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Interactive comment on "Solar radiative transfer in Antarctic blue ice: spectral considerations, subsurface enhancement, and inclusions" *by* Andrew R. D. Smedley et al.

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Major comment:

The word "inclusions" in the title refers to meteorites hidden just below the ice surface in the Antarctic blue-ice areas, where the searches for meteorites have been carried out for many years. As the authors say in their Introduction, they aim to improve the calculation of "the vertical movement of meteorites through blue ice". The paper would be much more interesting with a little more work, in fact far less work than the examination of different cloud properties described in the Supplement, which was of minor importance. The paper uses Monte Carlo modeling to compute the radiation absorbed

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by a meteorite in ice, but then stops just before coming to interesting answers on such questions as (1) How far down below the surface will a meteorite travel in the ice before it stops, as a function of the radius of the meteorite and the incident solar flux? The ice is typically ablating at $\sim$5 cm/year; can the downward-migrating meteorite outrun the sublimation front? (2) Many meteorites are found on the surface, not melting down into the ice. Is this because they are small enough that the heat from their absorbed radiation is quickly conducted away? These are questions for which the Monte Carlo method is eminently suitable. With just a small additional effort these questions could be addressed. Values of rock density, rock albedo, and thermal conductivity of ice are readily available.

Minor comments:

page 5 line 2. Change Muller to Mullen.

page 6 line 21. "with the dependent variable, the asymmetry parameter g". Henyey-Greenstein is a one-parameter phase function, whose parameter is g; so g is not a "dependent variable". You can just delete the three words "the dependent variable".

page 8 lines 12-13. "enhancement of the incident irradiance under cloudy skies from an albedo feedback mechanism." Change "from an albedo feedback mechanism" to "by multiple reflection between cloud and ground".

page 10 lines 11-12. These three albedo values (51.6, 62.1, 60.5%) should also be included in Table 1.

page 14, Eq. (9). Say that the units of d are meters.

Figure 6a. On the bars at the top, what do the two different colours indicate (blue versus grey)?

Supplement page 1 line 16. "the results for a diffuse sky lies close to the 69° result". I don't see this in Figure S1a; the diffuse sky looks closer to the 49° result.

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Figure S1b is unrealistic for the large values of SZA. Even if you ignore diffuse radiation, at SZA=89° the surface roughness present on all blue-ice areas causes the angle of incidence on sunlit surfaces to be considerably less than 89°. I suggest removing the curves for 79 and 89 degrees.

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