

## ***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.***

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**Summary** It is nice to see a rigorous study of Greenland albedo. The paper is of significance for findings that include 1.) “difference in mean albedo of up to 0.08 between the two remote sensing products north of 70 N 2.) a disagreement in the trend magnitude between the two MODIS albedo products for the accumulation area, and 3.) likely positive bias in MAR simulated bare-ice albedo.

**major critique** The use of relatively coarse 25 km horizontal resolution when the MODIS data are available at a much higher resolution raises the question of resolving the ablation area and fine structures [e.g. Wientjes and Oerlemans 2010] observed in the

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ablation area.

page 3734 lines 20-21 “not confirmed by either the model or in situ observations” untrue an accumulation area albedo decline is documented in in situ observations. See Box et al. (2012) for MODIS see section 4.2 Albedo trend verification 4th paragraph.

page 3735 lines 22-23 incorporate critique of Wang and Zender using Schaaf et al. (2011)

page 3745 line 1 While MAR background albedo has not yet been mentioned in the article, I suspect that “large positive bias in MAR albedo” are because a background albedo that ‘reflects’ [pun intended] MAR not incorporating impurities from, for example, outcropping dust [Wientjes et al. 2010]?

It is unfortunate PROMICE.org weather station data were not used. Presumably, the authors saw Cryolist emails from Dirk van As on the data availability. PROMICE AWS have [usually] more accurate radiometers than GC-Net radiometers. PROMICE AWS compliment GC-Net by being concentrated in the ablation area where the albedo change signal is largest.

page 3746 lines 10-11 The hypothesis: “MOD10A1 may also be positively biased north of 70 N” could be tested using PROMICE.org data from the KPC\_U and KPC\_L station data.

page 3750 section 4.1 1st paragraph seems unnecessary and speculative. Regarding “datasets”, it would be useful to make more distinction between simulation from MAR and observational datasets. The framing should perhaps be how well or not MAR performs relative to this and that observational data set.

section 4.2.1 Variation of albedo with latitude, it’s hard to conclude anything with confidence because all data sets (perhaps not MAR in this case) will have some solar and viewing geometry dependent bias.

minor critique throughout, consider replacing + “zone” with “area” to adopt a standard

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suggested by Dorothy Hall, one that is more accurate since, in my view, a zone is a latitude interval. "mean" with "average", the former is more jargon than the latter. page 3734 line 3 delete "crucial", unneeded page 3735 3 replace "accelerating" with "amplified" 11 "increasing" instead of "record" page 3736 lines 4-5 "To our knowledge, this is the first-time that a multi-tool integrated assessment of albedo over Greenland is presented." why is this important? Each publishable study does several things for the first time, no? This sentence should be removed. page 3741 midday instead of noontime page 3744 line 13 not just "meltwater and bare ice" but dust and algae. There are several papers on the topic such as: Bøggild, C. E., Brandt, R. E., Brown, K. J., and Warren, S. G.: The ablation zone in Northeast Greenland: ice types, albedos and impurities, *J. Glaciol.*, 56, 101–113, 2010. Wientjes, I. G. M. and Oerlemans, J.: An explanation for the dark region in the western melt zone of the Greenland ice sheet, *The Cryosphere*, 4, 261–268, doi:10.5194/tc-4-261-2010, 2010. Wientjes, I.G.M., R.S.W. van de Wal, G.J. Reichart, A. Sluijs and J. Oerlemans, 2011. Dust from the dark region in the western ablation zone of the Greenland ice sheet. *The Cryosphere*, 5, 589-601. Doi:10.5194/tc-5-589-2011 page 3746 17-18 remove "Therefore," unneeded page 3746 17-18 "of the four datasets examined, only MCD43A3 appears to exhibit a decrease with latitude above 70 N." Only 3 data sets have a substantial latitude range. PROMCE.org data would be a 4th data set. first page 16 "indicates" instead of "points to" page 3749 11 "undergoes" or "exhibits" instead of "experiences" which is a sentient phenomenon page 3753 6 "above 0.84" comes from Konzelmann, T. and Ohmura, A.: Radiative fluxes and their impact on the energy-balance of the Greenland ice-sheet, *J. Glaciol.*, 41, 490–502, 1995. where albedo was measured to a Swiss standard, i.e., extremely carefully and therefore their maximum values for fresh snow are credible. page 3756 21 remove "in" page 3758 16 refer also to Stroeve et al. (2013)

ps. I am sorry for taking so long to make the review after accepting the assignment.

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

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