

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 #1

Received and published: 13 August 2014

The following is a review of “Assessing spatio-temporal variability and trends (2000–2013) of modelled and measured Greenland ice sheet albedo” By P. M. Alexander, M. Tedesco, X. Fettweis, R. S. W. van de Wal, C. J. P. P. Smeets, and M. R. van den Broeke.

This manuscript is a brief communication, investigating how modeled albedo compares with satellite-based and in situ observations. The authors focus on comparison between the spatial and temporal variability of albedo on the Greenland Ice Sheet surface during the summertime. The modeled albedo is a product of the latest version of the MAR Regional Climate Model (v3.2). For comparison, the authors include results from a previous model version, which implements a different albedo scheme (v2.0). The

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study finds agreement amongst all products that low-elevation albedo has decreased over the last decade. They also find that, in this area, MAR exhibits a positive bias. In the accumulation area, they find that two different MODIS products show a decrease in surface albedo. However, this trend is neither reproduced in the model nor present in the in situ observations, suggesting that MODIS instrument degradation may play an increasingly significant role in these types of analyses.

As the authors point out, this is the first time an assessment of this kind has been presented with respect to surface albedo over Greenland Ice Sheet. The analysis presented here is thorough and well thought-out. Clearly, a good deal of work was put into trying to put model results on equal footing with different types of observations, so that they could be compared in this manner. Results are kindly presented in a variety of ways, in order to highlight product differences and to aid in the discussion. In addition, this study advances the scientific community's understanding of the biases that exists in regional climate models and at the same time, brings to light those that may be present in remote sensing products. Therefore, I recommend this paper for publication in *The Cryosphere*.

A few general comments for the authors' consideration:

- Title: The title is awkward, especially with placement of the years. Perhaps placing the years at the end might help with this? ('Assessing spatio-temporal variability and trends of modeled and measured Greenland ice Sheet albedo (2000-2013)'?)
- Abstract: An additional final sentence about the significance of these results or repercussions they would have on the community would make the abstract stronger. Also, it is not necessary to define ablation and accumulation in the abstract.
- A number of times, model results are referred to as 'data'. Please refrain from this terminology when discussing ECMWF and MAR output fields.
- Consider using the terms accumulation and ablation 'area' instead of zone, since you

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are usually assessing the entire area as a whole.

- You also may want to consider introducing results of the MAR3.2 and MAR2.0 comparisons earlier in the paper. If this was done in the results, it could make for a clearer and more direct discussion in section 4.2.3.

- Some simple titles, or indicators on the figures would be helpful for fast reference. It would save the reader from having to constantly refer to the captions for a reminder of what is being compared.

- I found myself getting confused about the values of min and max dry snow and bare ice albedo values for the different models. A simple table of these values would be very helpful for reference, and maybe make the albedo ranges clearer to the reader. Then you would not have to always insert the values into the text. (For example, 'maximum bare ice albedo' is equal to .55, but bare ice albedo can range up to 0.6 – section 4.2.3).

Below, I offer some more specific comments/suggestions:

Page 3735, line 23-29: Please consider rephrasing. This sentence is awkward.

Page 3736, line 23: Reference for ERA? (Uppala, 2005)

Page 3737, line 23: The use of 'vice versa' here is not clear.

Section 2.3: It would be nice to specify that MODIS is available 2000-2013, since you state the years in the MAR and the in situ sections.

Page 3746, line 1: Please be more specific that the term 'close to'.

Page 3748, line 2: Typo, 'products'

Page 3751, line 1: Reference for snow metamorphism?

Page 3751, line 11: This statement suggests that these papers showed that albedo trends are driven by atmospheric circulation changes. It is my understanding they con-

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nect the melt to circulation change (but not actually the albedo trends to the circulation).
Please review this sentence for clarity.

Page 3759, line 11: Perhaps 'confirm' instead of 'prove'?

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

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8, C1521–C1524, 2014

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