

Interactive comment on “The seasonal evolution of albedo across glaciers and the surrounding landscape of the Taylor Valley, Antarctica” by Anna Bergstrom et al.

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Major comment:

Further analysis is required to take into account the slopes of the glacier surfaces. Although the authors did not state this explicitly, I think the radiometers at the ground stations were probably leveled horizontal, rather than parallel to the surface. If the ice surface is sloping to the south, then at midday it is receiving less incident solar flux than a horizontally-leveled upward-looking radiometer, and the measured albedo needs to be corrected for this slope. An example of the bias that can result, if the slope-correction is not made, was shown in Figure 9 of Grenfell et al. (1994) and

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related discussion. A similar correction must be made to the upward flux measured from the helicopter, using the sun azimuth and elevation for the times that the different glaciers were overflowed. For flights under overcast cloud, no correction is needed, because both the upward and downward radiation are diffuse.

Some considerations for how to make albedo measurements from helicopter were discussed by Allison et al. (1993), which the authors might like to read.

Minor comments:

Some confusion results from the terminology. Going “up-valley” sounds like going to higher elevation, so I was at first puzzled to read that albedo increased with increasing elevation but also increased going down-valley. Maybe you could instead say “down-Taylor” and “up-Taylor” to forestall this confusion.

p 4 line 17. Explain why the radiometer was hanging so far (6 meters) below the helicopter. How was it maintained level?

p 6 line 4-5. “Accumulation due to foehn events is removed.” Why?

p 8 line 13. If the soil became damp or wet, this would explain the reduced albedo, as shown by Bøggild et al (2010, Figure 6) and explained by Bohren (1987).

p 14 line 27. “arguably”. Is this word needed? Who argues against this claim?

Figure 1. In the inset, the Ross Sea is to the left of the star, but it's to the right of the main map, causing confusion. The inset should be rotated 180 degrees, so that north (at the star) is toward the top.

Figure 2 is too small. I don't see the “polygons” (line 7); maybe they will be apparent when you expand the figure.

Figure 3g. The peak seems to be at 14:00. What time zone are you using? It would be better to use local sun-time for this plot.

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In Figures 4 and 5, the data are classified first by year and second by surface type. Consider reversing this hierarchy, or maybe add two figures with the reversed hierarchy. The years are different from each other, but the surface types are more different from each other than the years are. So try merging all three years onto one graph to plot the seasonal cycle for soil, for example. This will also resolve the seasonal cycle better, with 14 points from November to January instead of only 4 or 5.

Figure 4 caption line 1. Change “percent” to “fractional”. Also on Figure 5.

Figure 5. Most of the information in this figure (except for the snowfall events) seems to duplicate Figure 4. Readers looking back and forth between Figure 4 and Figure 5 will be frustrated trying to make sense of any differences.

Syntax and spelling:

It is jarring to read “We” six times in the abstract. Some of these can be replaced. For example, you could say “The seasonal evolution is yet to be fully characterized”, “A camera, gps, and shortwave radiometer were hung from a helicopter . . .”, “These data are coupled with incoming radiation . . .” Your sentence “We also observed that albedo followed a pattern . . .” can be shortened to “The albedo followed a pattern . . .”

page 3 line 31. “wind-transported material that frequently melts to form cryoconite holes”. It is the ice that melts, not the wind-transported material.

page 5 line 3. “. . . did not meet usability standards or associated with . . .”

p 9 line 16. “on the that flight”

p 9 line 31. Change “principals” to “principles”.

p 16 line 22. “This research a part of”

p 17 line 4. Change Antarcitca to Antarctica.

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p 19 line 13. Change Stoeve to Stroeve.

p 19 line 28. Change “Manag.” to “Research”

p 24 line 4-5 “shown are as”. Maybe you mean “are shown as”.

References:

Allison, I., R.E. Brandt, and S.G. Warren, 1993: East Antarctic sea ice: albedo, thickness distribution and snow cover. *J. Geophys. Res. (Oceans)*, 98, 12417-12429.

Bøggild, C.E., R.E. Brandt, K.J. Brown, and S.G. Warren, 2010: The ablation zone in northeast Greenland: Ice types, albedos, and impurities. *J. Glaciol.*, 56, 101-113.

Bohren, C.F., 1987: Multiple scattering at the beach. Chapter 12 of *Clouds in a Glass of Beer, Simple Experiments in Atmospheric Physics*. Wiley, New York, 195 pp.

Grenfell, T.C., S.G. Warren, and P.C. Mullen, 1994: Reflection of solar radiation by the Antarctic snow surface at ultraviolet, visible, and near-infrared wavelengths. *J. Geophys. Res.*, 99, 18669-18684.

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2019-146>, 2019.

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