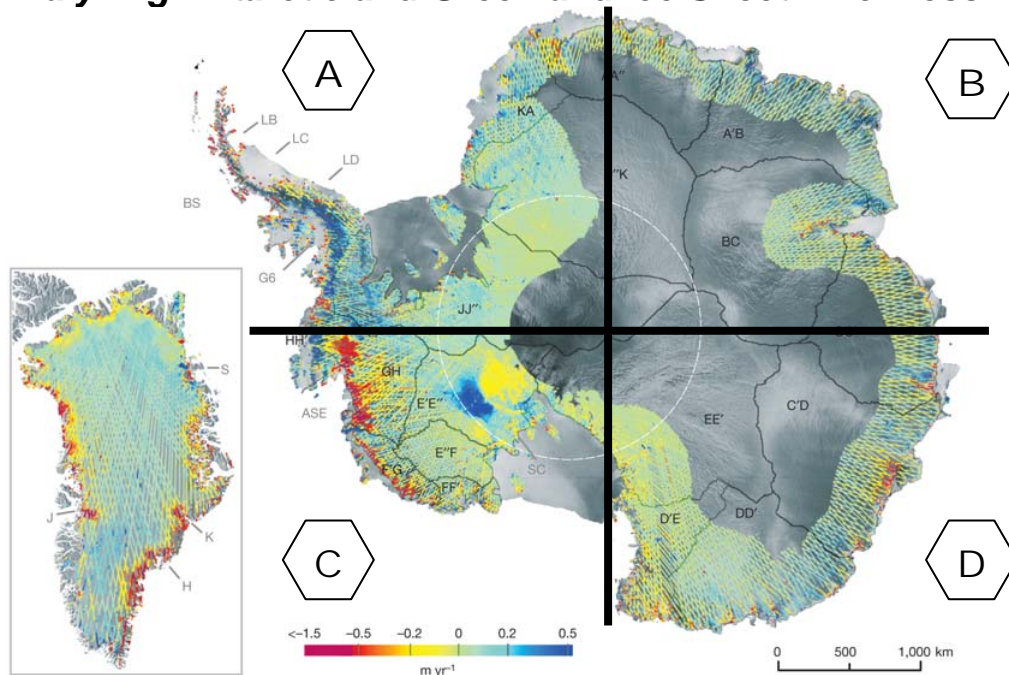


Thinking About Climate Change

Analyzing Antarctic and Greenland Ice Sheet Thickness



In the image above, the colored lines represent the change in elevation measured by the NASA Ice, Cloud, and Land Elevation Satellite (IceSAT) from 2003-2007. The satellite's instruments were able to measure changes in surface elevation as small as 1.5 cm (0.6 in) per year over the continents of Greenland and Antarctica. East Antarctic data is cropped to 2,500-m altitude (grey area). The white dashed line (at 81.5°S) is the southern limit of radar altimetry measurements. Labels are for sites and drainage sectors.

Let's look at the data from ICESat.

1. What unit is the change in elevation due to ice melt measured in? _____
2. Which colors indicate ice sheet thinning? _____
How much thinning and thickening does each color represent? _____
3. Which colors indicate ice sheet thickening? _____
How much thinning and thickening does each color represent? _____
4. On Antarctica, how is the thinning of the ice sheet distributed? _____
Can you think any reasons that it is occurring there? _____
5. On Greenland, how is the thinning of the ice sheet distributed? _____
6. Where is thickening occurring the most and what rate? _____
7. What other observations can you make from interpreting this data? _____
8. Look closely at Greenland and Antarctica, what are those straight line patterns you see or why does it look like Greenland is striped? _____

Thinking about data.

1. What are some reasons that these continental ice sheets may be thinning rapidly in some of the areas? _____

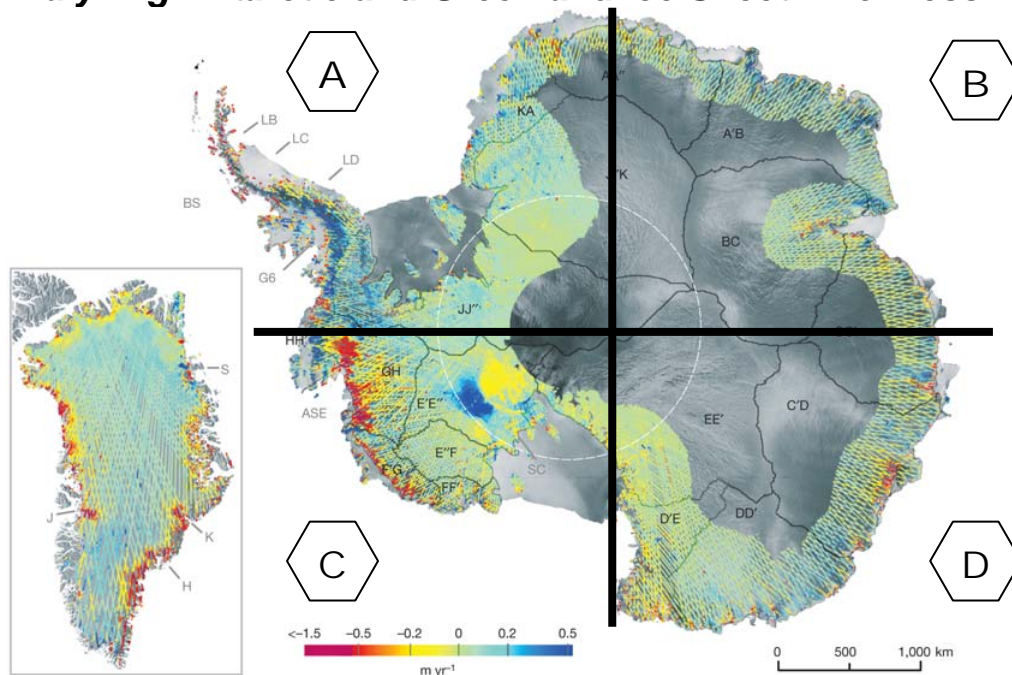
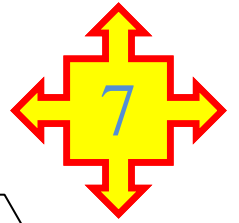
Image source: Pritchard, H. D., Arthern, R.J., Vaughan, D.G., & Edwards, L.A. (15 October 2009). Extensive dynamic thinning on the margins of the Greenland and Antarctic ice sheets. *Nature*, 461, 971-975. Accessed July 18, 2010, at <http://www.nature.com/nature/journal/v461/n7266/full/nature08471.html>.

Resources:

- British Antarctic Survey (2009, September 24). Lasers From Space Show Thinning Of Greenland And Antarctic Ice Sheets. *ScienceDaily*. Retrieved October 30, 2009, from <http://www.sciencedaily.com/releases/2009/09/090923143331.htm>
- Extreme Ice Survey website (no date). Accessed July 10, 2010, at http://www.extremeicesurvey.org/index.php/education_toc/
- James Balog's TEDGlobal 2009 Talk. Accessed July 10, 2010, at http://www.ted.com/talks/james_balog_time_lapse_proof_of_extreme_ice_loss.html?awesm=on.ted.com_2p&utm_campaign=tet&utm_medium=on.ted.com-twitter&utm_source=twitter.com&utm_content=site-basic
- Guardian.co.uk (2009). Thinning glaciers driving polar ice loss, satellite survey finds, Accessed July 10, 2010 at <http://www.guardian.co.uk/environment/2009/sep/23/glaciers-polar-ice>

Thinking About Climate Change

Analyzing Antarctic and Greenland Ice Sheet Thickness



In the image above, the colored lines represent the change in elevation measured by the NASA Ice, Cloud, and Land Elevation Satellite (IceSAT) from 2003-2007. The satellite's instruments were able to measure changes in surface elevation as small as 1.5 cm (0.6 in) per year over the continents of Greenland and Antarctica. East Antarctic data is cropped to 2,500-m altitude (grey area). The white dashed line (at 81.5°S) is the southern limit of radar altimetry measurements. Labels are for sites and drainage sectors.

Let's look at the data from ICESat.

1. What unit is the change in elevation due to ice melt measured in? **meters per year**
2. Which colors indicate ice sheet thinning? How much thinning and thickening does each color represent? **Reds and yellows indicate thinning of ice sheet thickness. Dark red = -1.5 m/year, orange = -0.5 m/year, and yellow orange = -0.2 m/year**
3. Which colors indicate ice sheet thickening? How much thinning and thickening does each color represent? **Light green indicate no change in elevation (thickness) of ice sheets. light blue = +0.2 m/year, and dark blue = +0.5 m/year.**
4. On Antarctica, how is the thinning of the ice sheet distributed? **On the Antarctica, the most serious thinning is occurring on the western shore.**
5. On Greenland, how is the thinning of the ice sheet distributed? **In Greenland, there are multiple places along both the eastern and western shores that are experiencing thinning. This thinning does not appear related to latitude.**
6. Where is thickening occurring the most and what rate? **The most thickening is occurring in Quadrant A and C on the Antarctica. The rate is ½ meter per year On Greenland, there is only one place (on the northeastern shore) that is thickening at this rate.**
7. What other observations can you make from interpreting this data? **Student answers will vary.**
8. Look closely at Greenland and Antarctica, why does it look like Greenland is striped? **These lines represent the IceSAT passes that were used to compile the data on the map.**

Thinking about data.

1. What are some reasons that these continental ice sheets may be thinning rapidly in some of the areas? **Continental ice sheet thinning is related to changing weather patterns such as precipitation patterns and warming atmospheric temperatures and accelerated melting due to interactions with the warming ocean. Warm ocean currents melt the continental glacier fronts where they meet the sea, which results in a more rapid movement of the glacier towards the sea.**

Image source: Pritchard, H. D., Arthern, R.J., Vaughan, D.G., & Edwards, L.A. (15 October 2009). Extensive dynamic thinning on the margins of the Greenland and Antarctic ice sheets. *Nature*, 461, 971-975. Accessed July 18, 2010, at <http://www.nature.com/nature/journal/v461/n7266/full/nature08471.html>.

Resources:

Louisiana Sea Grant College Program
<http://www.lamer.lsu.edu>

Thinking About Climate Change

British Antarctic Survey (2009, September 24). Lasers From Space Show Thinning Of Greenland And Antarctic Ice Sheets. *ScienceDaily*.

Retrieved October 30, 2009, from <http://www.sciencedaily.com/releases/2009/09/090923143331.htm>

Extreme Ice Survey website (no date). Accessed July 10, 2010, at http://www.extremeicesurvey.org/index.php/education_toc/

James Balog's TEDGlobal 2009 Talk. Accessed July 10, 2010, at

http://www.ted.com/talks/james_balog_time_lapse_proof_of_extreme_ice_loss.html?awesm=on.ted.com_2p&utm_campaign=t&utm_medium=on.ted.com-twitter&utm_source=twitter.com&utm_content=site-basic

Guardian.co.uk (2009). Thinning glaciers driving polar ice loss, satellite survey finds, Accessed July 10, 2010 at

<http://www.guardian.co.uk/environment/2009/sep/23/glaciers-polar-ice>