The Cryosphere
Discussions

Interactive comment on "Sensitivity of Greenland Ice Sheet surface mass balance to surface albedo parameterization: a study with a regional climate model" *by* J. H. van Angelen et al.

J. Box

jbox.greenland@gmail.com

Received and published: 2 June 2012

Overview

The paper presents a RACMO upgrade that is important to more accurately represent the melt process. The study gives some insight into surface mass balance sensitivity to albedo.

Major Critique

The choice of the 16-day MODIS MOD43 albedo product over the daily MOD10 product is questionable. Had the study chosen the daily product, more robust RACMO2

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

performance statistics would be calculable from e.g. Figs. 5 and 6. I find no rationale given for the choice of coarser temporal resolution data.

Why is the larger melt season in 2010 not assessed in this study? With even lower albedo in 2010 than 2007, is the background albedo is low enough everywhere?

The study should develop insight into the causes and implications of the identified systematic equilibrium line altitude bias.

The conclusions section needs improving. It should not spending valuable space speculating about future work. The earlier discussion section should point to future work.

Comments

Black carbon is not the only important solar absorber. Some combination of multiple sources of impurities including terrestrial dust and microbiological components should be mentioned. The authors should discuss this complexity.

Does the background ice albedo evolve AFTER being defined once using observations?

pg. 1533

4,5: It is not clear from the literature if over a snow and ice surface that cloud cover is a dominant control on incident solar radiation and in turn absorbed solar radiation. Under cloudy skies, an increase in multiple scattering can render the cloud radiative effect small. Further, an increase in UV downward occurs under cloudy skies. The authors should discuss this complexity or remove this unsubstantiated claim.

9: Stroeve, 2001 not Stroeve, 2007.

11-12: "high resolution" is ambiguous, quantify the statement or remove "high resolution"

17: replace"a particular" with "an"

Interactive
Comment

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

pg. 1534

10: please use "downward and upward" instead of "incoming and outgoing". These are hemispheric vertical fluxes.

15: use "ablation rate" instead of "mass loss" pg. 1536, 10-11, "discuss" twice in once sentence is awkward

pg. 1537, 3, "too expensive for this RACMO2 implementation"

8: quantify "very low"

11: remove "even"

pg. 1538, 24: be more explicit by what is meant by "missing". The solution chosen seems to produce erroneously low values (green areas) between 1500 m and 2000 m on the N and NE ice sheet (Figure 1). Averaging the non-missing data by elevation bins to fill in the gap using an elevation regression to solve for albedo should ∼eliminate this gap.

pg. 1539, 1-2, quantify the statement "Although ice albedos as observed by MODIS are reasonably stable from year to year, some inter-annual variability remains." "reasonably stable" and "some inter-annual variability" are vague. Once quantified, does the variability exceed the specified or expected accuracy of the data?

3: replace "MODIS-derived ice" with "MODIS MOD43"

9: remove "the"

10: Year 2010 is a larger melt year, especially because of low albedo (Tedesco et al. 2011, ERL) and thus would be a better test if the background albedo is low enough? I wonder if the prescribed background albedo is not low enough to handle year 2010. Year 2011 was also anomalously low for albedo (Box et al. 2012, TC). Even though the model tests are "computationally expensive and time consuming" (this reads more like an excuse) they are worth while to really know if the model upgrade can handle extreme

years, especially that are likely to occur in future years as melt increases further.

13: specify "MOD43" as the chosen MODIS albedo product.

lines 16, 17, 20, and 24: "MOD43" instead of "MODIS"

Fig. 5. The chosen MODIS data, lacking temporal resolution, make the comparison less effective than using the daily MODIS product (Stroeve et al. 2006, RSE). Provide some rationale why the higher temporal resolution data was not chosen.

pg. 1540, lines 3, 15, and 21: "MOD43" instead of "MODIS"

26: quantify "good agreement" ideally using correlation, average difference, and RMSE. If time resolution is a fundamental problem, use the nearest samples in time to the MOD43 data then these statistics may be calculable.

pg. 1541, 7: replace "MODIS uses a" with "MOD43 data incorporate a"

Table 1. State "MODIS MOD43" instead of "MODIS"

9: other reasons than the frequency of summer snow events are likely such as snow patches and whether or not the AWS radiometer is over one or over an area of bare ice. Discussion of this and the problems comparing point AWS measurements with area data (MODIS) is warranted here.

10: "when" instead of "where"

Is "preceding simulation" or the "control" the same? If so, just use "control"

Fig. 7. It's too hard to see the difference between the different experiments. Plot instead the difference with the "preceding simulation" or the "control", same units, just a difference map.

pg. 1542

It is good to see Table 2, is valuable.

13-16: Important results that deserve highlighting in the abstract and conclusions.

pg. 1543

1st paragraph, important results that deserve highlighting in the abstract and conclusions.

29: remove "gradually"

pg. 1544

2-3: quantify "good" and "regional differences remain". Good and bad are not useful in technical writing. Instead, make the effort to quantify allowing the reader to judge for themselves about the model performance. If the differences are smaller than the noise then you can conclude "insignificant" difference which I think is what is meant by "good". Anyway, back up such statements using quantities.

20: "contribution" instead of "rise"

22: It may not be possible to make this conclusion now that a more realistic albedo scheme is used. Is the conclusion still valid?

instead of Figure 9 in which an unscientific statement "well represented" is used and it's not easy to see difference in color, make a scatter plot (perhaps not show it, excluding Fig 9) and state the mean bias, correlation and RMSE, allowing the reader decide about model performance. Incidentally, it's controversial to smooth the gridded data in this type of mapping. Instead, plot the grid cells individually and assign them a color, adding realism to the representation of this digital data. The digital data will look more like Legoland of a facsimile than a smooth(ed) continuum.

pg. 1545

2: instead of using adjective "good", provide a quantitate assessment and allow the reader to judge model performance.

19: "MODIS 16-day albedo retrievals" instead of "MODIS satellite retrievals"

use "scheme" instead of "parameterization" consistently. The model upgrade is more than simply a new parameterization. Therefore, "scheme" (or algorithm) seems better because it suggests more than a line or 2 more code which a parameterization can often fit into.\

24: Figure 10 does not make this reader think about "well represented". A word choice like "better represented" is a start instead of this vain and unscientific statement. Discussing a % reduction in RMSE with values presented is even more desirable.

pg. 1546

first sentence is a hypothesis and therefore doesn't belong in a conclusions section. Move it into previous section. Reserve the Conclusion section for conclusions.

Expand the conclusions to capture more such as the very useful details in Table 2 and section 3.2 in which the implications of the model upgrade are felt and conclusions can be made about, for example, what is the ranked order of importance in model improvements.

The last paragraph referring to future work does not consist of Conclusions, only an outlook to work that may or may not happen. Move this to a previous section of just remove it and instead spend words on the present study, its implications.

Interactive comment on The Cryosphere Discuss., 6, 1531, 2012.