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Atmospheric Measurement Techniques Discussions

Interactive comment on "Remote sensing of aerosols over snow using infrared AATSR observations" *by* L. G. Istomina et al.

Anonymous Referee #1

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1. This paper addresses an important problem – performing satellite aerosol retrievals over bright snow surfaces. The authors have done a good job developing the theory, and validating the approach for AATSR using coincident, ground-based observations. In my opinion, this paper is appropriate for publication in AMT, though some questions regarding the sensitivity of the method to specific assumptions made in implementing the algorithm might be worth addressing first.

2. P36, line 25. The assumption that variations in snow emissivity at 3.7 micron are < 5% is key to this work. The reference provided, Hori et al. 2006, actually deals only with the spectral range 8-14 microns, and does not indicate the <5% variability even for those wavelengths. In the visible, snow BRDF can be scale-dependent, as sastrugi and other surface texture and shadowing elements affect the angular reflectance signature.

I do not have intuition about snow BRDF at 3.7 microns, but it would be reassuring to see some justification for the <5% assumption at this wavelength.

3. P37, lines 14-19, and Table 1. How are the results affected when other particle microphysical properties are assumed? In particular, the fine-mode effective radius of 0.64 micron is fairly large, especially for soot, and the resulting visible SSA, 0.38, is very low for particles in the atmosphere. As smaller particles will generally have flatter single-scattering phase functions, could this be significant for the proposed method?

4. P38, lines 13-28. The challenge of retrieving AOT over snow in the visible stems from the very bright surface, as small percentage errors or variations in surface reflectance can swamp the TOA aerosol signal. The simulations shown in Figures 3 and 4 were done assuming a black surface and an AOT of 0.1. Although the snow surface is darker at 3.7 microns than in the visible, you need to show it is actually dark enough that it does not significantly affect sensitivity. Also, is the AOT 0.1 at 550 nm or at 3.7 microns? AOT is typically 0.1 or less in the mid-visible at high latitudes, and would be lower at 3.7 microns, especially for accumulation-mode particles.

5. P40, line 9. I think you mean to say: "Conversely, if the TIR criteria. . ." Also, P42, line 1. No need to repeat the definitions of theta and phi.

6. Section 4.2. Given the assumptions required to extract the surface contribution to TOA reflectance at 3.7 microns, it would be helpful to have an actual error budget for the simulation.

7. The manuscript could use a little copy-editing; in particular, the definite article is sometimes applied correctly, sometimes not.

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