

Interactive comment on “Assessing spatio-temporal variability and trends (2000–2013) of modelled and measured Greenland ice sheet albedo” by P. M. Alexander et al.

Anonymous Referee #2

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This paper is an important contribution to understanding mass loss from the Greenland ice sheet as albedo is one of the central variables in this process. In this paper, several different products of Greenland ice sheet albedo are compared, including satellite, regional climate model and in situ data. The insights provided in this paper are highly valuable as many scientists use these datasets and models. The methods and data interpretations are sound. Most of my comments are about presentation of the material and organizing the manuscript.

Major comments 1. Follow the Introduction-Methods-Results-Discussion manuscript structure, which many readers expect of this kind of paper by making the following corrections: a. Add new sections to the methods section that describe your comparison

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methodology and analysis of trends. For example, describe the method you used to calculate trends (linear regression or non-parametric methods?). b. Several new analyses and their methods are introduced in the discussion section. Consider moving the presentation of analysis shown in Figure 12 - 14 to the result section, and explain the methodology of these two analyses in the methods section. 2. Paper can be rewritten to be more concise. For example, figure caption text sometimes appears in several figures or both in the caption and the text. It may be sufficient to only write it once. Furthermore, you do not have to explain what the figure shows in the text (e.g. sentences starting with “In Fig. X, we show” since this is made clear in the figure caption. I have pointed out some but not all occurrences below. 3. Could the correlation in Figure 7 be close to zero in the accumulation zone because the standard deviation is close to zero? If the data has no variation, no correlation is expected. If so, the correlation analysis is not suitable to describe the similarity between the datasets in this region.

Minor comments

P3734. L26: Consider rewriting this sentence. There is not ‘direct’ relationship between temperature and melt. It is the surface energy balance that drivers surface melting.

P3736. L1-4. Be more specific about what products you are using in your comparison and provide more insights to your methods to give a roadmap of the paper here. State the number and exact MODIS products used, as well as the two AWS datasets, also clarify that you are using MAR 2.0 and 3.2 as RCM. Mention that you have regridded data and calculated averages over the same time interval to make intercomparison possible. Here you can also state the study period and what part of the ice sheet you are considering. Finally, explain that you are investigating potential errors due to differences in albedo spectral range, MAR albedo scheme etc etc. You can remove lines 5-8 since it follows the standard structure for a science paper.

P3736. L4. The reference to Fettweis does not seem necessary unless you explain

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why he used MAR 2.0 over 3.2 in his 2013 papers.

P3736. L18. Rewrite. You are using both MAR 3.2 and 2.0 in this paper.

P3737. L10. Remove "some". Presumably, "all" ice edge stations with less than 100% MAR ice covered where analyzed this way. If not, you need to list which stations you applied this method too and explain why only 'some' ice edge station were analyzed this way.

P3737. L25. Repetitive

P3738. L7. Consider substituting "bands" with "ranges".

P3744. L1-8: This belongs in the method section. You can be more assertive, there is little doubt that surface albedo in JJA is most important for SMB.

P3744. L8-10: Consider remove sentences like this to make article more concise. This information is given in the figure and table captions. I propose you go straight to your results and refer to figures in parenthesis.

P3744. L 13: Add a reference to Figure 2 at the end of this sentence.

P3744. L20: Instead of "compared to Fig 3a" spell out what product differences are shown in Fig 3a.

P3744. L 20: I disagree with your interpretation of Figure 3. It is difficult to see if the spatial variability in 3a is less than in 3b and 3c. While 3a does not have the strong positive anomalies in Fig 3b and 3c, it appears to have the strongest negative anomalies.

P3745. L18-24. Consider removing to make paper more concise. This is "methods" and I believe it is already explained there.

P3746. L6-7. This sentence is also in the figure text. It only needs to appear once.

P3746. L23-25. Rewrite. Replace standard deviation with spatial variability. The figure

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"indicate" something about spatial variability.

P3747. L15. Specify what kind of correlation (e.g. Pearson or Spearman). Spearman correlation may be warranted given that the data does not have a normal distribution.

P3747. L18. Be careful how you refer to R² throughout the paper. R² is the coefficient of determination, while R is the correlation coefficient.

P3748. L13-17: Move to methods. Make a new section to explain your methodology to analyze trends.

P3749. L7-8. This sentence is unnecessary. It is clear from the figure captions.

P3756. L4-5. Clarify if this is a recommendation or something that will be implemented.

P3757. L1-2. Why not show this analysis in this paper? Rewrite, remove or add the analysis.

Table 2 and 3 captions: Consider removing "Summary of" or use "Summary statistics"

Figure 1: Clarify that the black stippled line in the inset represents elevation contours (not ELA as in the larger figure)

Figure 3: Explain what the 'hatched' areas represent

Figure 4: Graph can be improved so that different data can be distinguished more clearly. For example, give each line a unique color and show poor quality by using spilled lines instead of symbols. Consider removing the good or all quality data from this figure since it is not discussed in the text and it clutters the figure.

Figure 5: Figure 4b and 5 are extremely similar. Consider removing Figure 4b from the manuscript

Figure 7: Rewrite. R² is the coefficient of determination, and R is the correlation coefficient.

Figure 10: Correct "95% level" to "95% confidence level"

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Figure 11: Here the y axis labels denotes unitless with “(-)”. This is different from how albedo was presented in previous figures (the unitless only mentioned in the caption). Either way is fine, however, be consistent throughout the paper. Consider using the same axis interval for all the graphs to make it easier to compare the trends between the three plots.

Figure 13: Shouldn't the density distributions for MAR 2.0 in panel a and c be the same? The same goes for MAR 3.2 in panels b and d.

Figure 14. Consider adding a sentence that explain that the average SMB is negative, which means that a positive bias is “less” negative and results in “less” mass loss.

Interactive comment on The Cryosphere Discuss., 8, 3733, 2014.