

The COMET Program

Our Climate: A Global Challenge

Academy of Lifelong Learning

Denver, CO

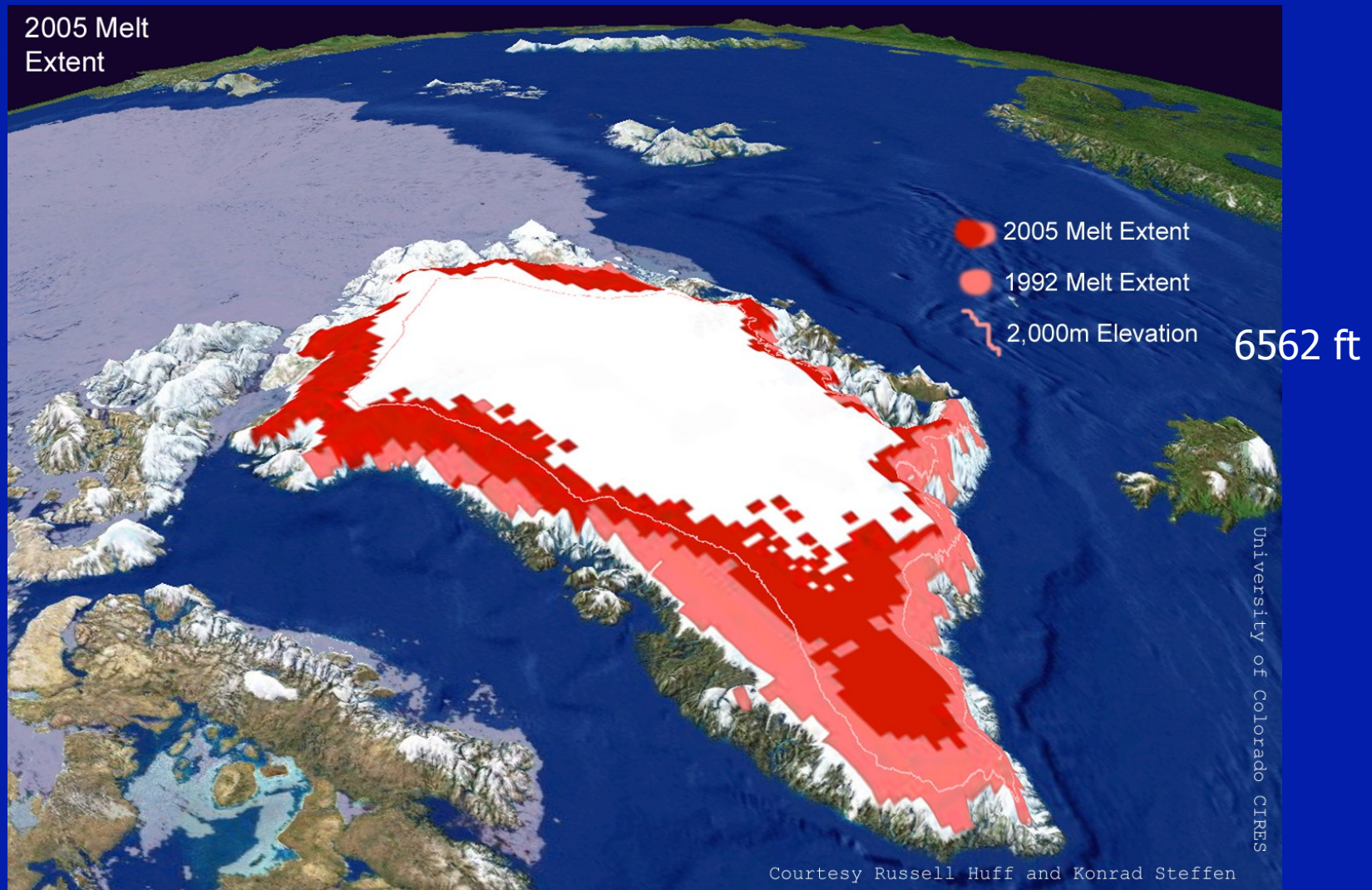
JFOrmes@comcast.net

April 16, 2015

Melting Ice Caps

Greenland and Antarctica

Greenland's accelerating melt



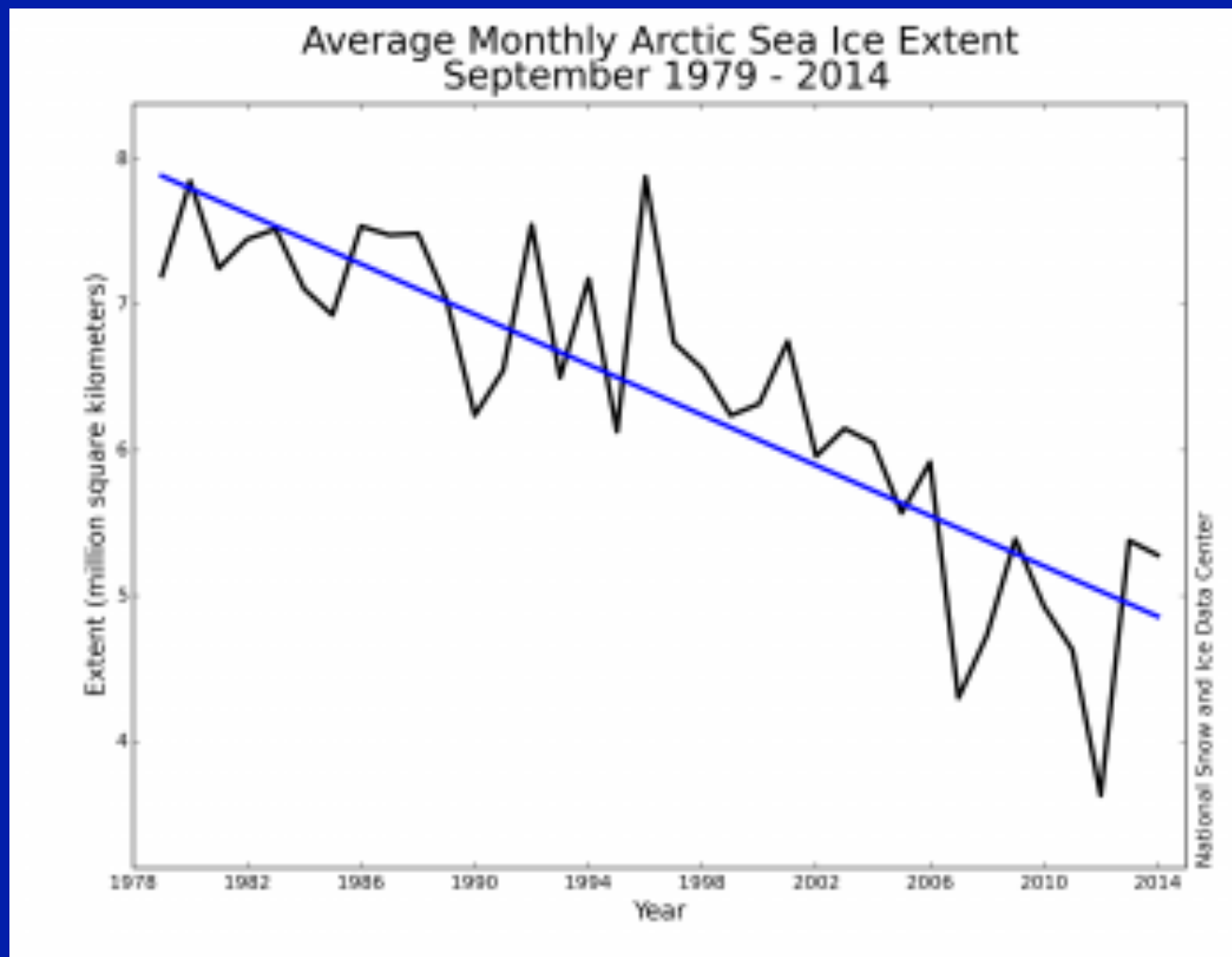
Glacier melt

- Can fresh water from melting ice counteract the increased acidity of the ocean? Not much, because the ocean has much larger volume. However, fresh meltwater can have big effects in the nearby ocean.

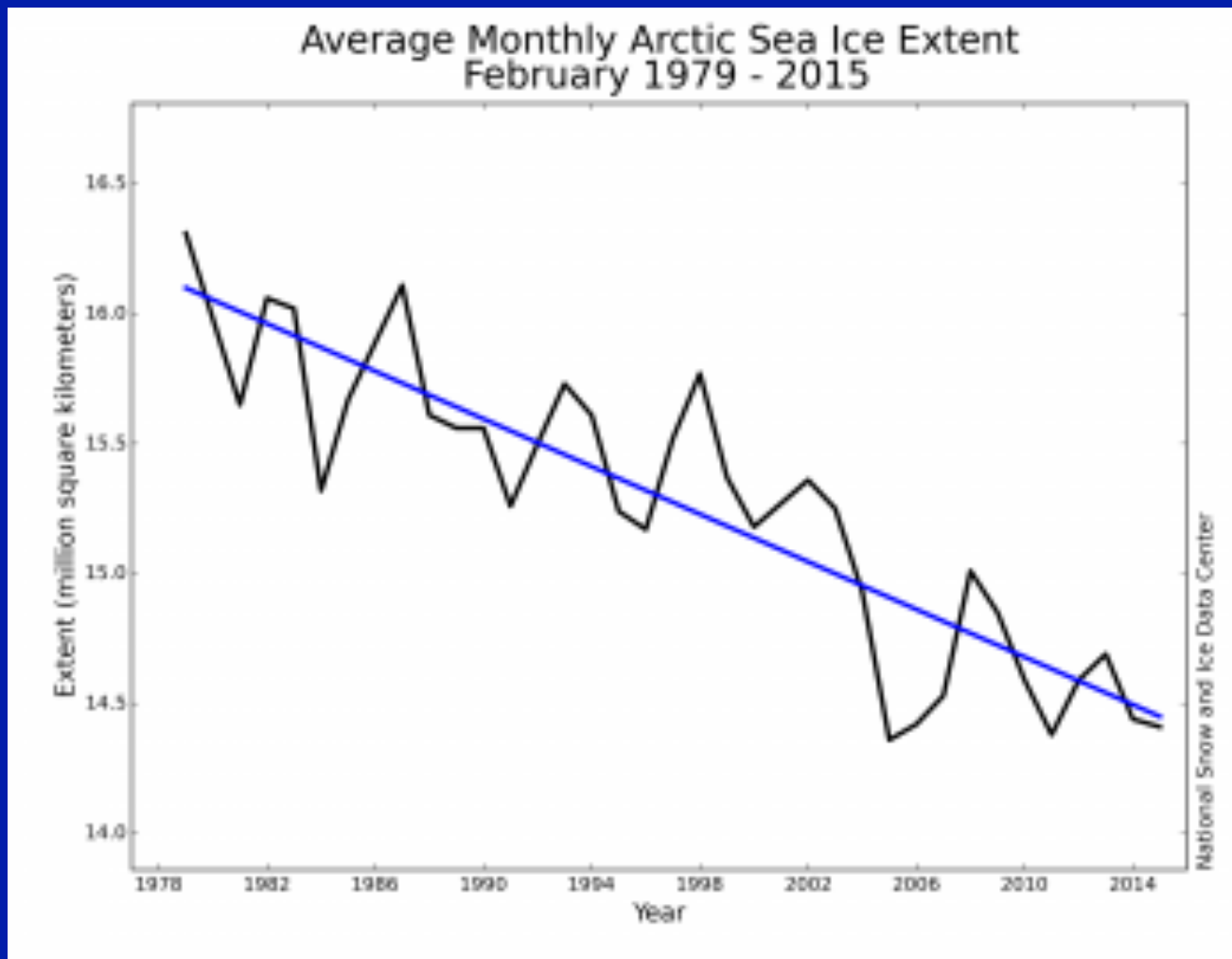
A river of meltwater on Greenland.



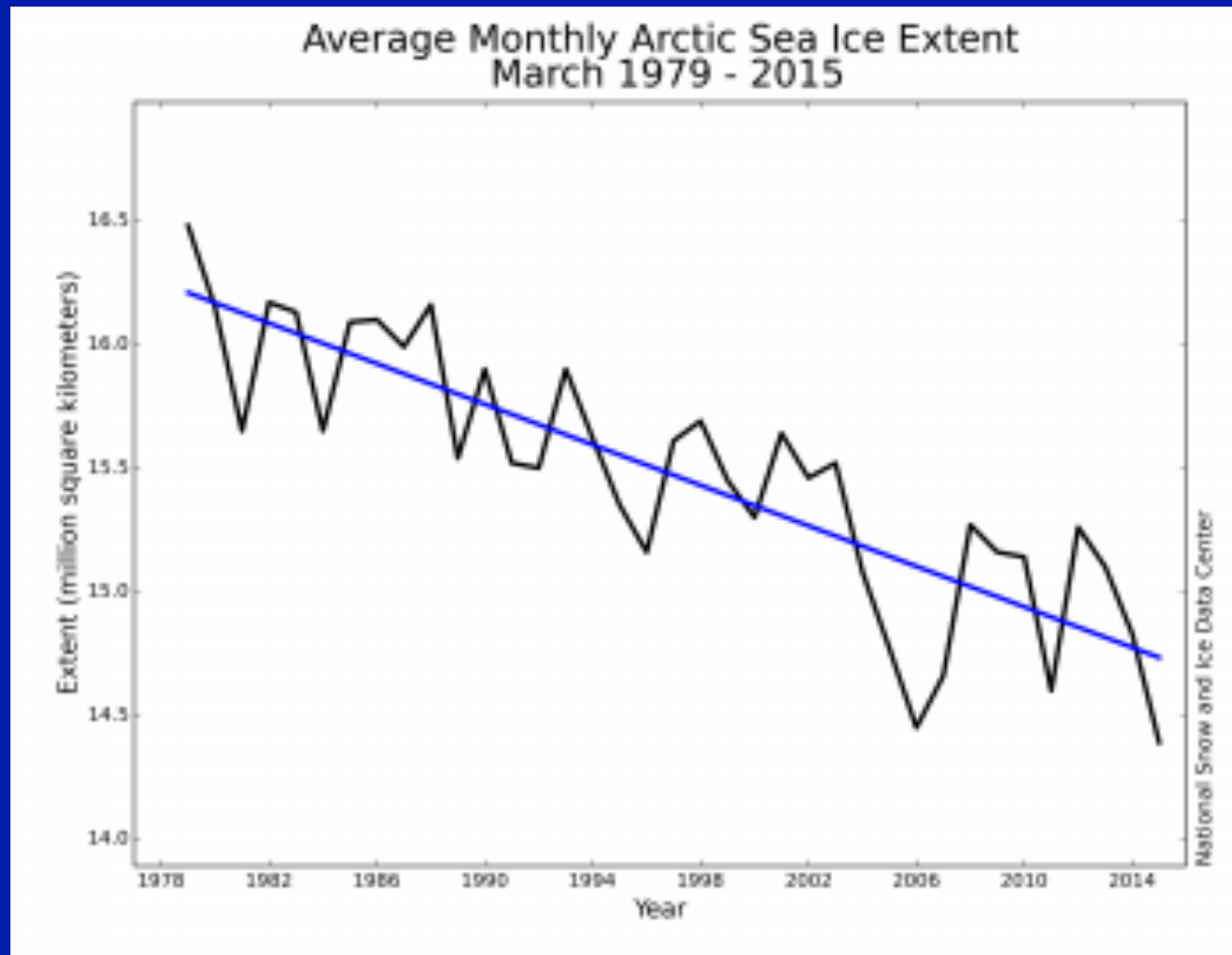
Arctic Sea Ice for Sept.



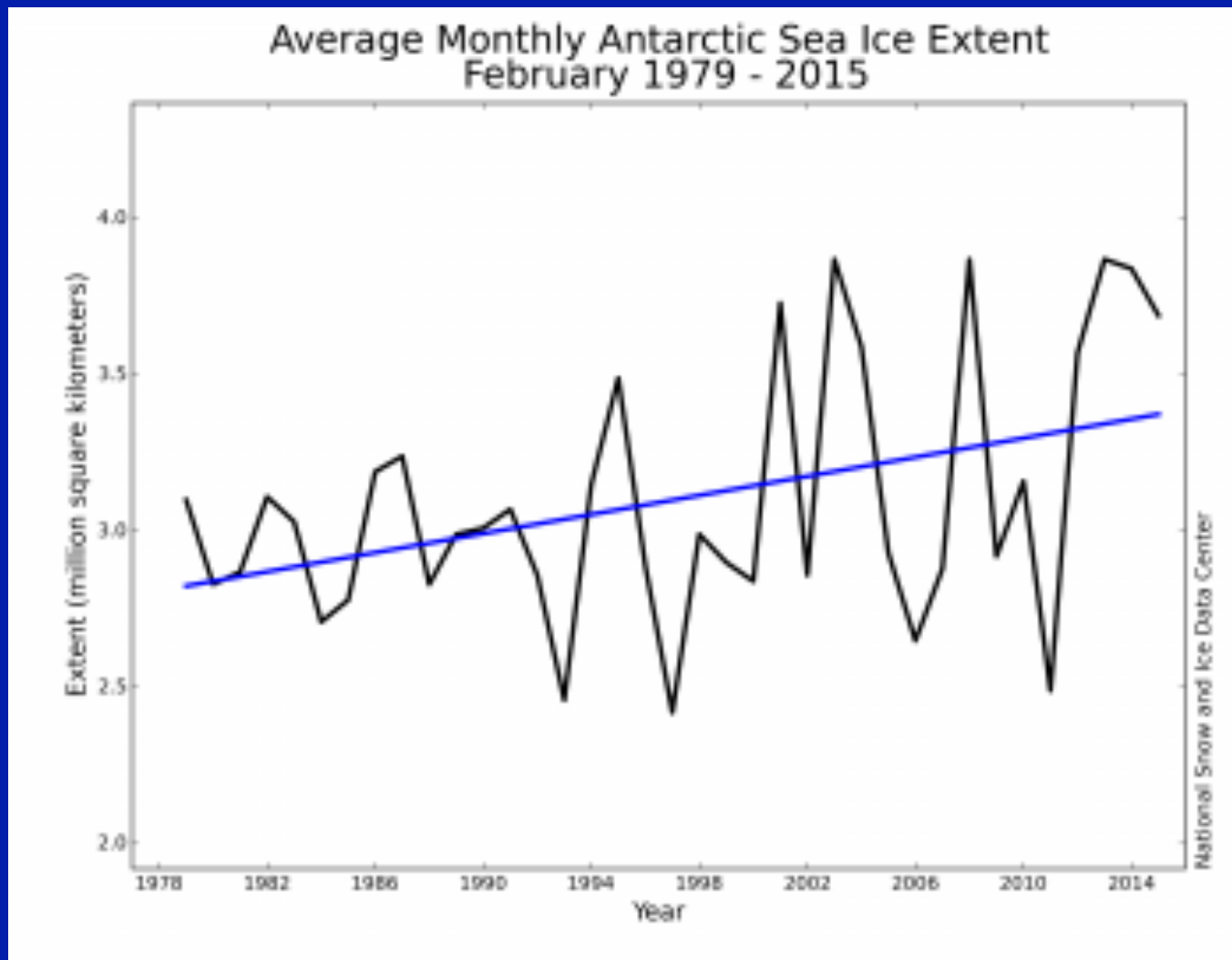
Arctic Sea Ice for Feb.



Arctic Sea Ice for March



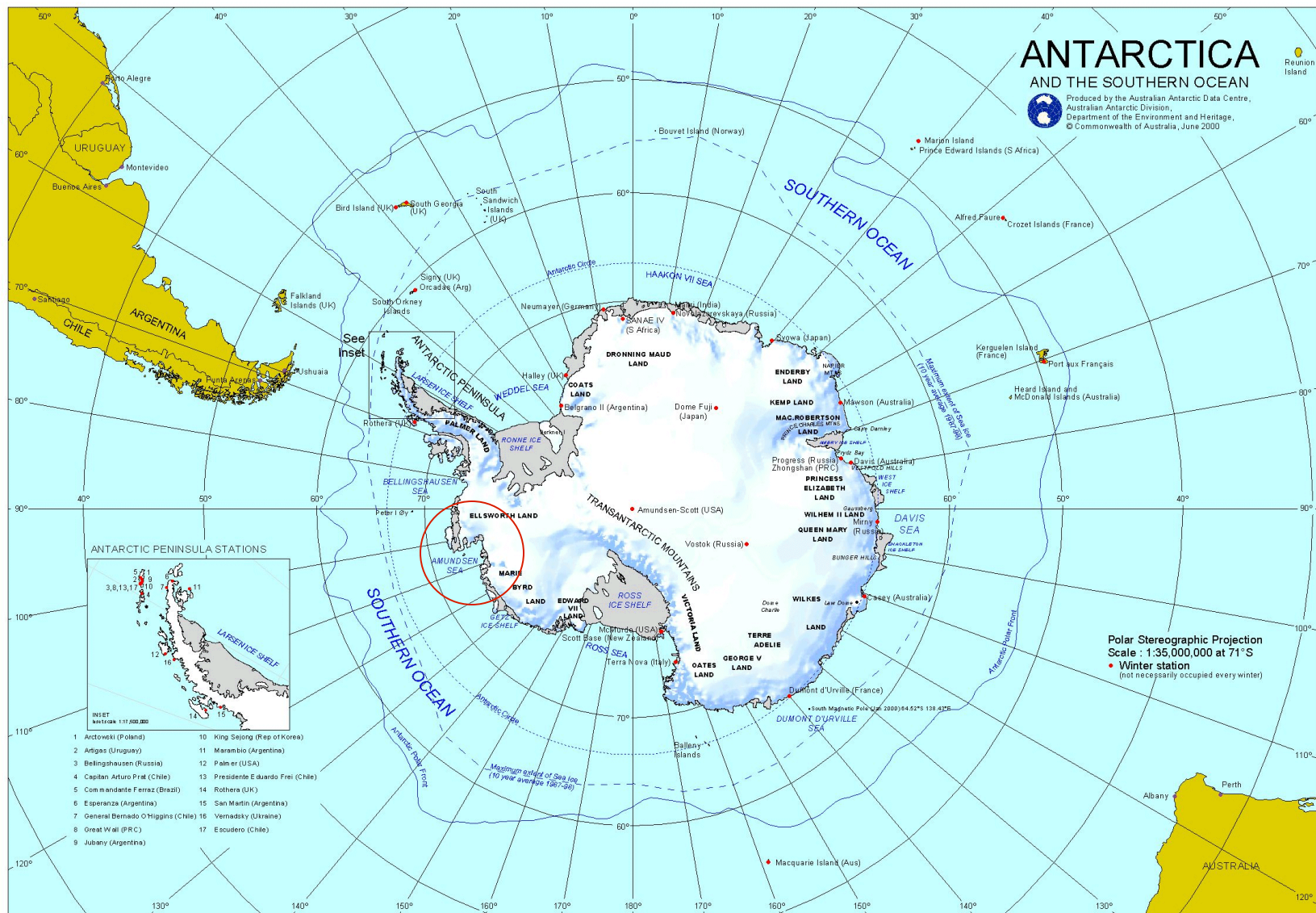
Antarctic Sea Ice for Feb.



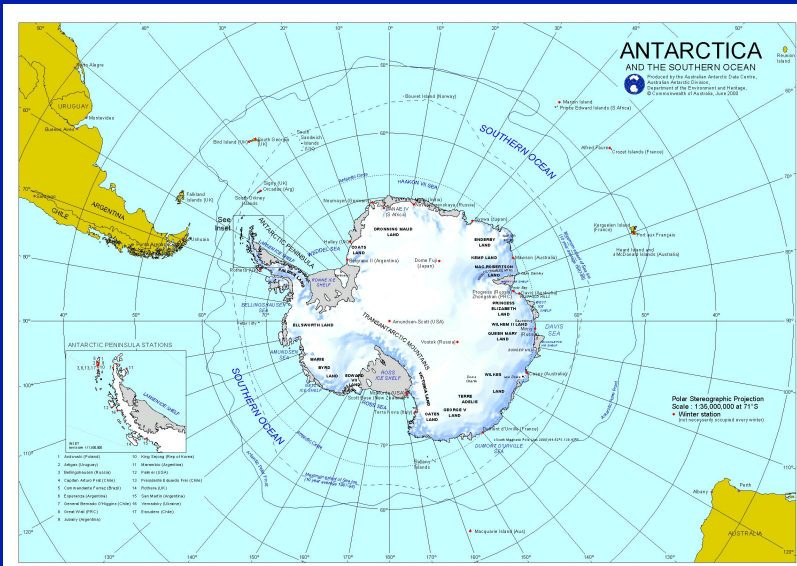
Why?

- Weather and ocean circulation patterns around Antarctica are changing
- Freshwater melt from the Antarctic continent freezes more easily than salty sea water
 - More freshwater melt, more sea ice
- Decreasing ice in the Amundsen Sea where the West Antarctic glaciers are

West Antarctic Ice Sheet

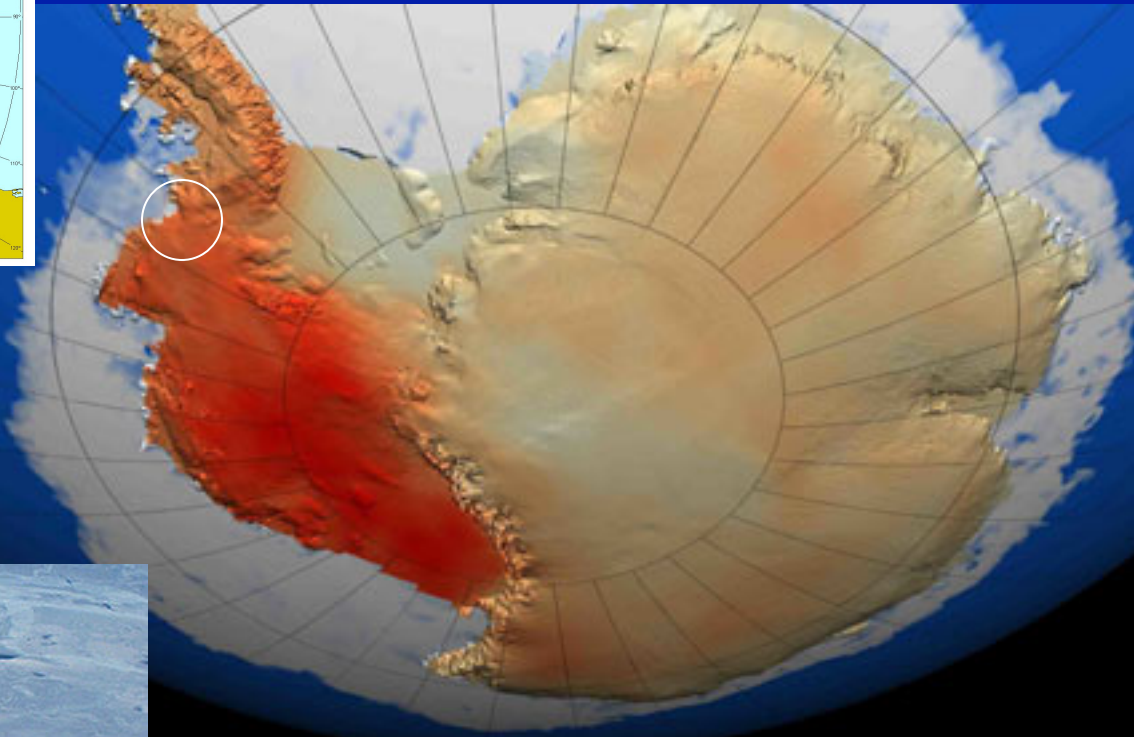


West Antarctic Ice Sheet



Grace measurements

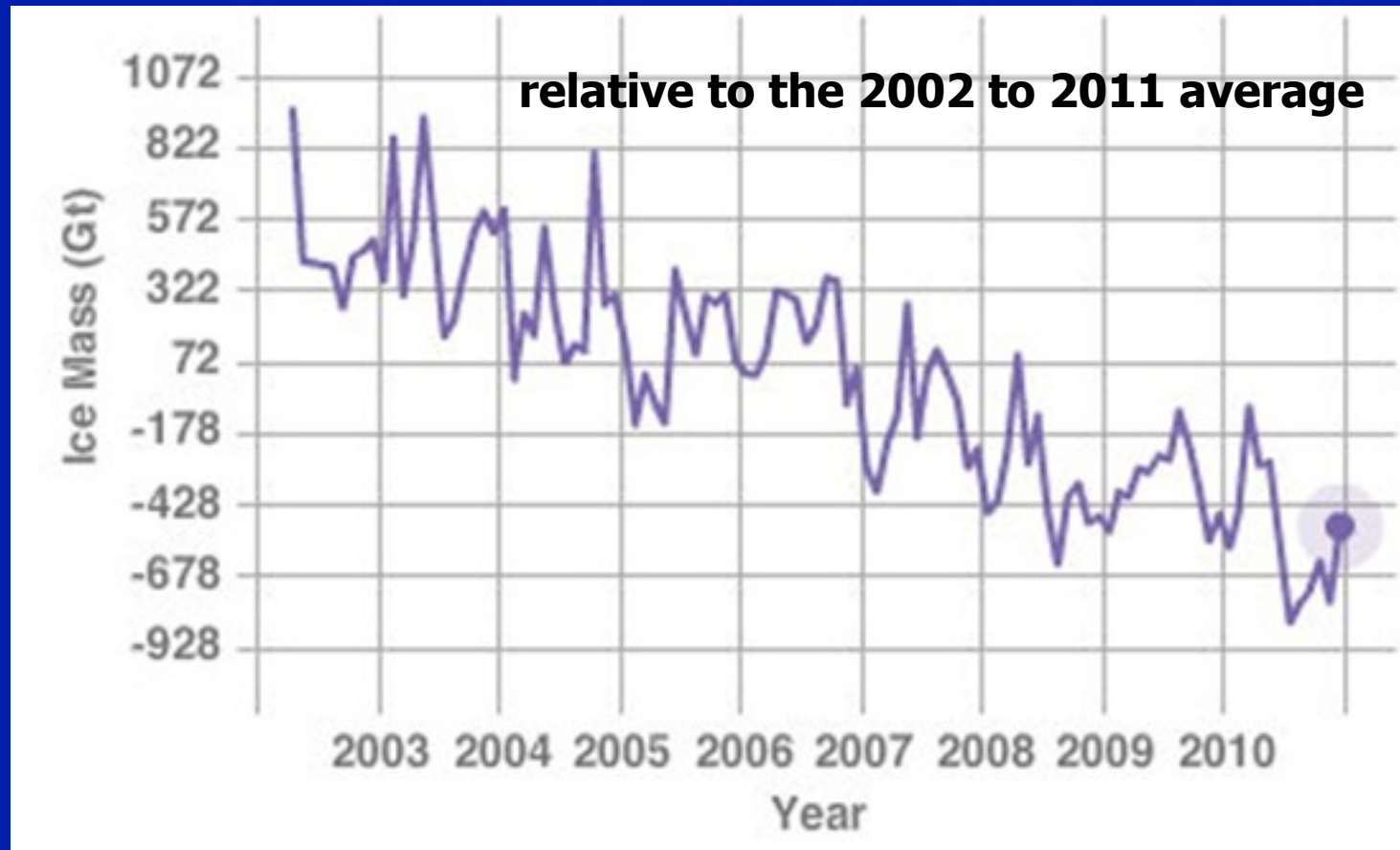
Thwaites Glacier, Amundsen Sea



Temperature change: red = $0.25^{\circ}\text{C}/\text{decade}$

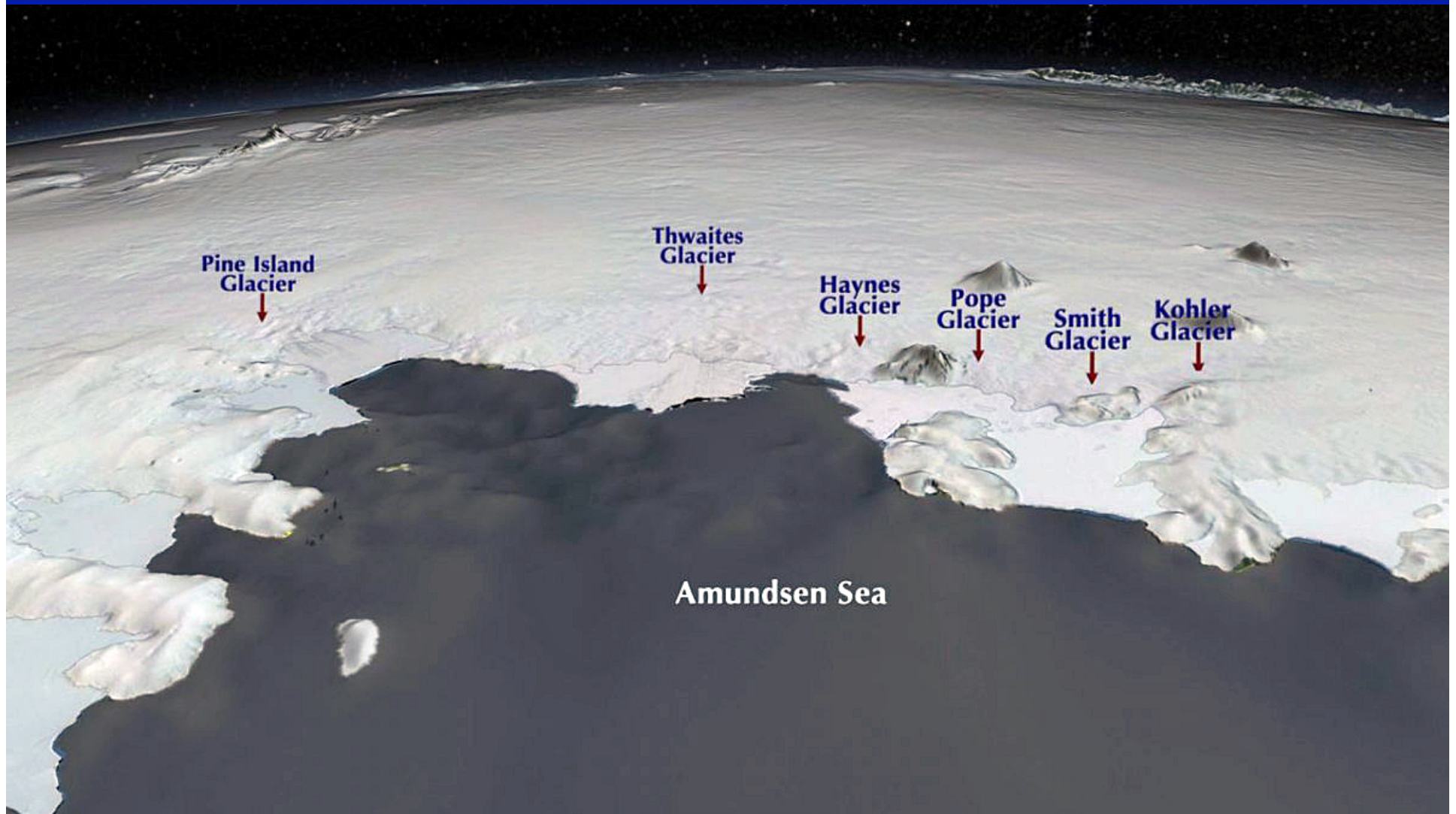
Thwaites Glacier has become ungrounded from sub-surface rock, allowing free flow of the glacier into the sea. Data only, no modeling involved!

Antarctic ice mass

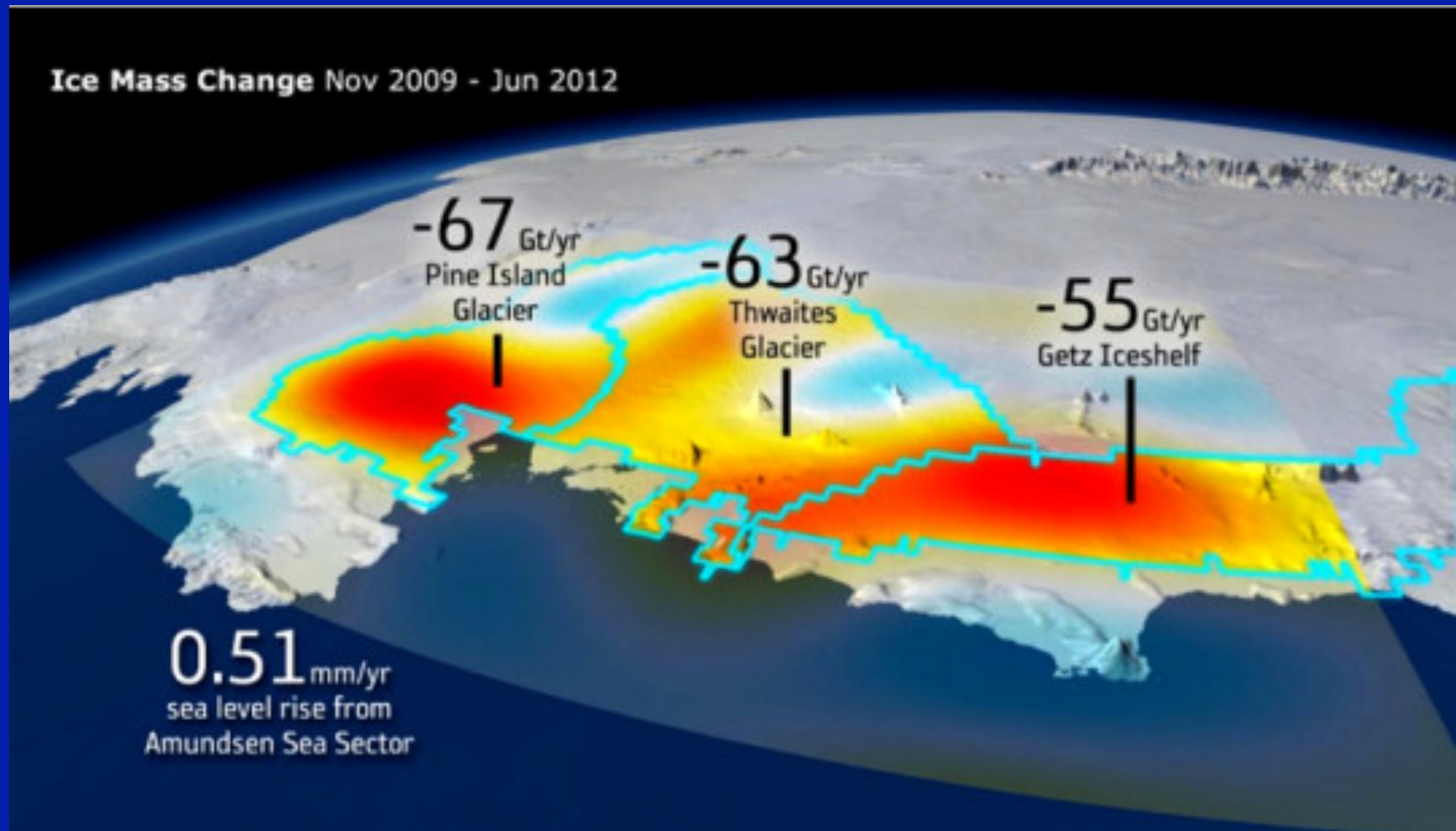


Antarctic waters are warming faster than the global average.

Amundsen Sea, West Antarctica



Antarctic contribution to sea level rise



Amundsen Sea



West Antarctic Ice Sheet

"Widespread, rapid grounding line retreat of Pine Island, Thwaites, Smith and Kohler glaciers, West Antarctica from 1992 to 2011." Rignot, Mouginot, Morlighem, Seroussi and Scheuchi, 2014, Geophysical Research Letters, **41**, 3502.

"Marine Ice Sheet Collapse Potentially Underway for the Thwaites Glacier Basin, West Antarctica", Joughin, Smith and Medley, Science, Published Online May 12, 2014.

Thwaites Glacier, Amundsen Sea Embayment

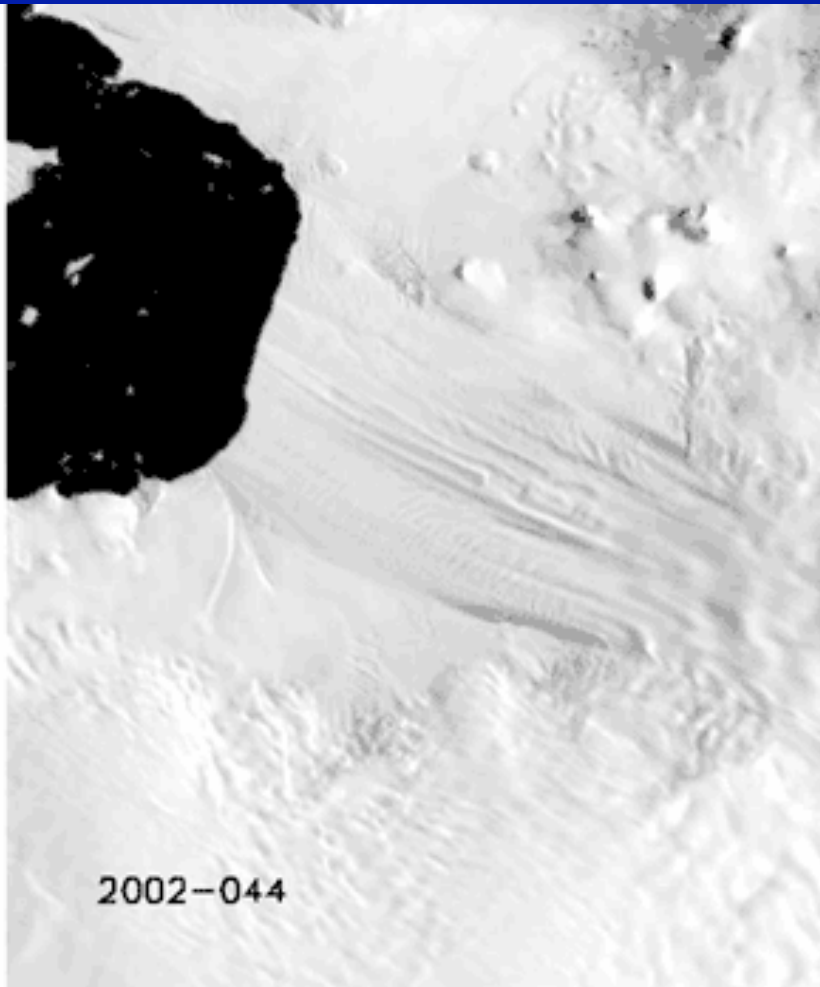


Thwaites Glacier has become ungrounded from sub-surface rock, allowing free flow of the glacier into the sea.

Estimated volume => 4 ft rise in sea level in "a couple of" centuries.

Thwaites Glacier: 2002-2014

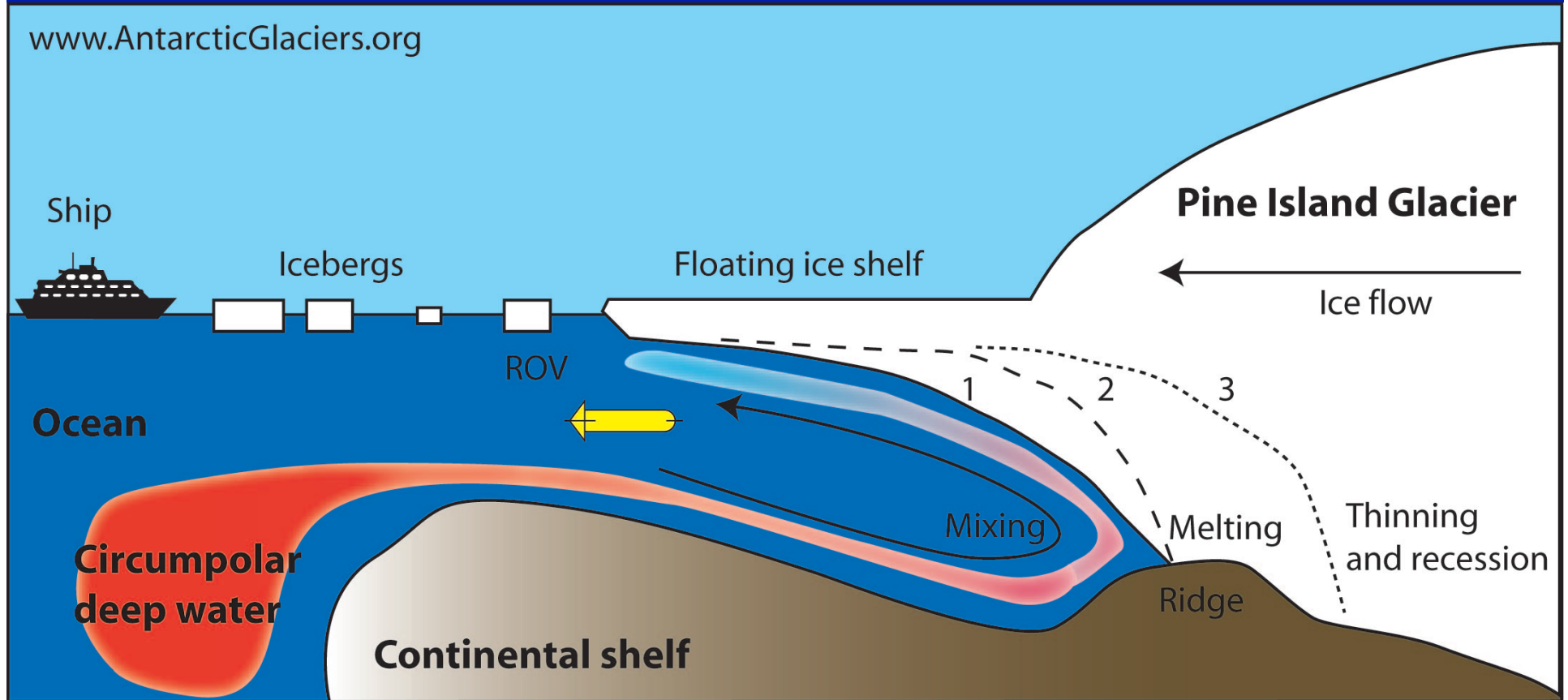
<http://www.jpl.nasa.gov/news/news.php?release=2014-147>



May 12: A new study by researchers at NASA and the University of California, Irvine, finds a rapidly melting section of the West Antarctic Ice Sheet appears to be in an irreversible state of decline, with nothing to stop the glaciers in this area from melting into the sea.

They contain enough ice to raise global sea level by 4 feet (1.2 meters) and are melting faster than most scientists had expected. Rignot said these findings will require an upward revision to current predictions of sea level rise.

Pine Island Glacier may be next



1. Early 1970s. Pine Island Glacier is grounded at a bedrock ridge.
2. Warm, inflowing Circumpolar Deep Water melts the base of the glacier. The glacier steepens and accelerates.
3. Present day, observed by a remotely operated vehicle (ROV). Glacier is thinning and receding.

Conclusion

Melting of the Greenland and Antarctic glaciers is underway and will increasingly drive sea level rise.

Ice caps are the canary in the mine for our climate. This evidence for serious effects of increasing temperature are hard to ignore.