

Review of “Monitoring of snow surface near-infrared bidirectional reflectance factors with added light absorbing impurities” by Schneider et al.

I highly appreciate the amount of work that was clearly provided by the authors to address the reviewers comments. The new structure of the paper is way more clear and easy to read and understand than the first version. However, I feel that some points still need to be addressed before it can be published. These points are listed below.

Specific comments

Title, abstract and everywhere in the text : LAI can be a misleading acronym, the use of LAP (light absorbing particle) is maybe to be preferred

P1, Line 20 – Picard et al., 2009 did not use only spherical ice particles

P1, Lines 14-15 – LAP can also be living particles, maybe the recent review from Skiles et al., NCC on LAP in snow can be added as reference in the introduction

Skiles, S. M., Flanner, M., Cook, J. M., Dumont, M., & Painter, T. H. (2018). Radiative forcing by light-absorbing particles in snow. Nature Climate Change

P2, Line 15 – References to SSA profilers such as ASSAP, POSSUM or SMP are missing

Arnaud, L., Picard, G., Champollion, N., Domine, F., Gallet, J.C., Lefebvre, E., Fily, M. and Barnola, J.M., 2011. Measurement of vertical profiles of snow specific surface area with a 1 cm resolution using infrared reflectance: instrument description and validation. Journal of Glaciology, 57(201), pp.17-29.

Proksch, M., Löwe, H. and Schneebeli, M., 2015. Density, specific surface area, and correlation length of snow measured by high-resolution penetrometry. Journal of Geophysical Research: Earth Surface, 120(2), pp.346-362.

P2, lines 16-18 – “in isothermal snow, highly faceted snow grains” this sentence seems a bit weird to me. Isothermal metamorphism and coarsening also happens for non faceted crystals.

P2, lines 25 and below – The beginning of the paragraph is a bit difficult to follow. I agree with the general idea I don't see any clear link with the objective of the paper and I would remove it. I would also reverse the order of the two objectives in accordance with the paper structure.

General remarks on the introduction: I am not all questioning the utility of the instrument and measurements but from the sole information provided by the authors, it is a bit difficult to understand why a new instrument is needed and what are the specifications. Regarding the objective one, I would also recommend that this quantification of snow albedo feedback impact on metamorphism be justified in light of previous studies and measurements.

Maybe start by section 2.3 (modelling) and then 2.2 and 2.4 (two “measurements” sections)

Section 2.2.2 lines 24-26 – Is it possible to provide the absolute changes calculated in SSA, also maybe give explicitly value of tau and n.

Section 2.4.2 what is the approximated mass of dust that was spread on the snow surface? 30g m⁻² ? How does it compare to values from Skiles and Painter, 2017?

P7, lines 6-9 – What’s the point of the last sentence? It needs to be removed or detailed a bit more.

P7 lines 10-15 – The information discussed here seems quite redundant with section 3.2, is it possible in sake of clarity to remove redundancies?

P7 lines 31 – This is also in line with more theoretical studies such as Kokhanovsky and Zege, 2004 and Malinka, 2014.

Kokhanovsky, A.A. and Zege, E.P., 2004. Scattering optics of snow. Applied Optics, 43(7), pp.1589-1602.

Malinka, A.V., 2014. Light scattering in porous materials: Geometrical optics and stereological approach. Journal of Quantitative Spectroscopy and Radiative Transfer, 141, pp.14-23.

P9, line 16 “realistic”, maybe a bit more details/references is required.

P9, lines 18-19 – “initiated melting” depends on the weather conditions (not only clear/cloudy), and the snow albedo feedbacks is also present before melting.

P3 line 13-14, the authors stated that the measurement is not sensitive to small BC concentrations, but is it sensitive to the large amount of BC or dust used in the experiments ?

Minor comments

P1, Line 1 – snow albedo -> broadband snow albedo

P1, Lines 11-12 – the last sentence should maybe be move after measurements (line 8)

P1, Line 9 -10 – “These findings ...” as stated in the main text, the results here is not a new finding so maybe rephrase

P1, Line 22 – “its effective radius” -> “its effective radius, Re”

P2, lines 23-24 – I would remove this last sentence,

P3, line 20 – “Flat paint” the details provided in the response to reviewer are maybe useful in the text of the paper too.

P4, line 3 – “at most a couple of centimeters” a few references would be useful for the reader here.

P5, line 1 - “were conducted” -> “were conducted only” ??

P5, line 5 - “at random” -> maybe one word is missing

P5, line 13 - typo for snowpacks

P5, lines 15 -20 – maybe explain why a different choice is conducted for spheres and for the other shapes.

P6 – first paragraph. I am a bit confused by all the different numbers of photons. In the end, 1,000,000 photons was chosen for the simulations ? maybe just rephrase this section.

P6, line 12 – “were sifted” -> which diameter ?

P6, line 22 – I don’t think that diffuse radiation is isotropic for cloudy conditions. Maybe rephrase “nearly isotropic”.

Figure 5 is quite difficult to read, maybe the model results can be shown in black without markers to ease the comparison with the NERD measurements?

P8, lines 19-22 , “As expected”, “typically” : can you provide any reference for that ?

P8, line 33 – “little to no effect” -> during the time of the experiment? “only” 16 hours

Figure 6 and Figure 7 : it is quite difficult to guess what are the limits of the errors bar, can it be modified ?

Legend of figure 7, the labelling is different for the upper and lower panels, maybe homogenize.