

General comments

I thank the authors for their substantial efforts in revising the manuscript. Most of my original comments have been addressed satisfactorily. However, a few minor points should still be addressed, along with some technical/language corrections.

Specific comments

1. p. 2, line 13: I think it should be clarified what the stated value (2.9 W m^{-2}) actually represents. E.g., “This value represents land areas with complete or near-complete snow cover, with little or no vegetation above the snow.”

2. p. 13, line 16: For Eq. (2) to be correct, $E_{\text{dif}}^{\text{clear}}$ should be the diffuse spectral irradiance on a *horizontal surface* and $E_{\text{dir}}^{\text{clear}}$ the direct spectral irradiance on a *surface perpendicular to the sun*. Please state this in the text, and importantly, check that this is indeed what SBDART provides.

3. p. 25, line 16: “significant altitude-dependent” trend? This requires a bit more explanation, e.g. are the values increasing or decreasing with altitude in the Russian Arctic?

4. p. 28, lines 4–18: It seems to me that the first factor listed here might be the best candidate for explaining why the ratio $\Delta\alpha_{\text{MODIS,daily}}^{\text{LAP}} / \Delta\alpha_{\text{in-situ,daily}}^{\text{LAP}}$ tends to be larger than 1, especially for relatively clean snow (the last three factors also cause errors, but it is not obvious whether they usually give rise to an overestimate or underestimate). Any vegetation in the MODIS scene likely reduces the derived albedo, and this probably also applies to the effect of snow surface roughness (Manninen et al.: Effect of small-scale snow surface roughness on snow albedo and reflectance, *The Cryosphere Discussions*, <https://doi.org/10.5194/tc-2020-154>, in review, 2020.). To my understanding this cannot be accounted for in the pure snow albedo calculation with SNICAR, which might give rise to a positive albedo bias compared to that derived from MODIS — yielding therefore an overestimate of the albedo reduction attributed to LAPs?

5. Figure 1: In each panel, one parameter is varied while three are kept constant. What were the constant (i.e. default) values assumed in this figure?

6. Table S1: In addition to MAE and RMSE, it would be useful to give the correlation coefficient between the corrected MODIS retrievals and the measurement-based albedo reductions.

Technical and language corrections

1. p. 3, line 8: Replace “radiances” with “radiation”. Also on p. 22, line 2.
2. p. 9, line 18: “which briefly”. Something missing here?
3. p. 11, line 6: Replace “is performed” with “are assumed”.
4. p. 15, line 4: Replace “competent” with “component”.
5. p. 20, lines 15-17: Reformulation suggested, to improve clarity: “... and the results mainly represent winter for midlatitudes (because spring is mostly snow-free) and spring for the Arctic (because albedos cannot be derived during polar night)”.
6. p. 21, line 2: “where is considerably higher”. Something is missing here. Should it be “where the emissions are considerably higher”?
7. p. 22, line 4: Remove “radiances”, or replace it with “radiative”, since “radiances flux” is not correct. “Radiance” refers to the intensity of radiation coming from a certain direction, and “radiative flux” (aka. “irradiance”) refers to the power radiated through a certain area, i.e., radiances integrated over a half-sphere.
8. p. 27, line 16 (and Fig. 6 and Fig. S8): The terms “negative uncertainty” and “positive uncertainty” are not commonly used. Do you mean “the lower bound and the upper bound of the uncertainty range”?
9. p. 27, lines 17-18: replace “by higher uncertainties” with “contributing more to the uncertainty”.
10. p. 28, lines 7-11: This is not expressed very clearly. What about: “MODIS has variably spaced and discrete spectral bands and thus cannot provide a continuous spectral measurement of reflectance. This results in a non-negligible uncertainty in retrieving the radiative forcing by LAPs in snow.”
11. p. 28, line 13: Should this be “a sample site located somewhere within the pixel”? (In-situ measurements are not necessarily taken at the midpoint of MODIS

pixels).

12. p. 28, line 14: replace “true” with “representative”.

13. p. 30, line 2: replace “radiances” with “radiative fluxes”.

14. p. 31, line 13, and p. 35, lines 8-9: replace “Earth system modeling” with “CESM2”. (The performance of other Earth System Models might well differ from CESM2).

15. Fig. 7: Thank you for including this figure! To improve its readability, please consider using a colour scale with other colours than just red and white.

16. Fig. 9 (upper panel): The geographic factor (G) seems not to appear at all in the colour bars. Is this an error, or is the contribution too small to be seen?

17. Several of the figures in the Supplementary material (specifically, Figs. S1, S3, S4 and S6) would benefit from making the figure panels larger. Currently, a magnifying glass is required for reading the axis labels!