The Antarctican Society

VOLUME 21-22 OCTOBER No. 1

"BY AND FOR ALL ANTARCTICANS"

www.antarctican.org

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LET'S GET TOGETHER

Summer travels this year took me to Vermont, where our Treasurer, Tom Henderson, graciously agreed to join my wife and me with his family for dinner in Burlington despite our last-minute invitation.

Purely by chance, it happened to be almost exactly one year before our Antarctican Society Gathering in Burlington next August 12-14, 2022.

We enjoyed a convivial dinner on a sunny outdoor deck overlooking the gorgeous steel blue waters of Lake Champlain. Afterwards we strolled around the waterfront area, taking in most of the sites where the Gathering will be held.

Tom truly deserves the thanks of every one of us Antarctican Society members for the invaluable work he has done for our Society. Not only has he, with attorney and Society member Michael Russell, regained our non-profit status after several years' effort, but Tom has also put together an absolutely superb group of venues and activities for our next Gathering.

For those who've already looked at the webpage for the Gathering (https://www.antarctican.org/2022-gathering), all I can say is, although the photos are great, they do not do Burlington full justice! It is beautiful and must be experienced in person.

Check out (via the webpage above) the comprehensive and detailed Planning Guide that Tom has written. It will answer nearly all of your questions. And yes, maintaining a longtime Gathering tradition, tent camping is an option (though no longer in Paul's front yard, sadly).

One thing Tom left out (deliberately?!) is a local favorite that I'll share: a small, red-roofed building at the south end of the waterfront park near the bike path. This is Creemees Ice Cream — and their maple soft-serve is not to be missed.

It will be terrific to reconnect — in person! — after the far-too-many months of Zoom, FaceTime, Duo, Teams, Messenger, WhatsApp. Ugh. It's been four years since we last Gathered, and that's just too long.

The 2022 Gathering will be a very worthy successor to our wonderful Gatherings that Paul and Gracie hosted in Port Clyde for so many years. I look forward to seeing you in Burlington next August. Register soon!

Jeff Rubin, Co-Editor

2022 Gathering Update

by Tom Henderson

Perkins Pier at Burlington Harbor

The next Gathering of the Antarctican Society will be held in Burlington, Vermont, August 12-14, 2022. Plans for the Gathering are proceeding apace. Check our website for details and updates as they come about (https://www.antarctican.org/2022-gathering). We have also produced a Gathering Planning Guide, which gives details on many key considerations in planning for the Gathering. A link to the Planning Guide is on the 2022 Gathering web page referred to above.

The Gathering schedule will include scientific, historical and other presentations in the state-of-the-art Film House, part of Main Street Landing. Six speakers have confirmed so far; we will be listing the speakers and their topics in the newsletter and on the website. If you would like to make a presentation at the Gathering, contact Tom Henderson at webmaster@antarctican.org.

The registration cost for the Gathering is $175.00 per person until January 1, 2022, which includes the day programs, the Friday evening Reception at the ECHO Science and Nature Museum, the Saturday evening sunset cruise on Lake Champlain with plated dinner aboard the *Spirit of Ethan Allen*, and the picnic at North Beach Park on Sunday. The cost will increase to $225.00 per person after January 1. Family and friends may attend the Friday evening reception, the Saturday evening sunset cruise and dinner as well as the Sunday picnic with a guest ticket; the cost will be $90.00 per person. Members may pay by check or by credit card through the website. A registration form is at the end of this newsletter.

We are watching the direction of the Covid-19 pandemic closely, as I am sure all of you are. We will factor that in as planning goes forward.

We are excited about finally getting together again in person and hope you'll join us in 2022 for a great time with old and new friends. If you think you might attend, even if you have not made a final decision, please send Tom Henderson a note at webmaster@antarctican.org. This will help us in planning for the Gathering.

Virtual Lecture on 2 Nov 2021: Scott Base Redevelopment Project

Artist's conception of the new Scott Base

The next lecture in the Antarctican Society Virtual Lecture series will take place on Zoom at 7:00 p.m. Eastern time, Tuesday, November 2. Matt Jordan's timely presentation will address the major rebuilding of Scott Base near McMurdo. Matthew Jordan (BEng (Hons), PMP) is a Project Manager with Antarctica New Zealand working on the Scott Base Redevelopment Project. He is Co-Chair of the Canterbury Branch of the New Zealand Antarctic Society and is a Board Director of The Antarctican Society. Matt will give us a status on

the Scott Base Project and a glimpse of the significant changes at the new base. Please join us for what will be a very interesting lecture. The Zoom details are:

https://us02web.zoom.us/j/84696862018?pwd=NldJdzNGdGw2VTFMRno3MG1lQVd4Zz09

Meeting ID: 846 9686 2018

Passcode: 053171

Holiday Membership Giving

by Liesl Schernthanner

Soon, the holiday season will be here! Last year, we initiated a holiday-outreach encouraging members to give one-year gift memberships to friends and family who might be interested in learning more about Antarctica and our Society. We were delighted to welcome new members this way and appreciate everyone who participated. As the festive season nears, please keep membership gifting in mind as a unique, convenient, inexpensive, and informative present that introduces others to the Society and reminds them of your kindness throughout the year. Watch for an email/facebook announcement including a decorated gift sheet which you can endorse and use to mail to your recipients. If you have questions, please contact antarctican.org.president@protonmail.com

Live Auction at Gathering

by Kathy Covert

Do you have one stuffed penguin too many? A rare old book on the heroic age of exploration? Consider donating some of your Antarctic memorabilia to benefit the Antarctican Society.

The Antarctican Society will be holding its next Gathering in August 2022 in Burlington, Vermont, and keeping with tradition, a live auction, to be masterfully managed by Andy Cameron (of the famed Cameron auction house) will take place on Saturday August 13.

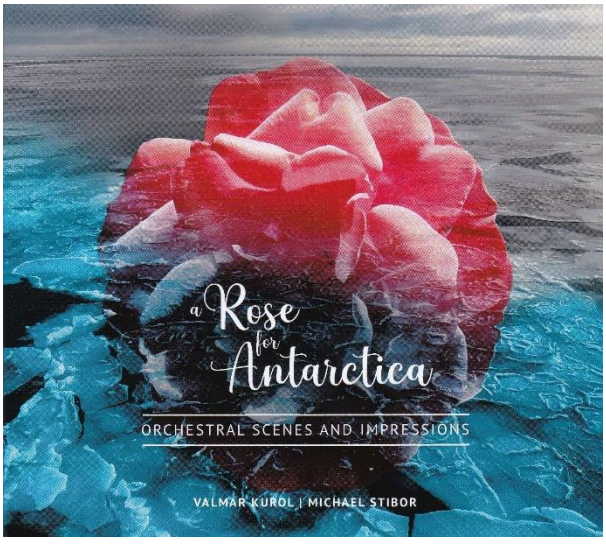
The Auction Subcommittee—Larry Antonuk, Andy Cameron, Kathy Covert, Tom Henderson and Marc Levesque—will catalog the donations and select the most suitable items for the live event, and the remaining items will be offered in an online auction soon thereafter.

Stay tuned for details. Send a description of your donation(s) to AuctionChair2022@gmail.com. Thank you.

CD Review: "A Rose for Antarctica"

by Tom Henderson

This CD album is the fourth in a collection of musical tributes to Antarctica by long-time Antarctican Society member Valmar Kurol. The last three have been with musical collaborator Michael Stibor. "I feel that this album is about experience, the feeling of being there for those who have never been, and the memories of being there for those who long to go back" says Michael in the introduction. It is a musical interpretation of a magnificent continent.



The symphonic and, in my opinion, somewhat cinematic album is divided into four movements: *Soaring Over Ice* takes a long view of Antarctica, emphasizing the vastness and awesome beauty of the continent; *Distress* is a lament for both the earth in general and Antarctica specifically as climate change brings irreversible changes to both; *Oceans and Ice* contemplates the Southern Ocean and the life beneath it; *Human Presence* reflects on the human experience and interaction with Antarctica.

The emotional connections between the music and its themes are deep, reflecting Valmar's passion for the continent and great concern for its future. Music can touch us as no other thing can, evoking another dimension of appreciation and understanding beyond the visual. That quality is evident in these compositions.

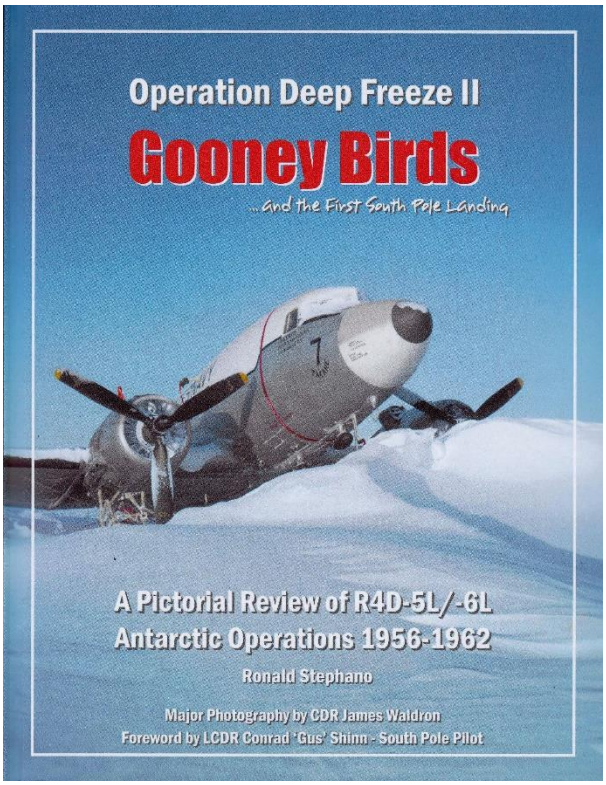
Taken together, the Kurol/Stibor musical tetralogy of works is perhaps the most comprehensive musical tribute to Antarctica ever composed. *A Rose for Antarctica* is a worthy complement to the previous three albums.

To learn more about the album, hear samples of the music and purchase the music, go to https://aroseforantarctica.com/.

Book Review: *Operation Deep Freeze II "Gooney Birds"*

by Tom Henderson

This is, without question, the most complete and accurate documentation of the R4D-5L and R4D-6L Skytrain aircraft and the men who flew them during the second year of Operation Deep Freeze, 1956-57. The Skytrains were used extensively in Deep Freeze from 1956 until they were phased out in 1968. Antarctican Society member Ron Stephano has devoted thousands of hours to producing this book over the past ten years which includes in-person interviews with U.S. Navy veterans who were directly involved in this history.



The historical highlight is the first landing of an aircraft at the geographic South Pole on October 31, 1956. The plane was R4D-5L 12418, nicknamed *Que Sera Sera*. The landing and takeoff were historic because this confirmed that it was possible to bring men, equipment, materials and supplies to the Pole by air, an absolute necessity if a permanent base was to be established there. LCDR Conrad "Gus" Shinn USN (ret.), who just celebrated his 99th birthday, was the pilot. Ron interviewed LCDR Shinn several times and visited the U.S. Naval Air Museum with him to see and photograph the *Que Sera Sera* which is on display there. Shinn wrote the forward to the book. Ron also received copies of, and permission to use, the only photographs taken at the historic landing from the brother of the man who took them, navigator Lt. Dick Swadener. The interview information and the photos alone make this a unique historical record.

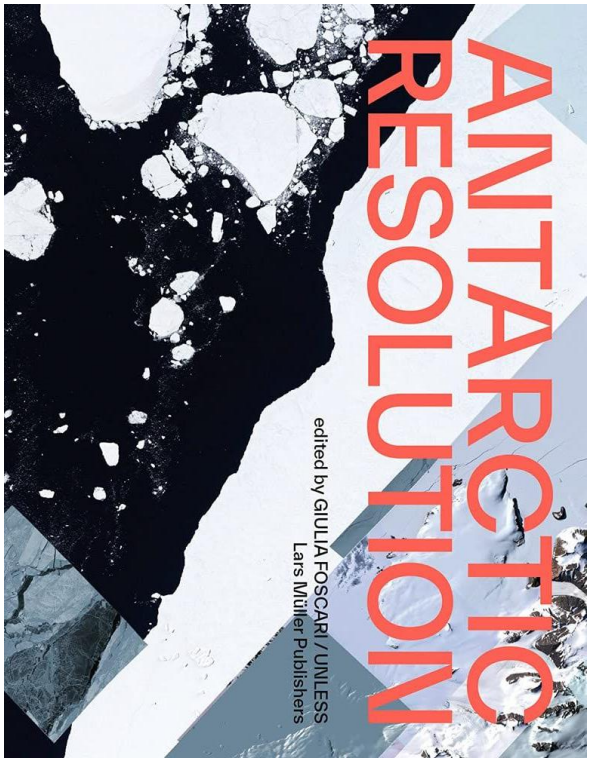
Ron has gone to great lengths to confirm every detail of these aircraft, down to the original stenciling on the fuselages and even the markings on the jet assisted takeoff (JATO) bottles hung beneath the planes. He uses a combination of photos and his own artwork to preserve these details for history.

Full disclosure: Ron contributed his artist's rendition of the *Que Sera Sera* in the form of a limited edition print as a donation reward for my film, *Ice Eagles*. That graphic is included as an illustration in the book.

Aircraft enthusiasts and history buffs alike will find a lot to like in *"Gooney Birds."* Ron Stephano has self-published the book so for information on how to obtain it, contact him at ronalds@pt.lu.

Book Review: *Antarctic Resolution*

by Guy G. Guthridge



Antarctic Resolution is a new 992-page hardcover book (8 by 10½ inches) with 165 articles by more than 200 specialists organized under 16 themes, or sections. The book also contains 60 "archives" (images, maps, drawings) of Antarctic architecture (stations and their environs). Five multipage sections of photographs each have the title, "The Antarctic through the lens of . . . ."

The book does not address all Antarctic topics; it is not an encyclopedia. For such, you might want the two-volume *Encyclopedia of the Antarctic* (Routledge, 2006).

It's an encyclopedia with a soul. Giulia Foscari, the editor of *Antarctic Resolution* (Lars Müller Publishers, Zürich, 2021), states in the introduction that the volume "urges the construction of a high-resolution image focusing on the continent's unique geography, experimental governance system, contemporary geopolitical significance, unparalleled scientific potential, and extreme inhabitation model." It aims also to show the "growing economic and strategic interests, tensions, and international rivalries." She writes that the book "offers no presumption of completeness and no authoritative finale." The goal is to provoke change and ultimately mobilize younger generations "to undertake a true Antarctic resolution."

The editor is, among other things, an architect. Five of the 16 sections explore the built environment. Her "Abstract Master Plan" essay, which heads the "Geography of Science" section, with 11 papers, considers the embassy-like stations that "punctuate the seventh continent to reinforce latent geopolitical ambitions." Like others, she observes that most nations build their own bases and sustain extra costs rather that join forces with other countries.

Top Antarctic specialists are here. Society member Lou Lanzerotti, with Andrew J. Gerrard, explains Antarctica's key role in studies of the magnetosphere. Anne-Marie Brady reviews China's strategic interests. Gillian Wratt describes COMNAP, which she headed. Andrea Kavanagh of the Pew Charitable Trusts discusses marine protected areas. David Vaughan, BAS, discusses ice.

Jonathan Shanklin explains discovery of the ozone hole. U.S. authors seem underrepresented, and the broad international range gives attention to newer players: a sobering but enervating perspective given the long domination of Antarctic affairs by us Americans. English is used throughout.

Critical attention includes a review in an online site, Degraded Orbit, which observes that the book, "though containing extensive scientific perspectives from leading researchers, is framed first and foremost as an artistic inquiry, or an interrogation of the relationship humans have developed with Earth's only uninhabited continent." The noble goal is "to create a new map of the continent with a 1:1 scale by overlaying data, maps, photographs, and firsthand accounts from a dizzying plurality of sources. The resulting document . . . is in many ways more illuminating than a more standard and straightforward approach might have produced."

This observation is consistent with mine, and I am glad to have a copy. The wide range from logistics to the arts brings fresh views of the Antarctic from experienced hands. Richly illustrated, with color on almost every page, it's a huge bargain at $45.49 from Amazon.

Chile building new International Antarctic Centre

by Tom Henderson

Artist's drawing of planned Chilean Antarctic Centre

Chile is solidifying its place as the gateway to the Antarctic Peninsula by creating a large, modern facility that will be a combination of research laboratory, logistics support center and museum. The 33,000 square meter building will be shaped to resemble a tabular iceberg and will cost over $140 million. The ambitious project will take three years to construct. To read more and see artists' renditions of the planned facility, follow this link:

https://polarjournal.ch/en/2021/08/06/international-antarctic-centre-to-be-built-in-punta-arenas/?fbclid=IwAR2aJ7gwPsfGf7APnYGZlCXS4Kaoi-7cwC501ZMgez4mZlnuVMZxq2HqIwk

Thanks to Elaine Hood for forwarding this link.

Southern water stymies the Atlantic Ocean's overturning circulation

Evidence implicates Antarctic icebergs as the culprit responsible for reorganizing the North Atlantic deep water to shallow depths during glaciations.

by Alex Lopatka

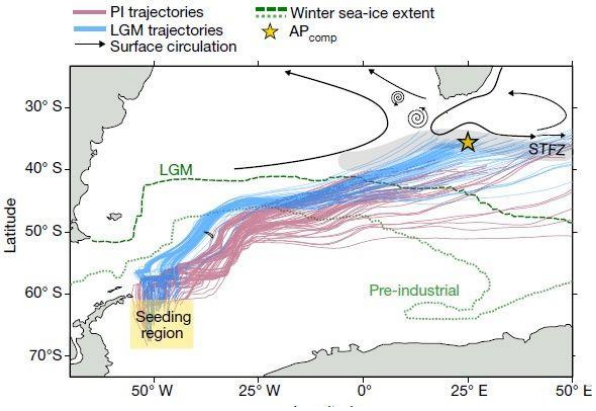
Penguins atop an iceberg in the South Shetland Islands at the peninsula of Antarctica. Credit: Andrew Shiva, CC BY-SA 4.0.

In 2019 a team of oceanographers published the first data set of continuous observations of the Atlantic Ocean's meridional overturning circulation (AMOC)—the ocean dynamics process that brings warm,

salty, tropical water to the North Atlantic where it sinks and then travels southward as deep water (see the article by Adele Morrison, Thomas Frölicher, and Jorge Sarmiento, *Physics Today*, January 2015, page 27). The modern observations helped oceanographers better resolve the spatial variability of the AMOC and how it affects and is affected by rapid climate change (see *Physics Today*, April 2019, page 19).

To better understand the primary influences on the AMOC, Aidan Starr and Ian Hall of Cardiff University in the UK, with the other members of the Expedition 361 Science Party, have now reported on oceanographic data that span the last 1.5 million years. Their work, combined with iceberg-trajectory modeling, suggests that the far-flung redistribution of fresh water from the Southern Ocean decreased the strength of the AMOC during glacial events.

The paleodata come from new and existing records of debris carried by ice and a new sediment core collected from the Agulhas Plateau in the southwestern Indian Ocean. Because the icebergs there are survivors from the Southern Ocean, Starr, Hall, and colleagues could infer their movement by collecting paleodata on the debris they carried.



Adapted from A. Starr et al., *Nature* 589, 236 (2021)

The researchers then compared those data to the isotopic record from foraminifera organisms in the sediment core. The isotopic record correlated significantly with the movement of water masses from the North Atlantic. The researchers found that icebergs originating in the Southern Ocean moved equatorward at the onset of glaciation events and about 1000–2000 years before the redistribution of the northern-sourced water masses.

Although previous observations indicate that the AMOC weakened during some glacial events over the past 1.5 million years, the picture that emerges from the new data is that of an influential Southern Ocean. If enough icebergs escaped the Southern Hemisphere, the influx of melted fresh water in the North Atlantic would have limited the strength of the AMOC. That weakening would have consequently decreased the formation of the deep water that supports Earth's transition into an ice age.

South Pole posts most severe cold season on record, an anomaly in a warming world

by Jason Samenow and Kasha Patel, *The Washington Post*

Amid a record hot summer in large parts of Northern Hemisphere, beset by devastating fires, floods and hurricanes, Antarctica was mired in a deep, deep freeze. That's typically the case during the southernmost continent's winter months, but 2021 was different.

The chill was exceptional, even for the coldest location on the planet.

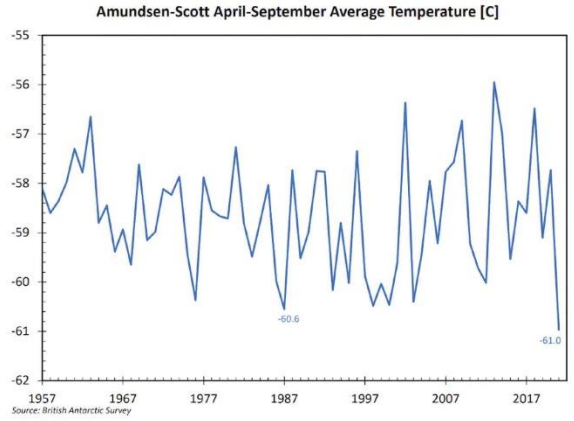
The average temperature at the Amundsen-Scott South Pole Station between April and September, a frigid -78º F (-61º C), was the coldest on record, dating back to 1957. This was 4.5º F (2.5º C) lower than the most recent 30-year average.

We first learned of this record through a tweet from Stefano Di Battista, who has published research on Antarctic temperatures. The legitimacy of Di Battista's information was confirmed by Richard Cullather, a research scientist at NASA's Global Modeling and Assimilation Office.

The temperature averaged over September was also the coldest on record at South Pole, wrote David Bromwich, a polar researcher at Ohio State University, in an email.

The extreme cold over Antarctica helped push sea ice levels surrounding the continent to their fifth-highest level on record in August, according to the National Snow and Ice Data Center.

Extraordinarily cold weather continues to grip the Antarctic Plateau. Maximiliano Herrera, a climatologist who monitors world weather extremes, tweeted that temperature at Russia's Vostok Station sunk to -110.9º F (-79.4º C) on Thursday (Sept. 30), which was just 1º F (0.6º C) from the world's lowest temperature on record during October.



The Amundsen–Scott South Pole Station experienced the coldest average temperature for April to September in 2021 on record. This chart displays the average temperature since 1957 in degrees Celsius. (Richard Cullather/British Antarctic Survey)

The current temperatures are still some distance from the coldest ever observed on the continent. In 1983, Vostok plummeted to -129º F (-89.6º C). Satellites have detected temperatures as low as -144º F (-98º C).

Matthew Lazzara, an expert on the meteorology of Antarctica and scientist at the University of Wisconsin, monitored the South Pole temperatures in recent months from his office in Madison with awe. In an interview, he said it was around -100º F (-73º C) on numerous occasions. Over the years, he's traveled to Antarctica numerous times to support his research.

"At these temperatures, it is difficult to operate aircraft," he wrote in an email. "[B]etween -50°C and -58°C (-58º F and -72º F) you put the aircraft at risk with the hydraulics freezing up or fuel turning into a jelly."

Once he visited the South Pole in late October. "I got to experience -50°C weather … with a wind chill beyond that. I was "thrilled" to be wearing my 75 lbs (34 kg) of Extreme Cold Weather gear to stay warm," he joked.

The conditions over Antarctica are in stark contrast to much of the rest of the planet which notched its fourth hottest June through August on record, according to the National Oceanic and Atmospheric Administration. The Northern Hemisphere registered its second hottest summer.

Scientists credited a very strong polar vortex, or a ring of strong winds in the stratosphere, surrounding Antarctica for the intensity of the cold.

The stratospheric polar vortex is a seasonal phenomenon. In the Southern Hemisphere, it forms in the fall, persists through the winter and weakens before reversing course in spring.

The strength of the vortex has connections to weather at the ground, said Krzysztof Wargan, a research scientist with NASA's Global Modeling and Assimilation Office. He said a strong vortex is associated with low surface temperatures.

Whether the vortex is strong or weak depends on a cycle known as Southern Annular Mode (SAM). Right now, the mode is in its positive phase and the vortex is intense.

"Basically, the winds in the polar stratosphere have been stronger than normal, which is associated with shifting the jet stream toward the pole," wrote Amy Butler, an atmospheric scientist at NOAA in a message. "This keeps the cold air locked up over much of Antarctica."

Butler wrote the strong polar vortex not only makes it very cold over Antarctica, but accelerates processes that lead to stratospheric ozone depletion, which in turn can strengthen the vortex even more. This year's ozone hole over Antarctic is much bigger than average at around 9.3 million sq. miles (24 million $km^{2)}$, a reflection of the vortex's strength.

Although the stratospheric ozone layer is on the mend since some ozone-depleting chemicals were banned by the Montreal Protocol in the 1980s, Wargan said year-to-year variations are expected to influence the size of the ozone holes in the coming decades.

Scientists stressed the record cold over the South Pole in no way refutes or lessens the seriousness of global warming. Antarctica is notorious for its wild swings in weather and climate which can run counter to global trends.

Ted Scambos, a senior research scientist at the University of Colorado, wrote in an email that the Antarctic climate is extremely sensitive to high-altitude winds and Pacific Ocean conditions and prone to rapid change. He pointed out that its sea ice, which was close to a record high at the end of August tanked to "to one of the lowest extents for this time of year that we've seen" by the end of September.

To evaluate what's happening with the climate of Antarctica, one must look beyond a seasonal snapshot, scientists said.

"One cold winter is interesting but doesn't change the long-term trend, which is warming," wrote Eric Steig, a professor of atmospheric sciences at the University of Washington in an email.

Not only is Antarctica warming over the long term, but its ice is rapidly melting, contributing to global sea level rise.

To see a BBC interview with Principal Investigator Matthew Lazzara, click this link: BBC interviewed Principal Investigator Matt Lazzara

Earth is now losing 1.2 trillion tons of ice each year. And it's going to get worse.

Ice is melting faster worldwide, with greater sea-level rise anticipated, studies show.

by Chris Mooney and Andrew Freedman, *The Washington Post*

Melt stream on the surface of a Greenland glacier. (Ian Joughin /University of Leeds)

Global ice loss has increased rapidly over the past two decades, and scientists are still underestimating just how much sea levels could rise, according to alarming new research published this month.

From the thin ice shield covering most of the Arctic Ocean to the mile-thick mantle of the polar ice sheets, ice losses have soared from about 760 billion tons per year in the 1990s to more than 1.2 trillion tons per year in the 2010s, a new study released Monday shows. That is an increase of more than 60%, equating to 28 trillion tons of melted ice in total — and it means that roughly 3% of all the extra energy trapped within Earth's system by climate change has gone toward turning ice into water.

"That's like more than 10,000 'Back to the Future' lightning strikes per second of energy melting ice around-the-clock since 1994," said William Colgan, an ice-sheet expert at the Geological Survey of Denmark and Greenland. "That is just a bonkers amount of energy."

There is good reason to think the rate of ice melt will continue to accelerate. A second, NASA-backed study on the Greenland ice sheet, for instance, finds that no less than 74 major glaciers that terminate in deep, warming ocean waters are being severely undercut and weakened.

And it asserts that the extent of this effect, along with its implications for rising seas, is still being discounted by the global scientific community.

Failing to fully account for the role of ocean undercutting means sea-level rise from the ice sheets may be underestimated by "at least a factor of 2," the new paper in the journal *Science Advances* finds.

"It's like cutting the feet off the glacier rather than melting the whole body," said Eric Rignot, a study co-author and a glacier researcher at NASA's Jet Propulsion Laboratory and the University of California at Irvine. "You melt the feet and the body falls down, as opposed to melting the whole body."

"I think this is an example that the current projections are conservative," Rignot said. "As we peer below we realize these feedbacks are kicking in faster than we thought."

Together, the two studies present a worrying picture.

The Oceans Melting Greenland mission carried out depth and salinity measurements of Greenland's fjords by boat and aircraft. (NASA)

The first finds that the current ice losses, which are accelerating quickly, are on pace with the worst scenarios for sea-level rise put out by the United Nation's Intergovernmental Panel on Climate Change (IPCC). That expert body found that ice sheets could drive as much as 16 inches of sea-level rise by 2100.

But on top of that, the new NASA work on Greenland suggests that the IPCC, whose sea-level projections have long been faulted as being conservative, could underestimate future sea-level rise if the panel, which has a new report expected later this year, does not take full account of the power of the ocean to knock the ice backward and undermine it.

A new tally of vanishing ice

The first study, in the journal *The Cryosphere* and led by University of Leeds researcher Thomas Slater, is basically an enormous work of accounting. It tallies losses from the vast Greenland ice sheet to the jagged peaks of the Himalayas and then southward to Antarctica during the 23-year period from 1994 through 2017.

Not all the ice the planet has lost translates directly into rising seas. For instance, 7.6 trillion tons, the largest single total, comes from the melting of the floating ice cover of the Arctic Ocean, which does not raise seas at all. Nor do the 6.5 trillion tons subtracted from Antarctic ice shelves, as those, too, were already afloat.

Still, the loss of floating ice paves the way for the unlocking of ice on land in Greenland and Antarctica, where 99% of all the planet's fresh water sits in frozen form, crushing down the invisible landforms beneath it. Greenland and Antarctica together have lost 6.3 trillion tons since 1994, the research finds, leaving out the past three years, which would surely add at least another trillion on top of that.

So far, the world's mountain glaciers have actually been keeping pace with the ice sheets, losing 6.1 trillion tons of ice over the same time period and thus adding roughly the same amount to sea level. Over time — probably starting right around now — the polar ice sheets will begin to massively outdistance the losses from mountain glaciers and become the dominant drivers of global sea-level rise.

"It is no surprise that the ice on our planet is melting," said Robin Bell, an expert on the polar ice sheets at Columbia University's Lamont-Doherty Earth Observatory. "We have turned up the temperature, and just like you can watch an ice cube in your glass melt on a hot summer day, our actions are melting our planet's ice."

The question now becomes: Just how fast will climate change lead to the melting of the biggest and thickest ice, the ice atop Greenland and Antarctica?

Where Greenland's toes dip into the sea, ice is melting

That's where the results of a six-year NASA campaign to study the influence of warming ocean waters on the melting of Greenland's glaciers have some unsettling news.

Together with the University of Leeds study, the NASA research helps show why global ice loss is likely to further speed up as global warming continues. One of the main mechanisms causing Greenland's glaciers to flow faster into the sea, unlocking inland ice and allowing it to slide toward the coast as well, is the encroachment of warm water underneath the ice in the many deep fjords of coastal Greenland.

Scientists have observed accelerating ice loss in nearly every sector of the Greenland ice sheet. While researchers have suspected that warming ocean waters, rather than increasing air temperatures alone, may be behind the melting of glaciers in typically frigid northwest Greenland, for example, the evidence had previously been lacking.

The new study, led by glaciologist Mike Wood, also of UC-Irvine and NASA's Jet Propulsion Laboratory, relies on measurements taken via hundreds of instruments deployed by aircraft and ships for the past six years, revealing the shape of the land that lurks under the ice where 226 glaciers terminate in the sea, as well as the temperature structure of waters coming into contact with the ice.

Glaciers that flow into Greenland's deepest fjords are losing the most ice, Wood said. The 74 glaciers situated in deep, steep-walled valleys accounted for nearly half of Greenland's total ice loss between 1992 and 2017, the study found. Greenland is now the largest contributor to global sea-level rise.

"In these deep fjords, warm water lurks hundreds of feet below the ocean surface, melting the glaciers from below," Wood said. "When those warm waters become even warmer — a phenomenon we saw through the early 2000s — the melt increases, causing the glaciers to recede, become unstable and lose ice."

The science produced by the six-year field campaign, known as Oceans Melting Greenland, may force modelers to rethink their estimates for future ice loss, not just in Greenland but also for glaciers where similar dynamics are at work in Antarctica, such as in the West Antarctic ice sheet.

The NASA-led research shows that the undercutting of glaciers by relatively mild ocean waters explains why so many of Greenland's glaciers have sped their movement into the ocean, adding to sea-level rise, while some others have not accelerated as much.

In many coastal locations, relatively mild, salty waters sit below a layer of colder, fresher water in glacial fjords. These mild waters are coming into contact with the base of glaciers, where ice meets bedrock, which destabilizes the ice.

"A large amount of a glacier's stability depends on ice at its base," Wood said. "Remove it and you destabilize the whole thing, like Achilles' heel."

At the same time, during the summer months, meltwater from inland areas can flow all the way to the base of glaciers that end in the sea and pour into the fjords. This fresh water can drag some of the heavier, warm

water toward the surface, accelerating melting further.

The NASA data shows that the shape of the land undergirding glaciers and the water temperatures in coastal areas help determine the rate of Greenland's ice loss, but this information isn't being translated yet into projections for sea-level rise.

"Very few ice-sheet models include that ice process at the frontal margin with realistic forcing," Rignot said. If models were to include undercutting, their estimates of sea-level rise from the faster loss of coastal glaciers could be up to twice what they are now, the study shows.

"I think that's a big deal," Rignot said. "You have to account for ocean temperatures in fjords and undercutting. If it's not in your model, you won't get the prediction right."

The Greenland results add urgency for research into the mechanisms that are destabilizing ice in Antarctica, where melting from warming oceans coming into contact with the base of glaciers is the main contributing factor, rather than increasing air temperatures.

"Because scientific progress is so often built small step on top of small step, I am not surprised by their findings," said Twila Moon, a research scientist at the National Snow and Ice Data Center in Boulder, Colo, who wasn't involved in either study. "But their results are still devastating, further confirming that we are losing ice both from a warming atmosphere and from a warming ocean."

"Ice loss is not a process that will stop itself," Moon said. "We humans are the ones with our hand on the climate control knob, and our decisions are the most important in determining the future of Greenland ice."

Society member Fred Davey seeks information on US-NZ history

Emeritus Scientist Fred Davey, a new member, writes from New Zealand that he first went to Antarctica in 1965 with the British, recruited by Peter Barker (Birmingham University and BAS) "just for a couple of months," to carry out the first marine (surface ship) gravity measurements in the western Scotia Sea and along the western Antarctic Peninsula. One discovery was that the South Shetlands – Bransfield Strait region is a subducting plate margin. In 1970 he moved to NZ, starting a long collaboration with US marine geophysicists.

In 1992, he was appointed Chairman of the NZ National Committee for Antarctica, where amongst other issues he dealt with revised Antarctic Protected Area management plans. He was NZ Delegate to SCAR from 1992-2002, was SCAR Secretary from 1996-2000 and then a SCAR Vice-President.

Recently, Fred's interest has focused on the history of NZ's involvement in Antarctica, in particular the NZ IGY story.

If anyone has any direct knowledge of when RL (Ron) Viets (Little America Station) flew to the South Pole with AL (Buzz) Burrows (NZ's Scott Base) to make absolute geomagnetic measurements in December 1957, he would appreciate hearing of it.

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