but data suggests this is not a purely natural decline and instead is correlating with other “[climate change](#)” data to paint a troubling picture.

BOTTOMLINE: The ice caps appear to be melting at what seems to be a greater rate than would be expected. Everything from how we measured temperatures in the past, to the natural ebbs and flows, to other factors are taken into account. [To what extent this is natural versus manmade](#) and to what extent it is a problem, is where the contention lies.

NASA | Climate Change: A Warming World.

TIP: “Skeptics” tend not to trust NASA because NASA is the government. The problem is that we rely on NASA’s collective funding to study climate issues, so rejecting their information based on bias makes the discussion very tricky. Unless you are going to travel to the poles and start

studying ice yourself, it's probably bad practice to dismiss all of NASA's raw data. See [an explainer of bias as a concept](#) if you are curious as to how this skews the argument.

FACT: Carbon Dioxide was at 405.6 ppm as of March 2017 according to [NOAA data presented by NASA](#). Greenhouse gasses like Carbon Dioxide are said to create a "green house effect" and cause "global warming" when they saturate the atmosphere (they trap heat, like a greenhouse). Consider, Carbon Dioxide levels are currently at an all time high and the data correlates with the melting of the icecaps. [Global warming is one type of climate change](#) and [climate change is something humans can impact for better or worse](#).^[8]

TIP: Part of what releases greenhouse gasses (like methane) into the atmosphere is permafrost melting. That means the melting of the icecaps can, in theory, create a cycle that accelerates global warming. With that in mind, the earths ecosystem can't be considered in isolation, there are many complex factors to consider (like to what well our atmosphere can absorb greenhouse gasses without warming).^{[9][10][11][12]}

Ice Cap Melt: Fact Vs. Theory

When lots of facts and data point to something being true, we call it a theory. When we know something for certain, we call it a fact. The more facts and data that point to a theory, the stronger that theory becomes.

- In this respect, it is a fact that the data points to the ice cap melting, and
- it is a well substantiated theory that the ice caps are melting.

To prove for certain that the icecaps are melting requires us to have lots of empirical evidence over time. Right now we simply have data pointing to ice cap melt.

The more data that comes out, the more certain we can be of what is happening.

Satellite data shows that since the late 1970s, Arctic sea ice extent has decreased by about 12% per decade.

That is the sort of data used to draw the conclusion that the ice caps are melting (similar data is used to conclude that this is due, at least in part, to [human impacted climate change](#)).

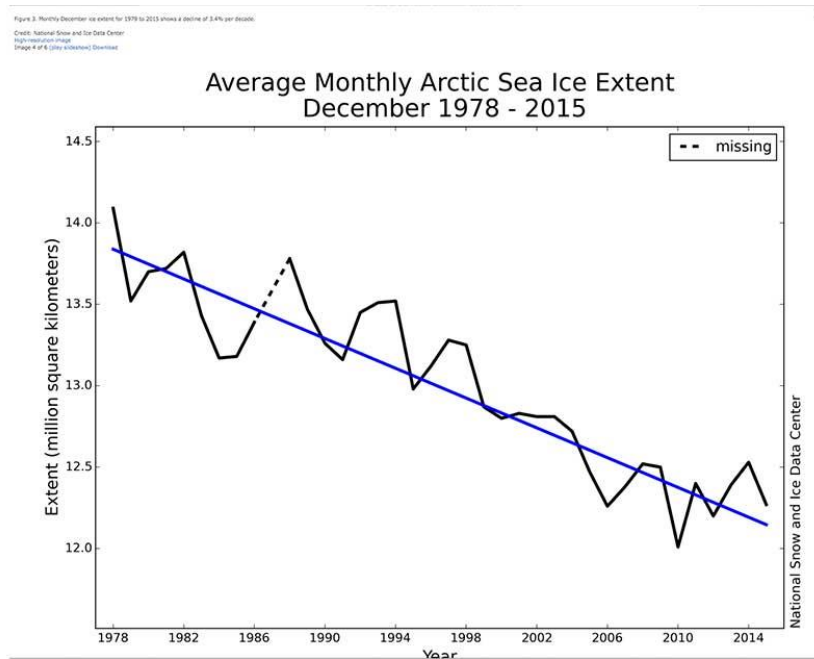
With science we always want to look for data that will prove us wrong, not just data that proves us right. At the same time, we want to take the data we do have seriously.

TIP: Learn more about [Arctic Sea Ice Decline data specifically](#).

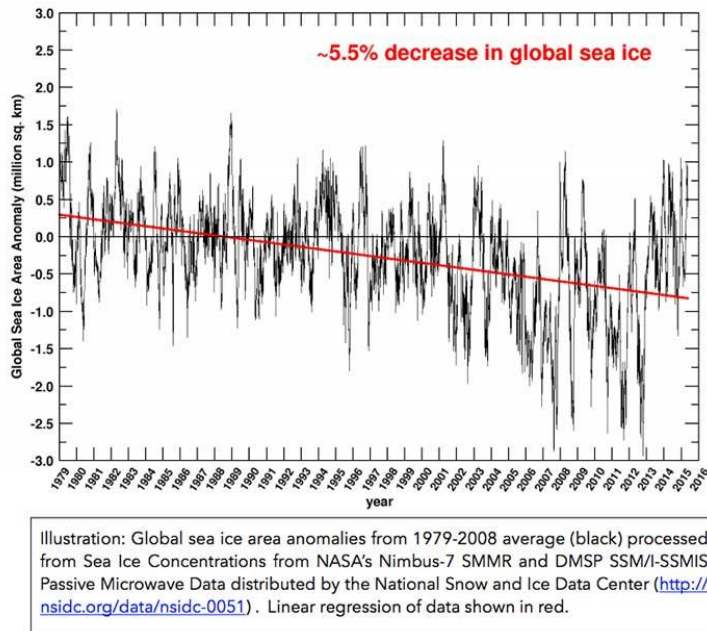
“Arctic sea ice extent for May 2017 averaged 12.74 million square kilometers (4.92 million square miles), the fourth lowest in the 1979 to 2017 satellite record. This contrasts strongly with the past several months, when extent tracked at satellite-era record lows.” – From [the June 2017 nsidc.org article Sluggish ice retreat, except in the Chukchi Sea.](#)

Looking at the Data From NASA

Below are a few charts showing data from NASA’s satellites, which measure the ebbs and flows of polar ice growth and recession. The data shows a long-term decline of global sea ice of about 5.5% (note this is GLOBAL sea ice, not land ice). What is more telling than global sea ice is the average monthly arctic sea ice data (as Antarctic sea ice acts differently than Arctic). What is most troubling is the implication of the data: that polar land ice is melting.



Data showing ice caps melting. [source.](#)



Data showing ice caps melting. [source](#). This is [a rebuttal to this article](#). As [explained here](#).

Updated NASA satellite data that skeptics use to show ice caps aren't melting. This ignores the fact that the sea ice problem is partially hidden by Arctic sea ice remaining consistent. [Source](#).

What Does it Mean That the Ice Caps are Melting?

Every year it gets hot, the ice melts, that warms the water, then it gets cold, ice freezes, and that cools the water. When the ice melts more rapidly than it freezes it causes a chain reaction that results in melting ice caps over [time](#). If the ice caps melt too much, it will cover most of the earth in water. That is bad.

There are a number of other climate changes caused by melting polar ice, this compounds the problem of studying the effects in isolation, and can result in the caps gaining elevation as snow and rain fall on top of the caps. No side single side effect or natural ebb or flow explains away the rest of the data or hints that the ice caps aren't actually melting.

FACT: According to 2000 facts sheet from NASA, together, Greenland and Antarctica contain [about 75% of the world's fresh water](#) (also quoted as [68.7% by water.usgs.gov](#)). That is only a little under 2% of the world's total water, but it is enough to raise sea level by over 75 meters, if all the ice were returned to the oceans. Imagine that water was in the ocean instead of sitting on top of it as ice at the poles. ^[13]

[What if All The Ice Melted On Earth? ft. Bill Nye](#). Bill Nye explains what would happen IF the polar ice melted. Bill Nye does popular science, so you'll want to check his insights against NASA data and other official sources cited on this page.

Why are the Ice Caps Melting?

The ice caps are melting because the earth's average temperature is rising (global warming). This means the cold needed to keep the ice frozen isn't sustained for long enough to do its job. This can and does happen naturally, but according to sources like NASA, the current average temperature increase can't be explained by natural cycles alone.

Sea Ice, Land Ice, and What is Happening in the Poles

There are two types of polar ice: sea ice and land ice.

1. Antarctic sea ice extent is increasing
2. Antarctic land ice mass is decreasing
3. Arctic sea ice extent is pretty much staying consistent
4. Arctic land ice mass is decreasing

The Arctic and Antarctic are both reacting differently, but both are actually signaling that there is a problem.^[9]

- In the Arctic, the land ice is melting and the sea ice is spreading out in cold weather and retreating in warm setting record maximums and minimums.
- In the Antarctic, land ice is melting, but sea ice is remaining consistent. The Antarctic has a different climate and is harder to study, so we are more certain about the Arctic.

The NASA data above is on sea ice, but land ice is much more troublesome. Ice already in the sea (not on top of it per-say), isn't going to raise water levels like land ice. Both ice types pose issues, and the issues are complex. But, this is important to note, as both sides will purposely use the differences to make their points sound valid. For instance, in 2015 sea ice didn't rescind as much as 2014, so skeptics used it as proof there was no problem while the other side underplayed it.

NASA reported in 2015 that "sea ice in the Arctic has been declining at a rate of 9% per decade for the past 30 years,^[5] whereas Antarctica has been losing land ice at a rate of more than 100 km³ per year since 2002."^[8]

According to NASA in February 2015, "As a whole, the planet has been shedding sea ice at an average annual rate of 13,500 square miles (35,000 square kilometers) since 1979, the equivalent of losing an area of sea ice larger than the state of Maryland every year." Even though Antarctic sea ice reached a new record maximum this past September, global sea ice is still decreasing. That's because the decreases in Arctic sea ice far exceed the increases in Antarctic sea ice.^[7] **NOTE:** rates slowed over 2015, so the number is a little less drastic with the full 2015 factored in.

“Even though Antarctic sea ice reached a new record maximum this past September, global sea ice is still decreasing,” said Claire Parkinson, author of the study and climate scientist at NASA’s Goddard Space Flight Center in Greenbelt, Md. “That’s because the decreases in Arctic sea ice far exceed the increases in Antarctic sea ice.”

<http://factmyth.com/factoids/the-polar-ice-caps-are-melting/>

Other Sources:

<https://www.nationalgeographic.com/environment/global-warming/big-thaw/>