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Interactive comment on "Measurements and modelling of snow particle size and shortwave infrared albedo over a melting Antarctic ice sheet" *by* R. Pirazzini et al.

Anonymous Referee #2

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Reviewer's Comments

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Measurements and modelling of snow particle size and shortwave infrared albedo over a melting Antarctic ice sheet

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General comments:

The paper use snow data collected at the Finnish research station in Antarctica. Snow measurements of grain size (macro and optical), density and temperature were com-

pared to modelled equivalent optical grain size with a certain degree of success. Specifically, the authors concluded that the r(eff) calculated from the metric distribution (macro photos) agrees well with the r(oeff) from ASD measurements. However, some discrepancies can be related to surface roughness of the snow sample.

Overall, the paper is very well written, with a much detailed literature review. The snow measurements methodology is thorough, which is in my mind one of the main reason behind the good agreement between modeled and measured grain size.

I suggest the paper to be accepted with minor revisions, highlighted below.

Specific comments:

It would have been nice to see a figure (scatter plot) with Y-axis the reflectance and X-axis the r(eff)...for the various snow grain types. The authors refer to rounds, rounding facets etc, and their electromagnetic responses can be expected different. How many measurements are available for each grain type? This will affect the 'b' factor in the Kokhanovsky model...which value was used? The larger optical diameter, the more important effect of the snow grain shape so I would appreciate a more detailed discussion on this topic.

In section 2.3. the authors refer to 'faceted rounded particles' and 'rounding faceted particles'. Since the grain shape is so important in this study, and I do no doubt the competence of the authors in its measurement, perhaps a clarification should be made as to what is the difference. 'Faceted rounded' does not mean much. I would understand 'Faceted rounding' as a snow grain that was recently under a decent temperature gradient, and begin associated metamorphism (facets)...but then confronted to equilibrium (rounding) = faceted rounding. From my avalanche background this is how we would refer the grain size. Or again, 'rounding facets', it tells you a story. If you refer to 'Faceted rounded' it does not say much. Why not use the international snow classification symbols?

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On Figure 6, I see a limited number of snow grains. How many grains typically per photo? It would be worthwhile to test how many grains are required to catch the distribution. In the past I did such tests and we found we needed about 10-15 grains before the standard deviation was flat. Extracting grains for photos is hard, I do understand this as I did thousands of them. . .this is why I ask if the authors considered what is an acceptable number of grains? Perhaps a short discussion on associated uncertainties be pertinent.

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