

Antarctic ice loss has tripled in a decade. If that continues, we are in serious trouble.

By [Chris Mooney](#)
June 13 at 1:00 PM
[Email the author](#)



Crevasses near the grounding line of Pine Island Glacier in Antarctica. (Ian Joughin/University of Washington)

Antarctica's ice sheet is melting at a rapidly increasing rate, now pouring more than 200 billion tons of ice into the ocean annually and raising sea levels a half-millimeter every year, a team of 80 scientists reported Wednesday.

The melt rate has tripled in the past decade, the study concluded. If the acceleration continues, some of scientists' worst fears about rising oceans could be realized, leaving low-lying cities and communities with less time to prepare than they had hoped.

The result also reinforces that nations have a short window — perhaps no more than a decade — to cut greenhouse-gas emissions if they hope to avert some of the worst consequences of climate change.

Antarctica, the planet's largest ice sheet, lost 219 billion tons of ice annually from 2012 through 2017 — approximately triple the 73 billion-ton melt rate of a decade ago, the scientists concluded. From 1992 through 1997, Antarctica lost 49 billion tons of ice annually.

The study is the product of a large group of Antarctic experts who collectively reviewed 24 recent measurements of Antarctic ice loss, reconciling their differences to produce the most definitive figures yet on changes in Antarctica. Their results — known formally as the "[Ice Sheet Mass Balance Inter-Comparison Exercise](#)" (IMBIE) — were [published Wednesday in the journal Nature](#).

"We took all the estimates across all the different techniques, and we got this consensus," said Isabella Velicogna, an Antarctic expert at the University of California at Irvine and one of the many authors from institutions in 14 countries. The lead author was Andrew Shepherd of the University of Leeds in England.

"The detailed record shows an acceleration, starting around 2002," Beata Csatho, one of the study authors and a

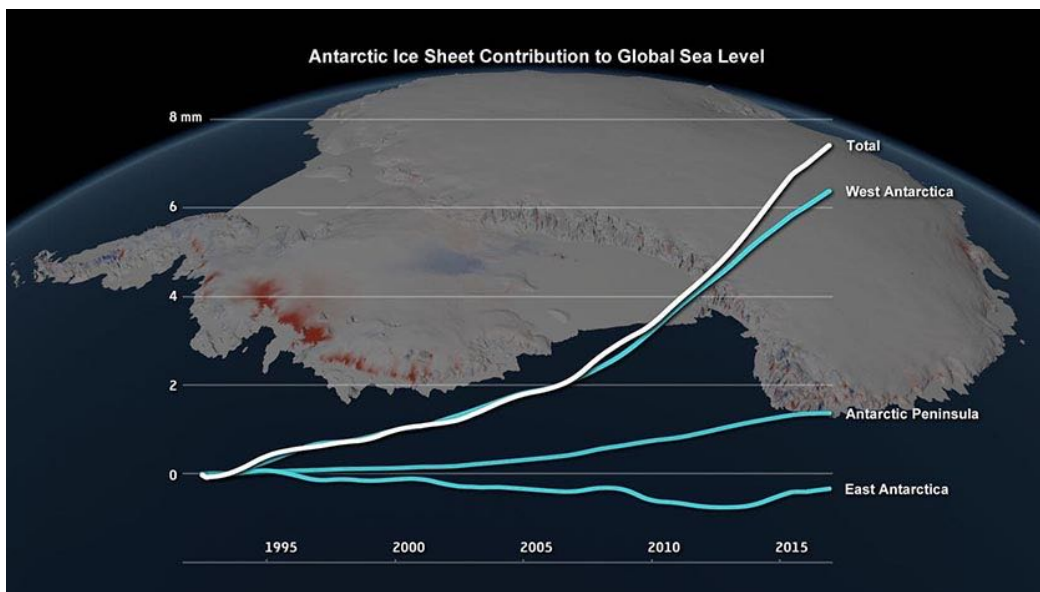
glaciologist at the University at Buffalo, said in an email.

Csatho noted that comparing the first and last five-year periods in the record reveals an even steeper acceleration. “Actually, if you compare 1997-2002 to 2012-2017, the increase is even larger, a factor of more than 5!!” she wrote.

For the total period from 1992 through the present, the ice sheet has lost nearly 3 trillion tons of ice, equating to just less than 8 millimeters of sea-level rise. Forty percent of that loss has occurred in the past five years.

The rapid, recent changes are almost entirely driven by the West Antarctic ice sheet, which scientists have long viewed as an Achilles’ heel. It is known to be losing ice rapidly because it is being melted from below by warm ocean waters, a process that is rendering its largest glaciers unstable.

West Antarctica lost 159 billion tons of ice a year from 2012 through 2017, compared with 65 billion tons from 2002 through 2007.



Sea-level contribution attributed to the Antarctic ice sheet between 1992 and 2017. (IMBIE/Planetary Visions)

The growth is largely attributable to just two huge glaciers: Pine Island and Thwaites. The latter is increasingly being viewed as posing a potential planetary emergency because of its enormous size and its role as a gateway that could allow the ocean to someday access the entirety of West Antarctica, turning the marine-based ice sheet into a new sea.

Pine Island is now losing about [45 billion tons per year](#), and Thwaites is [losing 50 billion](#). Both numbers are higher than the annual losses for any other glacier in the world.

“The increasing mass loss that they’re finding is really worrying, particularly looking at the West Antarctic, the area that’s changing most rapidly,” said Christine Dow, a glaciologist at the University of Waterloo in Ontario who was not involved in the research. “And it’s the area that we’re most worried about, because it’s below sea level.”

“If you start removing mass from there, you can have a very large-scale evacuation of ice into the ocean and significant sea-level rise,” Dow said.

Dow is the lead author of [just-published study](#) outlining one process that could be driving, and could worsen, some of Antarctica’s ice losses.

She and her co-authors found that at numerous major glaciers including Pine Island, warm ocean waters are helping to carve out deep crevasses underneath the floating ice shelves that brace these glaciers in place. The shelves then tend to crack at these thinned out points and break off large pieces, weakening their ability to hold back the flow of glacial ice into the ocean.

“Anywhere you have thinner ice, it’s going to be weaker,” Dow said.

In addition to West Antarctica, another increase in ice losses in the past decade came from the smaller glaciers of the Antarctic Peninsula, which are also melting rapidly but contain less potential to raise the sea level.

The largest part of the continent, East Antarctica, has remained more stable and did not contribute much melt to the ocean during the period of study, the assessment says. However, in the past five years, it too has begun to lose ice, perhaps as much as 28 billion tons per year, although the uncertainty surrounding this number remains high.

What’s happening in East Antarctica is important because it has, by far, the most ice to give, being capable of raising sea levels by well over 100 feet. A single East Antarctic glacier, Totten, has the potential to unleash as much total sea-level rise as the entire West Antarctic ice sheet, or more.

“We cannot count on East Antarctica to be the quiet player, and we start to observe change there in some sectors that have potential, and they’re vulnerable,” Velicogna said.



The late summer sun sets over mountains and icebergs around Adelaide Island on the Antarctic Peninsula. (Hamish Pritchard/British Antarctic Survey)

Scientists have previously raised fears about a scenario in which ice loss from Antarctica takes on an explosive rate.

In a [controversial 2016 study](#), former NASA scientist James Hansen and a team of colleagues, including Velicogna, found that Earth’s sea level could rise above one meter (or 3.3 feet) within 50 years if polar ice-sheet loss doubles every 10 years. A tripling every decade, were it to continue, would reach that volume of sea level rise even sooner.

There is no proof the current rate of change in Antarctica will continue. Scientists can’t see the future, but they do fear continuing and even worsening losses.

“I don’t know if it’s going to keep exactly tripling, but I think it has a lot of potential to keep significantly increasing,” Velicogna said.

The changes will not be steady, in any case, said Knut Christianson, an Antarctic researcher at the University of Washington. “We will not necessarily see solely rapid retreat,” Christianson in an email, noting that as glaciers such as Pine Island retreat down a submarine, downhill slope, they will sometimes encounter bumps that slow their movement. So we should expect “periods of stability interspersed with rapid retreat,” he said.

Under high greenhouse-gas emissions, the worst-case projections of sea-level rise eventually reach over a centimeter each year, said Rob DeConto, an Antarctic expert at the University of Massachusetts at Amherst who was not involved in

the new study.

We're nowhere near that point yet.

"We're still talking about roughly a half a millimeter per year," DeConto said. "That isn't going to sound horribly unmanageable. But remember for the Northern Hemisphere, for North America, the fact that the location in West Antarctica is where the action is amplifies that rate of sea-level rise by up to about an additional 25 percent in a city like Boston or New York."

That's because as Antarctica's mass shrinks, the ice sheet's gravitational pull on the ocean relaxes somewhat, and the seas travel back across the globe to pile up far away — with U.S. coasts being one prime destination.

Whether Antarctic mass loss keeps worsening depends on choices made today, argued DeConto, who [co-authored a separate paper](#) in this week's Nature outlining two visions of Antarctica in 2070.

Continuing high emissions could deliver massive sea-level rise — but strong compliance with the Paris climate agreement, while unable to stop changes happening now, could help to control how much they worsen.

"The kinds of changes that we see today, if they were not to increase much more . . . then maybe we're talking about something that is manageable for coastal stakeholders," DeConto said.

Or alternatively, he continued, Antarctica could drive faster changes, ones that "begin to exceed what we're going to be able to cope with."

Antarctica loses three trillion tonnes of ice in 25 years

By Jonathan Amos and Victoria Gill
Science correspondents
3 hours ago



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Image caption

Artwork: European satellites in particular have an unbroken record going back to 1992

Antarctica is shedding ice at an accelerating rate.

Satellites monitoring the state of the White Continent indicate some 200 billion tonnes a year are now being lost to the ocean as a result of melting.

This is pushing up global sea levels by 0.6mm annually - a three-fold increase since 2012 when the last such assessment was undertaken.

Scientists report the new numbers **in the journal Nature**.

Governments will need to take account of the information and its accelerating trend as they plan future defences to protect low-lying coastal communities.

The researchers say the losses are occurring predominantly in the West of the continent, where warm waters are getting under and melting the fronts of glaciers that terminate in the ocean.

"We can't say when it started - we didn't collect measurements in the sea back then," explained Prof Andrew Shepherd, who leads the Ice sheet Mass Balance Inter-comparison Exercise (Imbie).

"But what we can say is that it's too warm for Antarctica today. It's about half a degree Celsius warmer than the continent can withstand and it's melting about five metres of ice from its base each year, and that's what's triggering the sea-level contribution that we're seeing," he told BBC News.



Andrew Shepherd: "The study incorporates 24 independent satellite assessments"

Space agencies have been flying satellites over Antarctica since the early 1990s. Europe, in particular, has an unbroken observation record going back to 1992. These spacecraft can tell how much ice is present by measuring changes in the height of the ice sheet and the speed at which it moves towards the sea. Specific missions also have **the ability to weigh the ice sheet** by sensing changes in the pull of gravity as they pass overhead.

Imbie's job has been to condense all this information into a single narrative that best describes what is happening on the White Continent. Glaciologists usually talk of three distinct regions because they behave slightly differently from each other. In West Antarctica, which is dominated by those marine-terminating glaciers, the assessed losses have climbed from 53 billion to 159 billion tonnes per year over the full period from 1992 to 2017.

On the Antarctic Peninsula, the finger of land that points up to South America, the losses have risen from seven billion to 33 billion tonnes annually. This is largely, say scientists, because the floating ice platforms sitting in front of some glaciers have collapsed, allowing the ice behind to flow faster.

East Antarctica, the greater part of the continent, is the only region to have shown some growth. Much of this region essentially sits out of the ocean and collects its snows over time and is not subject to the same melting forces seen elsewhere. But the gains are likely quite small, running at about five billion tonnes per year.

And the Imbie team stresses that the growth cannot counterbalance what is happening in the West and on the Peninsula. Indeed, it is probable that an unusually big dump of snow in the East just before the last assessment in 2012 made Antarctica as a whole look less negative than the reality.

Globally, sea levels are rising by about 3mm a year. This figure is driven by several factors, including the expansion of the oceans as they warm. But what is clear from the latest Imbie assessment is that Antarctica is becoming a significant player.

"A three-fold increase now puts Antarctica in the frame as one of the largest contributors to sea-level rise," said Prof Shepherd, who is affiliated to Leeds University, UK.

"The last time we looked at the polar ice sheets, Greenland was the dominant contributor. That's no longer the case."

In total, Antarctica has shed some 2.7 trillion tonnes of ice since 1992, corresponding to an increase in global sea level of more than 7.5mm.



Pippa Whitehouse: "Push a balloon filled with honey - it rebounds when you remove your hand"

The latest edition of the journal Nature has a number of studies looking at the state of the continent and how it might change in a warming world.

One of these papers, led by US and German scientists, examines the possible reaction of the bedrock as the great mass of ice above it thins. It should lift up - something scientists call isostatic readjustment.

New evidence suggests where this process has occurred in the past, it can actually constrain ice losses - as the land rises, it snags on the floating fronts of marine-terminating glaciers.

"It's like applying the brakes on a bike," said Dr Pippa Whitehouse from Durham University. "Friction on the bottom of the ice, which was floating but has now grounded again, slows everything and changes the whole dynamic upstream. We do think the rebound (in the future) will be fast, but not fast enough to stop the retreat we've kicked off with today's warming."

"Ocean warming is going to make the ice too thin for this process to help."

In Imbie's last assessment, the contribution of Antarctica to global sea-levels was considered to be tracking at the lower end of the projections that computer simulations had made of the possible height of the oceans at the end of the century. The new assessment sees the contribution track the upper end of these projections.

"At the moment, we have projections going through to 2100, which is sort of on a lifetime of what we can envisage, and actually the sea-level rise we will see is 50/60cm," said Dr Whitehouse. "And that is not only going to impact people who live close to the coast, but actually when we have storms - the repeat time of major storms and flooding events is going to be exacerbated," she told BBC News.

Antarctic ice melting faster than ever, studies show

Rate of melt has accelerated threefold in last five years and could contribute 25cm to sea-level rises without urgent action

Matthew Taylor

Wed 13 Jun 2018 18.00 BST

Last modified on Wed 13 Jun 2018 21.13 BST



Scientists warn time is running out to save the Antarctic and its unique ecosystem, with potentially dire consequences for the world. Photograph: Daniel Beltrá/Greenpeace

Ice in the Antarctic is melting at a record-breaking rate and the subsequent sea rises could have catastrophic consequences for cities around the world, according to two new studies.

A report led by scientists in the UK and US found the rate of melting from the Antarctic ice sheet has accelerated threefold in the last five years and is now vanishing faster than at any previously recorded time.

A separate study warns that unless urgent action is taken in the next decade the melting ice could contribute more than 25cm to a total global sea level rise of more than a metre by 2070. This could lead eventually to the collapse of the entire west Antarctic ice sheet, and around 3.5m of sea-level rise.

Prof Andrew Shepherd, from Leeds University and a lead author of the study on accelerating ice loss, said: "We have long suspected that changes in Earth's climate will affect the polar ice sheets. Thanks to our satellites our space agencies have launched, we can now track their ice losses and global sea level contribution with confidence."

He said the rate of melting was "surprising."

"This has to be a cause for concern for the governments we trust to protect our coastal cities and communities," Shepherd added.

The study, published in *Nature*, involved 84 scientists from 44 international organisations and claims to be the most comprehensive account of the Antarctic ice sheet to date. It shows that before 2012, the Antarctic lost ice at a steady rate of 76bn tonnes per year - a 0.2mm per year contribution to sea-level rise. However since then there has been a sharp increase, resulting in the loss of 219bn tonnes of ice per year - a 0.6mm per year sea-level contribution.

The second study, also published in *Nature*, warns that time is running out to save the Antarctic and its unique ecosystem - with potentially dire consequences for the world.

The scientists assessed the probable state of Antarctica in 2070 under two scenarios. The first in which urgent action on greenhouse gas emissions and environmental protection is taken in the next few years, the second if emissions continue to rise unabated and the Antarctic is exploited for its natural resources.

The scenario which plays out largely depends on choices made over the next decade, on both climate-change and on environmental regulation, they conclude.

Co-author Prof Martin Siegert, from the Grantham Institute, said: "Some of the changes Antarctica will face are already irreversible, such as the loss of some ice shelves, but there is a lot we can prevent or reverse."

"To avoid the worst impacts, we will need strong international cooperation and effective regulation backed by rigorous science. This will rely on governments recognising that Antarctica is intimately coupled to the rest of the Earth system, and damage there will cause problems everywhere."

As well as being a major cause of sea-level rise, scientists say the oceans around Antarctica are a key "carbon sink" - absorbing huge amounts of greenhouse gases helping to mitigate the impacts of climate change.

Siegert said: "If the political landscape of a future Antarctica is more concerned with rivalry, and how each country can get the most out of the continent and its oceans, then all protections could be overturned."

"However, if we recognise the importance of Antarctica in the global environment, then there is the potential for international co-operation that uses evidence to enact changes that avoid 'tipping points' - boundaries that once crossed, would cause runaway change, such as the collapse of the west Antarctic ice sheet."

Greenpeace which is campaigning for a large tract of the ocean surrounding the Antarctic to be made into the world's biggest ocean sanctuary, said government's must heed the warning.

Louisa Casson, of Greenpeace UK's Protect the Antarctic campaign, said: "Governments can take a historic step forward in October this year if they decide to create an Antarctic Ocean Sanctuary, protecting 1.8 million square kilometres in what would be the largest protected area on Earth."

"Ocean sanctuaries create havens for marine life to build resilience to a changing ocean, but also crucially help us avoid the worst effects of climate change, by preserving healthy ocean ecosystems that play a vital role storing carbon."

Scientists lay out how to save a melting

Antarctica -- and the grim future if we don't

By [Jen Christensen](#), CNN

Updated 1920 GMT (0320 HKT) June 13, 2018

Source: CNN

CNN goes inside Antarctica 03:41

Story highlights

Nine scientists think though what could happen if sea ice melts in Antarctica by 2070
If no steps are taken, sea levels will rise; fish and penguins will die; the US could see \$1 trillion in damage
If policy-makers try to limit pollution, Antarctica will still be vulnerable but can be saved

(CNN)Sea levels will rise and all coastal countries could be seriously threatened by flooding if nothing is done to stop the massive melt of sea ice in Antarctica, according to nine award-winning scientists who have spent decades studying the icy continent and the waters around it.

They are proposing two scenarios, one bleak, one promising, for what could happen by 2070 in Wednesday's [edition of the journal Nature](#).

The paper is highly speculative rather than making forecasts. These scenarios are more like data-driven conversation starters according to the authors, all who have won the [Tinker-Muse Prize for Science and Policy in Antarctica](#) game out what could happen if the world does nothing -- or if policy-makers take significant action in the next 10 years to stop the destruction.

And although you may never get to see Antarctica for yourself, these scientists want you to know that what happens in this remote region has a significant impact in your own backyard.



The penguins aren't the only ones who could be hurt by rising seas.

Why we should care about Antarctica

Yes, there are adorable penguins living there, but that's not the only reason we should care about Antarctica. It is covered by [ice sheets](#) that get channeled into the oceans through a network of ice streams and glaciers. Recently, the continent has seen a reduction in the extent of floating ice shelves. The shelves have also thinned due to our warming planet, scientists think.



Penguins, Seals, and Krill: Antarctica's fragile food chain

The Southern Ocean that surrounds the continent is vital to the health of all the rest. It soaks up more heat and carbon than any other ocean, and in doing so, it helps slow the speed with which the atmosphere is warming. The region also does the world a real service by returning nutrient-rich deep water to the surface, and it exports these nutrients to lower latitudes that rely on them to support the life in our seas.



Antarctica has seen a reduction in the extent of floating ice shelves.

Why pollution hurts this region

The continent is particularly sensitive to the effects of pollution.

The [hole in the ozone](#), which is centered over this region, is caused in part by the release of chlorofluorocarbons that come from your air-conditioning, aerosol cans, solvents, refrigeration and other manufacturing processes. The hole allows in too much ultraviolet light, which contributes to higher temperatures. A stronger westerly wind, also due to climate change, hurts sea ice.

[Increased ocean acidity](#), a problem seen worldwide due to the increased amount of carbon dioxide from pollution, also hurts the animals that live in the waters and can cause some reproductive issues with fish.

The dire scenario

In the first scenario laid out in the new report, if no one does anything to reduce greenhouse gas emissions and the planet continues to warm, the [Southern Ocean](#) and Antarctica could see a major melt: About a quarter of the volume of the sea ice would probably disappear by 2070.

That's on top of the record rate at which the continent is already losing sea ice. Antarctica is believed to have lost an average of 71 billion to 53 billion metric tons of ice per year between 1992 and 2011, according to a new study.

If the sea ice melts, that would mean a rise in sea levels around the globe. In the worst case, by 2070, the sea would probably rise about half a meter from where it was in 2000. US coasts would probably see even higher sea rise, which would wreak havoc and be irreversible. It would cause an estimated \$1 trillion in damage in the United States alone, researchers believe.

In this scenario, the average temperature would rise about 3.5 degrees Celsius. The United Nations considers a [2 degrees](#) increase to be "catastrophic."

The water in the Southern Ocean could become corrosive to any animal with a shell. The warmer ocean would create more icebergs, which would have to be carefully watched to protect fishing, shipping and tourism. Fishing would get harder, since fish stocks would decline. There would be severe declines of penguins and other die-offs of seabirds and seals.

"Changing sea ice due to warming has played a role in significant breakups of [ice shelves like Larsen B](#), which collapsed in 2002 and was in place for 11,500 years, and almost overnight, there was a change. It was both astonishing and frightening at the same time," said paper co-author [Rob Massom](#) of the Australia Department of the Environment's Australian Antarctic Division and the Antarctic Climate and Ecosystems Cooperative Research Centre. "If you remove this protective buffer for the ice shelves, this could cause huge problems."

The optimistic scenario

By 2070 -- if the world worked together and made pollution a priority, limiting greenhouse gases -- the second scenario predicts that there is a chance Antarctica could look much like it does now. The ice sheets would still be thinning, but that could slow, as would increases in ocean acidity.

Some of the more sensitive species would still see population declines, but others would adapt. The continuing decline of sea ice would still be forcing seal and seabird populations to change the way they forage for food, and these animals may still have some challenges with breeding, as we see today, but sea ice stabilization could reduce the frequency with which extreme events happen and hurt these species.

Technology developed to redesign Antarctica's bases in the wake of these changes could be used to improve building and waste management in other parts of the world.

Worldwide impacts

The interdisciplinary team of researchers behind the theoretical glimpse into two possible futures hopes it will motivate policy-makers to make melting sea ice a priority.

"One good thing about showing these possibilities is that it shows the horse isn't out of the barn yet, and we can still do a lot for the melting ice, but as it stands, the Paris Climate agreement, even if every nation follows through on what they promise, we still have to do better than that," said co-author [Rob DeConto](#), a professor of geosciences at the University of Massachusetts Amherst.

"It's an interesting paper," said [Andy Mahoney](#), who was not involved in the work but is a [sea ice expert](#) and an assistant research professor in geophysics at

the University of Alaska Fairbanks. "While it is highly speculative, the scenarios they have chosen are not out of the bounds of reason, and I do hope it promote discussion.

"We need people to realize this is not something that only impacts a remote region. Fisheries that provide a lot of jobs and food for the masses will be impacted. Coastal regions will feel this. It has far-reaching consequences across the planet."

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DeConto is still optimistic about the future.

"I am by nature optimistic, but it may take some increasing hardships around the coastal regions before people put it together that, say, the nuisance flooding we see in Boston and in Miami and in other regions that is getting a little bit worse is an indication that something is going on really far away that is impacting us," he said.

"Now, we have firm attribution about what, at least in large part, is causing these changes. Hopefully, when people see that, they may pay attention, and we want that to happen sooner rather than later, before it is too late."