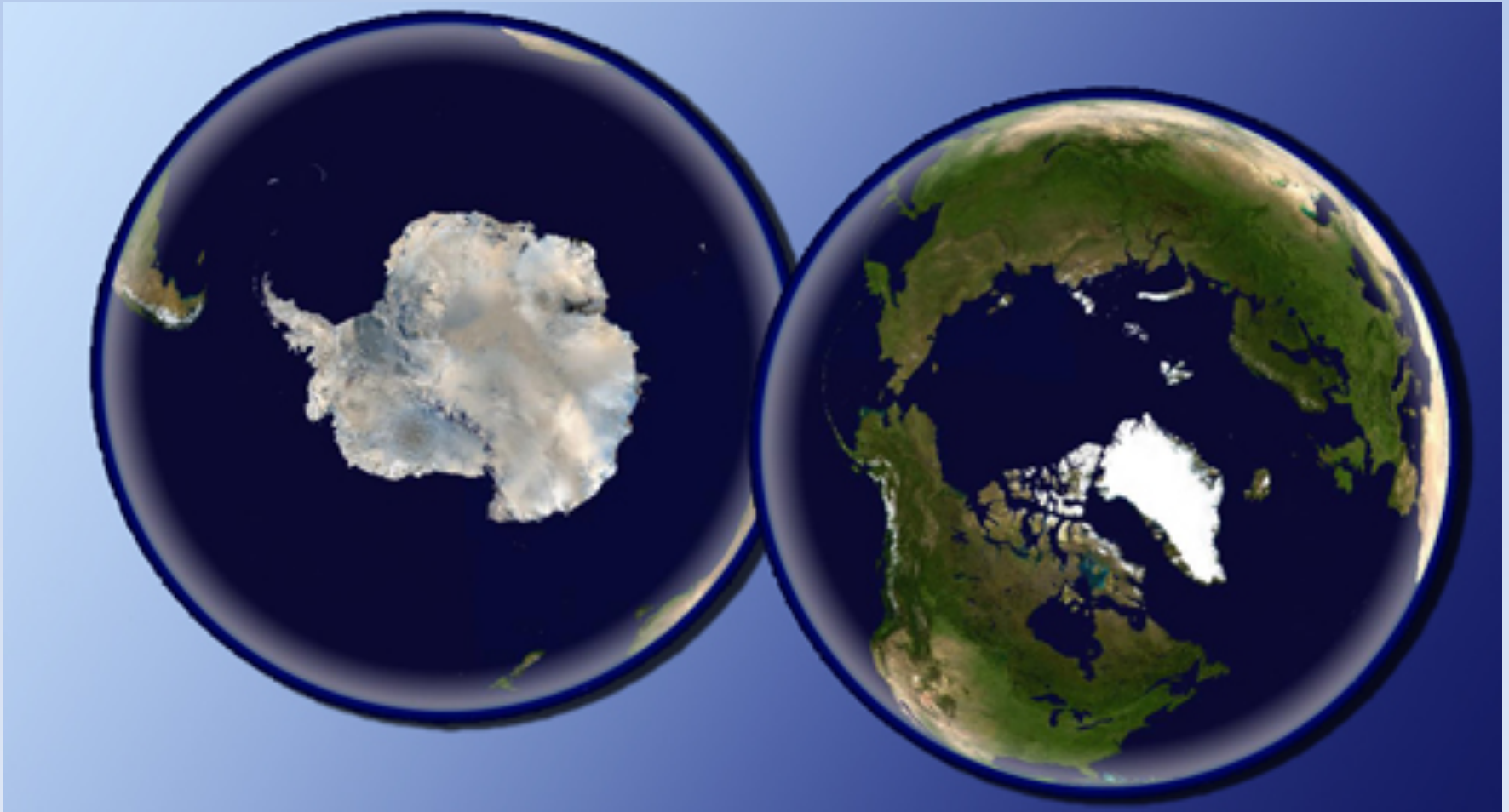


# Overview of Polar Oceans



by Maria (Masha) Tsukernik

Masha Tsukernik

Research Fellow, Monash University, Melbourne Australia

I am a “bipolar” scientist, studying changes in polar atmosphere, oceans and cryosphere (snow and ice). I am fascinated by sea ice the most!



# Overview

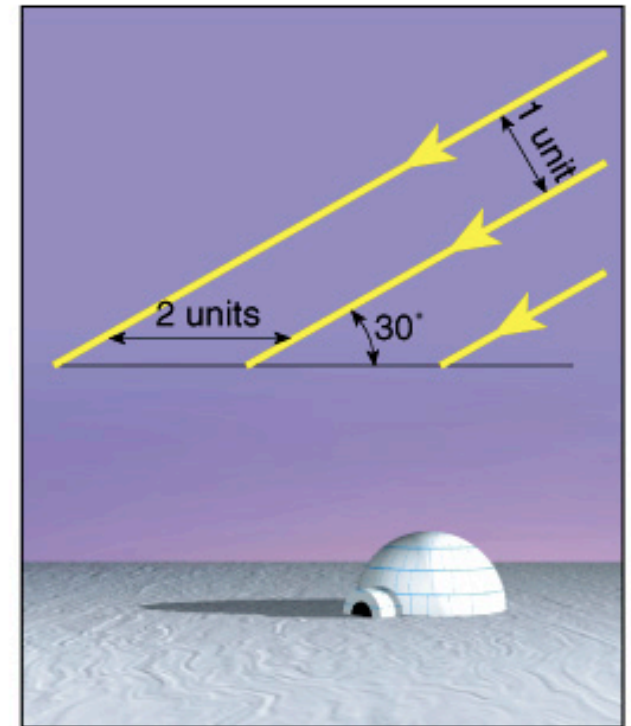
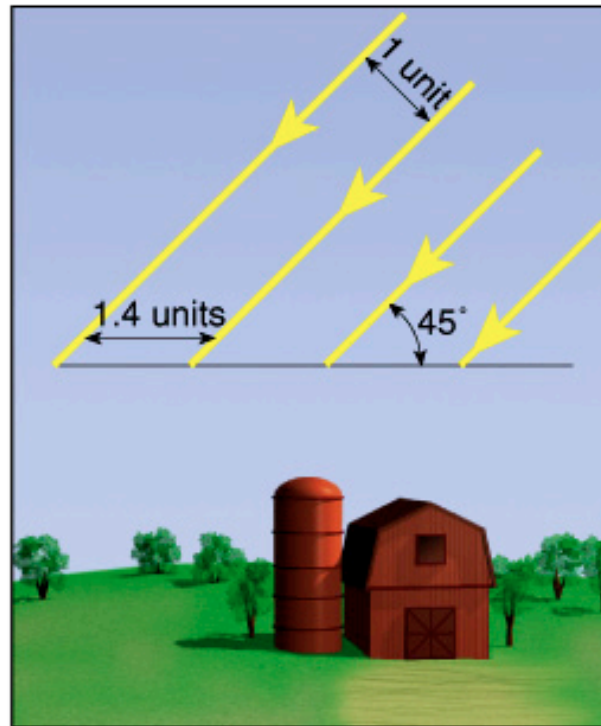
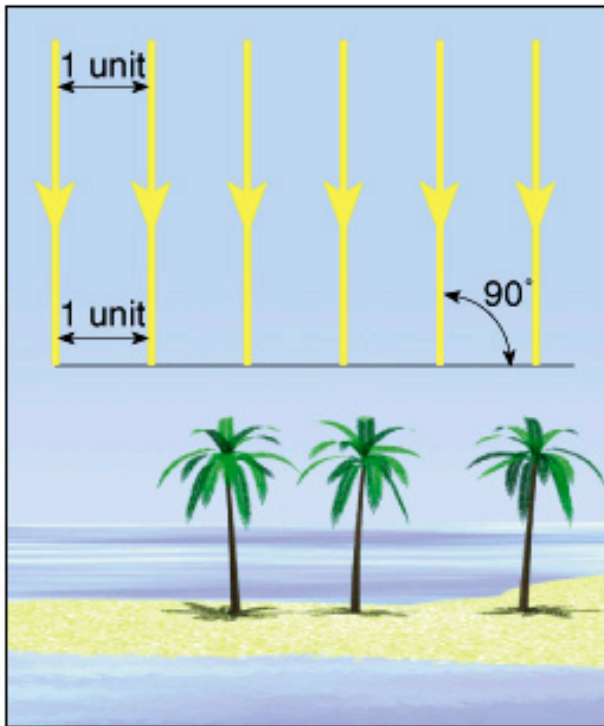
- Why are the polar regions important for global climate?
- What changes have been observed in polar oceans?
- So what?

# Why are the polar regions important?



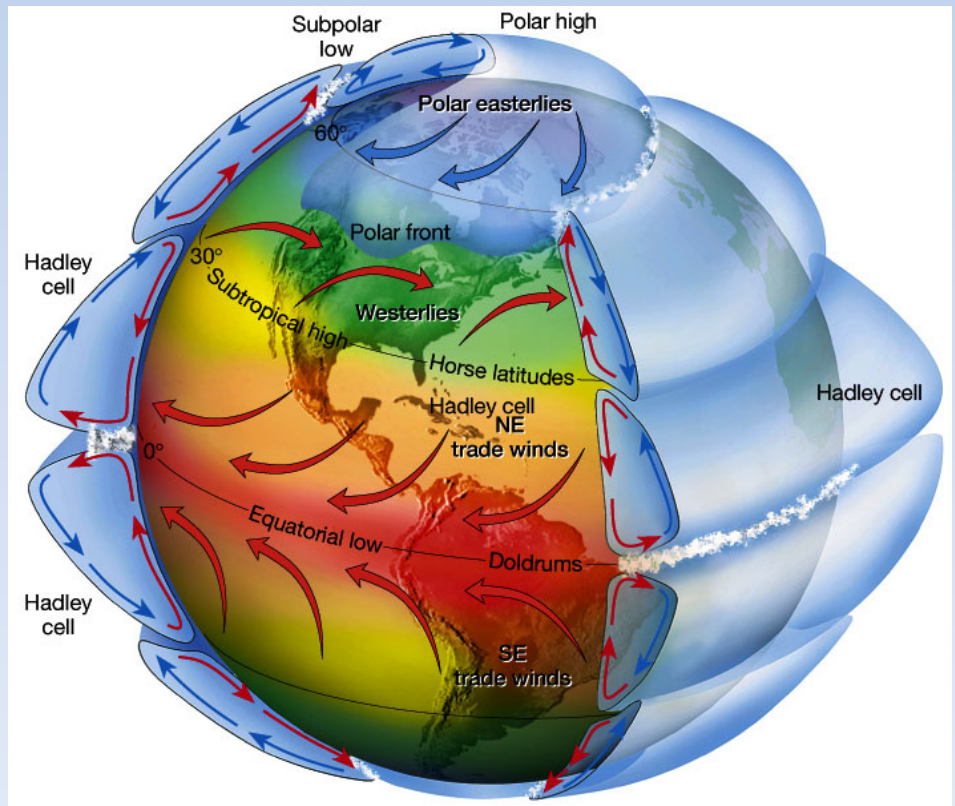
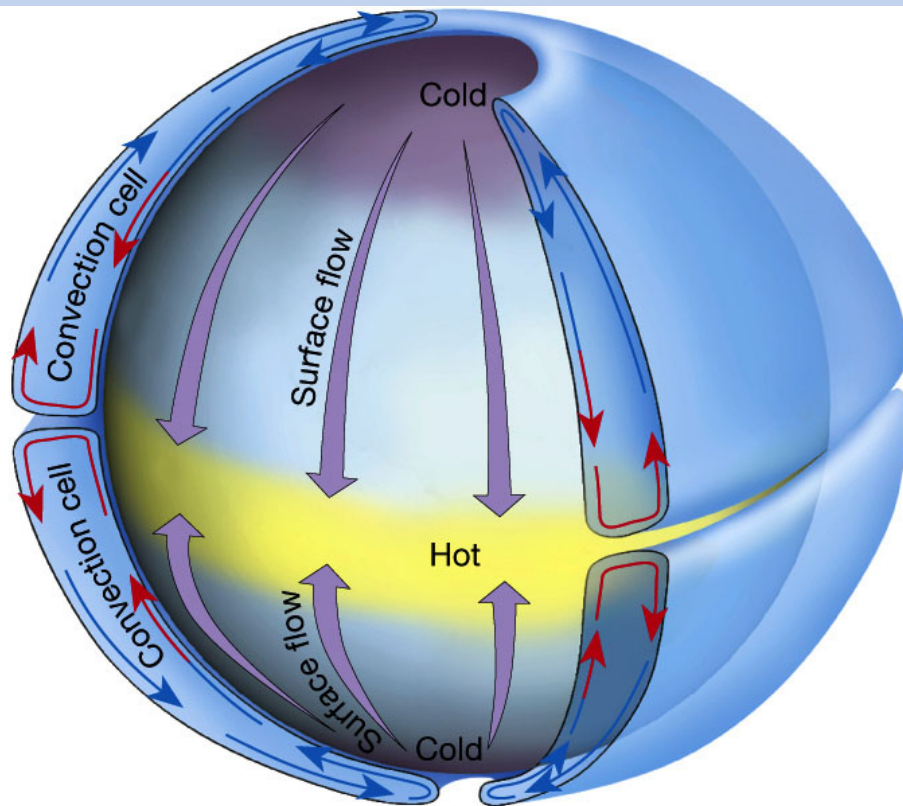
# Why are the polar regions important?

- The Earth is heated unevenly
- Polar regions are the “A/C” of the planet



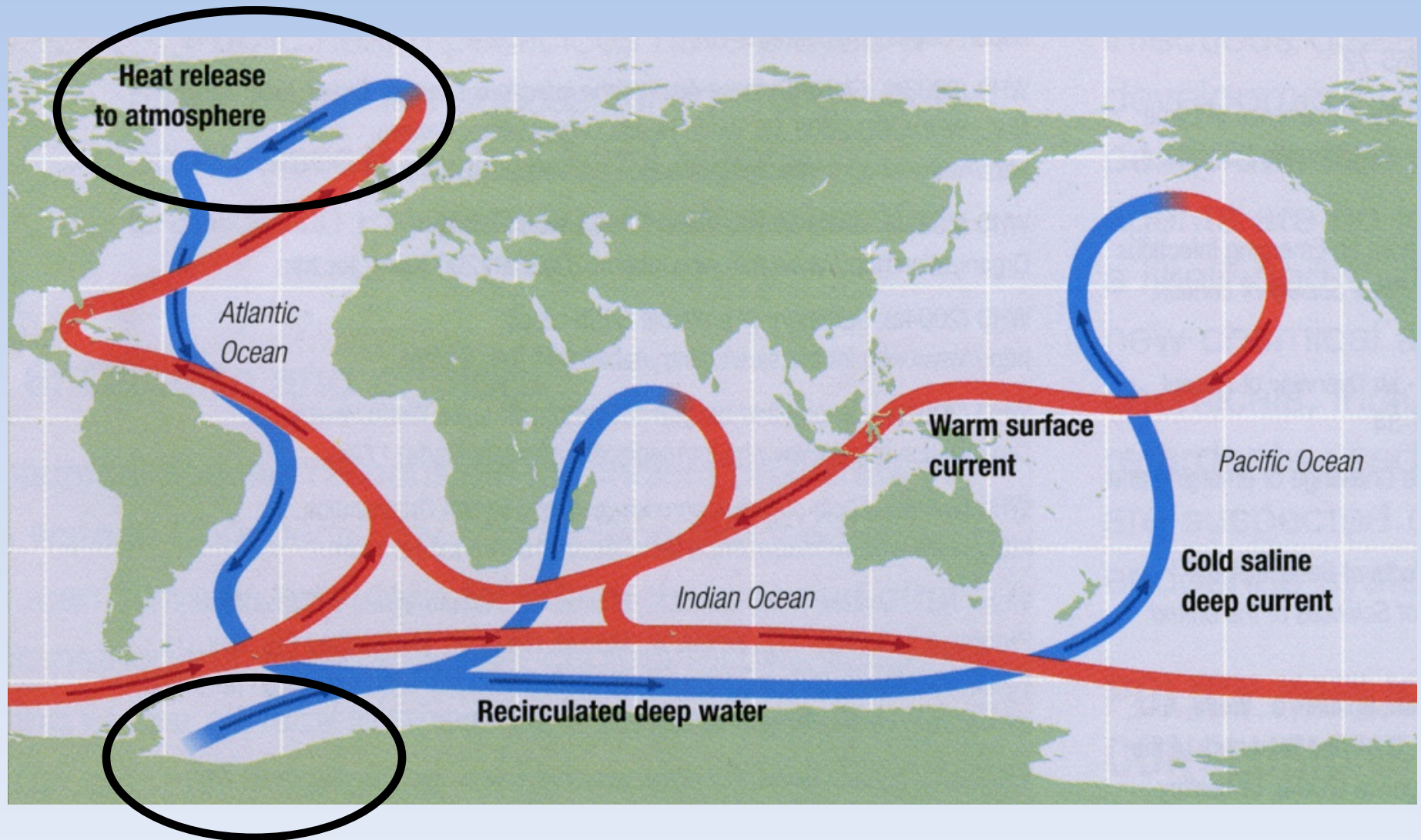
# Why are the polar regions important?

- The Earth is heated unevenly
- Atmosphere and ocean are correcting imbalance



Atmospheric circulation in theory and practice

# Why are the polar regions important?



Thermohaline circulation in the ocean

# Why are the polar regions important?

1. Polar regions play a crucial role in the global atmosphere and ocean circulations

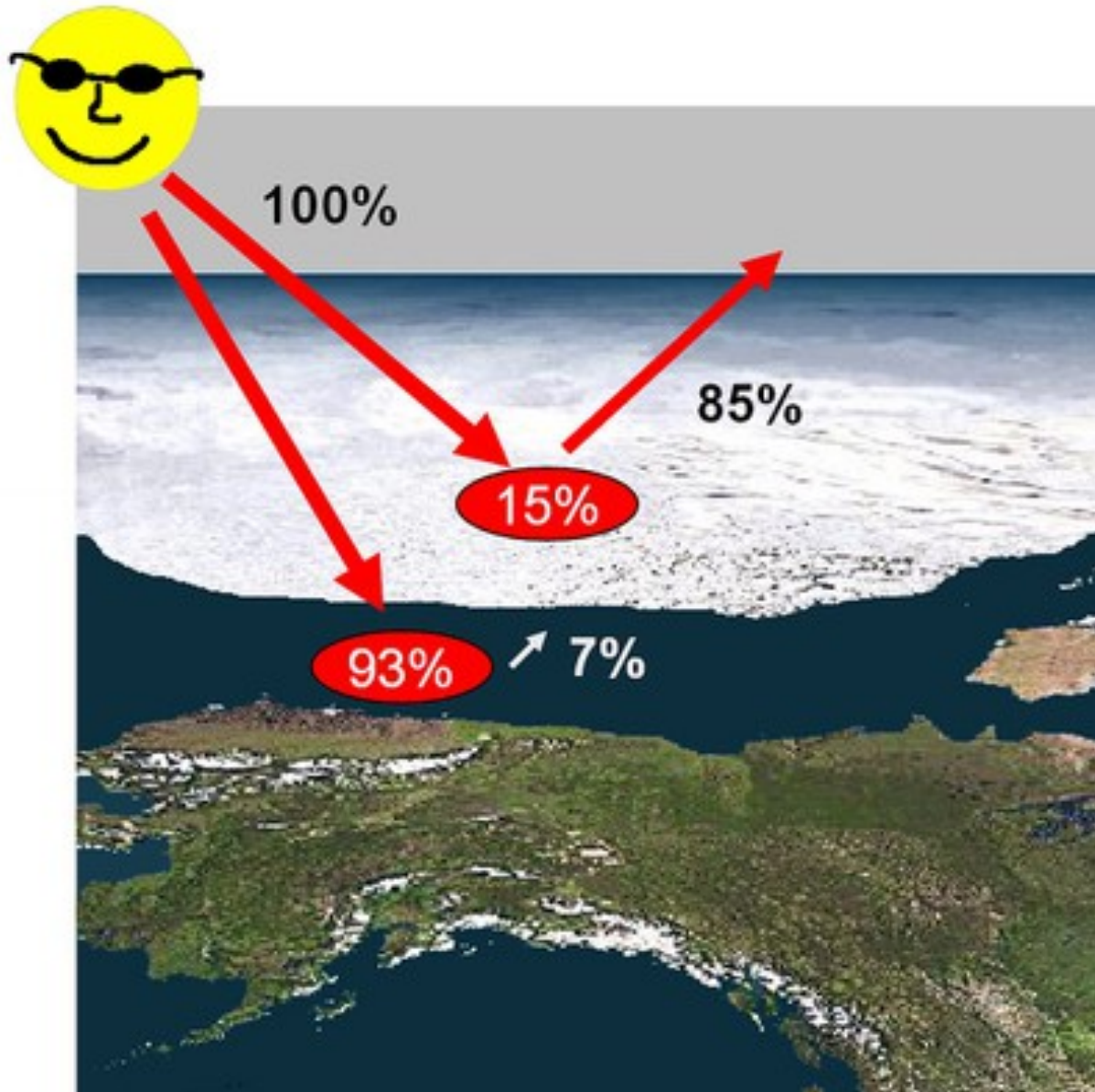


# Why are the polar regions important?



Sea ice, ice sheets, seasonal snow cover – all WHITE

# Why are the polar regions important?

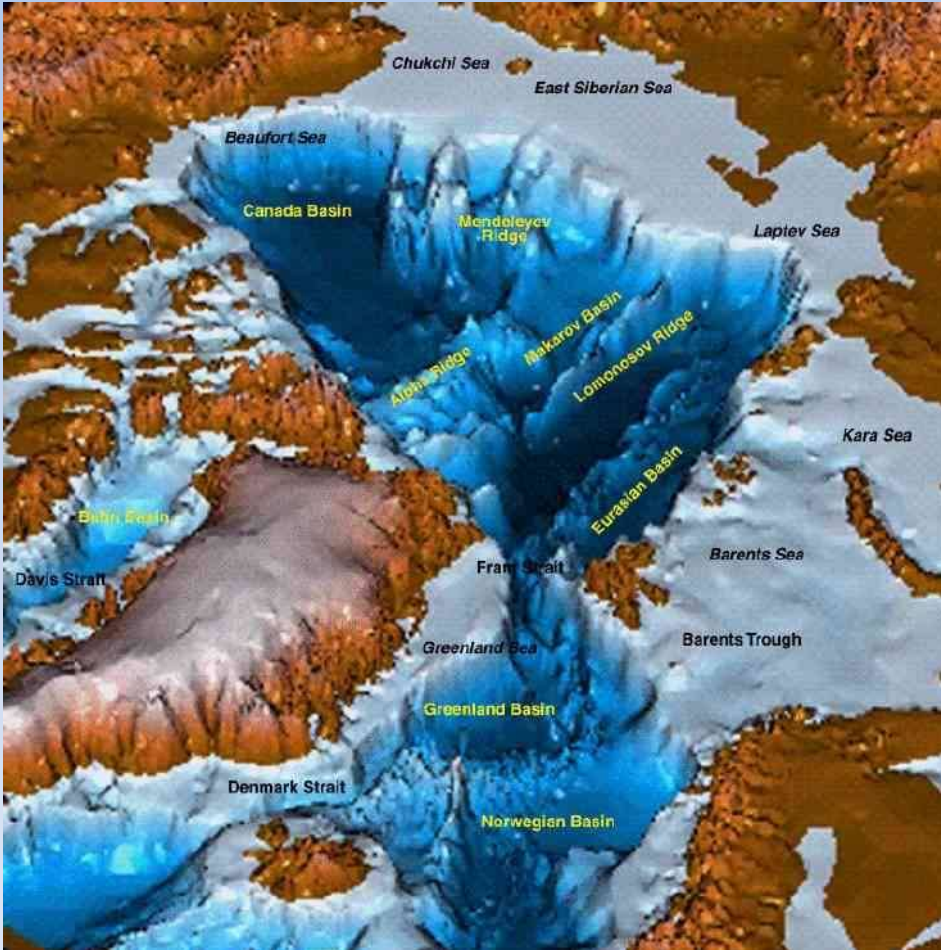


- Ice albedo positive feedback
- Snow/ice surface reflects sunlight
- Dark ocean surface absorbs sunlight
- Once melt starts, it is amplified by the feedback loop

# Why are the polar regions important?

1. Polar regions play a crucial role in the global atmosphere and ocean circulations
2. Polar feedbacks (e.g. ice-albedo positive feedback) intensify changes that occur at the poles

# Arctic Ocean



NATIONAL GEOGRAPHIC

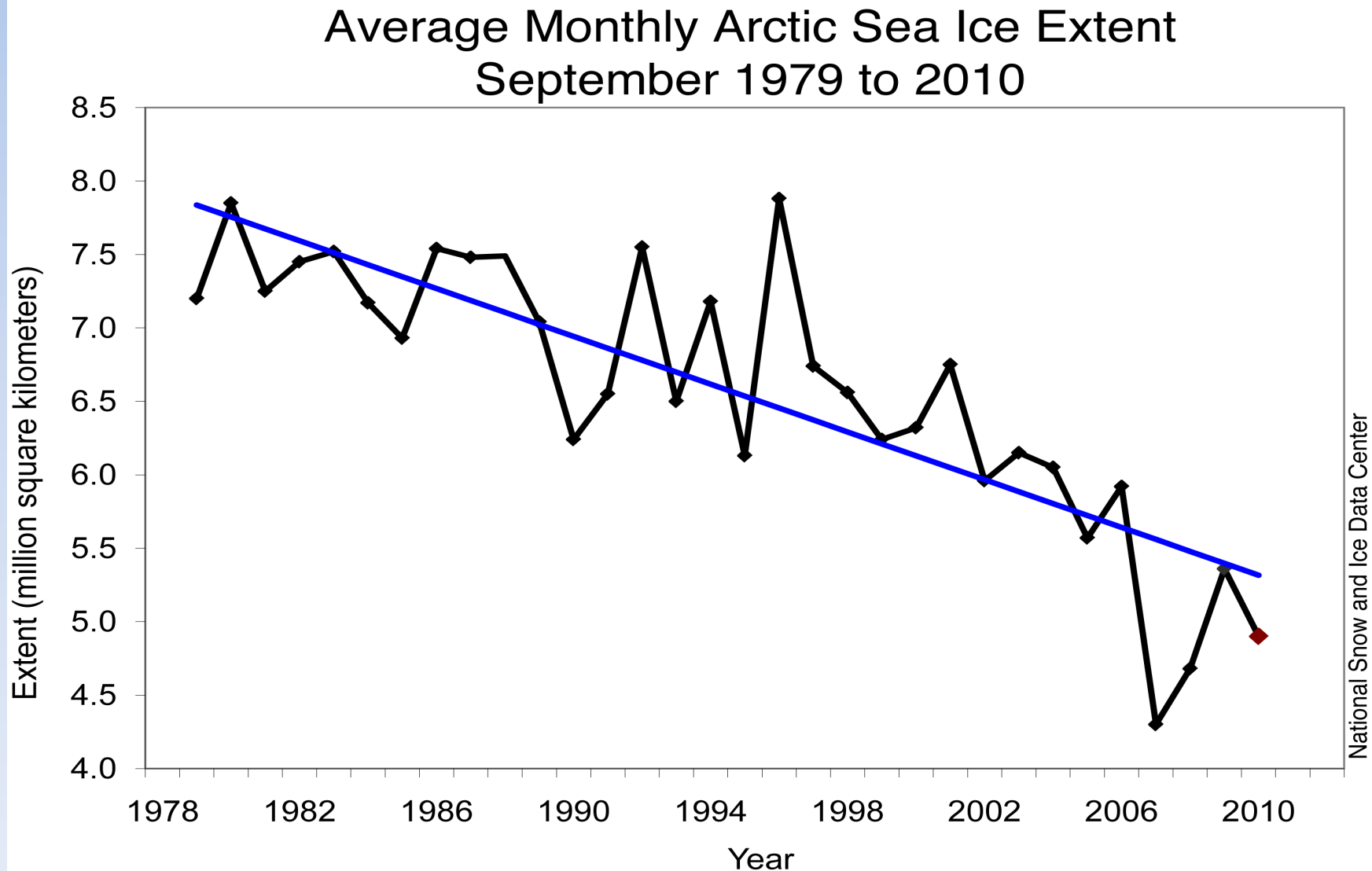
Find more wallpapers at [www.nationalgeographic.com](http://www.nationalgeographic.com)  
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Photograph by Emory Kristoff

Best known for its ice cover

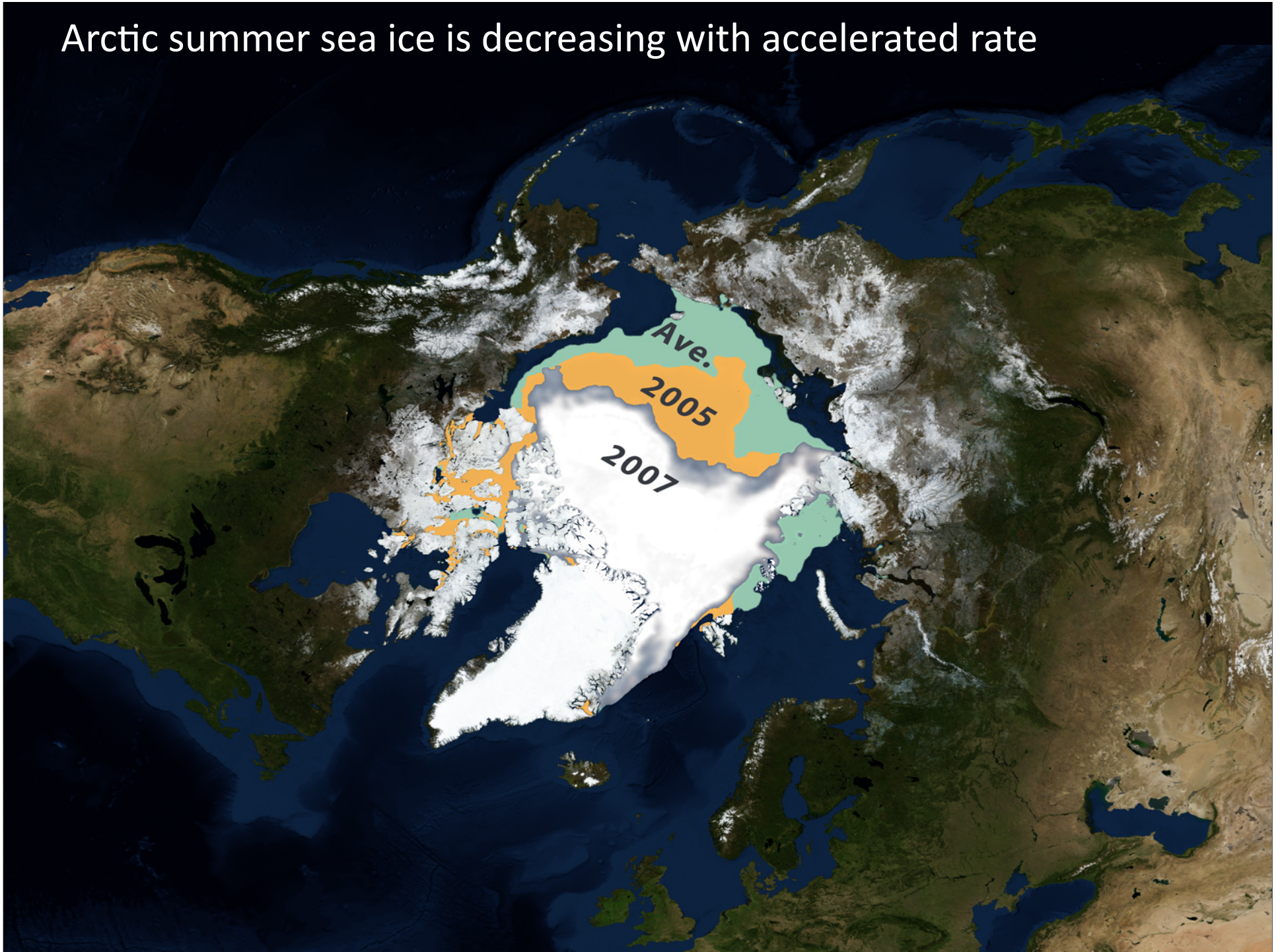
Average depth of **Arctic Ocean: 1038 meters (3407 ft)**  
Deepest point in the **Eurasian Basin: 5450 meters (17,881 ft).**  
Entire basin: **1.5 times** the size of the contiguous US

# What changes have been observed?

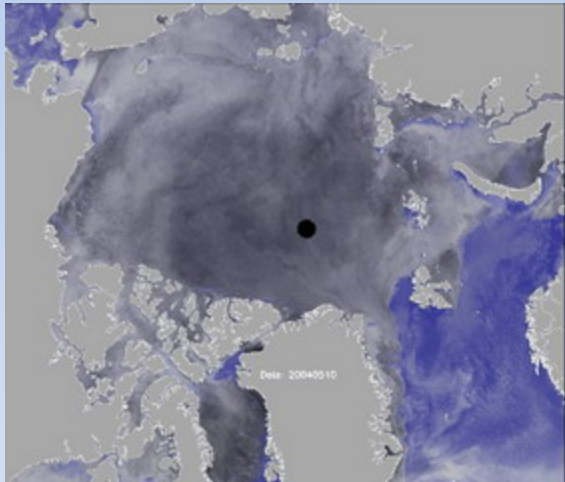


<http://nsidc.org/arcticseaicenews/>

Arctic summer sea ice is decreasing with accelerated rate



# Arctic sea ice

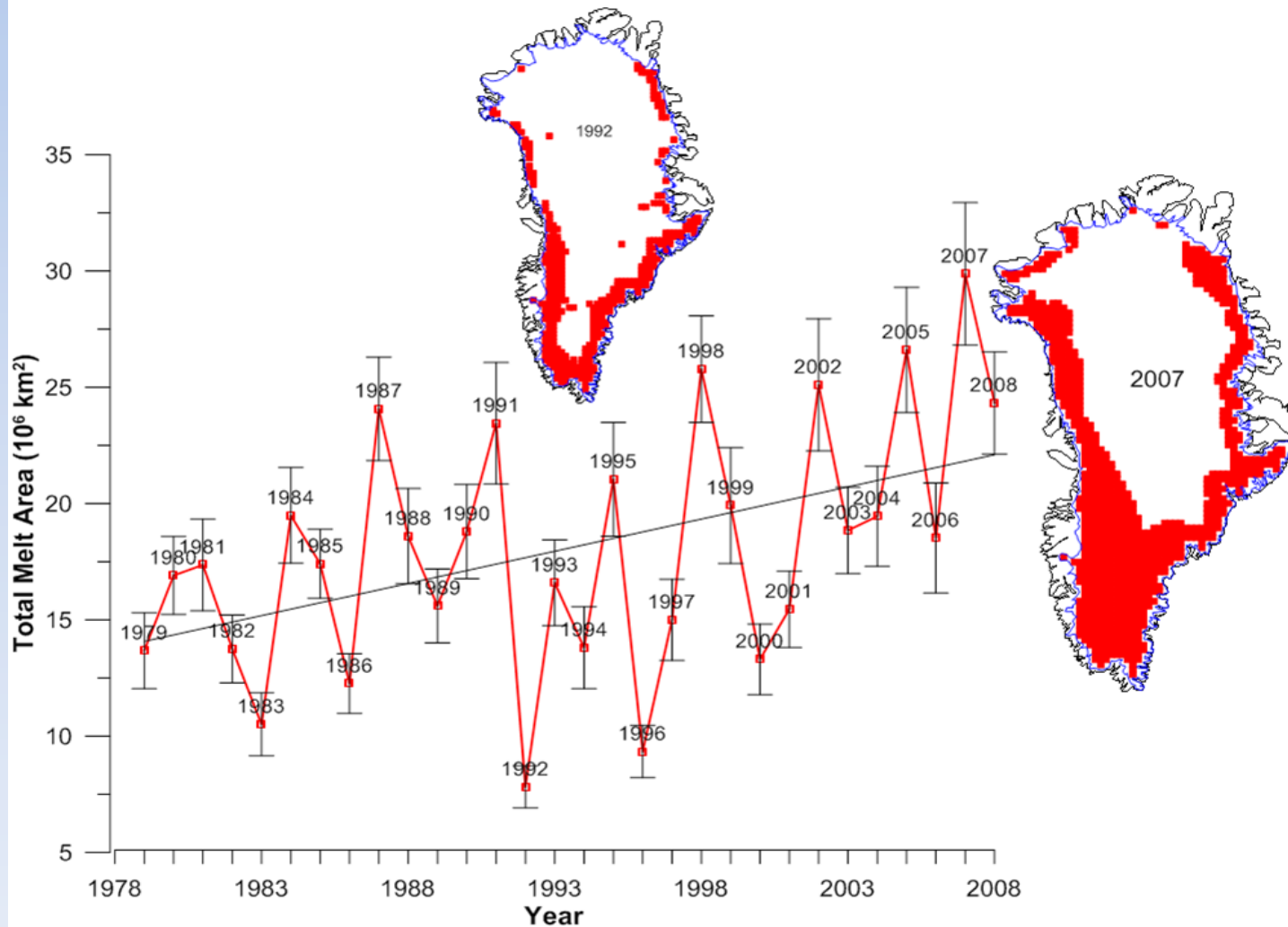


This animation illustrates how sea ice (in grey) grows in winter

The seasonal cycle and local weather still play a big role in day-to-day sea ice changes!

# What changes have been observed?

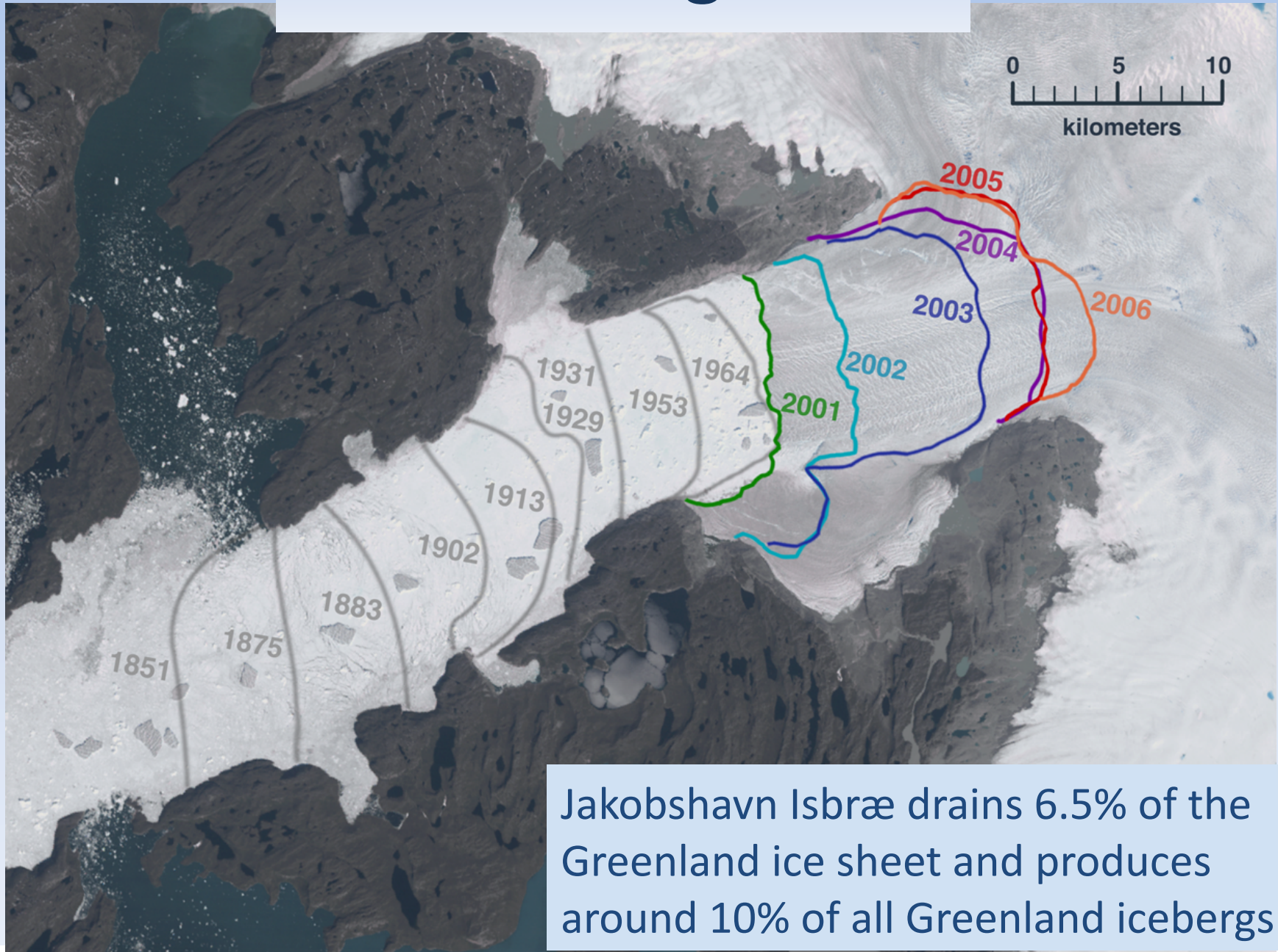
➤ Greenland melt



CIRES/NSIDC



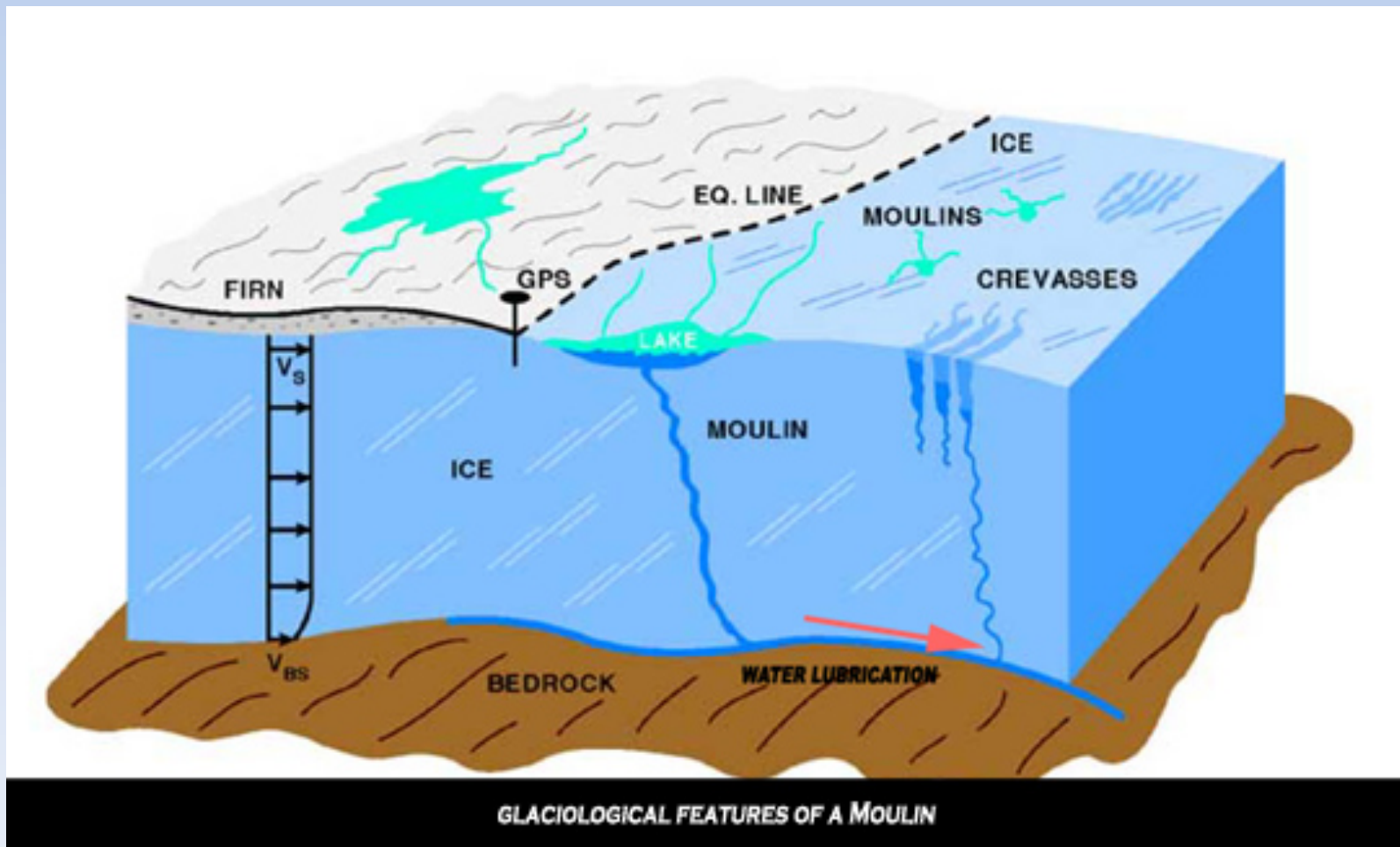
# Greenland glaciers



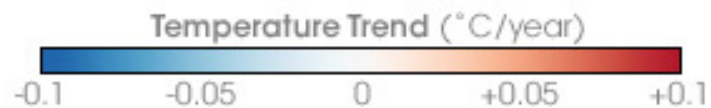
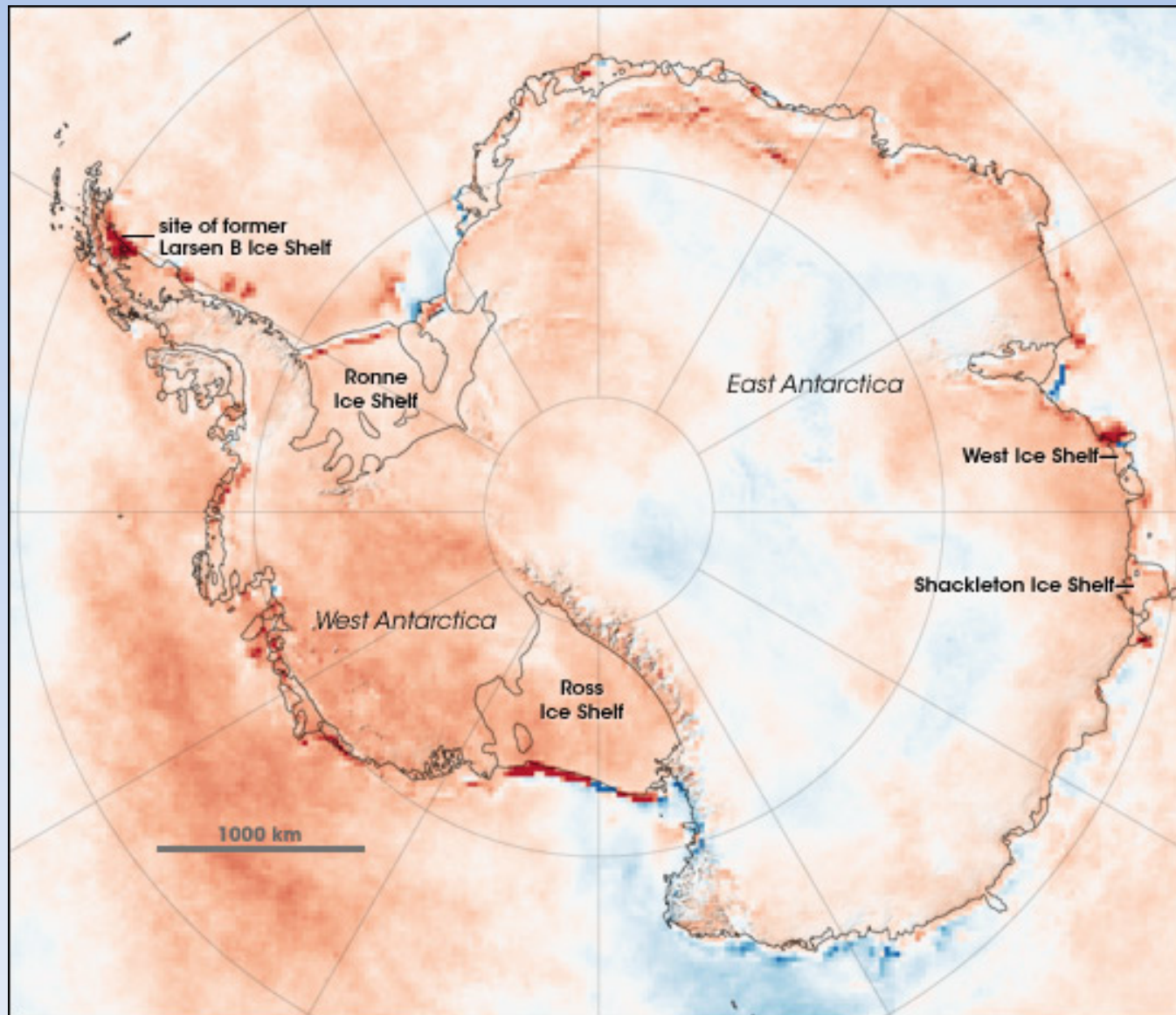
Jakobshavn Isbræ drains 6.5% of the Greenland ice sheet and produces around 10% of all Greenland icebergs

# What changes have been observed?

- Accelerated melt in Greenland
- Moulins and water lubrication



# Antarctica: frozen solid



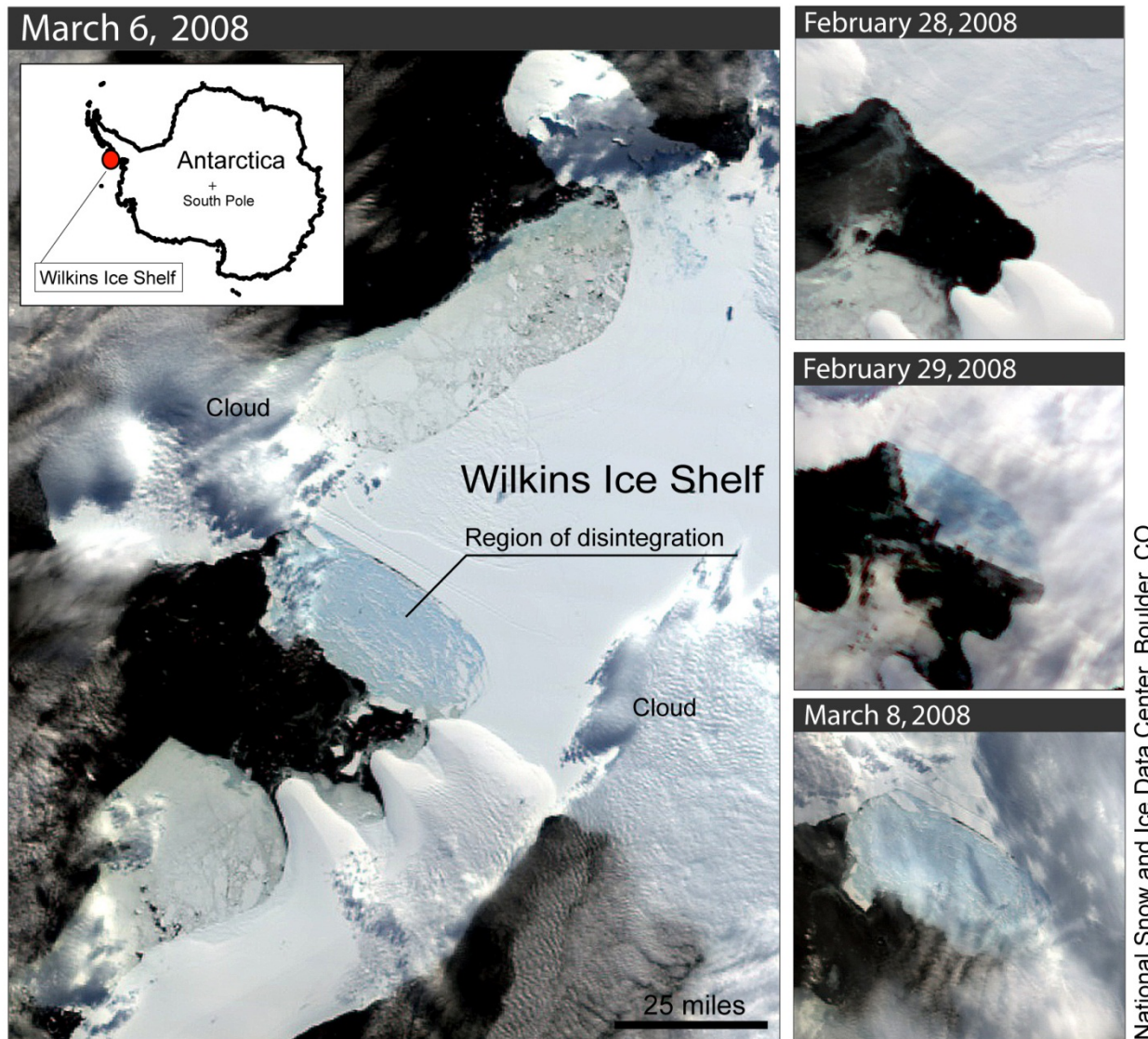
# What changes have been observed?



This animation shows a collapse of Larsen B ice shelf in February 2002 – it was the first time in history ice shelf collapse was monitored

NSIDC

# Ice shelf collapse



[http://nsidc.org/news/press/20080325\\_Wilkins.html](http://nsidc.org/news/press/20080325_Wilkins.html)

# Summary of observed changes

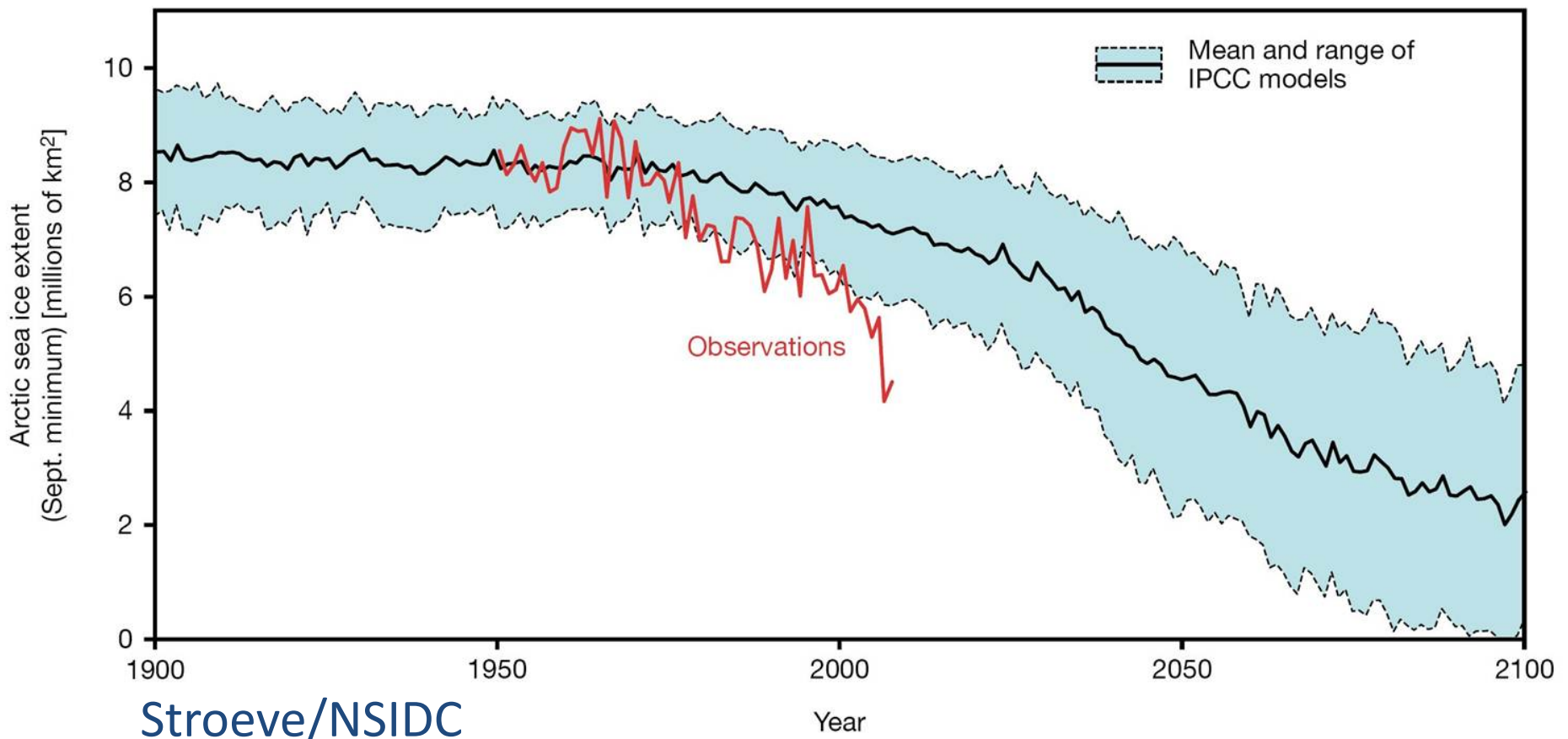
- Arctic sea ice cover in summer is decreasing
- Greenland glaciers are melting at accelerated rate
- Ice shelves around Antarctica are collapsing

So what?



# Arctic sea ice – faster than forecast

- More energy from the Sun will be absorbed
- Erosion, storm surge, changes in salinity-driven circulation
- Decreasing habitat for Arctic animals
- No direct increase in sea level (sea ice is floating)



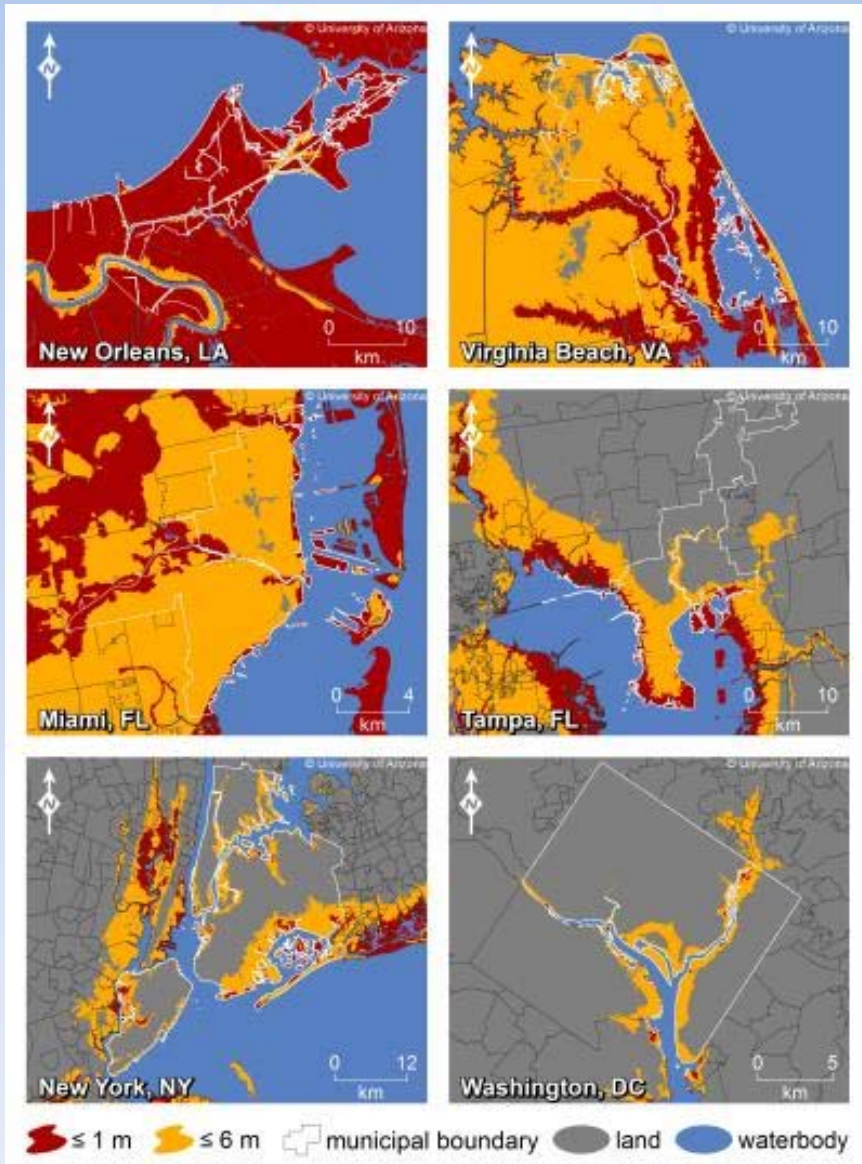


# Accelerated ice loss in Greenland and Antarctica:



- Polar regions are fascinating
- New data and new discovery awaits
- What happens at the poles affects us all

# Potential sea level rise



East Antarctica: 64.8m

West Antarctica: 8.06m

Antarctic Peninsula: 0.46m

Greenland: 6.55m

Other glaciers: 0.45m

TOTAL: 80.32 m

USGS

Thank you!



# Trivia

Most of the world's salt water is in the oceans.

On which continent is most of the world's fresh water ?

- Africa
- Antarctica
- Asia
- Australia
- Europe
- North America
- South America

# Trivia

What will happen to sea level rise if the summer Arctic sea ice disappears?

# Trivia

At which location would you be at the highest elevation above sea level?

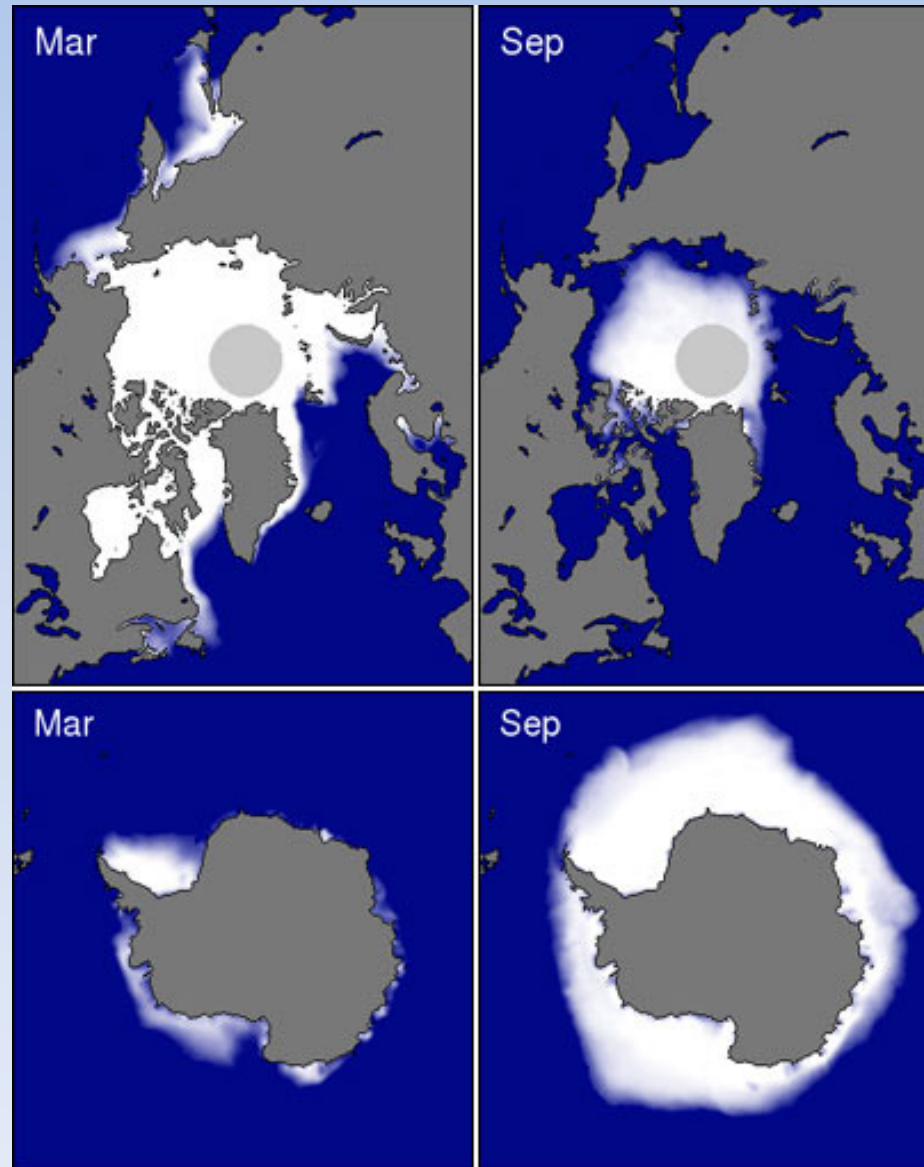
- \_ Base of Vail Ski Resort
- \_ Highest point in Australia
- \_ Highest point east of the Mississippi
- \_ South Pole

# Arctic vs. Antarctic sea ice

Summary of differences between Arctic and Antarctic sea ice characteristics		
	Arctic	Antarctic
<b>Average Maximum Areal Extent</b>	15,000,000 km <sup>2</sup> (9,320,568 mi <sup>2</sup> )	18,000,000 km <sup>2</sup> (11,184,681 mi <sup>2</sup> )
<b>Average Minimum Areal Extent</b>	7,000,000 km <sup>2</sup> (4,349,598 mi <sup>2</sup> )	3,000,000 km <sup>2</sup> (1,864,114 mi <sup>2</sup> )
<b>Typical Thickness</b>	~ 2 m (6 ft)	~ 1 m (3 ft)
<b>Geographic Distribution</b>	Asymmetric	Symmetric
<b>Snow Thickness</b>	Thinner	Thicker
<b>Trend, 1979-2008</b>	Significant decrease of 4.1% (~500,000 km <sup>2</sup> ; 193,000 mi <sup>2</sup> ) per decade	Small increase of 0.9% (~100,000 km <sup>2</sup> ; 42,000 mi <sup>2</sup> ) per decade

<http://nsidc.org/seaice/characteristics/difference.html>

# Arctic vs. Antarctic sea ice



<http://nsidc.org/arcticseaicenews/>



# Sea ice and salinity in the Arctic

