

Interactive comment on “Algal growth and weathering crust structure drive variability in Greenland Ice Sheet ice albedo” by Andrew J. Tedstone et al.

Anonymous Referee #1

Received and published: 16 August 2019

Tedstone et al. investigate the importance algal growth and weathering crust formation on bare ice albedo variability in western Greenland. They use observations from a field camp in 2017 to describe the bare ice surface and optical satellite imagery provided by MODIS and Sentinel-2 to demonstrate that coarser resolution satellite imagery will underestimate algal presence. They also find that bare ice surfaces have a left-skew albedo distribution at the scale of MODIS pixel which suggests that when MODIS data are used for energy balance modelling, meltwater production may be underestimated by 2%. The combination of field observations with satellite imagery to investigate the scale-gap between point and pixel albedo measurements enables new insights into Greenland's bare ice surface that should be considered when modelling the surface

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mass balance of the ice sheet. The manuscript therefore fits within the scope of The Cryosphere and deserves to be published.

My one major comment on the manuscript is that, considering the availability of high-resolution DEMs for both sites, the relationship between albedo and topography is not investigated in great detail. For example there is only one figure showing surface topography and that only shows the UPE site. At least consider adding more panels to Fig. 2 showing the surface topography at S6. Better would be include some additional analysis which demonstrates that low albedo pixels are more likely to be found in topographic depressions. This would provide some evidence to back-up the qualitative statements in the conclusions (P8 L4-11, P15 L20- to P16 L1-2).

Below are some more specific suggestions that the authors may find useful to consider.

P2 L1: Consider adding “into the ocean” after “directly” to clarify for non-specialists.

P2 L9: The Box et al. (2012) paper does not appear to have mapped bare ice so cannot have attributed the importance of snowpack melting, consider removing this reference.

P16 L3: Consider quantifying this statement with a percentage change.

Figure 2 Slightly confusing that panel a is on the right. Consider switching to the left of b and c.

Figure 3 Consider adding some lines from the the top left and bottom left of the yellow boxes to the top left and bottom left of panels f, g and h to make it clearer that these are zoomed versions of the same image.

Figure 6 Consider adding dates to panels a and b so it's more obvious that these are the same area on two different days.

Interactive comment on The Cryosphere Discuss., https://doi.org/10.5194/tc-2019-131, 2019.

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