Antarctic Ice Loss: Is There Really a Problem?

A Review Of Rignot et al.

by

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Antarctic Ice Loss: Is There Really a Problem?

The *Washington Post's* front page headline for January 14 2008 screams –

Escalating Ice Loss Found in Antarctica:
Sheets Melting in an Area Once Thought to Be Unaffected by Global Warming

Michael Kaufman, a *Post* staff writer, describes new research results by Eric Rignot and colleagues that "Climatic changes appear to be destabilizing vast ice sheets of western Antarctica that had previously seemed relatively protected from global warming…raising the prospect of faster sea-level rise than current estimates."

However, Antarctica's contribution to future sea level rise is far from certain. It is much too early to tell whether the variations found by Rignot capture the real behavior of the Antarctic ice sheets, whether they are natural, or whether they indicate a substantial (or even sustainable) increase in ice-melt.

These uncertainties are highlighted in a just-published paper by Antarctic researchers Hugb Corr and David Vaughn (2008). Corr and Vaughn report that volcanic activity beneath the Antarctic ice may have increased the flow rate of some of the region's largest glaciers. While volcanism is probably not responsible for all of the ice loss found by Rignot et al., it nevertheless serves to illustrate that many different factors are at play in determining the dynamics of the cryosphere in and around Antarctica.

The ice loss suggested by Rignot is similar in magnitude to that found in other recent papers. The Rignot results, therefore, do little more than confirm that in recent years Antarctica may have lost some of its land-based ice and has contributed to sea level rise – but only at a rate of about *two-hundredths* of an inch per year, or 2 inches in 100 years. An inconsequential amount.

Furthermore, it is impossible to assess the degree to which this ice loss and consequent sea-level rise is related to anthropogenic climate change, because, as is evident for example by the findings of Corr and Vaughn, other Antarctic observations produce a highly complex and highly inconsistent picture of what is happening there.

Rignot's paper makes some understandable but nevertheless questionable assumptions.

1. Modeled mean snowfall vs. actual annual snowfall

Rignot used satellite observations to determine ice-stream velocity and ice thickness, which are combined to calculate how much land-based ice is flowing into the ocean. This run-off represents the total ice loss from Antarctica, which is much too cold for melting to be a significant source of ice loss.

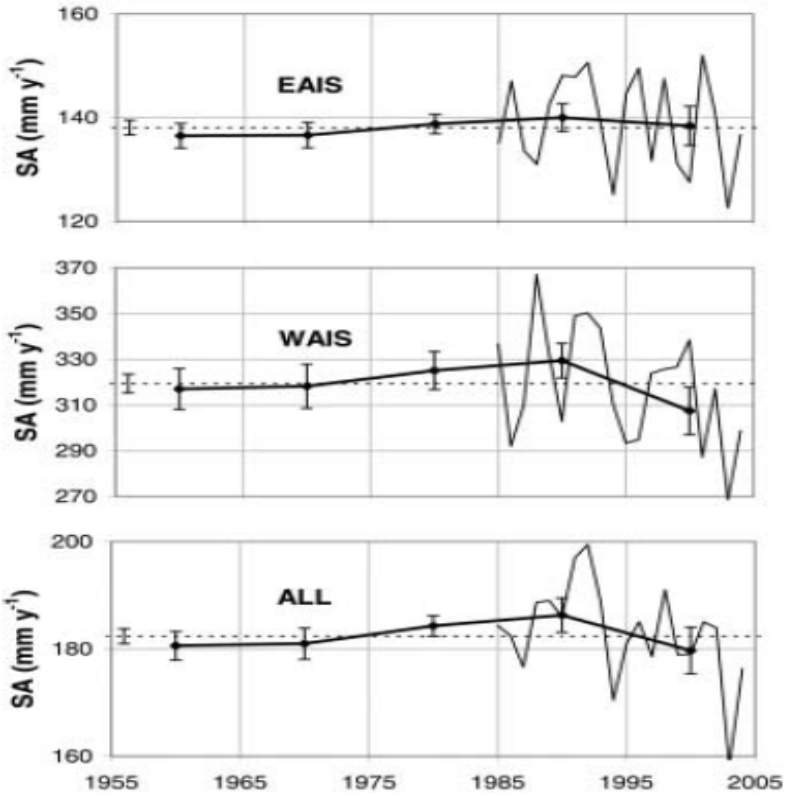
To determine ice-mass gains from snowfall the researchers used a weather model to simulate snowfall, since observations of snowfall are sparse and unreliable in high winds. The net change in ice mass is the accumulating snowfall minus the glacial outflow.

Actual snowfall over Antarctica – and hence the net change in ice mass - may not be identical to that simulated by Rignot's model. The difference may impact the relative sizes of the ice inputs and outflows over Antarctica.

Also, Rignot is not comparing like with like. He uses annual satellite data for ice runoff, but uses mean snowfall from 1980-2004. This may significantly alter the calculations of net ice change, because interannual and interdecadal variation in Antarctic snowfall is substantial.

2. Interannual and interdecadal variations in Antarctic snowfall

In 2006, Monaghan *et al.* examined the Antarctic snowfall record over Antarctic from 1955-2004 (again weather models verified by the limited available observations—mostly ice cores rather than direct snowfall observations), and found no appreciable change in Antarctic snowfall trends, despite considerable annual and decadal variation:



Upper panel: *Snowfall variations over the East Antarctic Ice Sheet (EAIS).* ***Center:*** *West Antarctic Ice Sheet (WAIS).* ***Lower:*** *All of Antarctica. Contrary to long-term climate model projections, Antarctic snowfall has not risen. In recent decades, it appears to have declined. From Monaghan et al. (2006).*

Monaghan suggests that the substantial snowfall variation may influence ice-mass balance more than is usually assumed. Certainly, since Rignot used long-term average snowfall instead of modeled annual snowfalls, he compared fixed average input against annual outflow changes—even though input changes might well have altered the results.

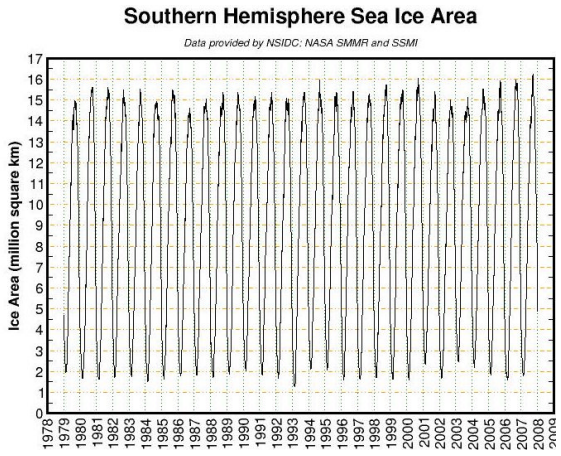
3. Warmer climate is predicted to lead to more snowfall

Almost all climate models predict that Antarctica will gain mass (and lower sea level) as the climate warms and moisture and hence snowfall increase to offset ice runoff. IPCC (2007) said: "All studies for the 21st century project that Antarctic surface-mass balance changes will contribute negatively to sea level, owing to increasing accumulation exceeding any ablation increase." (p. 816)

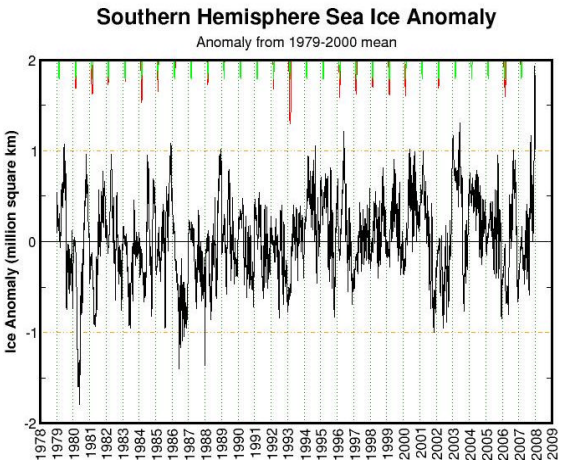
Krinner *et al*. (2007), using a general circulation climate model with high resolution over Antarctica, confirmed this finding. They found that snowfall would outstrip ice runoff in Antarctica, producing a ~0.05 in/yr decrease in global sea levels. However, as Monaghan et al. (2006) reported, this projected snowfall increase has not yet been seen. Does this represent a modeling failure? An inadequate snowfall observation network? Or not enough climate change yet to yield more snowfall? Only time will tell.

4. A Firsthand Look

Michael Kaufman closes his *Washington Post* article by noting that the head of the IPCC, Dr. Rajenda Pachauri, would visit Antarctica "to get a first-hand view of the situation." What awaits Pachauri will certainly be eye-opening.



Southern Hemisphere sea ice area, 1979-2007. In 2007 there was more sea ice than since the record began in 1979. There has also been no decline in summer sea-ice extent. From Cryosphere Today, http://arctic.atmos.uiuc.edu/cryosphere/)



Southern Hemisphere sea-ice area anomaly, 1979-2007. The Antarctic summer sea-ice area anomaly is at a record high, more than 500,000 km^2 above the previous record. From Cryosphere Today, http://arctic.atmos.uiuc.edu/cryosphere/)

The amount of sea ice around Antarctica has recently set several all-time *high* records. The greatest extent of sea ice observed since satellite observations began in 1979 was observed during the Southern Hemisphere winter of 2007 and the greatest sea ice anomaly (departure from average), occurred during the summer of 2007-08, breaking the old record by more than an additional 500,000 square kilometers. While sea ice is not the same as the land ice that Rignot was studying, it is, nevertheless, a major part of the Antarctic cryosphere. So Pachauri will witness an icier ocean surrounding Antarctica for the time of year than at any time since satellite records began.

The behavior of the Antarctic cryosphere is not well understood or explained. Sea ice extent is growing, and land ice may be shrinking. It is not known whether either of these trends will continue. Neither matches climate model projections and current changes do not well-represent the recent past. There is no firm scientific basis to predict or account for Antarctic snow and ice variability. Statements to the contrary are ill-founded.

References

Corr, H.F.J., and D.G. Vaughn, 2008. A recent volcanic eruption beneath the West Antarctic ice sheet. *Nature Geoscience*, doi:10.1038/ngeo106.

Intergovernmental Panel on Climate Change, 2007. *Fourth Assessment Report*, www.ipcc.ch.

Krinner, G., et al., 2007. Simulated Antarctic precipitation and surface mass balance at the end of the twentieth and twenty-first centuries. *Climate Dynamics*, **28**, 215-230.

Monaghan, A.J., et al., 2006. Insignificant change in Antarctic snowfall since the International Geophysical Year. *Science*, **313**, 827-831, doi:10.1126.

Rignot, E., et al., 2008. Recent Antarctica ice mass loss from radar interferometry and regional climate modeling. *Nature Geoscience*, doi:10.1038/neo102.

Pancake ice in the Bellingshausen Sea.

Photograph by: Glenn Grant

National Science Foundation
Date Taken:
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