

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

Anonymous Referee #2

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The paper presents an innovative approach to measure aerosol optical depth over snow-covered surfaces using AATSR infrared dual-viewing observations. The topic is definitely appropriate for AMT, but the authors need to elaborate and explain better several assumptions stated in the manuscript.

The authors implicitly present the aerosol IR retrieval technique as a general method that could work for different aerosol types. Based on the restrictive implied assumptions in the application of the method, it seems to me, the technique works best for dust, but it would probably break down for other aerosol types in which the fine aerosol mode may be dominant. Please address the following issues:

Pg 36, line 25. Is the snow emissivity variability of less than 5% documented by Hori et al (2006)? If so, please reword to associate the statement on line 25 with the reference.

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Otherwise, include appropriate reference.

Pg 37, line 15. The authors assume that the fine and coarse aerosol size modes associated with a smoke event apply equally to dust, water soluble and oceanic aerosols. Is the assumed coarse mode for dust aerosol consistent with AERONET observations?

Tables 1 and 2. The model representation of soot aerosol seems unrealistic. Although soot is an important aerosol component, pure soot is rarely present in the atmosphere. The authors should offer some observational evidence of the very low SSA of 'soot aerosols' in tables 1 and 2.

Pg 38, line 26. In the sentence '...to employ values of same magnitude...', values of what?

Pg 42, line 5. How small must AOT be to justify this assumption?

Pg 43, line 4. Neither figure 1 nor figure 2 is related to nadir reflectance. I think the authors mean figures 3 and 4.

Pg 43, line 5. Nadir direction for a solar zenith angle of 65 degrees corresponds to a scattering angle of 115 degrees. According to the phase function calculations in figures 1 and 2, equation 12 would only apply to aerosol types where the coarse mode predominates. For aerosol types where the number density of fine mode dominates, equation 12 may yield zero or even negative aerosol reflectance. Please elaborate on the applicability of the approach to the water soluble, oceanic aerosols, or soot-containing aerosols.

Pg 43, line 10. In addition to no angular variability of snow emissivity, equation 12 is also based on the assumption of no angular variability of the aerosol scattering phase function between nadir and off-nadir viewing geometries. Under these assumptions the equation is only valid for dust aerosols. It wouldn't hold for water soluble nor oceanic aerosols, because the larger reflectance at nadir associated with the larger phase function would probably be interpreted as surface contamination.

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