

Interactive comment on “Area, volume and mass changes of southeast Vatnajökull ice cap, Iceland, from the Little Ice Age maximum in the late 19th century to 2010” by Hannes Áróttir et al.

Anonymous Referee #1

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Hannesdóttir et al. investigate area, volume and mass changes of southeast Vatnajökull since the LIA. The article's strength is a well-described and thorough reconstruction of glacier changes which is a useful contribution to scientific literature. There are some methodological details I would suggest to reconsider and I have some suggestions for restructuring the article. Most of that comes in the detailed comments, however, I find 3.2. and 4.1. could be combined to one and checked for redundancy.

The part where the results are related to climate change could use some refinement.

In my opinion, the discussion on the scaling laws does not add very much to the paper and I think it could be omitted without big loss of substance as the main outcome is

C2097

that there is no trend in scaling parameters but also that the sample size is too small and probably also biased in terms of size distribution.

In general, the paper is quite long and could be shortened at several locations, especially in 6. Some of them I indicate as a suggestion below.

Specific comments

p4682

L12 by 164 km²...from XX to XX km²

L14: suggest to put the numbers in meter

L17: most negative compared to what? Very different lengths of time periods are looked at so it is a bit arbitrary

p4683

L11: every place on earth is ...influenced by changes in the atmospheric circulation... specify

L13: mean monthly T?

L19: the '1' in the units should be removed

L20: reads strange after the semicolon. Not a full sentence

L21: is that also true for snow melt water? To be sure, suggest 'glacial meltwater input'

p4484

L1: repetition to L20 on previous page

L4: ...'at their deepest' as this is not true for all areas at the terminus

L13: ELA from Modis images is in principle wrong. Snow line is OK, equilibrium line is also acceptable, ELA is the point where the balance profile crosses 0 and therefore

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not to be acquired from Modis.

L21: The hypsometry comes much later in the paper but actually it could be good if Fig 13 appears already there.

L21-end of paragraph: very descriptive. Consider omitting this as all this is visible in the map.

P4685

L9: I agree with that until the glaciers are small enough not to touch the lakes anymore. It is therefore only partly coupled to climate. Suggest reformulating

L12: numbers of significant digits?

P4686

L10: make location of AWS more prominent in fig 1.

L20: How have the 10 yr periods been defined? Is that running average? Explain

L21: and why now 1884-1890?

L26: why undercatch only at one of the stations?

P4687

L1-3: not entirely logical there, reformulate or specify.

L18: define where you have the knowledge from that iLIA maximum was at around 1890 at some point

L22: how has the accuracy been determined? It sounds quite optimistic to me for a reconstruction taking problems as trimline erosion etc into account.

P4688

L3: remove 'a'

C2099

L15: explanation for abbreviation right after AMS

L19: is it then valid to use them for the calculation of geodetic MB?

p4689

L25: have been...

p4690

L3 and entire chapter: so i understand: the shape is assumed to be the same but some vertical displacement is subtracted from the LIDAR DEM. Where do you take this from? I assume this is the next paragraph that explains that. However, it remains unclear how these 'upper reaches of the accumulation area' are defined. I consider this an important point to clarify. And in this view, are the accuracies you determine for the individual DEMs realistic? How about other problems in photogrammetry like oversaturation?

L11-13: unclear, specify 'available data points'

L17: how about an abbreviation for the Glaciology Group... that appears several times.

L28: not in the most recent DEMS... but in previous ones? Clarify.

P4691

L23: bedrock or rock?

General with all the accuracies given: would it be a good idea to include a table specifying them to shorten the text?

P4692

L13: not clear what mosaiced means in this context. Resampled? Which cell size?

L19: what is ehf? Is that part of the name? L21 and paragraph: so DGPS data from 2000-2003 has been used to derive 2002? and then a seasonal adjustment? And then you get to 1-2m accuracy? How is that estimated?

C2100

P4693

L5: suggest mass balance profile

chapter 4.3- additional to the points i raised before: the average and std depends on the density of points digitized. Comment on that. And how was the end of summer image defined? I guess the latest with clear sky. But how close is that really to the end of the ablation season? And what do you use it for in the end? The snow-line/ELA part does not appear to me to be crucial in the discussion.

P4694: isnt 5.2. the principle result and should be mentioned before 5.1?

p4695

L11-13: here it is relevant how far the images are apart. Suggest table with image acquisition dates.

L18: I dont understand how the 164 km² result. I assume this is for the total numbers, i.e. Öraefaj and Eastern (Tab. 2). but I get down to another number.

I suggest also in Tab 2 and Tab3 to put the percentage changes in brackets for the overall numbers and not only for the individual glaciers.

L24: would DEM differencing be a way to go to detect debris covered ice from rocks? For your multi-temporal GI with high-quality DEMs this could be a way to go?

P4696

L4: single year data point??

Fig. 9 could be saved if an overall bar would be added to fig 10 I would say.

L22: 'southern outlets' if that is correct?

L26: very confusing sentence I find...

p4697

C2101

L7: add here that there definitely were some yeras with positive b. It is just with the intervals you are looking at that they are negative.

p4698

Chapter 5.5: the classification is of limited use. I suggest removing that. The few points where you argue in the discussion with them you can just name the particularities of the class. If it should be kept, I suggest to move it to the method section.

L17-22: how does that relate to other areas in the world? The fluctuations seem to be slightly ahead of for example alpine data.

P4699:

L11: here for example the authors should be clear and always have to add that this is compared to the periods they are investigating

L14: add which period you are referring to for this comparison

Generally in this discussion it would be nice to add the existing measured glaciological mb time series. For example superimposed in fig 12?

p4700:

L1: the ice volume...

L1-3: ?? equals? What equals what? Give numbers! The mb numbers that follow in L4 are not equal and if it is volume loss that equals it is not that relevant for different sizes. But maybe i misunderstand

L7: very easily misleading: i assume you mean 25% in terms of mass balance. But the total mass loss will be very different. Reformulate and in this context i would stick to absolute numbers

L9-17: write more concise.

L19-21: this has to be changed. In my opinion you cant compare 'after 2000' with the

C2102

'mid-90s'. Be clearer about the periods and choose ones that are beyond the natural variability. Whatever is meant by mid-90s but a few years should not be used for such a conclusion.

L22: what would this LIA ELA mean in terms of AAR? Is that a common way to determine the ELA for the LIA? I am rather used to the AAR assuming a steady state but maybe that is just as good.

L27: 'spatial variability

p4701-p4702, L9: I think this part could be very much condensed. Basically you conclude that hypsometry is the governing factor for the variability in changes and not different climate.

L15, very long sentence, cut in 2

P4703: 'deflation' very unusual in this context to me.

P4704:

L29 delete 'not'

p4705:

L15: -1.34m

L16: put overall relative area and volume change numbers and compare to for example the Alps.

P4716

L13: range of the averages of all years? I dont understand that. The ela is from Modis derived, right? Which years?

P4717: add % for total values. Caption very long: remove for instance the sentence with the ice divides.

C2103

Fig8: could maybe be omitted? It is not referred to substantially.

Fig13: is the AAR related to LIA max?

Interactive comment on The Cryosphere Discuss., 8, 4681, 2014.

C2104