

Review of Gardner et al., (2012) "Long-term contributions of Baffin and Bylot Island Glaciers to sea level rise: an integrated approach using airborne and satellite laser altimetry, stereoscopic imagery and satellite gravimetry." *The Cryosphere*.

General Comments

The paper is very clearly written and provides a comprehensive explanation of the methods used to calculate both long and short-term mass loss rates for the glaciers on Baffin and Bylot islands from a comprehensive suite of elevation data. The paper provides a substantial new source of observations for the Penny and Barnes ice caps and the southeastern portion of the Canadian Arctic Archipelago. It provides compelling evidence that the recent regional rates of mass loss have accelerated compared to the long-term rates. I recommend that the manuscript be accepted for publication in *The Cryosphere*.

Specific Comments

I am not very familiar with previous studies on the region. Similarly to reviewer one, I think the paper only needs some minor tweaks before it goes forward.

I have no specific comments, other than I disagree with reviewer one, and feel the GRACE analysis should be retained – it is interesting to see the agreement between the gravimetric and geometric methods, deriving about the same numbers in an independent manner.

Technical Corrections

The title to the paper is too long, and the paper covers timescales of various lengths, not just long term. It may also be worth noting the location of the study in Canada in the title to aid those unfamiliar with the locations involved.

Page 1564, Line 18.

I don't think the comparison to Patagonia is particularly useful (these are two very different climate and glacial environments), maybe a comparison to Svalbard would be more appropriate?

Page 1564, Line 25.

I think it might be worth using the figures for Baffin and Bylot for 2006-2009 instead of the whole archipelago here (24 ± 7 Gt/yr, based on Gardner et al., 2011)

Page 1566, Lines 1-4.

Should cite Andrews et al., (2002).

Page 1568, Line 12.

Data are plural.

Page 1568, Line 17.

From

Page 1568, Line 21.

Elevation data on a map with mixed inputs from optical stereo photogrammetry and radar interferometry can be problematic due to biases in the radar data. Please report the area filled in using the interferometry

Page 1569, Line 27.

The date range involved is not particularly late summer. Maybe adding the dates to the actual acquisitions on the previous lines would be better.

Page 1573, Line 3.

Differencing.

Page 1573, Line 9.

Please explore the effect of curvature as well as spatial-, slope- and elevation-biases. See Gardelle et al, 2012. *Journal of Glaciology*. 58 (208), 419-422.

Page 1573, Line 11.

..corrected for. These biases can result from...

Page 1575.

I agree with the comment by reviewer one. Are the medians and means for each bin similar? Please more clearly define “Regional” on line 11, too. Were the “regional rates of volume change” completed on an ice cap by ice cap, or glacier complex basis?

Page 1576, Line 3.

“GRACE” could be defined earlier in the paper.

Page 1578, line 13.

Just a question - is 5% appropriate? – What are area differences between early data and more up to date imagery?

Page 1579, line 11.

I agree with reviewer one that 925 kg m^{-3} for ice density is problematic

Page 1580, line 7.

I agree with reviewer one, for all areas combined the uncertainty should be summed.

Page 1581, line 16.

Repeats line 13 to some extent (very small trend, trend is small)

Page 1584, line 22.

Remaining

Page 1585, line 1-5

Kind of a big deal can you do any better at attribution?

Page 1585, line 14.

A significant difference in the GRACE estimates (30%!) needs more fully explained, especially when their rate is from only one less year of data. Also their rate has a ± 5 Gt/yr uncertainty on it.

Page 1586, line 5.

What height does the 700 mb equate to, approximately?

Page 1588, line 10 onwards.

These are not great sentences to end on. They were almost an aside in the manuscript and their effects were not fully explained (what are the large errors due to geoid transformation errors, for example?).

Table 1.

Month of year in the date might become useful for shorter timescale.

Figure 3.

Unfortunately in your color scheme, the lakes are gaining elevation and the ocean is neutral.

Figure 4.

Move the Navy Board Inlet label from behind the legend.

There is a hint of thickening at higher elevation, but it is very hard to see due to all the data gaps. If you can make no-data a shade of grey, does your image still work? The elevation gain at the front of D78 is not obvious due to the colour of the adjacent lake.