**The Cryosphere
Discussions**

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Comment

Interactive comment on "Application of asymptotic radiative transfer theory for the retrievals of snow parameters using reflection and transmission observations" *by* H. S. Negi et al.

H. S. Negi et al.

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Response to Referee-2 comments:

General comments:

In the present paper we are not comparing the two theories i.e. AART and two-stream theories. We are introducing the applications of AART for various snow optical parameters retrievals and we state that the results obtained by AART are comparable with previously retrieved AFEC by other theory. At the same time analytical equations of AART described in the paper are able to provide other optical and physical parameters. These are possible with some other radiative transfer methods, where quite large

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computation power is needed. So our approach is more simple as compared to the previous one and (we are sure) will be used in many applications in future (e.g., in cold labs worldwide). This is especially true because not only AFEC but also other characteristics (like extinction coefficient, e.g.) can be used in the framework of our method.

We do not think that the value of asymmetry parameter is a crucial one for the determination of AFEC from the reflectance and transmittance measurements. This was discussed in the response to the Reviewer 1.

We do not agree with the reviewer that two-stream approximation is also an AART. The two flux theory and AART give similar equations but the constants in the equations are different and they are more accurate in the framework of AART (Kokhanovsky A. A., 2006). Two-flux methods can not provide accurate calculations of BRDF and AART can (Kokhanovsky A. A., 2006). Therefore, it is of importance to replace 2-flux approximations by AART in the snow remote sensing applications. Also equations are simpler and corresponding retrieval codes are faster. This is the main idea behind this publication. In addition, understanding the fundamentals of radiative transfer in snow (and, e.g., extinction coefficients of snow samples) can not achieved if only snow reflectance measurements are performed. So, clearly, simultaneous measurements both transmission and reflection (together with internal light fields) are needed. Our paper is aimed at the development of analytical solution of corresponding inversion problem (not possible with earlier approaches).

Specific comments:

1. Eq.(6) represent the diffusion exponent of the radiative transfer theory. However, y is a term in exponential approximation which completely determines the spherical albedo and can be defined in terms of local optical characteristics as shown in p1242, line 17.

2. Labels in Fig.(2) are correct and there was a shift between the retrieved AFEC by AART and Perovich(2007), the possible reason is discussed in p1248.

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3. The English grammar will be taken care in revised paper.

4. The suggested reference will be cited in revised paper.

References:

Kokhanovsky, A. A.: Cloud optics, Springer-Praxis, Chichester, Netherlands, 2006.

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