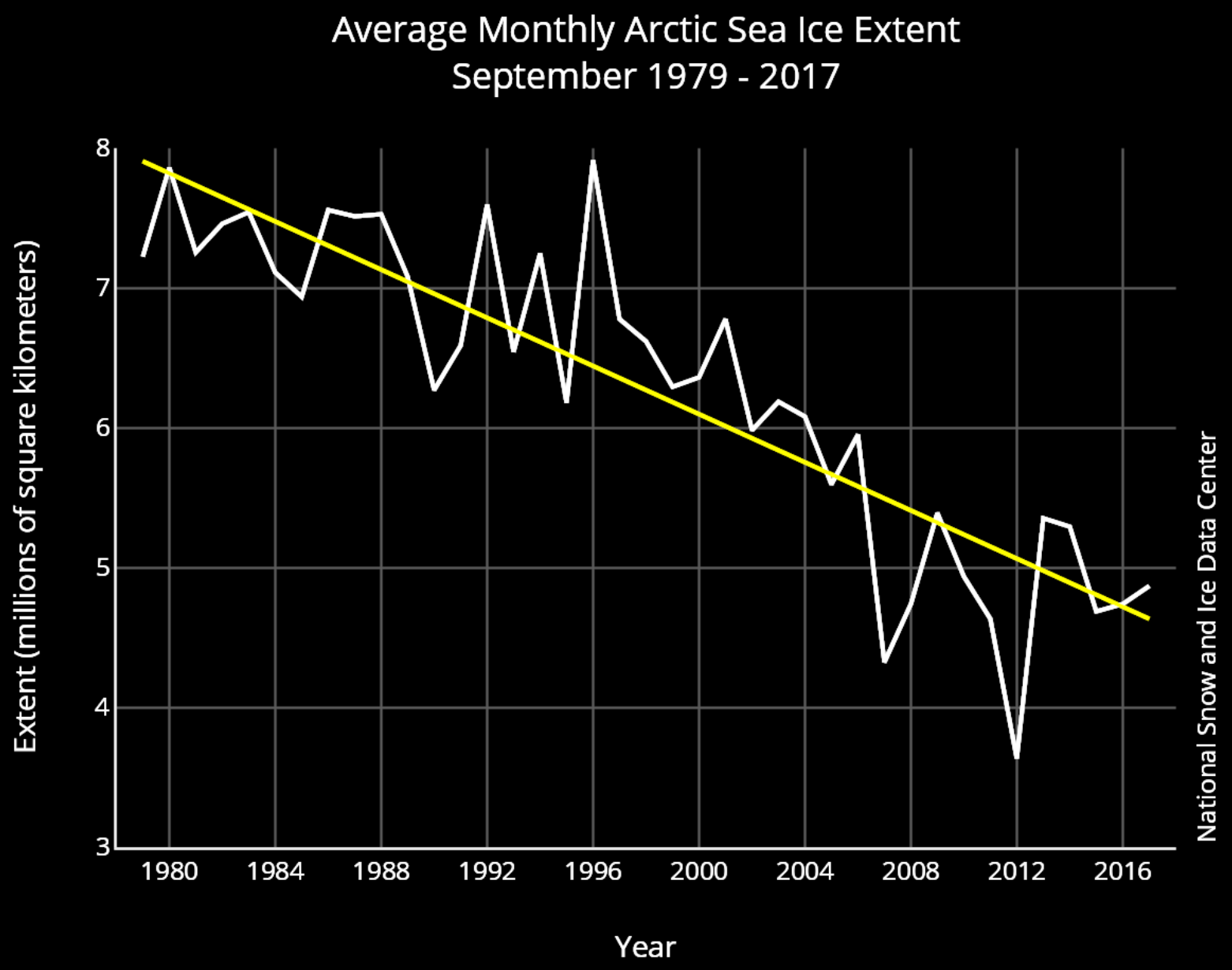
Rapid declines in Arctic sea ice cover: *what does this mean for Alaska?*

Alek Petty, NASA Goddard Space Flight Center

www.alekpetty.com / @alekpetty / alek.a.petty@nasa.gov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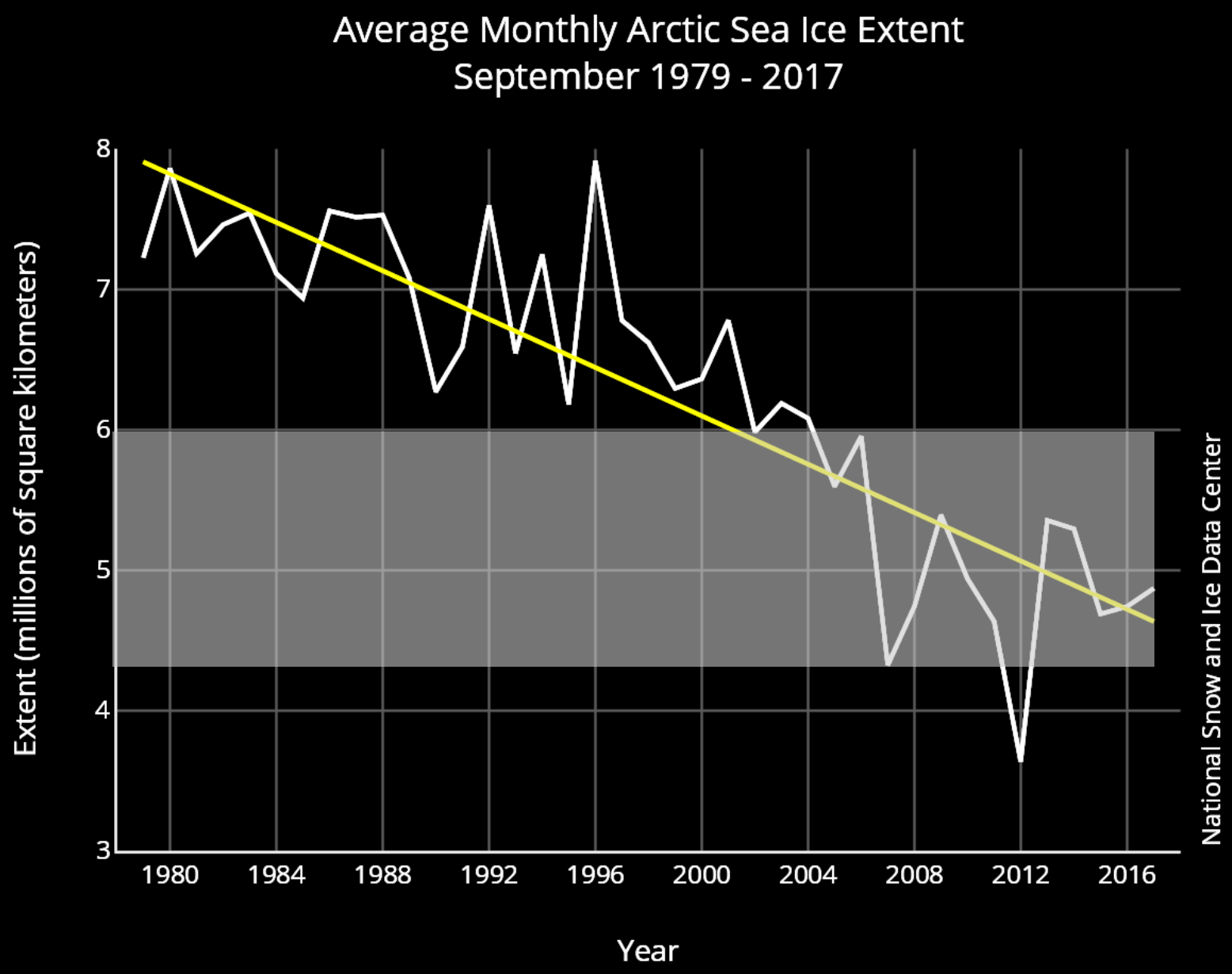
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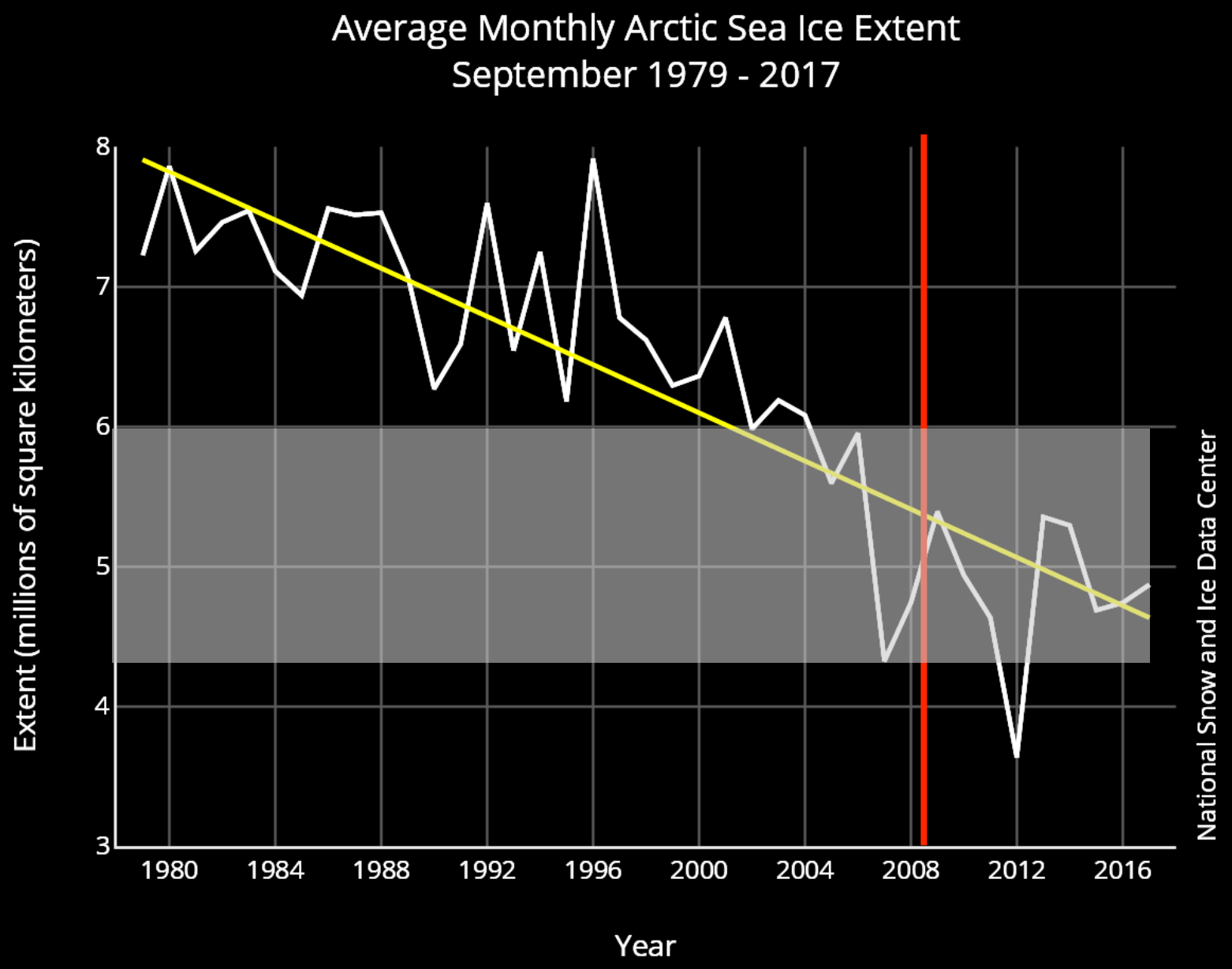
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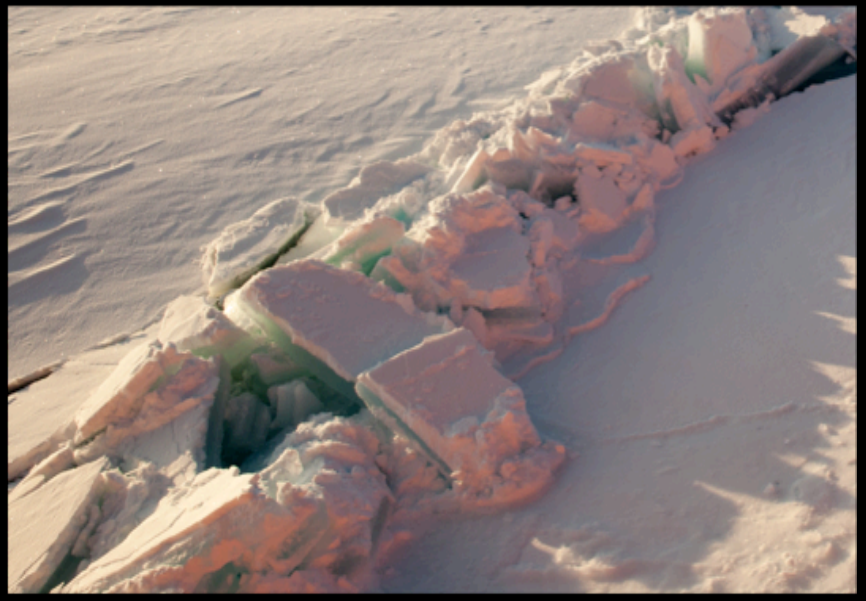
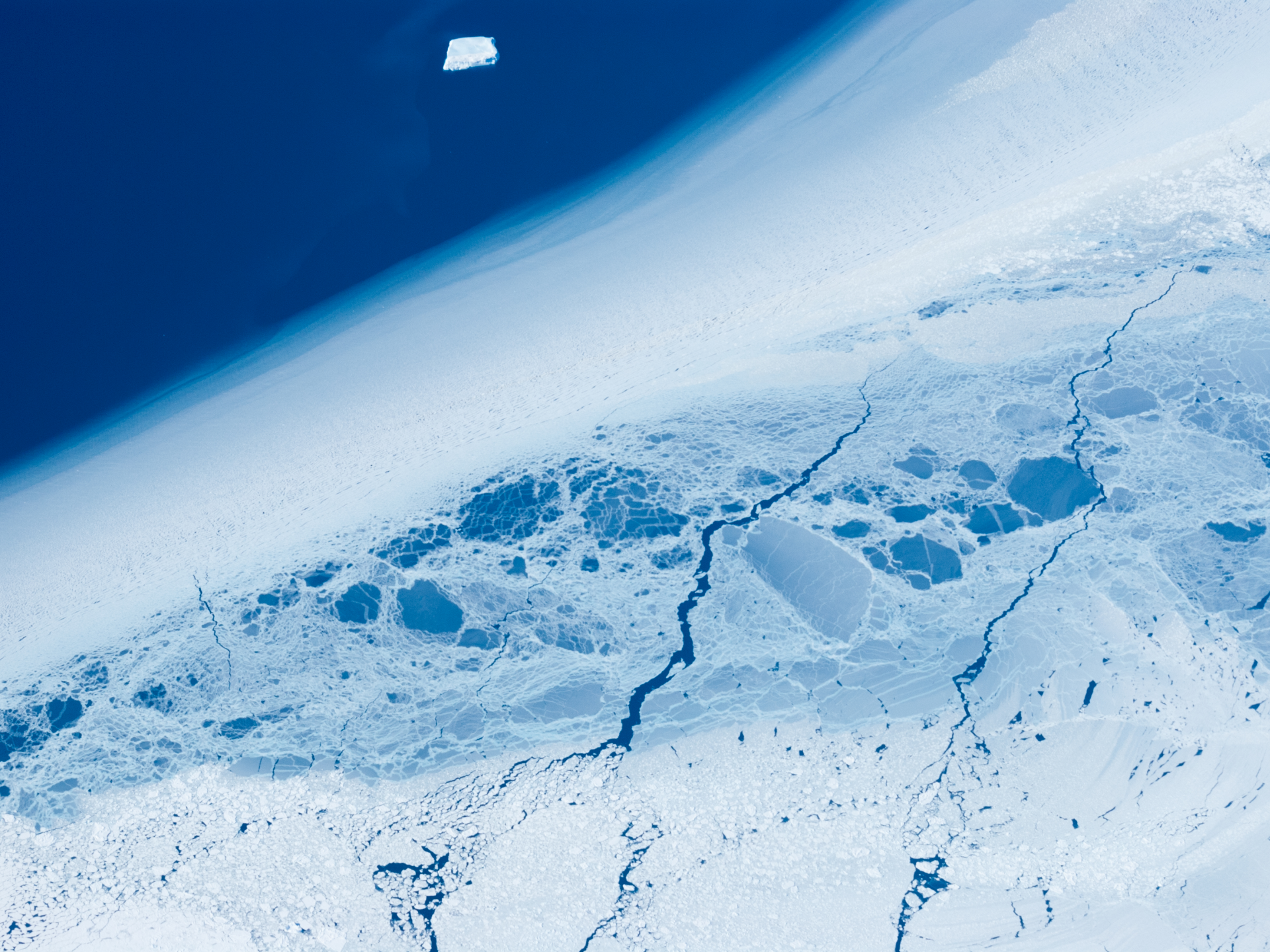
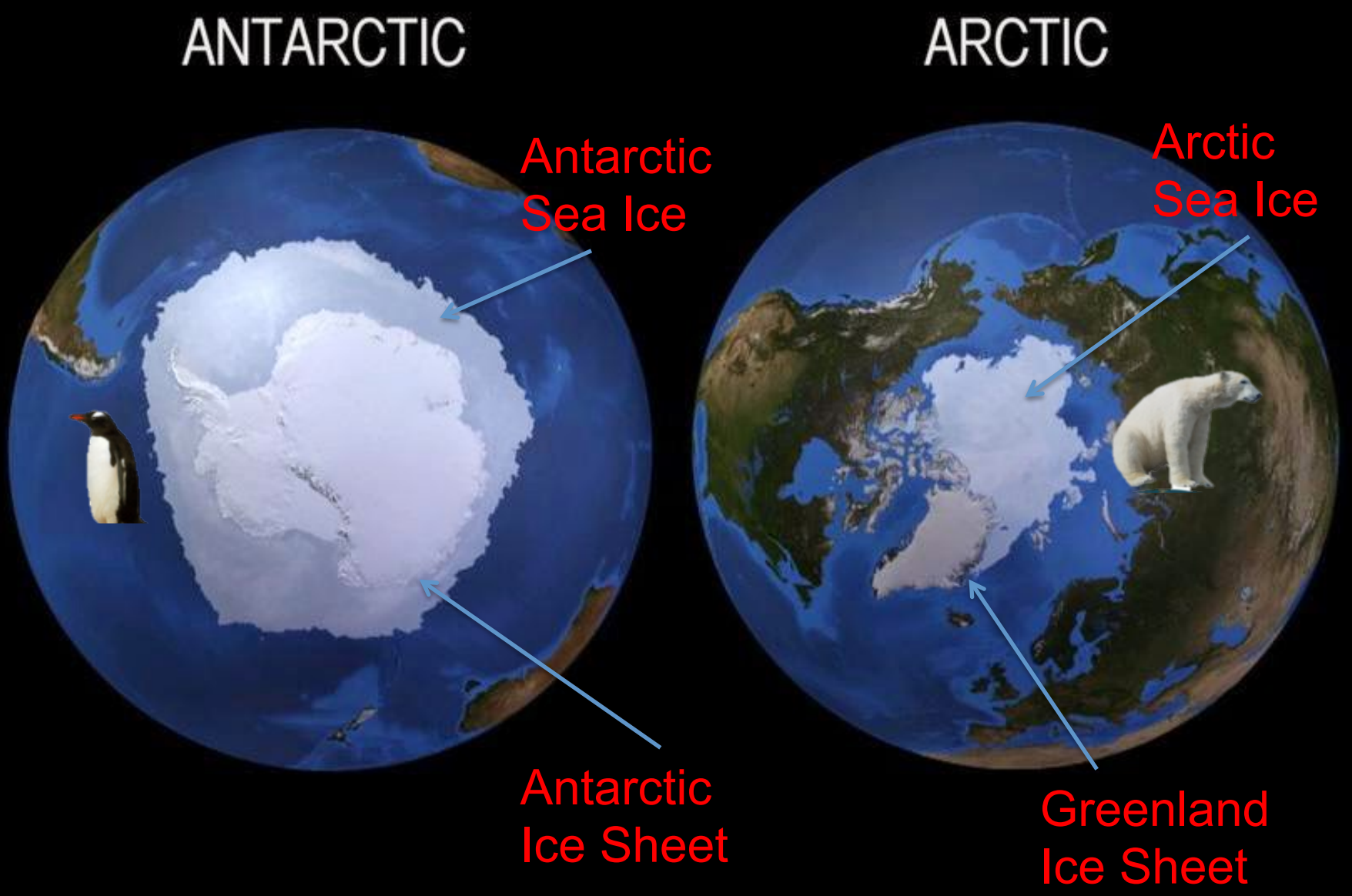
Sea ice



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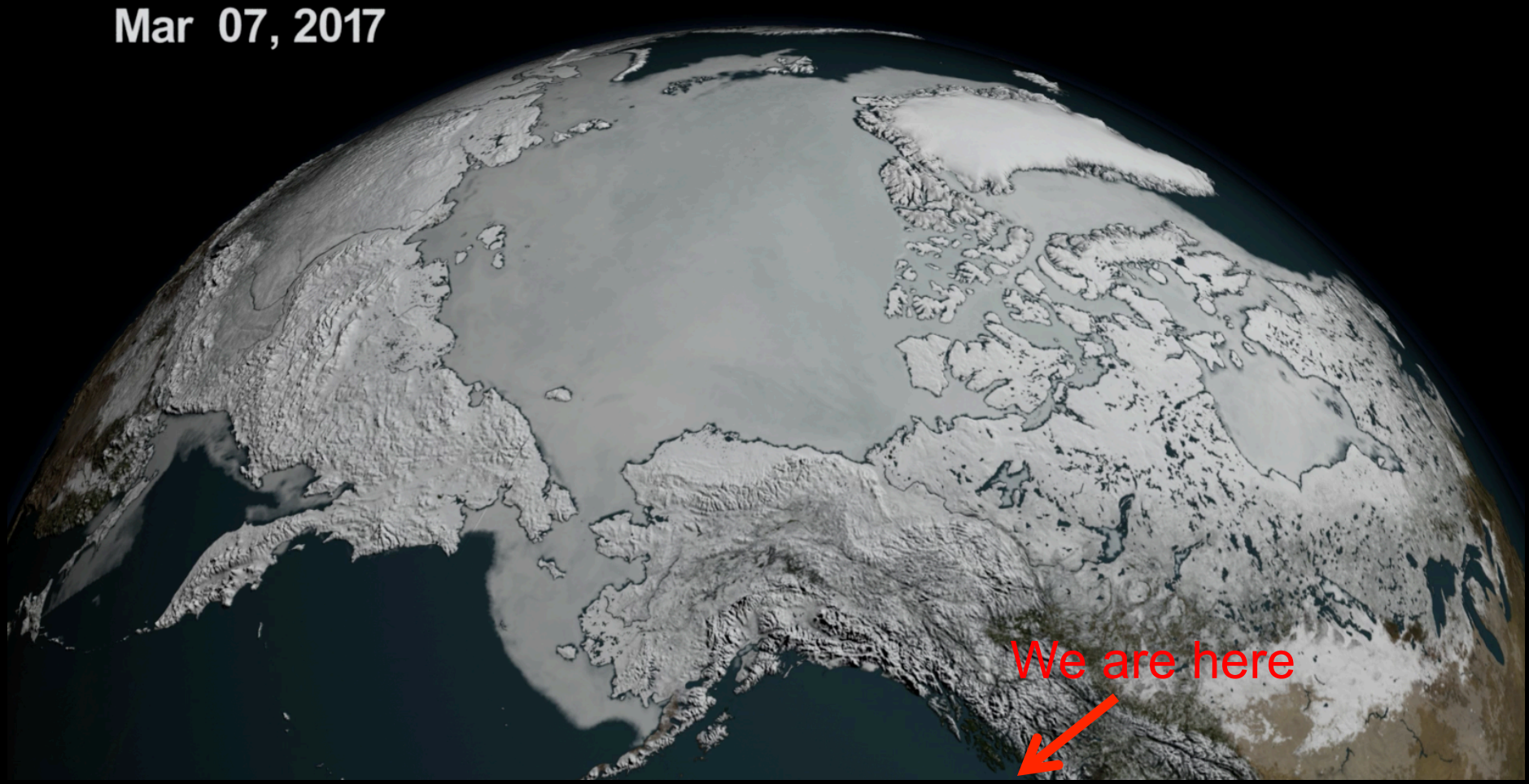
Ice Sheet



Sea ice = frozen sea water

Ice sheets/glaciers = frozen land ice

Humans have been observing Arctic sea ice for centuries…

J.P. West

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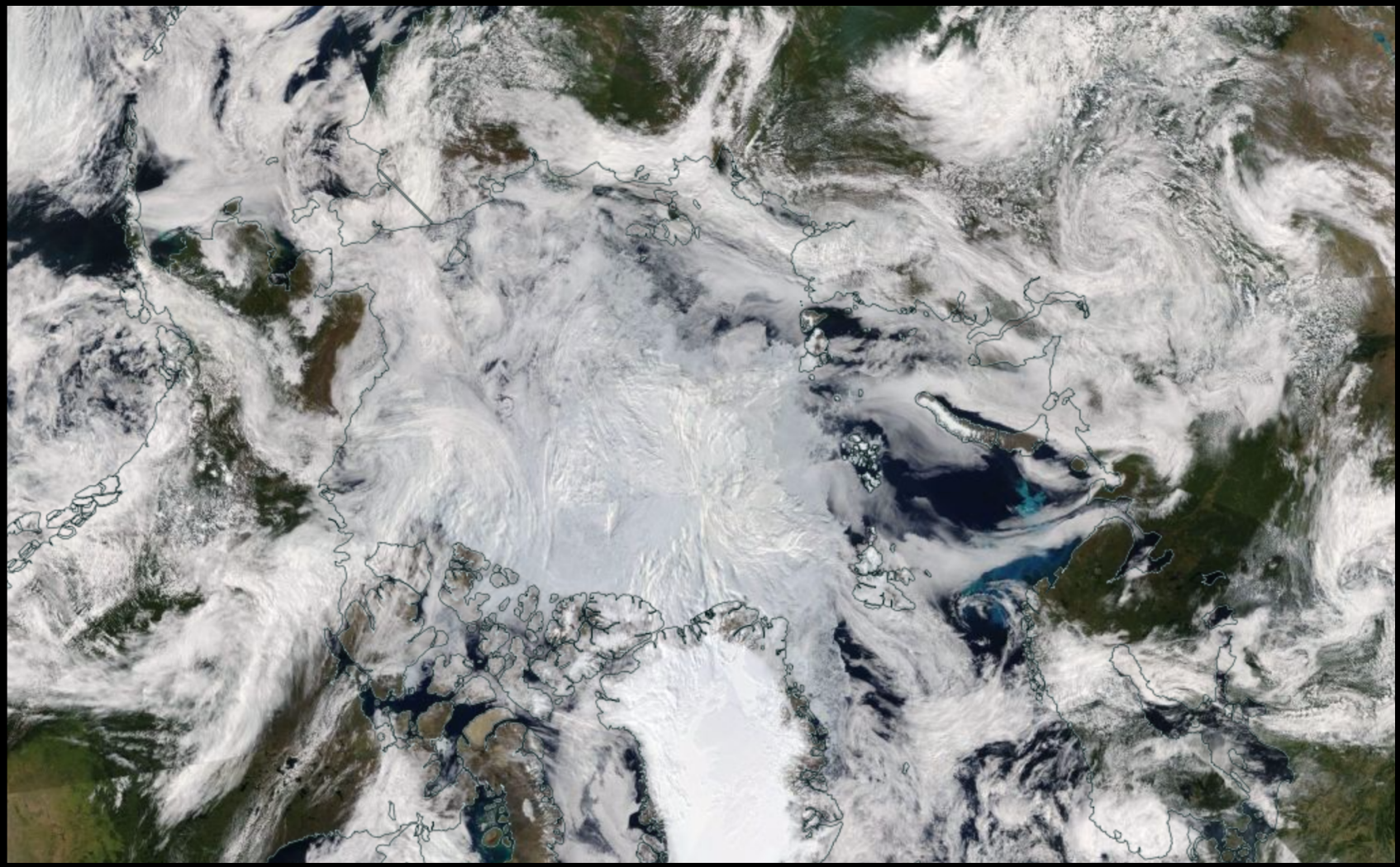
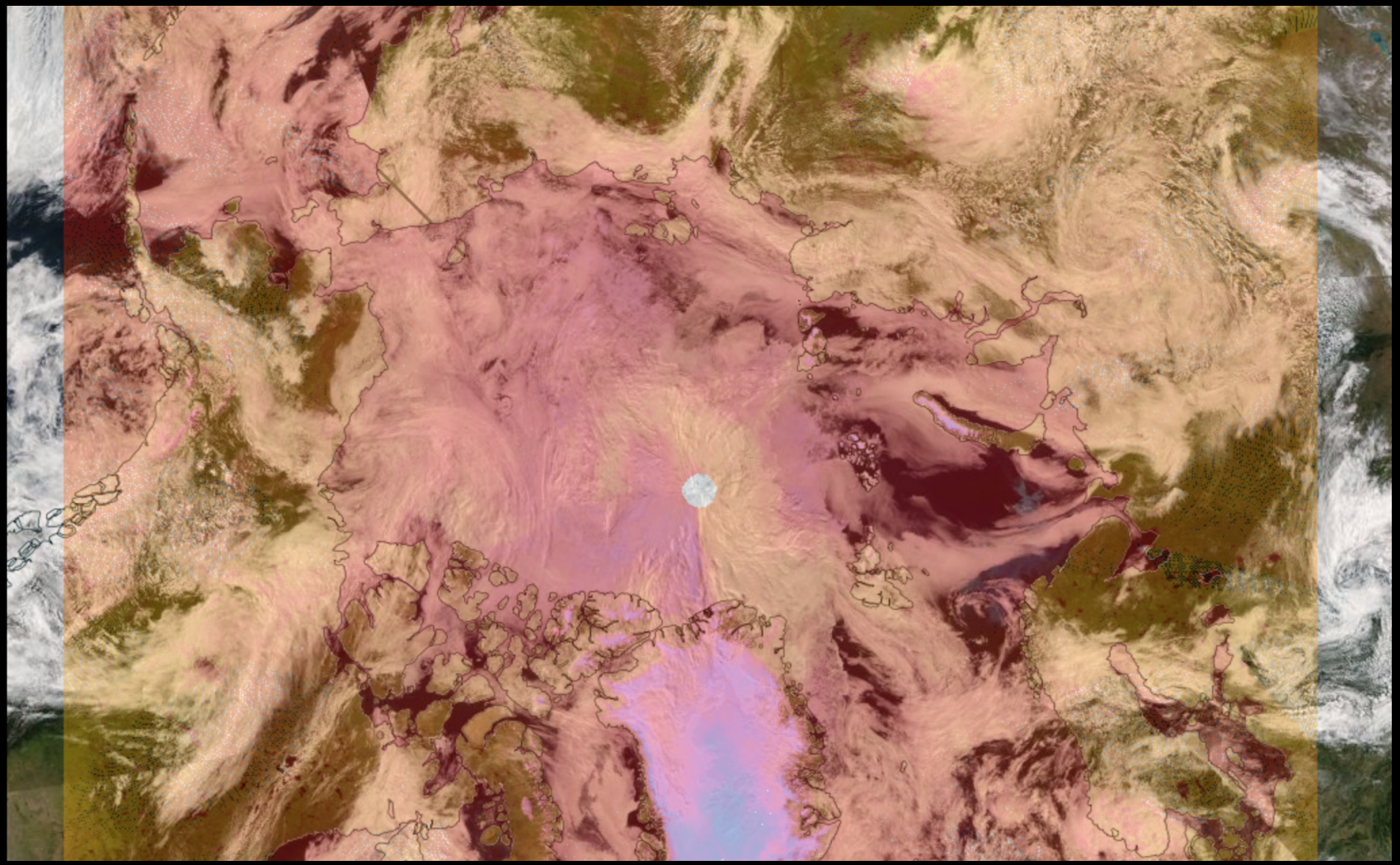
THE STATE OF THE ICE IN THE ARCTIC SEAS 1926.

The Arctic in the satellite era



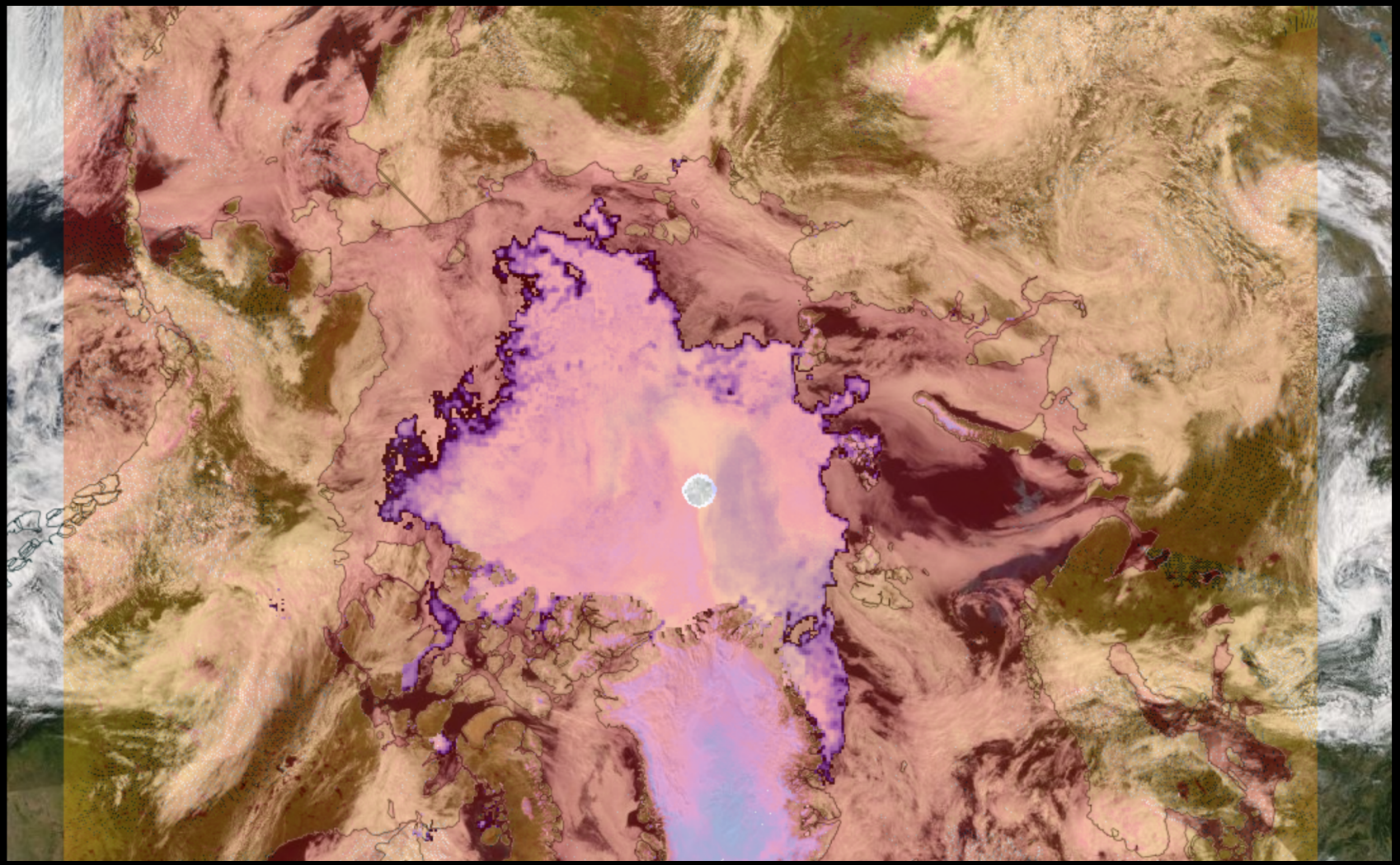
MODIS imagery, September 2011

The Arctic in the satellite era

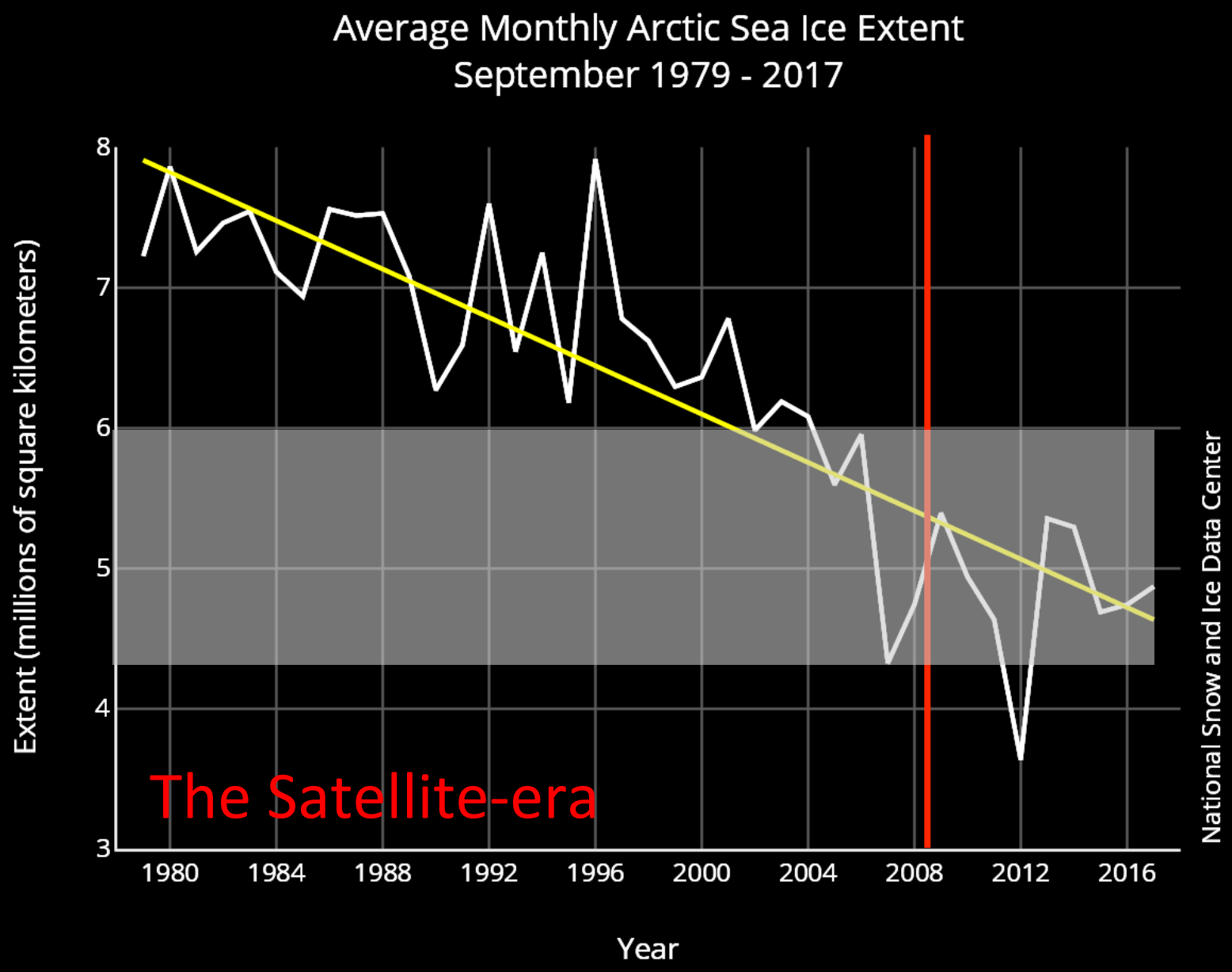


Brightness temperature, September 2011

The Arctic in the satellite era



Sea ice concentration, September 2011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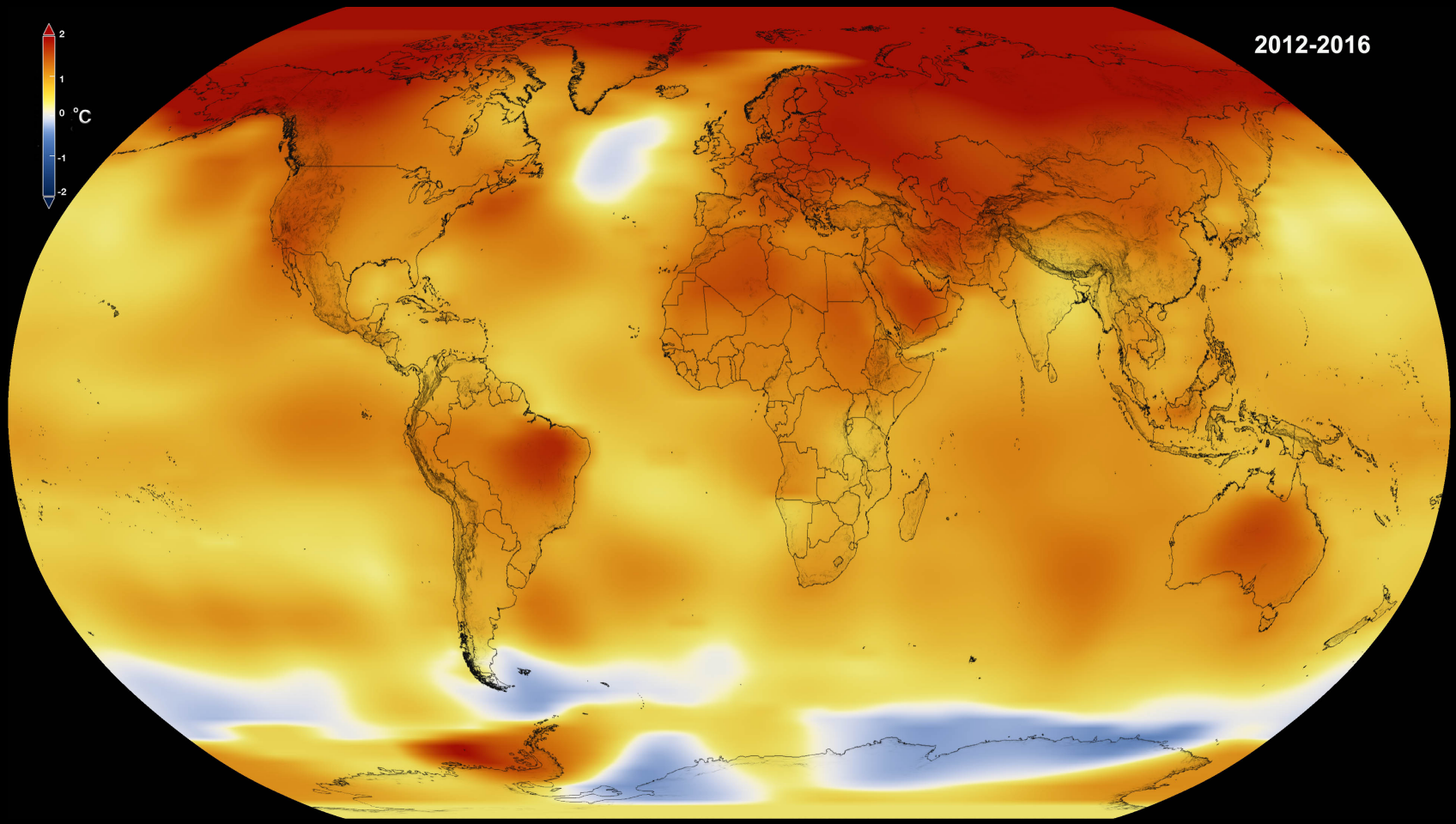
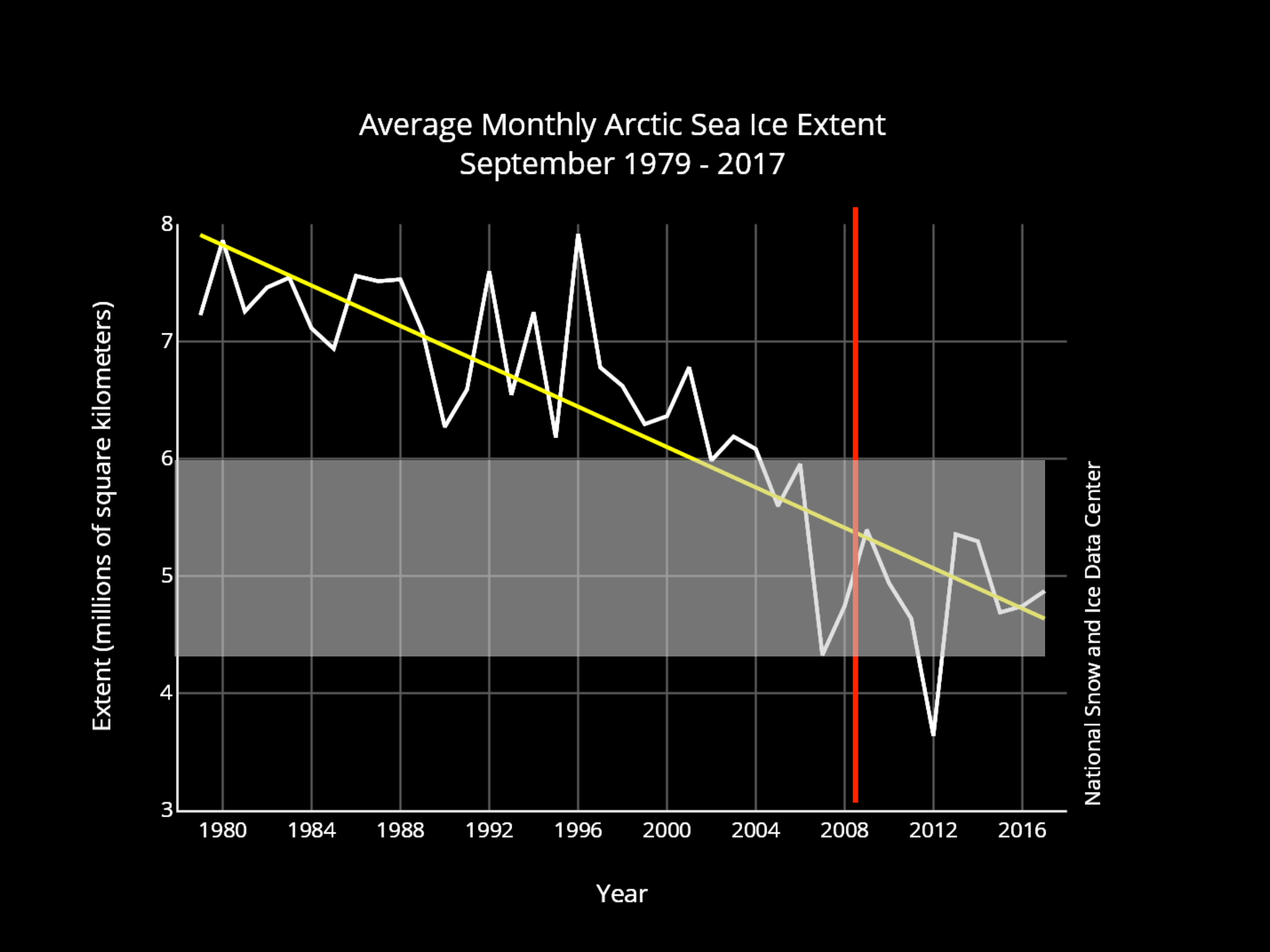
The Arctic is warming rapidly

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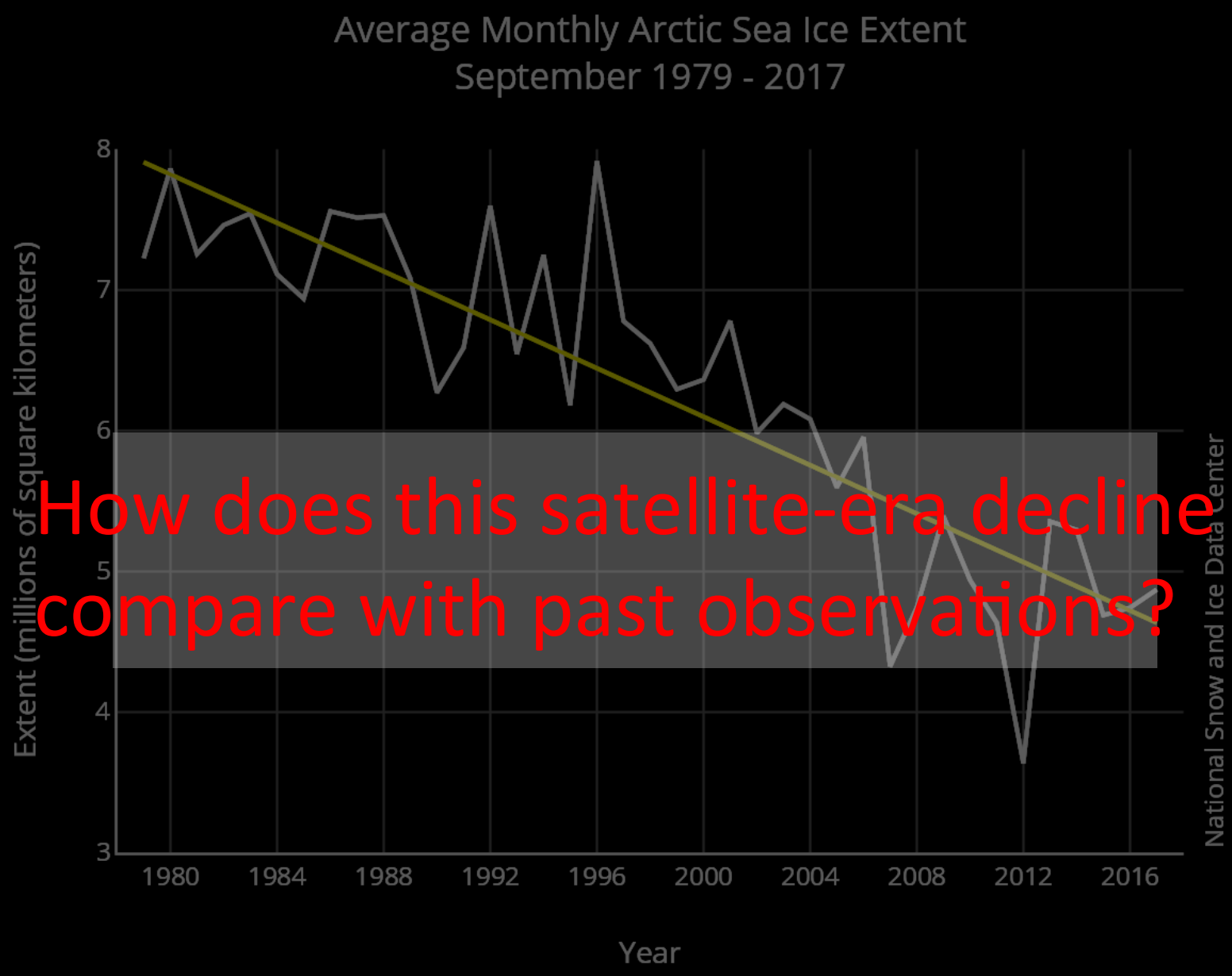
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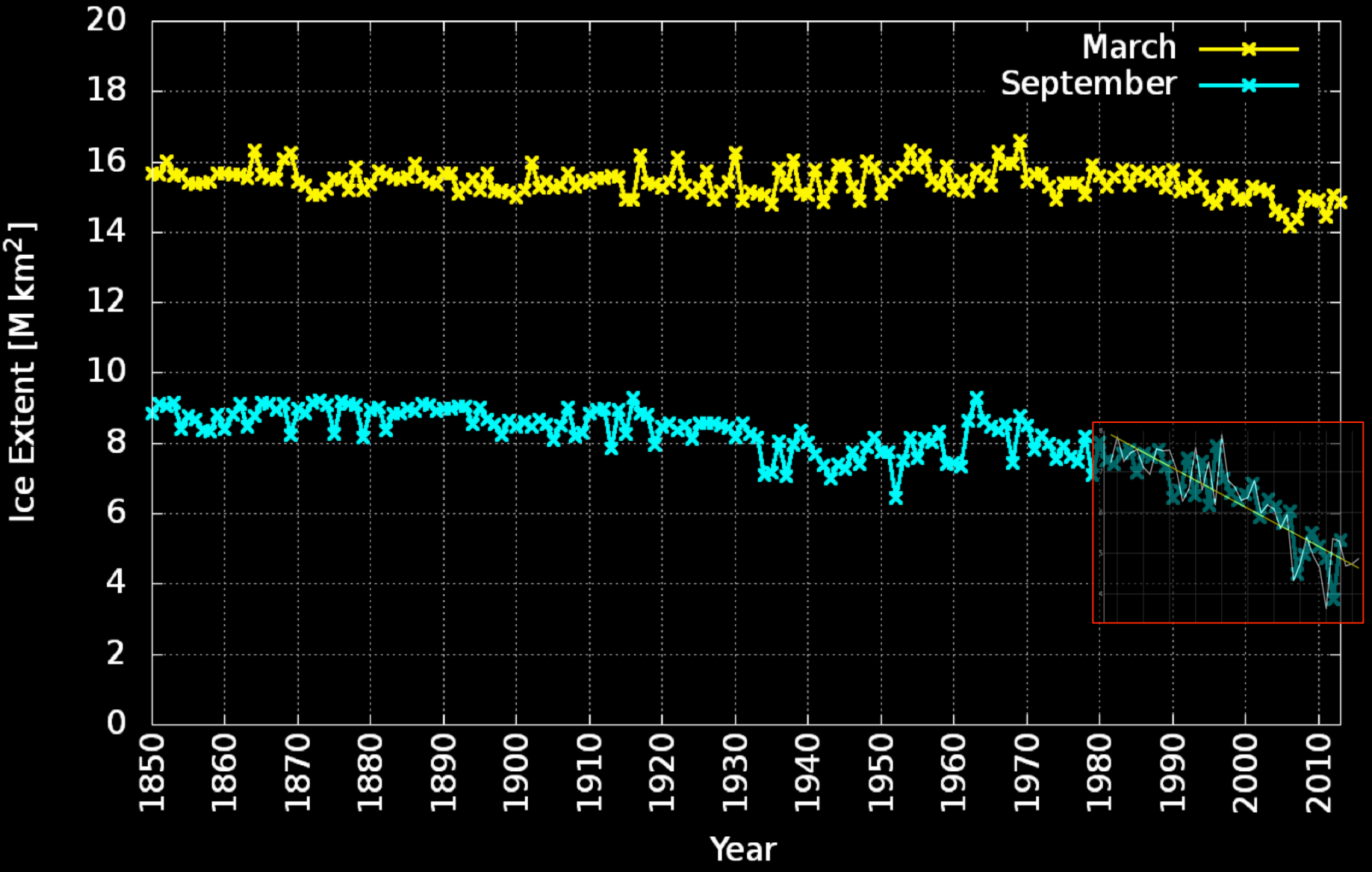
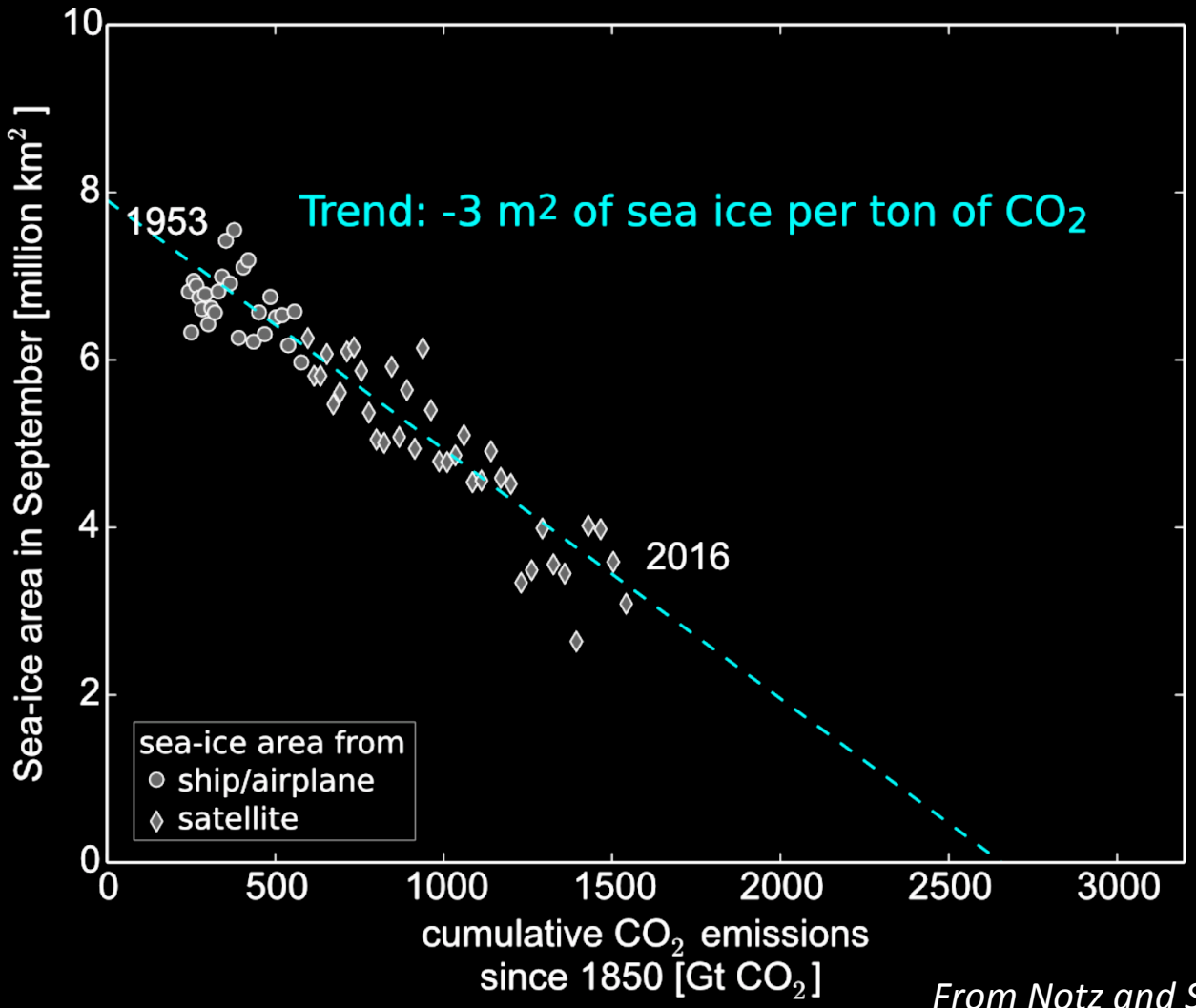
How does this satellite-era decline compare with past observations?

Current rate of decline is *unprecedented*

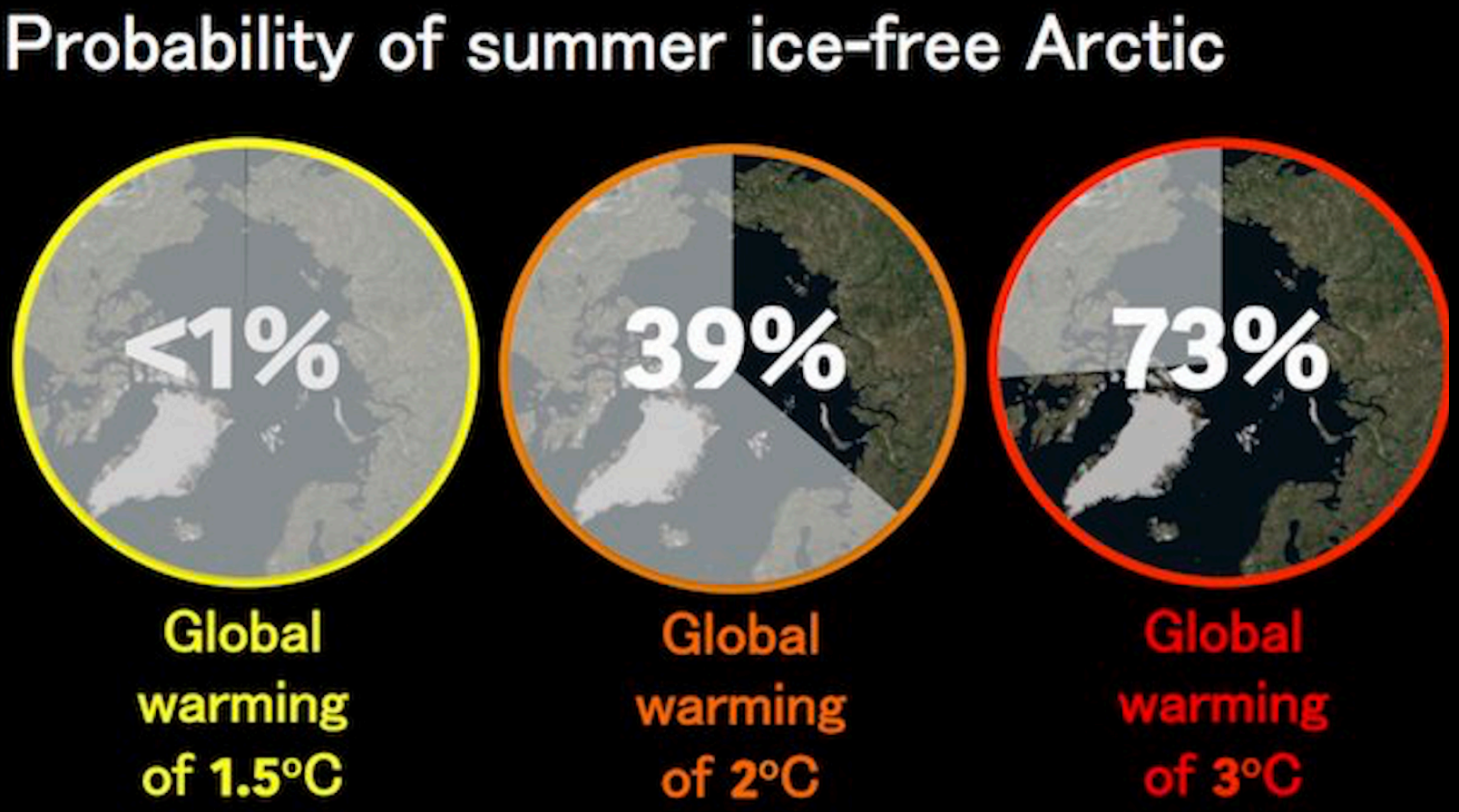


We are personally responsible for this ice loss



From Notz and Stroeve , 2017, Science.

The Arctic will very likely become ice-free in summer.



From *Screen and Williamson, 2017, Nature Climate Change.*

Sea ice is declining and this is linked to increased levels of greenhouse gases and global warming.

A summer ice-free Arctic is very likely (but not guaranteed) sometime mid-century

What next?

Keeping track of Arctic sea ice conditions…

The Cryosphere Discuss., https://doi.org/10.5194/tc-2017-207
Manuscript under review for journal The Cryosphere
Discussion started: 9 October 2017

The Cryosphere Discussions
Open Access
EGU

The Arctic sea ice cover of 2016: A year of record low highs and higher than expected lows

Alek A. Petty[1,2], Julienne. C. Stroeve[3,4], Paul R. Holland[5], Linette N. Boisvert[1,2], Angela C. Bliss[1,2], Noriaki Kimura[6], Walter N. Meier[4]

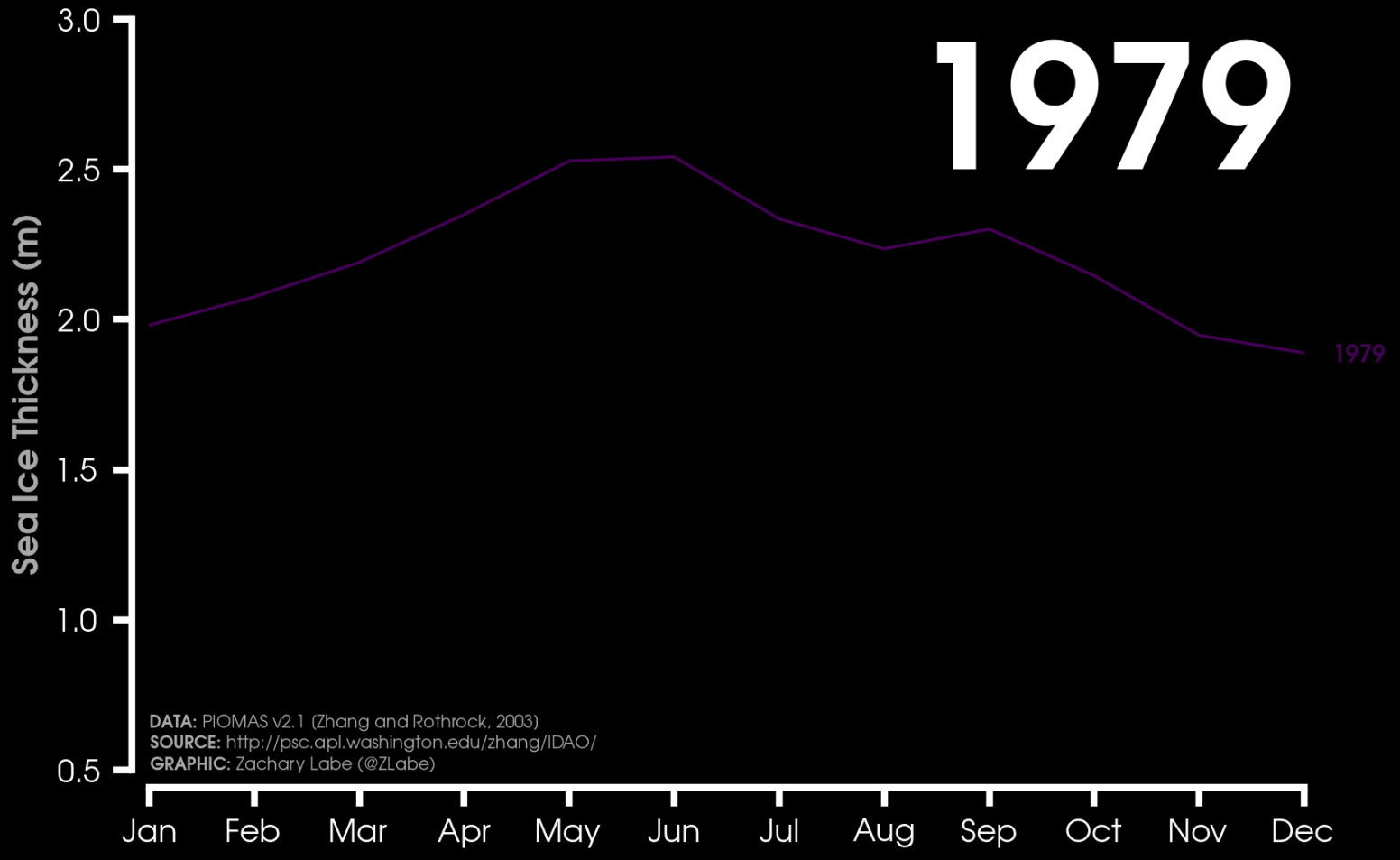
[1]Earth System Science Interdisciplinary Center, University of Maryland, College Park, MD, USA

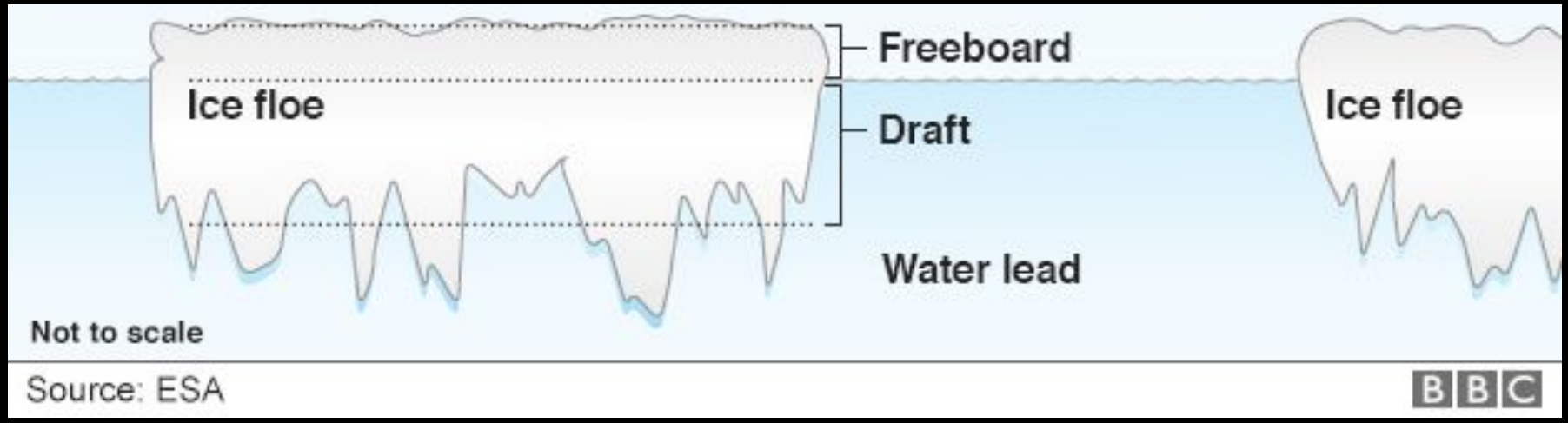
[2]Cryospheric Sciences Laboratory, NASA Goddard Space Flight Center, Greenbelt, MD, USA

What next?

Improve knowledge of the sea ice state – e.g. thickness!

Coverage isn’t everything..

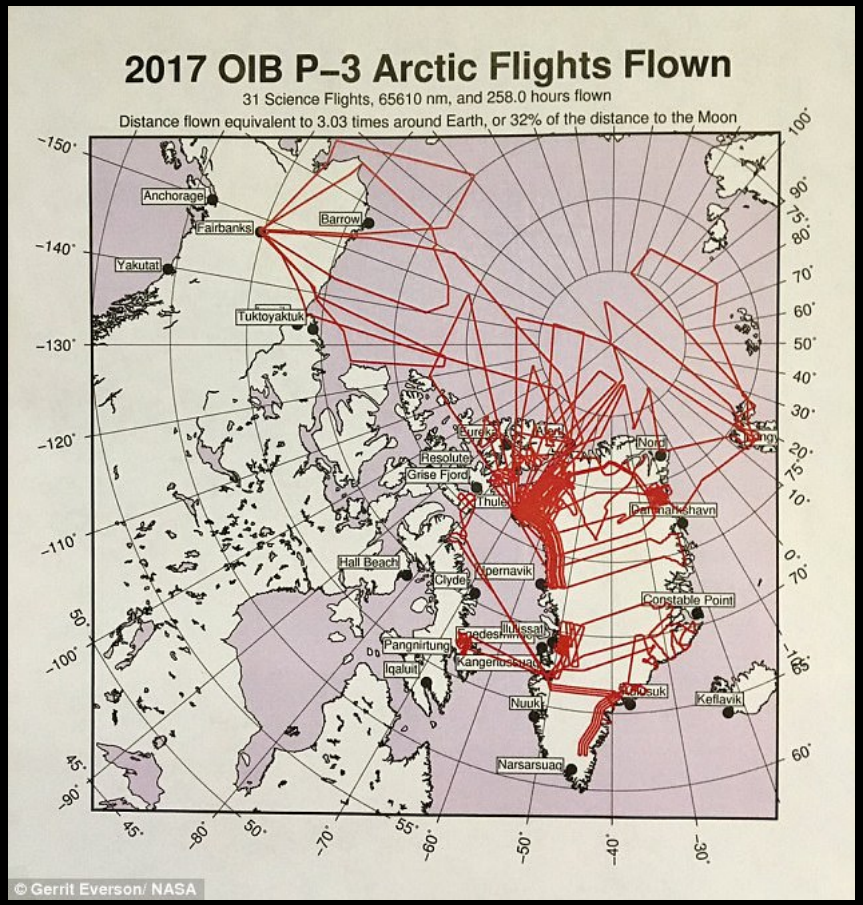




Source: ESA

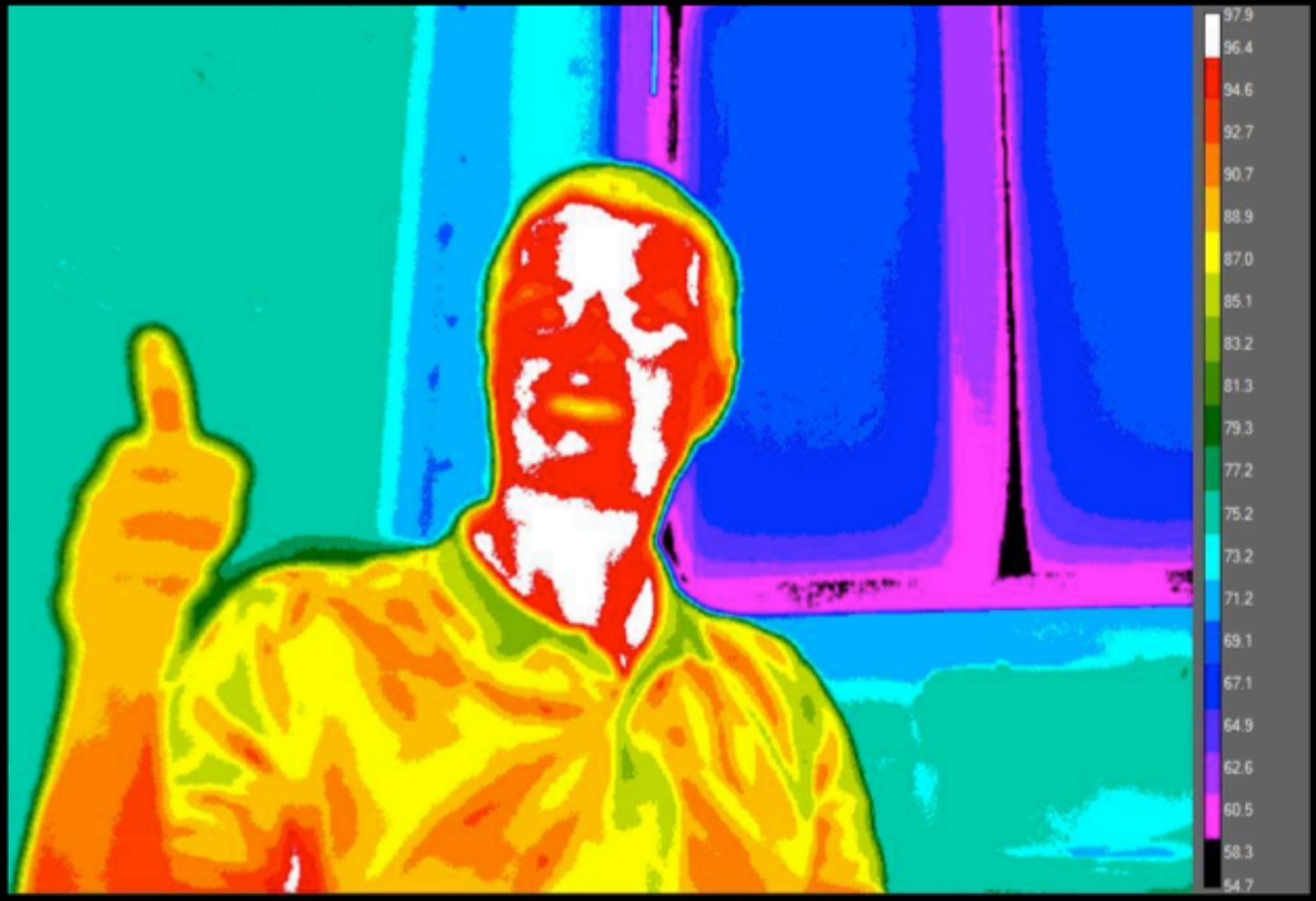
BBC

NASA's Operation IceBridge



NASA’s Operation IceBridge

NASA's Operation IceBridge Infrared imagery



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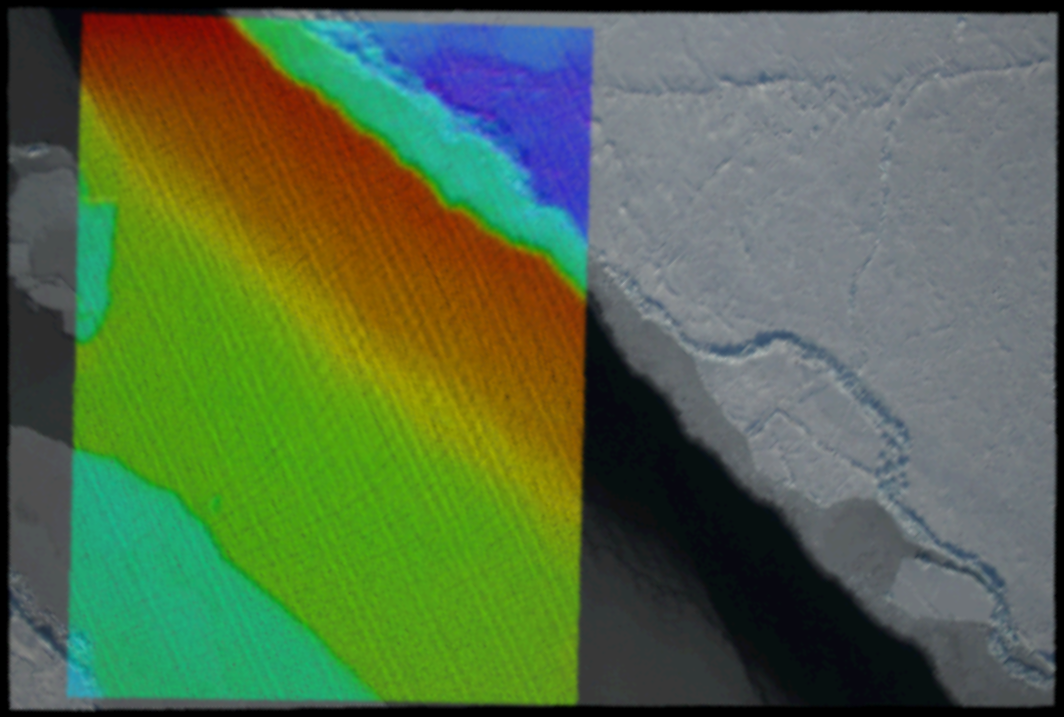
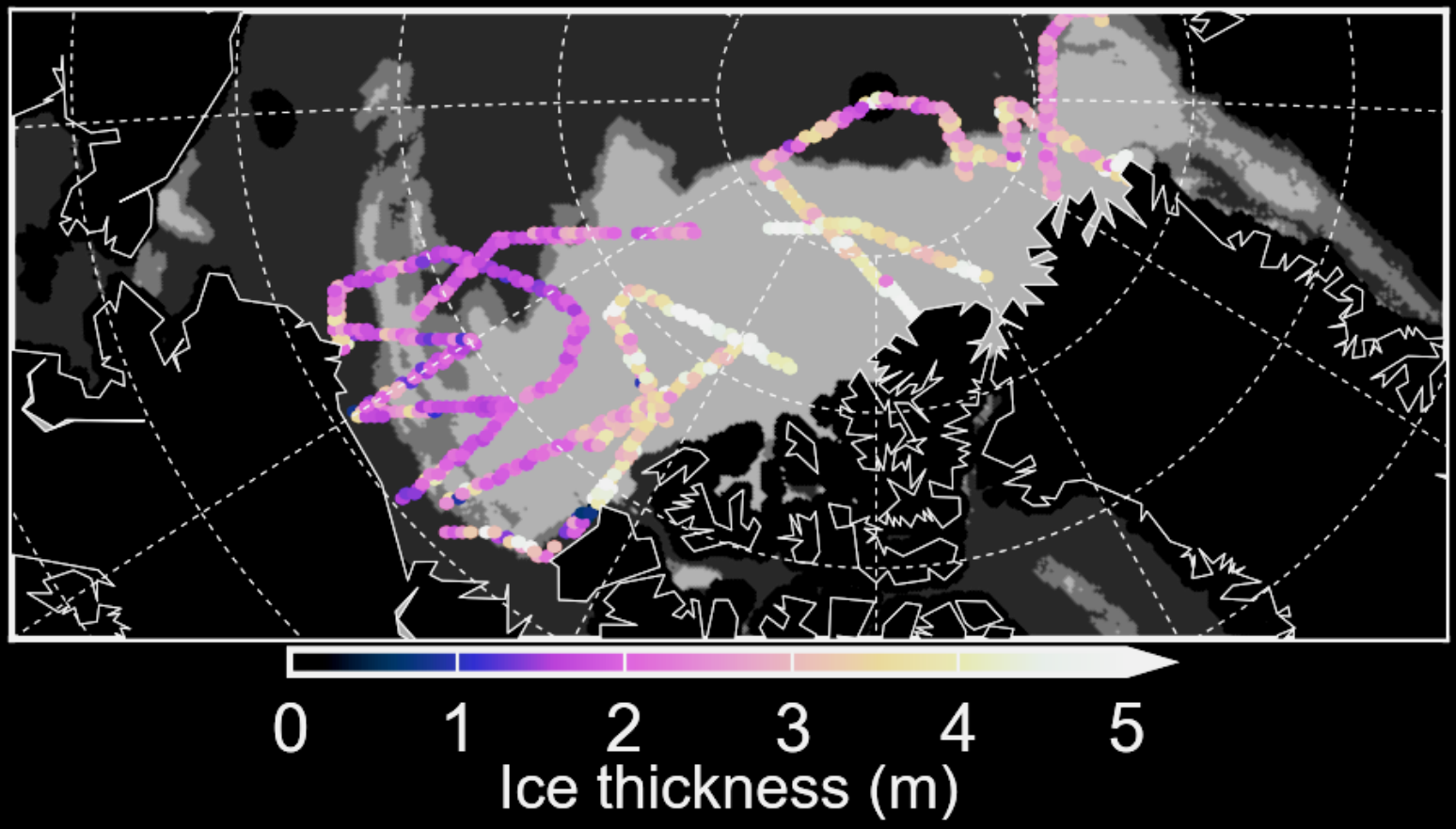
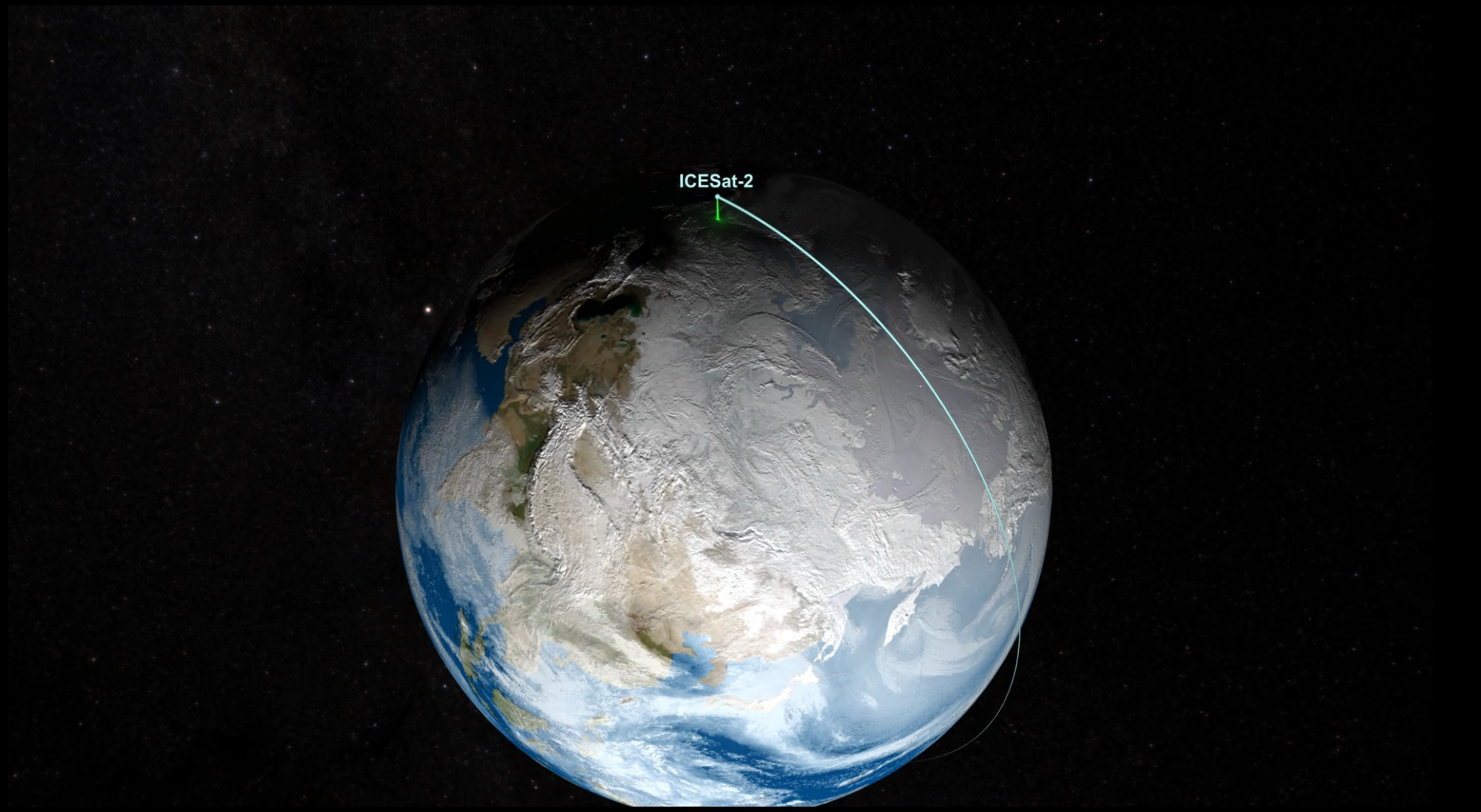


NASA's Operation IceBridge
Sea ice thickness results

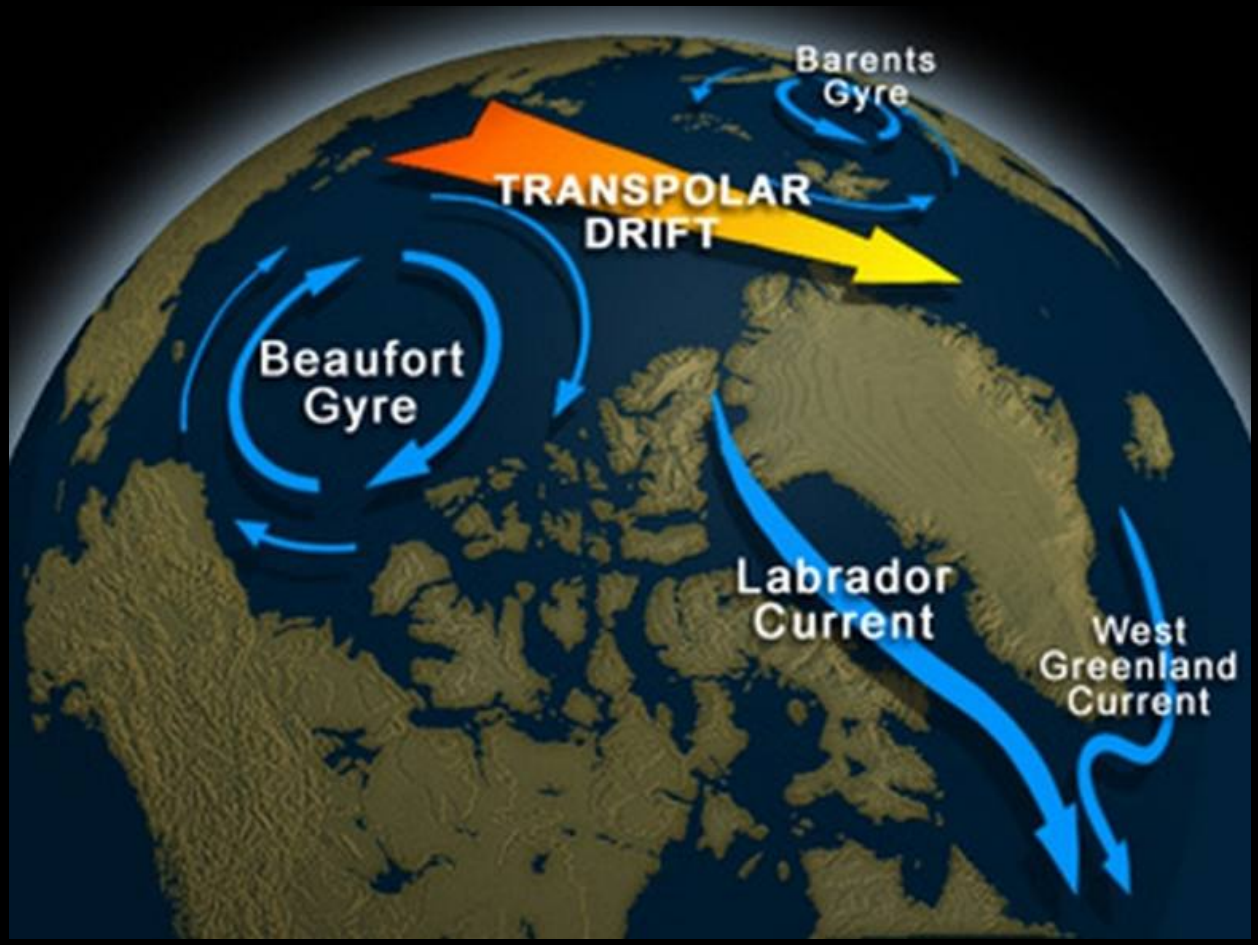


Data from spring 2015

NASA’s upcoming ICESat-2 mission



Beaufort Gyre research expeditions



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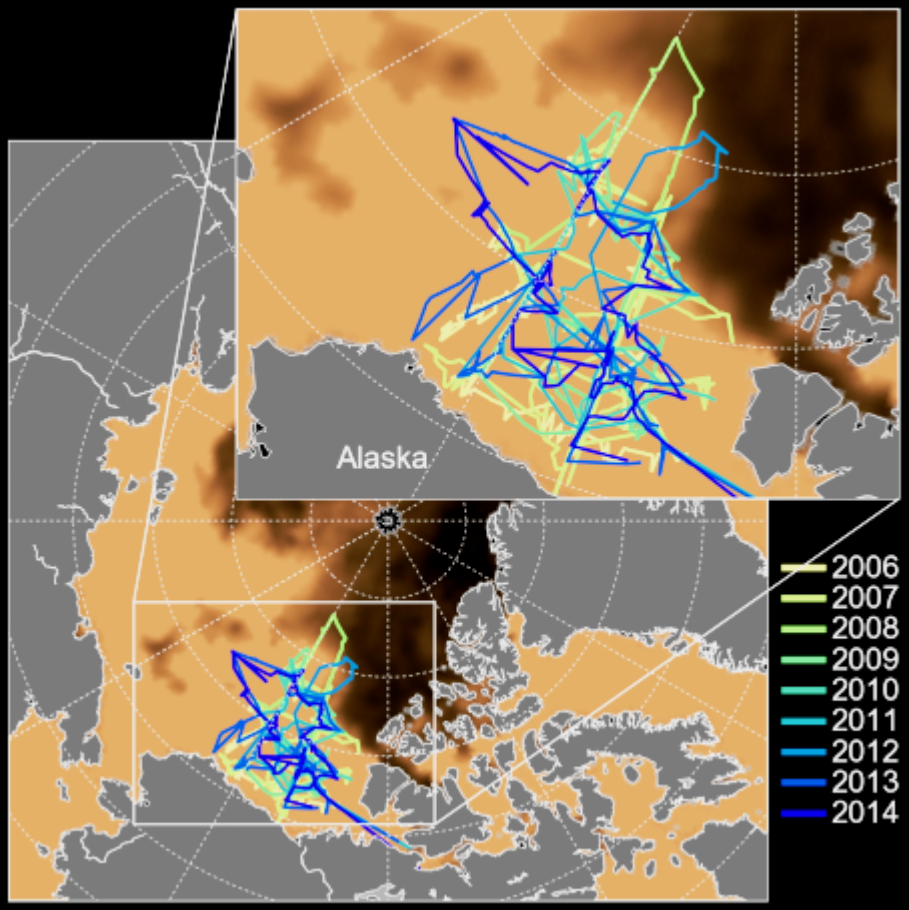

What next?

Improve knowledge of the sea ice state – e.g. thickness.

What next?

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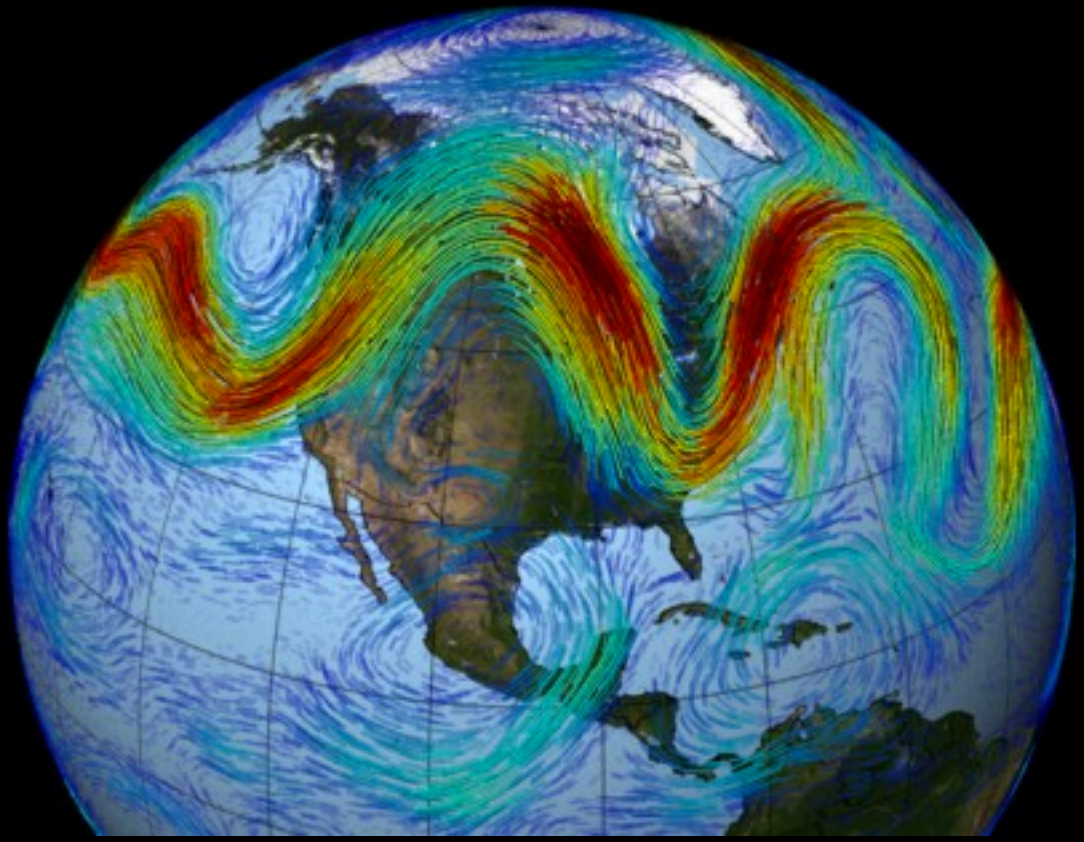
Understand complex feedbacks/ impacts.

Warming feedbacks

A wetter Arctic

Weather patterns – a wavier jet stream?



What next?

Improve knowledge of the sea ice state

Understand complex feedbacks/ impacts.

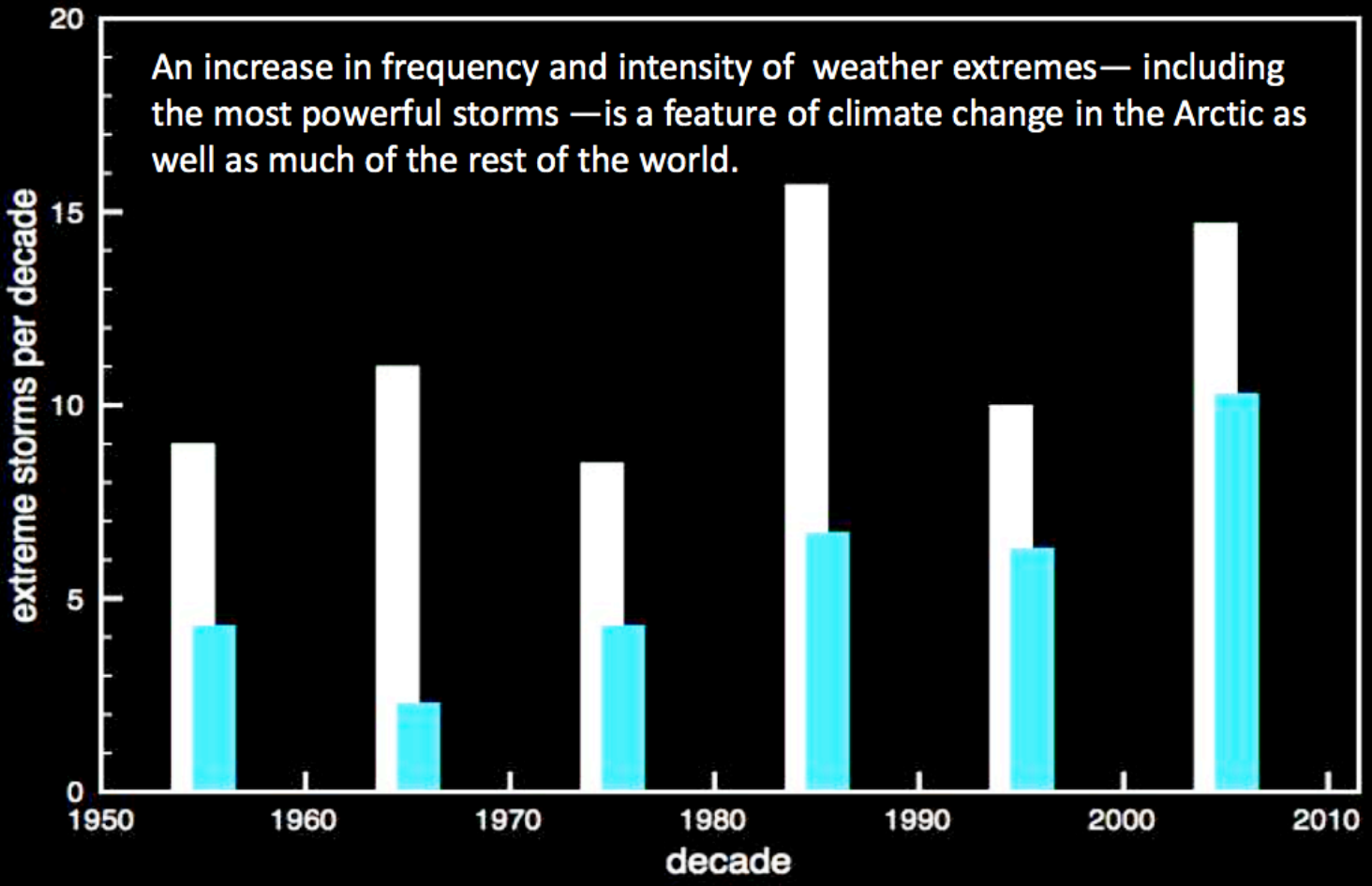
What next?

Improve knowledge of the sea ice state

Understand complex feedbacks/ impacts.

Improve information for decision making (at the local scale)

Storms/coastal impacts



(Black = total # of extreme storms; red = those with open water)

From *Walsh & Chapman, UAF*

Navigability/globalization of Northern Alaska

Crystal serenity cruise ship being escorted through the Northwest Passage by the British icebreaker RRS Shackleton

Fisheries

Low sea ice year

Increased small body plankton

Decreased young pollock survivability

Vice versa!

Mammals/hunting/subsistence

Better communication between scientists and locals through the:
Sea Ice Prediction Network (SIPN) and
Sea Ice for Walrus Outlook (SIWO)

Sea ice is declining but is also highly variable.

Still a lot we don't know about the Arctic

We need to understand what this means for changing climate, weather and ecosystems.

There is a lot left to learn.

Questions?