



Central Coast Climate Science Education
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OMG: The “Oceans Melting Greenland Project”
And
Communicating Climate Science
Both Featuring
JPL Oceanographer and Extraordinary Communicator Josh Willis as
Climate Elvis
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Climate scientists are becoming increasingly aware that they need to communicate the implications of their research to the general public. But it is rare to know climate scientists who combine excellence in research with exceptional ability to communicate with the general public like Pasadena’s Jet Propulsion Lab (JPL) oceanographer **Dr. Josh Willis**.

This post is the first of a two-part post. In this first part, the “*OMG*”: *Oceans Melting Greenland* airborne science mission is described, which is led by Dr. Willis.

The forthcoming second part of this post gives glimpses into Josh’s infectious enthusiasm for communicating information about climate science to the public. A highlight features his hilarious appearance as “*Climate Elvis*” as he explains the difference between climate and weather in “*The Climate Rock*”.

The Oceans Melting Greenland (OMG) Mission

OMG is a five-year long NASA mission to better understand the complex processes governing the rate at which the huge ice sheets covering Greenland are losing mass and causing sea level to rise as Earth’s climate warms. Understanding these processes is critical towards preparing for the amount of sea level rise expected in the coming decades.

Watch this short video by Dr. Josh Willis, made October 1, 2018 for a great introduction to the OMG project: <https://www.jpl.nasa.gov/video/details.php?id=1549>. A popular account of OMG is available¹. I encourage reading that full account, but here are a few excerpts to give a flavor of OMG:

Skimming low over the gleaming white glaciers on Greenland's coast in a modified 1940s plane, three NASA scientists, led by an Elvis-impersonating oceanographer, waited to drop a probe into the water beneath them.

They are part of Oceans Melting Greenland -- or OMG --- a mission that has flown around the vast island for four summers, dropping probes to collect data on how oceans contribute to the rapid melt of Greenland's ice...Joshua Willis, 44, is the oceanographer from NASA's Jet Propulsion Laboratory behind the project — and, along with his wife, [came up with] the name “OMG.”

"We're looking at probably meters of sea level rise in the next hundred years and that's a huge threat to hundreds of millions of people around the world, so a bit of alarm and OMG is probably warranted," he said."

Here are portions of the Abstract from a professional paper by Dr. Willis and several colleagues. It describes the behavior of the large Greenland glacier (called Jakobshavn Isbrae) that flows to the ocean.

Abstract: Jakobshavn Isbrae has been the single largest source of mass loss from the Greenland Ice Sheet over the last 20 years. During that time, it has been retreating, accelerating and thinning. Here we ...show that since 2016 Jakobshavn has been re-advancing, slowing and thickening...Ocean temperatures in the bay's upper 250 meters have cooled to levels not seen since the mid 1980s....We conclude that projections of Jakobshavn's future contribution to sea-level rise that are based on glacier geometry are insufficient, and that accounting for external forcing is indispensable.

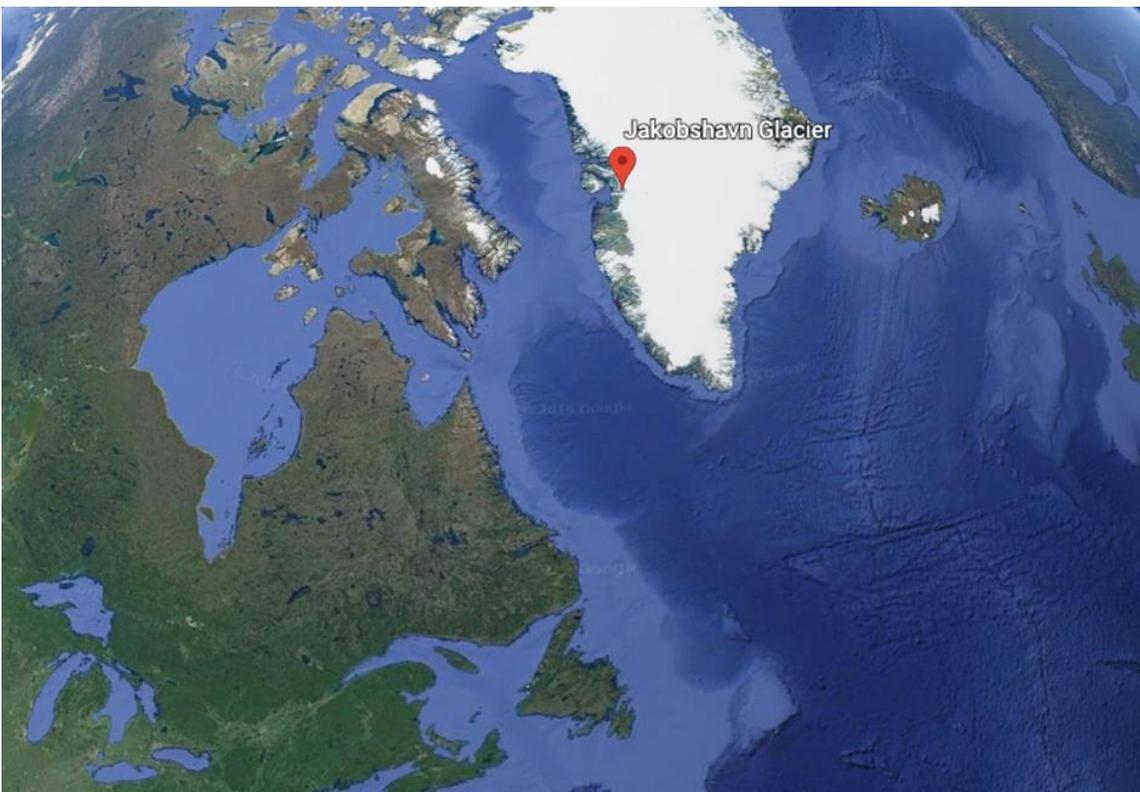
[For an explanation of the concept of 'forcing' see my "revised tutorial" #2 on my website; RJW]

The cooling mentioned above may be surprising given the rapid global increase of ocean warmth. But the northernmost third of the North Atlantic Ocean has recently cooled, associated with a cycle of warm and cold that changes naturally from warm to cold to warm again every 5 to 15 years. In the latest cold phase of this cycle, colder water mixed onto the shallow continental shelf around Greenland, where it appears to be responsible for the recent advancement and thickening of the mighty glacier Jakobshavn.

But it would be a mistake to conclude that this is a permanent reversal or that it is representative of all Greenland glaciers. Here are excerpts from another popular account of the implications of the OMG research, including quotes from Dr. Willis.²

“...after 20 years of unprecedented melting in Greenland— Jakobshavn's rapid retreat has slowed down considerably and the glacier has even grown bigger. This might appear to be a rare dose of good news for the Arctic — a place that's heated up over twice as much as the rest of the planet...But no. Instead, a team of researchers led by scientists at NASA's Jet Propulsion Laboratory discovered that Jakobshavn's stagnated melt is only a temporary blip brought on by cooler ocean currents...though worryingly, the recent slowing also carries ominous news for the thawing landmass... "The big story here is the ocean," said Josh Willis... "If these deep glaciers are this sensitive to the water, then we could be looking at faster sea level rise out of Greenland than we thought...”

Other Greenland experts agree that Jakobshavn's recent stagnation is not optimistic news. "This study does not mean we are out of the water," said Luke Trusel, a geologist at Rowan University who had no role in the study. "In fact, I'd say it says the opposite by demonstrating just how sensitive this major glacier is to changes in the ocean."



Indeed, there are other Greenland glaciers besides Jakobshavn under detailed study that seem to bear this out. On the southeastern side of Greenland is Sermilik Fjord where Helheim glacier is dumping huge amounts of ice to the sea. The dominant process seems to be basically the same as those contributing to the longer term behavior of many Greenland glaciers: Ocean currents from the south carry warmer waters that slide along the floor of the outlet portion of the fjord. There they encounter cold melt water from the bottom of the glacier. This fresh water mixes with the saltier warmer ocean water making it more buoyant. The resulting rising “plume” of warmer water brushes against the glacier face leading to calving and retreat of the glacier.³

To conclude part 1 of this post I would like to take a step back from the close look at Greenland’s glaciers to see their role in the more global context of a warming world. To do this, here are excerpts from another popular account of a recent (August 2019) report by about 100 climate scientists who are experts in the ocean and the frozen component of the Earth’s climate system (the cryosphere).⁴

The ocean isn't alright. The seas, which hold some [332,519,000 cubic miles](#) of water, are [warming](#), [rising](#), [acidifying](#), and [losing oxygen](#). And a new comprehensive U.N. climate [special report](#), presents an encyclopedic review of how Earth's oceans and ice sheets have been altered as the [world relentlessly warms](#).

Over 100 scientists from 36 nations (who cited over 6,900 studies) wrote the stark dispatch, called the "Special Report on the Ocean and Cryosphere in a Changing Climate."

Today's disrupted seas, though, are just the inception of the ocean's transition. That's because the oceans are the [true keeper of climate change](#): Most of the heat humanity traps on the planet gets soaked up by the ocean. And modern civilization [won't stop saturating the atmosphere](#) with heat-trapping carbon dioxide anytime soon.

"Over 90 percent of heat from global warming is warming the oceans," said Josh Willis, a NASA oceanographer who had no role in the U.N. report. "Global warming is really ocean warming," Willis emphasized.

For anyone inhabiting the planet in the coming decades and centuries, this means increased sea level rise and warming, among other effects. The problem will get worse, but humanity still can limit the consequences, specifically by [radically curbing carbon emissions](#).

"If we reduce emissions sharply, consequences for people and their livelihoods will still be challenging, but potentially more manageable for those who are most vulnerable," Hoesung Lee, chair of the U.N.'s Intergovernmental Panel on Climate Change (IPCC), said in a statement.

The report is exhaustive. But here are some of its many important takeaways:

Sea level rise will probably be worse than you imagine.

The U.N. report concluded that sea level rise will continue for centuries. In a fairy tale world, wherein society can curb Earth's warming at 1.5 degrees Celsius (or 2.7 degrees Fahrenheit) above pre-Industrial Revolution temperatures...sea levels [would] likely rise between one and two feet by the century's end, the report found.

But if emissions continue to increase at persistently high levels, the IPCC found sea levels would rise between nearly two feet and over three and a half feet. That's because Earth's most massive ice sheets, on Antarctica and Greenland, "are projected to lose mass at an increasing rate throughout the 21st century and beyond," the report said.

Even so, U.N. climate estimates are often conservative. Accelerated melting of the Greenland and Antarctic ice sheets...could boost sea levels significantly more than the report considers.

"I don't think there's any science that rules out two meters by 2100," said NASA's Willis. "I think most people who study Greenland and Antarctica think [sea level rise] could be higher than current projections."

In large part, that's because warming oceans eat away at and [melt the edges of glaciers](#), said Willis, noting that this is a significant effect that Arctic and ocean researchers are just beginning to grasp.

And guess what? The oceans are certainly expected to keep warming. "Over the 21st century, the ocean is projected to transition to unprecedented conditions with increased temperatures" among other changes, the report concluded.

I wish to thank Simo Nylander and Dean Thomas for editorial comments. I especially thank Josh Willis, not only for his editing but also for his important research. Be sure to read part two of this post describing his unique approach to communicating climate science to the general public.

¹ Here is the link to the popular fuller account by Tom Little, a journalist who writes for Agence France-Presse. : <https://www.thejakartapost.com/life/2019/08/26/high-above-greenland-glaciers-nasa-looks-into-melting-ocean-ice.html>

² Here is the popular account by science writer Mark Kaufman:
<https://mashable.com/article/greenland-jakobshavn-glacier-ocean-climate/>

³ A very readable popular account of the research effort on Helheim by Paul Voosen appears in the 11 October 2019 issue of Science magazine, the publication of the American Association for the Advancement of Science. (The AAAS, by the way, is deserving of support by all who value the role of science in our society.)

⁴ The link to his full account is here and I have left in his links to some relevant background material:

<https://mashable.com/article/climate-change-report-oceans-un/>

In this account, the link called ‘special report’ takes you to the actual IPCC report.