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The Cryosphere Discussions
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Interactive comment on "Impact of MODIS sensor calibration updates on Greenland ice sheet surface reflectance and albedo trends" *by* Kimberly A. Casey et al.

Anonymous Referee #2

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General comments:

The paper carefully examines how MODIS sensor calibration impacts estimates of surface reflectance and surface albedo on the Greenland ice sheet (GrIS). The issue is that results from the old Collection 5 (C5) showed a clear decreasing trend in GrIS albedo from Terra data. In this paper, newly calibrated results show that the differences between the old C5, which suffers from the problem of calibration drift, and the new C6 are significant. After the correction, results between Terra and Aqua become mutually consistent (Fig. 4), and the erroneous results from C5 are largely removed. This finding is certainly important because misidentifying albedo trend over the Greenland ice sheet may lead to erroneous conclusion on impacts of climate change because albedo

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is a key parameter determining surface energy balance. In this regard, utmost care should be taken to ensure the quality of remote sensing data, and I highly commend the authors for making the effort to correct the data calibration problem.

The paper is well written and the figures are well presented (especially Fig. 4). I strongly recommend this paper for publication.

Specific comments:

I do have a number of comments for the authors to consider in improving the paper presentation:

1. Abstract, line 21: “Wet snow albedo” means “Albedo in the wet snow zone”?

2. Abstract, line 24: Can you be more specific about “other fields”?

3. Introduction, line 27: “past two decades” means “1997-2017” or otherwise? Some references you quoted was back to 2000?

4. In the introduction, explain how this paper advances beyond the results by Polashenski et al. (2015) so readers can see right away the significance of the results presented in subsequent sections of this paper.

5. Page 3, line 6: How stable is “stable reference over time” for how long the time is?

6. Page 3, line 25: Any bias expected in the reflectance and albedo products due to residual cloud shadow effects between melt and non-melt zones? Some reference should be good.

7. Page 4, line 22: 0.04 over what value range?

8. Page 4, line 29: “dry and wet snow regions” means “dry and wet snow zones” or otherwise? Check for wording consistency.

9. Include in a relevant section of the paper a map of Greenland DEM contours and names of places over the GrIS.

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10. Section 4.3 Spatial Pattern of Albedo Trend: As seen in both Aqua and Terra after correction, Figs. 4 c and f hint that the overall pattern in southern Greenland may have some correlation/consistency with topography (thus good to include a DEM contour map as suggested in item 4), e.g., areas of Saddle and South Dome. What is the main factor causing the albedo change in southern Greenland, melt/snow grain change or back carbon/dust change, and why such factor is related to or governed by topography? Some discussion on this observation may be interesting to include, and perhaps can be related the trend of snow/ice change in southern Greenland influenced or modulated by topography.

11. Section 5.1, page 7, lines 27-28: "decadal trend of declining reflectance at a rate of up to several percent per decade" is significant. It is interesting to highlight the significant by equating such change to an equivalent of how much heat absorption trend (i.e., how much it impacts surface heat balance). This is only a suggestion and the authors can decide to include it or not.

12. Page 8, lines 14-15: Good if you can verify the "enhanced snowfall in the dry regions of NE Greenland." Simply provide a reference if such fact has been published. Similarly, verify "increasing grain size on southern and western areas of GrIS" and provide a reference if available.

13. Section 5.2, Item 2: Good that you point out "degradations can by magnified in band ratio products." Any expected impacts of such degradations on some specific MODIS products that you can point out as examples?

14. Future work: What is the plan to furthermore verify C6 Terra/Aqua results of reflectance/albedo by comparing remote sensing results with independent field observations to assure the quality of both?

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