Reviewer #2

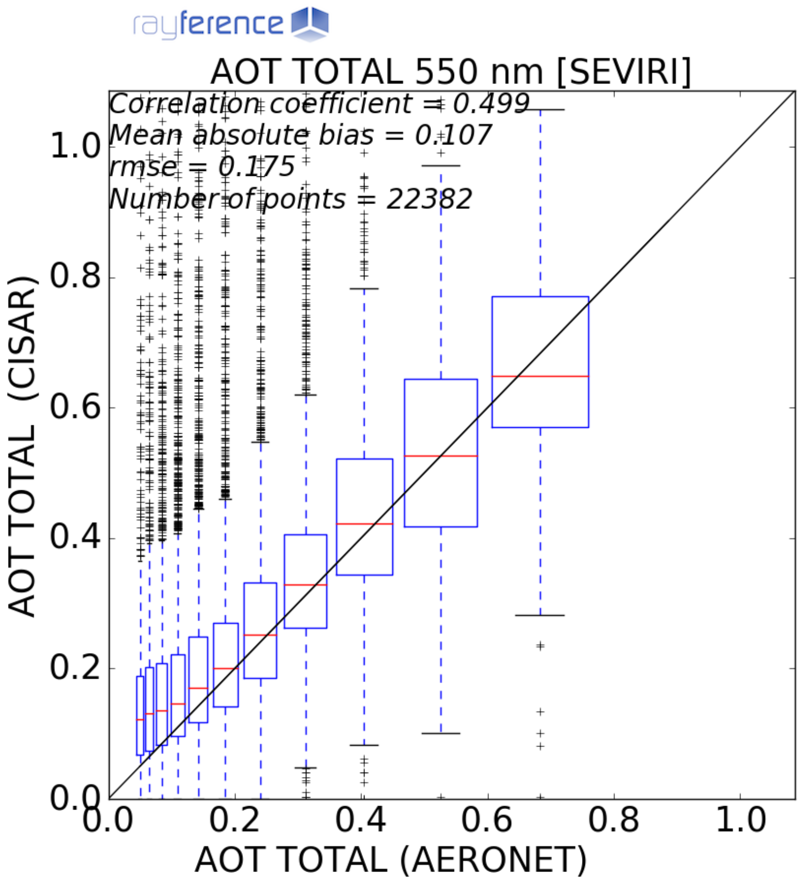
The manuscript fails in providing the most interesting piece of information, i.e. HOW to choose the set of vertices for each operational inversion.

There are several ways to determine the location of the aerosol vertices. One possibility is to look at the Fig. 3 has been modified. This Figure shows a density plot of the ssa – asymmetry factor derived from AERONET observations in the blue band. Such type of information can be used to adjust the location of the vertices. The following text has been added to the manuscript:
The actual extent of possible solutions in the [g,ω0] space for a given spectral band can be outlined by a series of vertices characterizing aerosol single scattering properties. Following Fig. (2), these vertices are defined by an absorbing and a non-absorbing fine mono-mode classes with a small radius, labelled respectively FA and FN and by two coarse mono-modes with different radii, *i.e.*, large and small, labelled respectively CL and CS. Such vertices define a polygon within the [g,ω0] solution space (Fig. 3). The number of vertices can be adjusted according to the amount of spectral observations and expected type of aerosols. In Section (4), we will see how any pair of single scattering albedo and phase function values in that space can be expressed as a linear combination of the vertex properties. The choice of these vertices is critical as they should encompass all possible aerosol single scattering properties that could be observed at a given time and location. Different approaches could be used to define the position of these vertices. These positions could be derived from the analysis of typical aerosol single scattering properties available in databases such as Optical Properties of Aerosols and Clouds (OPAC) (Hess et al., 1998). Alternatively, it is also possible to follow a similar approach as the one proposed in Govaerts et al. (2010) who analysed the single scattering albedo and phase function values derived from AERONET observations acquired in a specific region of interest for a given period (Dubovik et al., 2006). Fig. (3) shows an example of such type of analysis performed in the blue spectral region. The red isoline on that Fig. delineates the area of the [g,ω0] space where 99.7% of the aerosol single scattering properties derived by Dubovik et al. (2006) from AERONET observations are located. The green and blue lines show respectively the 95% and 68% probability regions. These values have been derived using all available Level 2 AERONET observations since 1993. Finally, the model proposed by Schuster et al. (2005) can be used to determine the spectral variations of the single scattering properties outside the spectral bands measured by AERONET. The present study relies on simulated data and the aerosol vertices have been positioned to sample the solution space in a realistic way. In case of the processing of actual satellite data over a specific region or period, it is advised to calculate the isolines corresponding to that region of interest and to adjust the position of the aerosol vertices accordingly.

- Major concerns remain towards the real applicability of this inversion given the highly idealized choice of parameters and observation scenario (rather atypical of satellite observations). It's OK to make this the first part of a dual-paper study, but at this point the two manuscripts should be submitted together so that the reviewers could be convinced of the ultimate and general performance of the method. I have looked into http://www.rayference.eu/CISAR/SEVIRI_report.pdf as suggested in the authors' preliminary response, yet that report deals with only one study case where the conclusion seems to be that the AOT is systematically underestimated (by ∼50%!) with respect to AERONET observations (it is of course possible I'm missing something).

This report contains the analysis of a very limited number of aerosol stations. The following Figure taken from Luffarelli, M., Y. Govaerts, and C. Goossens. 2017. 'Joint Retrieval Of

Surface Reflectance And Aerosol Properties: Application To MSG/SEVIRI in the Framework of the Aerosol_cci Project'. In *EGU General Assembly Conference Abstracts*, 19:5398. EGU General Assembly Conference Abstracts and have been derived over a large number of AERONET stations. These results will be published in the second part of this manuscript.



- All figures should be re-plotted with fonts at least twice in size

Figure fonts have been enlarged.

- I trust that in Figure 2 now the arrows have lengths proportional to the discussed changes. Nonetheless, more wavelengths would be needed to make the figure informative. Perhaps, it could be made into a two-panel figure with Fig. 3?

Wavelengths 0.55 to 0.87 have a behaviour very close to 0.44. Hence, adding these wavelengths to Figure 2 provides pretty confusing results.

- Figures 6-12 should be merged in a single figure (or two).

These Figures are split to avoid having an endless single Figure that can be far away from the text. Splitting the Figures allows to keep the Figures close to the text.

- The comments to Figs. 6 and 7 confuse me: for example, in Fig. 6 it is said that w_0 is well retrieved and the g parameter systematically underestimated, but the figure shows the opposite. Similar arguments hold for Fig. 7 (g no longer systematically underestimated, w_0 slightly underestimated).

In Figure 6, the truth w_0 values lay between 0.94 and 0.95 while the retrieved ones between 0.91 and 0.95. This parameter is therefore quite well retrieved as stated in the text. Considering the asymmetry parameter g, the truth values in band 0.87 is 0.58 and the retrieved one 0.48. This underestimation in the retrieved values is also present for the other bands.

- Could you make Table 6 into a figure instead? The would also eliminate the need for Table 5, since the true values could be pitted as you did for Figs. 7-12.

We think that in case of the RPV parameters a table is sufficient to fully understand the performances of CISAR and we do not want to add even more and unnecessary figures to the paper.

L23: This is not universally true. what about absorbing aerosols? what about very large optical depths? Could you prove that enhanced forward scattering does NOT highlight anisotropy? Such claims at least call for appropriate references

An in-depth understanding of the radiative coupling effects between diffuse sky radiation and surface reflectance anisotropy. For instance, when the scattering optical thickness becomes very large, surface behaves almost as a Lambertian one as no shadows are present anymore. This is pretty independent from the type of aerosols. This is what it is stated in our sentence. We also say, “In most cases” and not “Always”. This statement would be erroneous for a shadowless type of surface, which does not exist on Earth. References where the effects of this coupling are illustrated have been added to the text.

L52 what's the difference between these two aspects?

These sentences read now:

Firstly, only a limited region of the solution space is sampled as a result of the reduced range of variability for state variables. For instance, in order to reduce the size of the LUTS, Pinty et al. (2000b) limit the maximum aerosol optical thickness to 1. Secondly, the solution space is not continuously sampled due to the use of pre-defined aerosol classes.

L94 could you add a sentence of whether this issue is still of concern? What did Luffarelli et al 2016 concluded?

The sentence reads now:

This latter issue has been addressed by Luffarelli et al. (2016) who retrieve an aerosol optical thickness value for each SEVIRI observation.

L130 The connection between Dubovik's classes and the ones in Fig. 1 must be made clear. All I get from the figures is the strange impression that the fine mode is spherical and the coarse mode is non-spherical.

That is indeed the case