Review of the paper by F. Seidel and C. Popp
"Critical Surface Albedo and its Implications to Aerosol Remote Sensing"

General comments

This paper addresses the question of the critical surface albedo and its impact on the retrieval of aerosols using remote sensing data. The authors carried out a large series of experiences in order to study and assess the impact of the CSA for a set of conventional aerosol classes typically used by aerosol and/or surface albedo retrieval algorithms.
I wish the authors had dealt with anisotropic surfaces instead of Lambertian targets. However they stated clearly the scope of the paper to address only isotropic scenes.

Generally speaking, the paper is well structured and clear. It is well written and the English language and grammar is fine (but I am not a native speaker).

I recommend this paper for publication after the small corrections to take into account my comments.

Detailed comments

The abstract: the authors mention the retrieval of aerosols over bright surfaces such as clouds, snow and ice. Surprisingly, they do not mention bright desert scenes when the retrieval of aerosols above such targets is problematic. The authors address this issue at the end of Section 3.2.1 but it should be also mentioned somehow in the abstract.

Line 77: "the CSA is also of relevance"

Lines 120-130: the authors set one of the scopes of their work by considering only Lambertian surfaces. Did they look at cases of non-Lambertian surfaces? Are they intending to do so? In order to apply some of the results of this work to surface albedo and aerosol retrieval it seems to me that surface anisotropy should be considered.

Lines 151-157: the authors say that the continental, urban and maritime aerosol models are taken from d'Almeida et al., whereas the desert and stratospheric aerosols are from Dubovik et al., and Russell et al. However the caption of Table 2 says that the desert aerosol type is from d'Almeida et al., whereas the biomass burning one is from Dubovik et al. Can the author clarify? What kind of desert particles do they consider (spherical or no-spherical [or spheroid])?

Again, in Section 2.2, it would be interesting to cover the case of non-Lambertian desert surfaces, with larger AOD values than presented.

Lines 200-205: the authors define the condition for retrieving the critical surface albedo, using the derivative of the fifth order polynomial that approximates the TOA reflectance.

To be completely exact it should be added that the derivative should be zero for any value of the AOD. Otherwise, it is a minimum or a maximum.

Line 221-226: can the authors explain that part better and provide more comments in the text to justify the changes in the CSA with AOD. They state earlier in the same section that the CSA is obtained when Equation 6 is zero. It should be true for any value of the AOD. Therefore I do not understand this result.

Lines 231-235: please show on Fig. 5 the regression line with the slope, offset and the residuals. Avoid comments like "in general, the points are aligned" and use in the text the results of the regression instead.

Lines 261-262: "The CSA is almost spectrally neutral for absorbing SSA and vice-versa". Please avoid such a formulation.

Lines 289-291: the minimum for the CSA corresponds also to the minimum in the aerosol phase functions (around 120 degrees)…

Line 492: reference Popp et al. The year of publication is missing.

TABLES AND FIGURES

Table 2: the caption should be clarified as indicated previously, as there seems to be a discrepancy with the text of the paper (origins of the aerosol classes).

Figure 2: the title of the Y-axis for panel (b) is half hidden. Please correct.

Figure 4: the caption should recall that the derivative is plotted at 550nm, as mentioned in the text.

Figure 6 - Panel (b): is there a particular reason why a scattering angle of 104 degrees was taken for panel, instead of more rounded values like 100 or 110 degrees? Same comment for Figure 8.

Figure 6 - Panel (f): what "A179 degrees" mean for the scattering angle? Looking at Figure 8, I guess it is typo.