Anonymous Referee #1
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1) The description of the algorithm is hard to understand due to insufficient symbol identification and usage coupled with a too brief explanation of individual algorithmic steps.

rho_sub_surf is used in Eq. (3)
used again in the text at the bottom of page 2114 to describe
the two-compont (vegetation and soil) spectral properties
and used a third time in Eq. (9) to describe the surface contribution to the TOA reflectance
If these three parameters represent different physical quantities, then the symbol representation should be sufficiently different.

Equation (3) gives the used correspondence between surface reflectance ρ_{Surf} and surface albedo A_{Surf} [$\rho_{Surf}(\lambda, z_0, z_S, \varphi) = BRDF(z_0, z_S, \varphi) \cdot A_{Surf}(\lambda)$], which is used in equation (1). I agree with the reviewer, that the term ρ_{Surf} in equation (9) has to be equivalent with the complex surface term in equation (1) and ρ_{Surf} the equation on page 2114, describing the mixing is only the spectral behaviour of the surface properties, not the angular ones.

Resulting actions in the text:
The used symbols have been modified in the text in a consistent way. We introduced $\rho^{\Diamond}_{Surf}$ for the spectral properties in the equation on the end of page 2114 and modified equation (6) for more clearity. Also equation (9) has been modified with the full expression for the surface term.

I noticed that a surface BRDF is introduced in section 3.2, and used in Eq. (3) through (6). Can you give some information as to why it is now needed?

We noticed from temporal series of retrieved AOT results around AERONET sites biases in AOT depending from location within the swath, which could not come from aerosol phase function. The surface 'hot spot' lead to an overestimation of AOT, regions away from 'hot spot' gave an underestimation. Thus we decided to describe the surface 'hot spot' with a BRDF model, which lead to a reduction of the scatter of AOT around AERONET data, see Dinter et al., 2009 in Tellus.

Resulting action in the text:
We included the finding of Dinter et al before introducing non-lambertian surface and added the reference of this paper.

Also, Eq. (6) is not understandable to me. If A_sub_surf in Eq. (6) is the same as A_sub_surf in Eq. (1), shouldn't the normalized BRDF be in the numerator in Eq. (6), instead of the denominator?

As mentioned in the answer to the first remark, equation (1) is defined with the albedo in the last term. To transfer directed surface reflectance to an albedo in equation (3) we have to divide the surface reflectance by the BRDF.

I hope with the changes in equation (6) and (9) above this can be explained. – no specific action.

Also, the scaling factor, SF, defined in Eq. (8), would seem to include the total transmission, t_sub_tot, for the viewing and illumination geometries, but are not there. What happened to these terms?

We didn't use the total transmissions in our approach until now. We will test the use of total transmission, however, we don't introduce them in this paper. – no specific action.

2) In section 3.4 the iterative procedure is described. I understand the need to retrieve a smooth spectrum for the AOT, but I am confused as to what is actually being iterated in order to accomplish this. Is it strictly a modification of the k parameter in the BRDF? If so, is this the reason for introducing the BRDF into the retrieval scheme?

This is not correctly expressed in equation (15). The k there is not identical with the k of the BRDF. This k here is a running index of the iteration. We will change it to j in the revised version of the text.
Action: running index k is changed to j in equation (15) and in the text to avoid a misunderstanding.

Upon reading sections 3.2 and 3.3 , it still isn't clear to me how the AOT is "tuned" to arrive at the accepted retrieval value. Looking at Eq. (1), the AOT result depends on what the value of A_sub_surf is determined to be. It would seem that the scaling factor SF is the important parameter. Below Eq. (8) for SF on page 2115 it is stated that a black surface is initailly assumed. I don't understand how SF is then systematically adjusted to arrive at a surface reflectance that is not black. I would be extremely helpful if a more detailed step-by-step description of this process of separating the atmospheric and surface contributions to the TOA reflectance is made available to the reader.

Equation (8) gives the ratio of an estimation of the surface reflectance from the observation for the wavelength 0.665 µm to the model mixing of the spectral surface components of this channel. To estimate the surface reflectance an estimate of the aerosol reflectance ρ_{Aer}^{Guess} is required. We estimate here aerosol reflectance from channel 1 (0.412 µm). Here a rough estimate of the aerosol reflectance, using a 'black' surface can be made for a wide range of surface types, giving a first guess AOT for channel 1, because spectral surface reflectance decreases with decreasing wavelength. Then this first guess AOT is transferred to the channel 0.665 µm assuming Angström power law with an exponent of 1.0 and this gives the aerosol reflectance for channel 0.665 µm.

Action: A description of this estimation id inserted after equation (8).

3) What is PC on the top of page 2126?

This is normal office computer.

Action: The sentence is modified for the revised version.