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Interactive comment on "Grain shape influence on light extinction in snow" *by* Q. Libois et al.

Anonymous Referee #3

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Abstract: Please eliminate AFEC and other abbreviations (SSA, etc.) from the abstract and elsewhere. Abbreviations save a tiny amount of space at the expense of comprehensibility. People do not think in terms such as AFEC. This is not a word. Authors who use an abbreviation again and again for weeks and months and years know what it means. But this is not necessarily true of readers. For example, I had never seen AFEC and SSA before. If I read it on one page, then I am expected to stop and make a conscious effort to memorize what it means in case I encounter it again. But I am unwilling to do this. If I encounter AFEC again I have to go back to find out what it stands for. In other words, the authors are training me like a rat in a maze.

Scientific papers are becoming ever more painful to read, and this is exacerbated by littering them with abbreviations the meanings of which may be unknown to readers. Every effort should be made to make papers as readable as possible to the greatest number of readers. Arcane abbreviations, initialisms, and acronyms run counter to this

goal.

Papers by the giants of science (Rayleigh, Einstein, Stokes, Maxwell, Faraday, etc.) are completely free of ghastly abbreviations such as AFEC. And these older papers are quite readable, especially when compared to modern papers. How did all these authors write such beautiful and enduring papers without abbreviations? Modern scientific writing has become more and more infected with "abbreviationitis". There are much better ways of shortening manuscripts than resorting to abbreviations. For example, getting rid of all the references that merely serve as decoration (e.g., Mie, Chandrasekhar, Schuster,. . .).

The authors do not know how to write an abstract. An abstract is a condensed version of the text that follows and *completely independent of it*. But instead of writing an abstract, most authors write what amounts to a brief introduction. Statements such as "we present an experimental method" are inappropriate in a proper abstract. Such an abstract should stand completely on its own with no reference to what follows. Abstracts are very difficult to write, which is why most authors don't write them (they write brief introductions instead).

Page 2804. Please eliminate the reference to Mie. This is false scholarship. Did you use anything from Mie's paper? Have you read it? If you had used Newton's laws of motion would you have cited Newton? These days, I am pleased to say, people are becoming more scrupulous about calling the theory of scattering by a homogeneous sphere Lorenz-Mie theory. Lorenz preceded Mie by 20 years. I have read Lorenz's paper. He deserves much more credit than he is given. Mie's paper is excellent, but he was preceded by Lorenz (and others).

If readers want more details about scattering by a sphere, would you direct them to Mie's paper? There are more comprehensible modern sources such as the books by van de Hulst, Kerker, Bohren and Huffman, and by Mischenko, Travis and Lacis (Scattering, Absorption, and Emission of Light by Small Particles).

Two embarrassing questions should be asked about a reference: (1) Did the authors read it? (2) Did the authors use anything in it? If the answer is no to both questions, the reference is merely a decoration. It is becoming increasingly evident that these days only a fraction of cited papers are actually read. One study claims that this fraction is only 20%.

Also, there is no need to cite Chandrasekhar's book. Again, have you read it? Have you used anything from it? It is not easy to understand, and there are more comprehensible sources on radiative transfer. This book is now more than 60 years old. It is mostly of historical interest.

Snow is not "semi-transparent". It is translucent. A transparent medium is capable of transmitting images (more or less faithfully). A translucent medium transmits light.

Page 2806. See previous remark about Chandrasekhar's book. There are much better sources on radiative transfer. See, for example, Thomas, Gary E., and Knut Stamnes, 1999: *Radiative Transfer in the Atmosphere and Oceans*. Cambridge University Press. van de Hulst also published a two-volume treatise on radiative transfer. Also, Multiple Scattering of Light by Particles by Mischenko, Travis, and Lacis.

TARTES AART etc. Horrible. See previous remarks about abbreviations.

Page 2807 "independent scatterers" This is an archaic and misleading term. Scattering by an ice grain in snow is excited by the incident radiation and by light scattered by its neighbors. Thus radiative transfer theory is a theory of dependent scattering: scattering by each grain depends on scattering by its neighbors. The term independent scattering goes back at least to van de Hulst's 1957 book. But by 1980, in his treatise on multiple scattering, he changed this to the more correct term "incoherent scattering." The concepts of coherence and incoherence are well-established in optics and are unambiguous. Incoherent scattering means that phases (strictly phase differences) of scattered waves can be ignored.

Page 2808 "The average cosine of the phase function" You mean the average cosine of the scattering angle.

Page 2809. "convex particles" As far as I know, there is no simple expression (such as Vouk's) for concave particles. But surely some snow grains must be concave or partly concave, partly convex. The authors should clearly state this.

Page 2810 Shuster (1905) Again, have you read this paper? Have you used anything in it? It is mostly of historical interest. There are more modern treatments of two-stream theories.

Page 2811 What on earth is HULIS? And is it really necessary to abbreviate black carbon as BC?

Page 2812 What are "summarizing rules"?

Page 2815 It is easy to show that the extinction coefficient is much more sensitive to particle shape (i.,e., to g) by considering the simplest possible two-stream theory of reflection and transmission by an incoherently scattering infinitely deep medium. The derivative of the albedo with respect to g is zero in the limit of a single-scattering albedo of 1. In the same limit, the derivative of the extinction coefficient is infinite. No elaborate calculations are necessary. What is missing from this manuscript is a simple sensitivity analysis.

Page 2816 "spectral intensity" The preferred term these days is radiance (if that is what is meant) or irradiance (if that is what is meant). Intensity is used carelessly to mean many radiometric or photometric quantities (radiance, irradiance, luminance, illuminance, proper intensity, the square of the electric field, the electric field, ...). Sometimes intensity is used to mean two different quantities in the same paragraph, or the meaning flips back and forth at random.

I see that the authors also use "flux" for (I think), intensity (irradiance?), another example of changing terms at random

BC again and again is unnecessary. Is it such a terrible burden to write black carbon or simply carbon?

The authors have taken the data for carbon from Chang and Charamopolous. This is OK but the optical constants of carbonaceous substances vary considerably depending on the sample. There is no such thing as an invariable substance "black carbon". This is just an unpleasant fact of life about which nothing can be done. Better measurements won't help. There is an irreducible range of the absorption coefficient of carbonaceous substances misleadingly labeled "black carbon". I have no objection to the use of the term carbon as long as it is noted that it is not an invariable substance (in contrast with the element carbon).

Page 2818 DC, POSSUM

Page 2819 ASSSAP The authors certainly love abbreviations [or perhaps I should write TACLA]

What are "dedicated measurements"?

Page 2820 See previous comment about BC. The policy of the authors seems to be that if a term consisting of two or more words is used more than once, it needs to be abbreviated.

Page 2825 I agree that "snow cannot be systematically represented by a collection of spheres." Unfortunately, snow cannot be systematically by a collection of particles of any shape. Grains in snow are just too variable in space and time, and hence uncertainties in their shape will always plague any attempt to accurately model the optical properties of snow. Such is life. Sometimes one just has to accept that Nature is not kind.

Recommendation

This manuscript can be published if for no other reason than that it presenta measurements, which are always in short supply. The manuscript can be shortened by getting

rid of all the references that the authors did not read, will not be read, and hence are not necessary. All the ugly abbreviations should be transformed into words.

I suggested a simple sensitivity analysis that shows why the albedo is much less sensitive to asymmetry parameter than is the extinction coefficient (provided that the single-scattering albedo is close to 1). No modeling, no detailed calculations are necessary.

Interactive comment on The Cryosphere Discuss., 7, 2801, 2013.