Earth's future in being written in fast-melting Greenland

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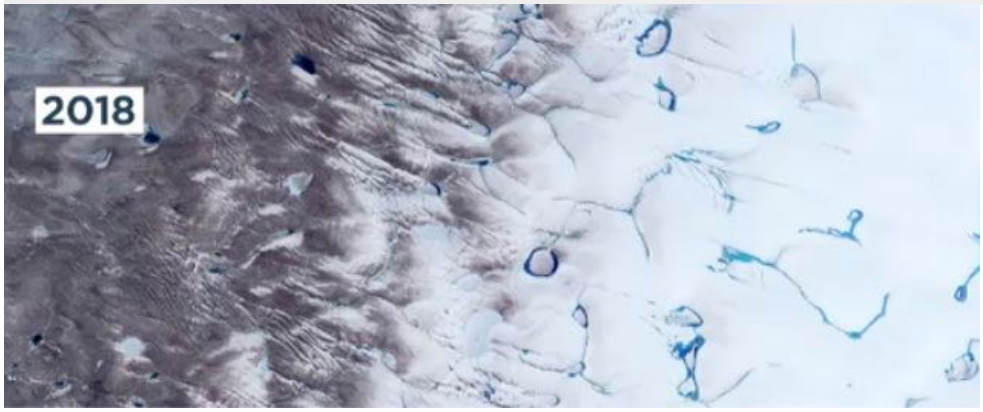
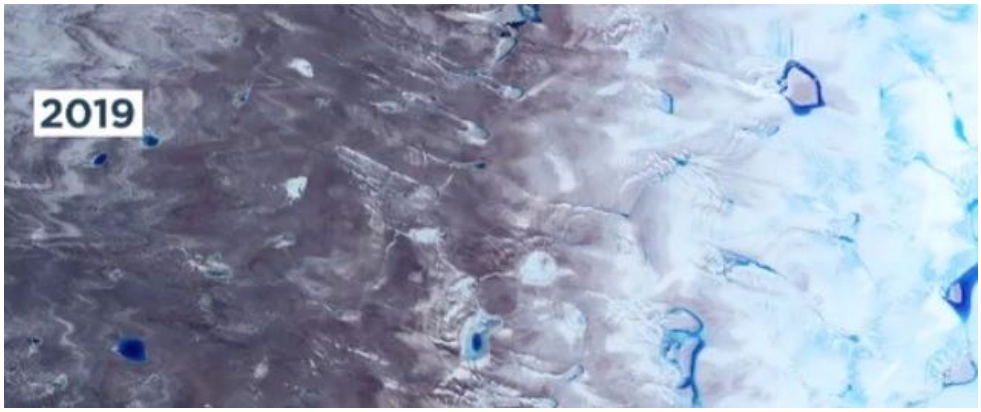
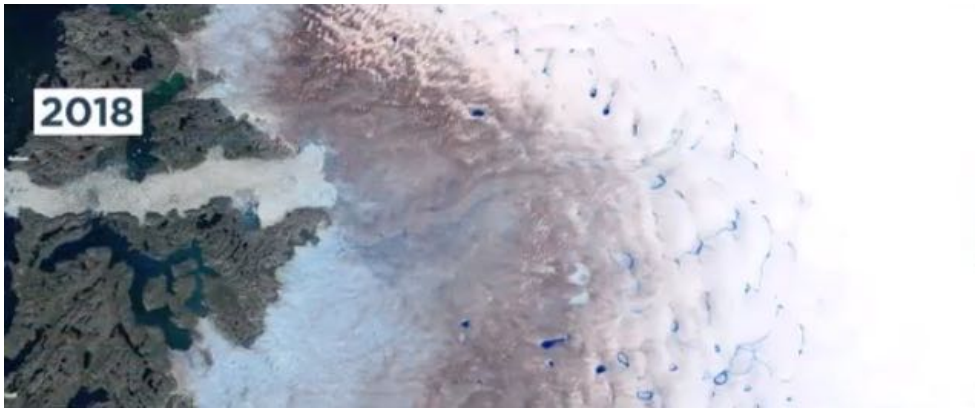
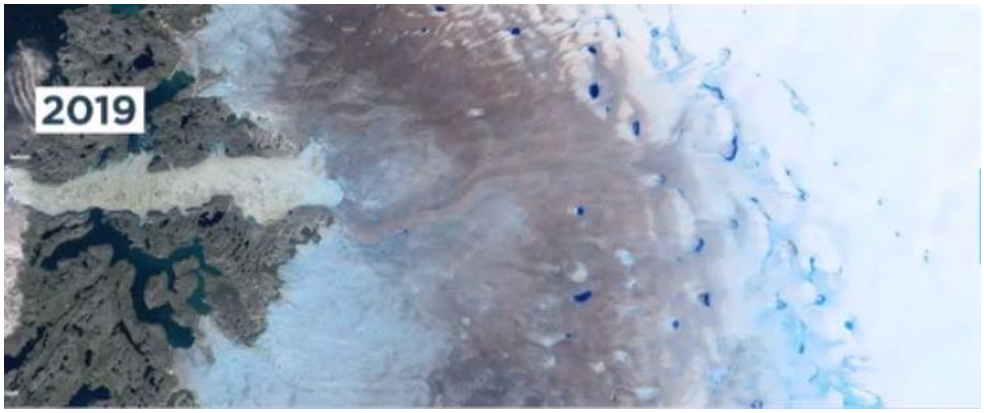
Before and after pictures show Greenland's rapid ice melt from space





The scale of the melt in Greenland during the August heatwave is difficult to comprehend but satellite imagery shows the true extent of the thaw.





This is where Earth's refrigerator door is left open, where glaciers dwindle and seas begin to rise.

New York University air and ocean scientist David Holland, who is tracking what's happening in Greenland from both above and below, calls it "the end of the planet." He is referring to geography more than the future. Yet in many ways this place is where the planet's warmer and watery future is being written.

It is so warm here, just inside the Arctic Circle, that on an August day, coats are left on the ground and Holland and colleagues work on the watery melting ice without gloves. In one of the closest towns, Kulusuk, the morning temperature reached a shirtsleeve 10.7 degrees Celsius.

FELIPE DANA

Brian Rougeux, NYU Field Safety Officer, walks after installing a flag to help identify a GPS position at the Helheim glacier, in Greenland.

The ice Holland is standing on is thousands of years old. It will be gone within a year or two, adding yet more water to rising seas worldwide.

Summer this year is hitting Greenland hard with record-shattering heat and extreme melt. By the end of the summer, about 400 billion metric tons of ice - maybe more - will have melted or calved off Greenland's giant ice sheet, scientists estimate. That's enough water to flood Pennsylvania or the country of Greece about 35 centimetres deep.

In just the five days from July 31 to August 3, more than 53 billion metric tons melted from the surface. That's over 40 billion tons more than the average for this time of year. And that 58 billion tons doesn't even count the huge calving events or the warm water eating away at the glaciers from below, which may be a huge factor.

FELIPE DANA

A helicopter flies over hundreds of icebergs floating near the Helheim glacier, in Greenland.

And one of the places hit hardest this hot Greenland summer is here on the southeastern edge of the giant frozen island: Helheim, one of Greenland's fastest-retreating glaciers, has shrunk about 10 kilometres since scientists came here in 2005.

Several scientists, such as NASA oceanographer Josh Willis, who is also in Greenland, studying melting ice from above, said what's happening is a combination of man-made climate change and natural but weird weather patterns. Glaciers here do shrink in the summer and grow in the winter, but nothing like this year.

Summit Station, a research camp nearly 3200 metres high and far north, warmed to above freezing twice this year for a record total of 16.5 hours. Before this year, that station was above zero for only 6.5 hours in 2012, once in 1889 and also in the Middle Ages.

This year is coming near but not quite passing the extreme summer of 2012 - Greenland's worst year in modern history for melting, scientists report.

"If you look at climate model projections, we can expect to see larger areas of the ice sheet experiencing melt for longer durations of the year and greater mass loss going forward," said University of Georgia ice scientist Tom Mote. "There's every reason to believe that years that look like this will become more common."

A NASA satellite found that Greenland's ice sheet lost about 255 billion metric tons of ice a year between 2003 and 2016, with the loss rate generally getting worse over that period. Nearly all of the 28 Greenland glaciers that Danish climate scientist Ruth Mottram measured are retreating, especially Helheim.

At Helheim, the ice, snow and water seem to go on and on, sandwiched by bare dirt mountains that now show no signs of ice but get covered in the winter. The only thing that gives a sense of scale is the helicopter carrying Holland and his team. It's dwarfed by the landscape, an almost imperceptible red speck against the ice cliffs where Helheim stops and its remnants begin.

Those ice cliffs are somewhere between 70 metres and 100 metres high. Just next to them are Helheim's remnants - sea ice, snow and icebergs - forming a mostly white expanse, with a mishmash of shapes and textures. Frequently water pools amid that white, glimmering a near-fluorescent blue that resembles windshield wiper fluid or Kool-Aid.

FELIPE DANA

Summer 2019 is hitting Greenland hard with record-shattering heat and extreme melt.

As pilot Martin Norregaard tries to land his helicopter on the broken-up part of what used to be glacier - a mush called a melange - he looks for ice specked with dirt, a sign that it's firm enough for the chopper to set down on. Pure white ice could conceal a deep crevasse that leads to a cold and deadly plunge.

Holland and team climb out to install radar and GPS to track the ice movement and help explain why salty, warm, once-tropical water attacking the glacier's "underbelly" has been bubbling to the surface

"It takes a really long time to grow an ice sheet, thousands and thousands of years, but they can be broken up or destroyed quite rapidly," Holland said.

Holland, like NASA's Willis, suspects that warm, salty water that comes in part from the Gulf Stream in North America is playing a bigger role than previously thought in melting Greenland's ice. And if that's the case, that's probably bad news for the planet, because it means faster and more melting and higher sea level rise. Willis said that by the year 2100, Greenland alone could cause more than 1 metre of sea level rise.

So it's crucial to know how much of a role the air above and the water below play.

"What we want for this is an ice sheet forecast," Holland said.

FELIPE DANA

Brian Rougeux, NYU Field Safety Officer, installs a GPS antenna at the Helheim glacier.

In this remote landscape, sound travels easily for miles. Every several minutes there's a faint rumbling that sounds like thunder, but it's not. It's ice cracking.

In tiny Kulusuk, about a 40-minute helicopter ride away, Mugu Utuaq says the winter that used to last as much as 10 months when he was a boy can now be as short as five months. That matters to him because as the fourth-ranked dogsledder in Greenland, he has 23 dogs and needs to race them.

They can't race in the summer, but they still have to eat. So Utuaq and friends go whale hunting with rifles in small boats. If they succeed, which this day they didn't, the dogs can eat whale.

"People are getting rid of their dogs because there's no season," said Yewlin, who goes by one name. He used to run a sled dog team for tourists at a hotel in neighbouring Tasiilaq, but they no longer can do that.

FELIPE DANA

New York University air and ocean scientist David Holland, left, and field safety officer Brian Rougeux, right, are helped by pilot Martin Norregaard as they carry antennas out of a helicopter to be installed at the Helheim glacier.

Yes, the melting glaciers, less ice and warmer weather are noticeable and much different from his childhood, said Kulusuk Mayor Justus Paulsen, 58. Sure, it means more fuel is needed for boats to get around, but that's OK, he said.

"We like it because we like to have a summer," Paulsen said.

But Holland looks out at Helheim glacier from his base camp and sees the bigger picture. And it's not good, he said. Not for here. Not for Earth as a whole.

"It's kind of nice to have a planet with glaciers around," Holland said.

At the bottom of a glacier in Greenland, climate scientists find troubling signs

By Mary Ilyushina and Frederik Pleitgen, CNN

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Kulusuk, Greenland (CNN) On one of the hottest days this summer, locals in the tiny village of Kulusuk, Greenland heard what sounded like an explosion. It turned out to be a soccer field's worth of ice breaking off a glacier more than five miles away.

Greenland lost 12.5 billion tons of ice to melting on August 2, the largest single-day loss in recorded history and another stark reminder of the climate crisis.
Kulusuk is also base camp for NASA's OMG (Oceans Melting Greenland) program. OMG scientists traveled to the world's biggest island this year after a heatwave scorched the United States and Europe, smashing temperature records and triggering the mass melting of its ice sheet.

NASA oceanographer Josh Willis and his team are investigating how the ice is being attacked not only by rising air temperatures but also by the warming ocean, which is eating it away from underneath.

A remodeled World War II DC-3 plane, now called Basler BT-57, takes a group of OMG researchers around the coast of Greenland. From the air the crew launch special probes through the ice floor, which then transmit data on temperature and salinity, which is used to plot possible sea level rises and what they would mean for humanity in the future.
"There is enough ice in Greenland to raise the sea levels by 7.5 meters, that's about 25 feet, an enormous volume of ice, and that would be devastating to coastlines all around the planet," said Willis. "We should be retreating already from the coastline if we are looking at many meters [lost] in the next century or two."
NASA took CNN on a dramatic flight over Helheim -- one of the largest glaciers on Greenland and the fastest flowing on the eastern edge of the island. Helheim, named after the realm of the dead in Norse mythology, is majestic, standing at more than four miles wide and roughly the height of the Statue of Liberty.

As our plane approached Helheim, the scientists spotted an ice-free "lake" at the very front of the glacier, something they said they don't see often. The probes also brought back troubling data -- Helheim was surrounded by warm water along its entire depth, more than 2,000 feet below the surface.

"It's very rare anywhere on the planet to see 700 meters of no temperature variation, normally we find colder waters in the upper hundred meters or so, but right in front of the glacier it's warm all the way up," said Ian Fenty, climate scientist at NASA. "These warm waters now are able to be in direct contact with the ice over its entire face, supercharging the melting."

Ice-free "lake" at the front of Helheim glacier seen from a DC-3 plane.

Helheim has become famous in recent years as it has been retreating at a stunning rate. In 2017, the glacier lost a whopping two miles, and a year later scientists from New York University captured a miles-long ice column break off the glacier's front. The melt doesn't seem to be slowing this year either.

"It retreats by many meters per day, it's tens of meters per day. You can probably set your iPhone on timelapse and actually see it go by," Willis says as the data flashes up on his phone screen.

Glaciers like Helheim, and even the much smaller ones around villages like Kulusuk, are powerful enough to make the global sea level rise by half a millimeter in just a month -- something NASA researchers say cannot be ignored.

"Greenland has impacts all around the planet. A billion tons of ice lost here raises sea levels in Australia, in Southeast Asia, in the United States, in Europe," Willis said. "We are all connected by the same ocean."

Even though most still think of rovers and other planets when they think of NASA missions, in the 50 years since the moon landing, the public perception of what the agency should pour its resources into seems to be shifting. According to a recent study from the Pew Research Center, a majority of Americans now think that NASA's top priority should be monitoring key parts of Earth's climate system rather than sending a man to Mars.

And the OMG is just one of the projects looking at our home planet that NASA has been bulking up in the past few decades. As the budget of NASA's Earth Science Division increases, the agency is lining up at least two new satellites and exploration programs to track natural hazards.