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Interactive comment on "Time-evolving mass loss of the Greenland ice sheet from satellite altimetry" *by* R. T. W. L. Hurkmans et al.

Anonymous Referee #1

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The paper use radar and laser altimetry data between 1995 and 2009 to reconstruct the evolving ice volume changes. This could be very useful in the future with the inclusion of CryoSat II data. Overall the ice-sheet-wide mass loss presented here agrees well with estimates in the literature. However, when considering drainage areas, there seems to be some minor disagreements. In general, the paper is well-written and well organized. However, I have minor comments before publication.

p. 1058, line 4: Please state that the "ice-sheet-wide" mass loss from GRACE agrees well with the IOM method. GRACE cannot deliver mass loss of individual glaciers.

p. 1059, line 6-7: This paper was submitted before Khan et al. (2014), which actually do provide shorter term mass loss estimates from altimetry (3 year interval). Please include Khan et al (2014), also in table 3. Khan et al (2014) provides mass loss estimates

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for 2003-2006, 2006-2009.

p. 1064, line 5-10: Jakobshavn Isbræ (also other glaciers) has velocities of more than 10 km/yr. Have you removed the points near the glacier front in figure 2a? If so, please state it in the text.

p. 1068, line 13-20: Figure 4 show trends for 2003-2009. Please show trends for 1995-2001. Figure 4b shows dH/dt caused by firn compaction. What is the total rate in km3/yr for the GrIS? List the rate in the test, as it will make it easier to compare with other studies.

p. 1069, line 8: I assume the elastic uplift of bedrock has been taken into account in the final mass loss estimate? If so, please mention it in the text. GIA is small, less than 2 Gt/yr and can be ignored (ice5g).

p. 1073, line 24: I do not like that you state that mass loss peaked around 2006. This is true only if you ignore 2010-2014 data. As many GRACE studies have shown, 2010 and 2012 were extreme years with huge melt and mass loss.

p. 1074, line 10-13: I am not sure whether delay can explain discrepancy for Jakobshavn (see figure 8) between this study and Howat et al. (2011). However, it should be mentioned that independent GPS measurements of crustal uplift (Khan et al., 2010) support a mass loss rate of $\sim$20 Gt/yr during 2006-2009 (as suggested by this study) rather than >30 Gt/yr (as suggested by Howat et al., 2011).

p. 1074, line 17: What are the main differences between RACMO and RACMO2?

Figure 8. There is something wrong with the way you compare mass loss from this study with mass loss from Howat et al. (2011). According to your figure 8, Helheim, Kanger and Jakobshavn were in mass balance in 2000 (dM/dt=0). This is very unlikely. I suggest you remove the first point from the time series. Simply start from 2001.

References:

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8, C706–C708, 2014

Khan, S. A., L. Liu, J. Wahr, I. Howat, I. Joughin, T. van Dam, and K. Fleming, GPS measurements of crustal uplift near Jakobshavn Isbræ due to glacial ice mass loss, J. Geophys. Res., 115, B09405, doi:10.1029/2010JB007490, 2010.

Khan, Shfaqat Abbas, Kurt Kjaer , Michael Bevis , Jonathan Bamber , Kristian Kjeldsen , Anders Bjørk, Niels Korsgaard , John Wahr , Leigh Stearns , Michiel van den Broeke, Lin Liu, Nicolaj Larsen, Ioana Muresan, Sustained mass loss of the Northeast Greenland ice sheet triggered by regional warming, Nature Climate Change, 4, 292-299, doi: 10.1038/NCLIMATE2161, 2014.

Interactive comment on The Cryosphere Discuss., 8, 1057, 2014.