We are thankful to the anonymous reviewer for her/his help in improving the quality of this manuscript. Please, find below our answer to your question and commentaries.

Let us mentioned that some plots in this document have not been included in the new version of the manuscript when they only illustrate a specific answer to the reviewer question.

Main comments:

(1) It should be mentioned clearly in the abstract and the conclusions that the results presented here are only valid for COT > 3. Since DRE is highly dependent on COT, cloud albedo and cloud fraction, this selection criterion automatically generates DRE that are biased high, since many negative and low values are not considered.

The abstract and the conclusion now mention the information about the selection of the scene. Thank you for the suggestion:

Page 25534 line 14: The retrieval of aerosol and clouds properties (i.e. aerosol and cloud optical thickness, aerosol single scattering albedo and angström exponent) is restricted to homogeneous and optically thick clouds (cloud optical thickness larger than 3).

Page 25555 line 10: Its range of application is restricted to homogeneous cloud with COT larger than 3.

Page 25556 line 24: Let us point out that differences between the result of this study and the literature are expected and are mainly due to the selection of the AAC scenes: this analysis does not include thin clouds (i.e. COT < 3) and scene with fractional cloud coverage which leads to biased high the DRE.

(2) 2.4 Sensitivity analysis (25542-25544) This is the weakest part of the paper. Some hints are given as to how the algorithm behaves in a few cases, but no clear picture is given of how sensitive the algorithm actually is under different circumstances. A few results are given in tables, but pictures showing the various limitations and sensitivities would be much more helpful. This should be incorporated in this paper, as this paper presents the applicability of the polarization measurements for the computation of the DRE. To assess the uncertainty of the DRE results it is necessary to understand the sensitivity of the retrievals of the aerosol and cloud parameters. The lack of this sensitivity study is most clearly indicated by the following sentences: Lines 21-23: " Of course, we expect larger biases for larger AOT. However, the quantity of aerosols chosen to process the synthetic radiances is representative of the ACA events that have been already observed in Waquet et al. (2013b)." The range of 'quantity' given in table 3 is AOT=0.12 to AOT=0.2. Even in the present manuscript the range in AOT is much larger than that. It should be clear what happens to the accuracy of the retrievals in those cases.

Similarly, the last paragraph (lines 25544, 7-17) signal a very important uncertainty, which will impact the DRE results dramatically. Showing only two points is not very adequate. Do the results respond linearly to the bias? And 70% falls within 8-16 microns, but the remaining 30% will provide the extreme values that are presented in the manuscript. Are they reliable?

These issues should be addressed in a sensitivity analysis that shows the most important relationships between the algorithm assumptions, the retrieved parameters and the resulting DRE.

The sensitivity analysis in section 2.4 has been entirely revised. The impact of the approximation according to which polarized radiances translate only scattering processes has been assessed together with the assumption on the real part of the refractive index. This analysis has been performed in terms of biases on both retrieved properties and DRE estimation. This section also includes sensitivity tests about the coarse mode size distribution and refractive index.

Regarding the extreme values of the DRE, we have plotted the distribution of the DRE of aerosols above clouds as a function of the cloud droplet effective radius for the African biomass burning event the 4 August 2008 (Fig. 1). No correlation is observed between these two parameters. Moreover, the extreme DRE are obtained for cloud droplet effective radius between 10 μm and 12 μm.

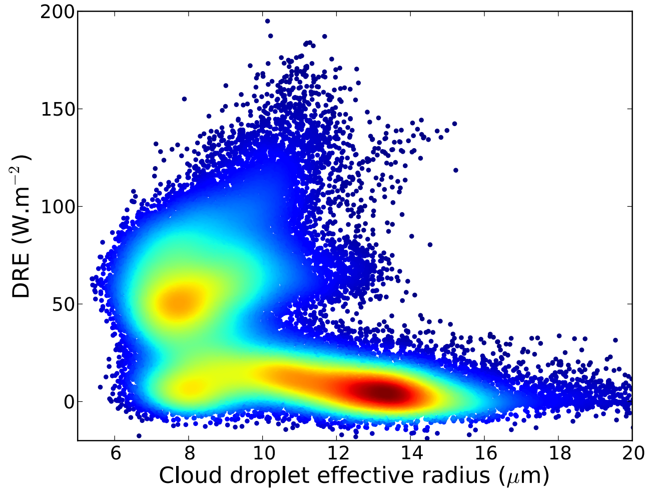

Figure 1. Distribution of the aerosol above cloud DRE as a function of the cloud droplet effective radius for the African biomass burning event off the Namibian coast, 4th August 2008.

(3) Figures 6,7, and 8 -In all these figures the scales of the plotted quantities do not match the description in the text! Apparently the ranges have been cut at a certain maximum, but this is not clear in the picture. This should be corrected. If the authors prefer to show only a part of the whole range, than the color bars should be annotated indicating that the range was cut. E.g. 6a: 0.0, 0.1, 0.2, >=0.3. The figures should be clear by themselves, and not only after a thorough (and confusing) read of the text. Since all three figures were created like this, as I understand after reading the text, I urge the authors to reconsider all figures to make sure this is corrected in all of them. -The captions are too short and too general. All 6 panels should be described in the caption, so that the figures make sense without a thorough read through the text. -The colorbar annotations are illegible.

Figures 6, 7 and 8 (for now on, 7, 8 and 9) has been modified to make clear that some colorbars are saturated and to make legible the annotations. The descriptions of the 6 plots have been added to the caption of Fig. 7:

Figure 7. Biomass burning aerosols above clouds off the South West African Coast the 4 August 2008. The panel displays the Above Cloud AOT at 865 nm (a), the Angström Exponent (b), the aerosol SSA at 865 nm (c), the Aerosol Corrected COT at 550 nm (d), the difference ΔCOT of the AACOT and the MODIS COT (e) and the Direct Radiative Effect of aerosols above clouds in $W.m^{-2}$ (f).

(4) In all experiments the used parameters should be mentioned and presented, e.g. in tables.

Textual comments:

Abstract

lines 2-7: "While most of the retrievals of above clouds aerosol characteristics rely on assumptions on the aerosol properties, this study offers a new method to evaluate aerosol and cloud optical properties simultaneously (i.e. aerosol and cloud optical thickness, aerosol single scattering albedo and angström exponent)". The word 'while' implies that this is not true for his method. However, the method presented here still relies on the correct selection of aerosol models through use of an inversion method, and is essentially not different from most other methods. However, since more independent information is used, the selection of the aerosol properties can be better constrained. Please, rephrase.

The beginning of the abstract has been rephrased:

This study presents an original method to evaluate key parameters for the estimation of the direct radiative effect of aerosol above clouds: the absorption of the aerosol layer and the albedo of the underneath cloud.

line 15: '..based on exact modeling.' The authors mean 'exact' here as opposed to the approximate method of eq. 1. However, this is not clear here in the abstract without the context. Obviously, one would use an exact (as possible) method to compute something. This should be rephrased to indicate which exact and approximate methods are meant. Or just removed.

This part has been removed.

line 15-16: Similarly: " beside THE three case studies..". These three case studies have not been introduced at this stage, so describe more generally in the abstract what the paper is about.

A brief description of the case studies have been added to the abstract:

Three case studies have been selected: a case of absorbing biomass burning aerosols above clouds over the South-East Atlantic Ocean, a Siberian biomass burning event and a layer of Saharan dust above clouds off the North-West African coast.

lines 19-24: In my opinion, the result that cloud heterogeneity of clouds "leads to a slight underestimation" of the DRE is a very important result. It has become clear that highly models underestimate the DRE of ACA, and most analyses indicate that cloud brightness/fraction is probably the culprit, since it has such a strong influence on the resulting DRE. Heterogeneity also has an important effect, as shown here: 10% underestimation for an inhomogeneity parameter of 0.6. To me, 10% is a serious effect, the authors claim that an inhomogeneity parameter of 0.6 represents a normal value for stratocumulus clouds. This effect should be investigated further, and the authors should present a sensitivity analysis of the inhomogeneity of clouds on the DRE of ACA. That would present a real new addition to this scientific field.

Not taking into account the cloud heterogeneity in the retrieval and the processing of the DRE leads to biases in the evaluation of the DRE of aerosols above clouds. We agree that a study of the impact of cloud heterogeneity on the estimation of the DRE would be very useful. However, 3-D radiative transfer simulations are time-consuming (especially for spectrally integrated fluxes) and a complete analysis of this effect would require a separate study. Also, as mentioned, from now on, in section 2.3, the retrieval of aerosol and cloud properties is only attempted for relatively homogeneous clouds (filter based on MODIS product). We expect to have the highest DRE (and thus, the largest biases) over the South East Atlantic Ocean during the fire season. A statistical analysis has been performed from June to August 2008 over this area. Figure 2 shows the distribution of the heterogeneity parameter ρ for ACA events selected by the algorithm. Only 5% of events have a heterogeneity parameter larger than 0.45 and it is lower than 0.3 for 73% of these ACA scenes. For this reason, we expect a limited impact of cloud inhomogeneity in this study.

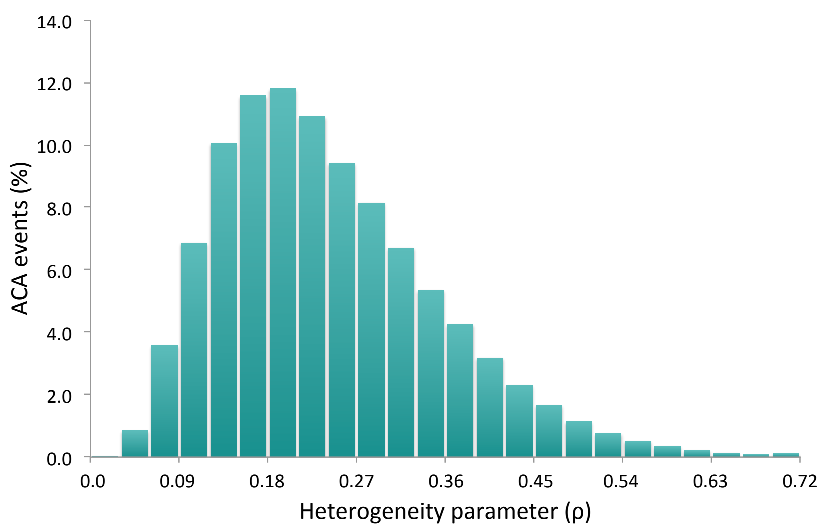

Figure 2. Heterogeneity parameter distribution for ACA events over the South East Atlantic Ocean in June to August 2008.

In the manuscript, page 25553 lines 9 to 11 have been replaced by:

To process the cloud field, the inhomogeneity parameter ρ has been fixed at 0.6, which represents a standard value for stratocumulus clouds [Szczap et al., 2000a & 2000b]. A statistical analysis of the inhomogeneity parameter has been performed over the ACA scene sampled by the algorithm. It shows that ρ = 0.6 can be considered has a high value in this study.

25535

line 2: The last ones -> The latter

line 13: thanks to -> using

These sentences have been corrected.

line 26: "Over a bright surface such as clouds": Clouds are not surfaces, please rephrase.

“Surface” has been replaced by “scene”.

line 28: darkening effect -> darkening

25537

line 4: couple -> number

The manuscript has been modified according to the reviewer suggestion.

line 9: Since -> When I think the consistency shown in Jethva et al (2014) does not yet warrant the claim that this can be done in general.

It is now mentioned that this analysis has been performed for a case study:

Jethva et al. [2014] have carried out a multi-sensor comparison of the above-cloud AOT retrieved from different sensors on board NASA’s A-train satellite for a biomass burning event off the South West African coast.

lines 11-13: "Though, ACAOT retrieval techniques presented above generally require an assumption on the absorption character of the overlying particles or do not enable to estimate it." This sentence is unclear, please rephrase.

This sentence has been rephrased:

However, most of the ACAOT retrievals presented above do not evaluate the aerosol single scattering albedo.

line 18: latest -> latter

The manuscript has been corrected, thank you.

line 21: "it becomes hazardous for coarse mode particles" -> "it cannot be applied to coarse *mode particles."*

This sentence has been modified:

While this method is expected to work efficiently for fine mode aerosols as their interactions at longer wavelengths are minimal or even nil, it may not work for coarse mode dust aerosols due to their radiative influence at longer wavelengths.

line 23: scenes -> in the scene

25538

lines 3-4: remove "based on exact modeling"

These modifications have been included to the manuscript.

lines 4-6: "Beyond their types, aerosol absorption properties are expected to vary a lot depending on space, time and formation processes (Dubovik et al., 2002) and thus, resulting on different radiative responses." This sentence is unclear, especially 'beyond their types', please rephrase.

Similarly, the words "Consequently" (line 6) and "Similarly" (line 7) indicate a reasoning in the text that's not there. Please, rephrase using a clear reasoning or simply sum up the paper's contents.

This part of the introduction has been rephrased:

Both algorithms have been applied to three events with contrasted aerosol properties: absorbing biomass burning aerosols off the South West coast of Africa, scattering ones from Siberia and Saharan dust. Then, aerosol and cloud properties as well as the DRE have been evaluated and averaged through August 2006 over the South East Atlantic Ocean.

line 17: thanks to -> owing to

lines 20-21: all along this paper -> in this paper

lines 21: would refer -> refers

25539

line 3: angle -> angles

line 5: are -> is

These corrections have been made, thank you.

line 10: Figure 2 is valid for fine mode particles (0.1 micron), but coarse mode particles are not mentioned here. How do coarse mode particles effect the (polarized) signal? More importantly: What is the uncertainty in the retrieved aerosol parameters? Is it the same for the fine and the coarse mode? And how does this uncertainty effect the uncertainty in the final DRE?

The polarized signature obtained for dust and fine mode aerosols above clouds is displayed in Fig. 3. Contrary to fine mode aerosols, mineral dust particles do not generate an important polarized signal at side scattering angle. However, they strongly attenuate the cloud bow (at scattering angle around 140°). This attenuation is almost spectrally neutral between 670 nm and 865 nm and is directly related to the total AOT for coarse mode aerosols. Let us add that the entire polarized signal is used to retrieve the AOT at 865 nm for dust while only measurements acquired for scattering angle lower than 130° are kept to retrieve the scattering AOT for fine mode aerosols (cf. Fig. 4 in Waquet et al., 2013). The complex part of the refractive index is not expected to vary a lot at 865 nm. Consequently, the same assumption on the SSA at 865 nm is used in the polarized and the total radiance part of the retrieval for dust (i.e. $SSA_{865nm} = 0.984$). Then, the second part of the retrieval consists in the evaluation of the COT and the dust absorption at 490 nm.

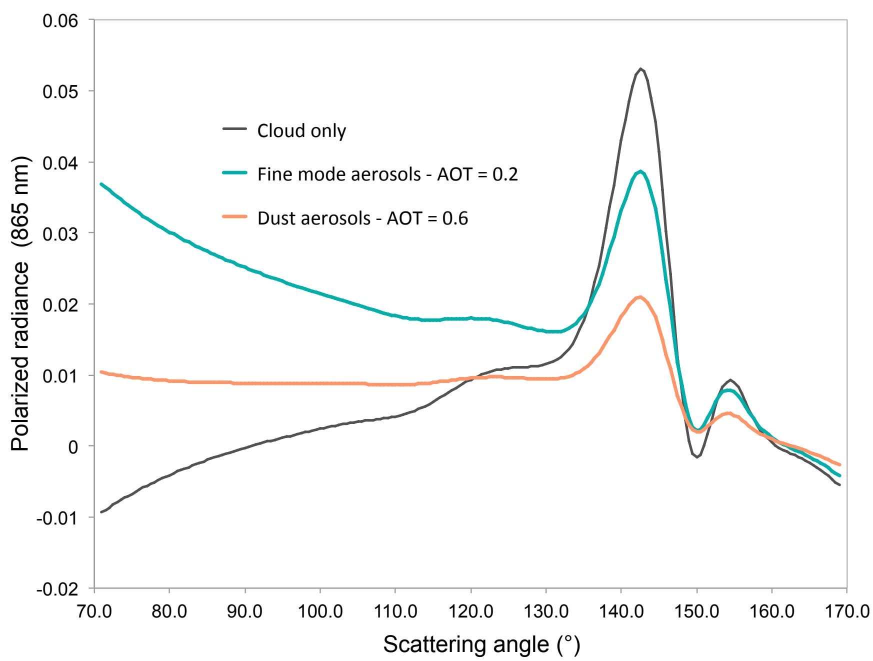

Figure 3. Simulated polarized radiance at 865 nm plotted against the scattering angle. Black line corresponds to the cloud only (COT = 10, r_{eff} = 10 μm). Green line corresponds to a fine mode aerosol layer (r_{eff} = 0.1 μm) above cloud with AOT_{865nm} = 0.2. Dust aerosols (AOT_{865nm} = 0.6) above cloud are represented in orange. (Extracted from Waquet et al., 2013.)

Waquet, F., Cornet, C., Deuzé, J. L., Dubovik, O., Ducos, F., Goloub, P., Herman, M., Lapyonok, T., Labonnote, L., C., & Vanbauce, C. (2013). Retrieval of aerosol microphysical and optical properties above liquid clouds from POLDER/PARASOL polarization measurements. *Atmospheric Measurement Techniques*, *6*(4), 991-1016.

line 11-12: "In case of clean sky condition (i.e. without aerosols), the total radiances scattered by cloud water droplets are expected to be relatively spectrally independent from the UV to the Short Wave InfraRed (SWIR) part of the spectrum." I think this is not "expected", but shown in other studies, e.g. De Graaf et al (2012), using SCIAMACHY measurements.

This clarification has been added to the manuscript:

In case of clean sky condition (i.e. without aerosols), the total radiances scattered by cloud water droplets are relatively spectrally independent from the UV to the Short Wave InfraRed (SWIR) part of the spectrum [De Graaf et al., 2012].

line 22: .. for a given aerosol size distribution." In fact, this size distribution is not given at all. Please, indicate which experiments were performed. If necessary, add tables with all relevant cloud and aerosol parameters listed, so results can be checked and understood.

This sentence has been rephrased and the caption of Fig. 3 has been completed:

In the same way as Fig. 3 in the study of Jethva et al. [2013], Fig. 3 highlights the color ratio effect. The radiance ratio (L_{490}/L_{865}) is plotted against the SWIR radiance (L_{865}) for several Cloud Optical Thicknesses (COT) and for aerosols with an effective radius of 0.1 µm.

25540

line 11-12: "Meanwhile, the data used in this paper corresponds to the previous version." Please, give version numbers and description, which will be important for readers who know this. Be exact.

The information about the data version is mentioned in the manuscript (i.e. PARASOL Collection 2 v02.04).

lines 20-22: Again, please provide a table with all relevant information.

A precise description of the models used in the LUT is given in the table below (added to the manuscript):

	Polarized LUT	Total radiance LUT
	Aerosols models	
Vertical distribution	gaussian layer with a mean altitude of 3 km	homogeneous layer between 2 and 3 km
Fine mode:		
Size distribution	lognormal distribution with $\sigma_f = 0.4$ $r_{eff} = 0.06$ to 0.16 µm (by 0.02 µm step)	
Refractive index	1.47 – i.0.01	1.47 – i.k with k = 0.00 to 0.05 (by 0.0025 step)
Dust:		
Size distribution	bimodal lognormal distribution with $\sigma_f = 0.4$ $r_{eff,fine} = 0.35$ µm $r_{eff,coarse} = 2.55$ µm	
Refractive index	1.47 – i.0.0007	1.47 – i.k $k_{865nm} = 0.0007$ $k_{490nm} = 0.0$ to 0.004 (by 0.0005 step)
	Cloud models	
Vertical distribution	homogeneous layer from 0 to 0.75 km	homogeneous layer from 0 to 1 km
Size distribution	gamma law with veff = 0.06 $r_{eff} = 5$ to 26 µm (by 1 µm step)	$r_{eff} = 10$ µm
Refractive index	$m_{r,490nm} = 1.338$ $m_{r,670nm} = 1.331$ $m_{r,865nm} = 1.330$	

Table 1. Aerosol and cloud model properties used to compute the polarized and total radiance LUT of the POLDER algorithm.

25541

line 2: a SD -> a standard deviation (SD)

line 3: thanks to -> using

line 5: one -> AOT

The manuscript has been corrected as suggested by the reviewer.

line 7: "We consider that the aerosol size corresponds to the one of the nearest model". How is the data fitted and what is the critical selection criterion for aerosol model/type? Does this mean only aerosol optical properties interpolated and not the size distribution?

The size distribution is not interpolated. The retrieval of the scattering AOT is attempted at 6 km x 6 km resolution using polarized radiances at 670 and 865 nm. A first estimation of the total AOT is made based on an assumed complex part of the refractive index. The AOT at both wavelengths is then filtered and aggregated from 6 km x 6 km to 18 km x 18 km. The angström exponent is calculated at the lowest resolution. We consider that aerosols have the size distribution corresponding to the model with the nearest angström exponent. The sentence has been rephrased:

We consider that the aerosol size corresponds to the one of the model with the nearest model (i.e. not interpolated).

lines 14-15: "For the fine mode, k varies from 0.00 to 0.05" Which values have been used? Be specific.

The values used in the LUT are mentioned in the Table 1.

lines 15-16: "..it is assumed to be the same at both wavelengths since a weak variation of this parameter is expected between the used bands.." Why since? Do you mean ONLY a weak variation is expected? Then rephrase it like that.

The sentence has been rephrased:

… it is assumed to be the same at both wavelengths because only a weak variation of this parameter is expected between the used bands …

line 19: radiations -> radiation

This correction has been made, thank you.

25542

lines 3-4: "The retained solution is the one that minimizes the least square error term." This is the usual approach. But please provide the equation that is actually minimized.

The equation of the error term ε has been added to the manuscript

$$\varepsilon = \sum_{i=1}^{N_\Theta} \sum_{j=1}^{N_\lambda} \left[L_{ij}^{meas}(\Theta) - L_{ij}^{calc}(\Theta) \right]^2 \quad (3)$$

L referring to measured (*meas*) and calculated (*calc*) radiances and Θ being the scattering angle.

line 6: thanks to -> using

line 13: level -> levels

25543 line 19: of -> off

These words have been corrected, thank you.

25544

lines 3-6: "To finish with the assumptions about aerosols, we have taken an interest in the altitude of the aerosol layer. We have processed the signal for an aerosol top altitude of 4 and 6km while the aerosol layer reaches 3km in the LUT. However, the results are not displayed since they do not have shown any impact." The purpose of the first sentence is unclear. This is an clear result, and should be mentioned as part of the complete sensitivity study.

The paragraph has been rephrased:

The last assumption about aerosols that has been investigated concerns the vertical distribution of the aerosol layer. We have processed the signal for an aerosol top altitude of 4 and 6 km and the algorithm has retrieved the correct aerosol and cloud properties. In polarization, the bands used to retrieve the scattering AOT (i.e. 670 and 865 nm) are weakly impacted by the molecular contribution. Aerosols in the clouds do not contribute to the polarized signal. Hence the polarized radiances are not impacted by the aerosol vertical distribution as long as the aerosol layer is distinct from the cloud.

line 15: At last -> Lastly

25545

line 6: thanks to -> based on

The manuscript has been modified according to the reviewer suggestion.

line 23: is weakly -> is only weakly

This sentence has been rephrased:

The cloud top height is derived from the POLDER apparent O2 cloud top pressure [Vanbauce et al., 2003] since the O2 retrieval allows a reliable estimation of the cloud top height in the presence of an aerosol layer above [Waquet et al., 2009].

25546

Line 1: "The ACA scenes have been selected since they are very usual at global scale." I'm not sure what is intended here. ACA scenes are not very common globally. Change to "Common/representative ACA scenes were selected?"

The sentence has been removed.

lines 11-12: "biomass burning particles are frequently observed around the Southern Africa due to man made vegetation fires" -> biomass burning particles, due to man made vegetation fires, *are frequently observed around the Southern Africa.*

line 12 : in the same time -> at the same time

lines 13-14: the deck stratocumulus deck does not favor long-range transport, the wind does, or meteorological conditions. Please, rephrase.

The beginning of the section has been rephrased:

From June to October, biomass burning particles, due to man made vegetation fires, are frequently observed above the persistent deck of stratocumulus covers off the South West African coast.

line 15: an important amount -> a large amount (or better just biomass burning aerosols were detected/observed).

The sentence has been rephrased:

On August 4th 2008 (Fig. 6a), biomass burning aerosols have been observed over clouds.

line 16: The aerosol layer over the Atlantic Ocean is very often a few kilometers thick. If this is the case, please givemore information on the height than just one position of 3 km. Was this the average weighted height, does it extend from the cloud top to 3 km? Or further. And how do you treat that in the LUT?

The aerosol layer is located between 3 and 5 km and does not touch the cloud layer located 2 km below. The information about the vertical distribution of the aerosol layer is now given Table 1. As shown in section 2.4, the algorithm is not sensitive to the aerosol altitude.

line 19: The ACAOT value of 0.74 is not shown in the plot! The ACAOT in Fig 6a ranges up to 0.3. After further reading I noticed that the range scales were cut in the plot (or so I assume). This should be corrected in Figs. 6,7, and 8, see the comments on those Figures elsewhere.

25547

line 1: "is respectively of 0.875 and 0.840 at 550 and 865 nm" -> "is 0.875 and 0.840 at 550 and 865 nm, respectively"

line 10: "that takes into the" -> that takes into account the

These sentences have been corrected as suggested by the reviewer.

lines 14-15: "due to the logarithmic relation curve between radiances and with COT". This is bad English, please rephrase.

This sentence has been replaced by:

The impact of the aerosol absorption on the signal gets bigger as the COT increases.

line 16: "the bias is around 15". The highest values shown is 8. Please, correct.

line 18: "As expected for very" -> As expected for highly

This sentence has been modified.

line 19: "DRE up to 195.0". The maximum value shown in 100.

25548

line 2: "due to" -> and / following

The manuscript has been corrected.

lines 5 and 6: "important". Why important? To you? Rather say 'Large'. Or better yet, stay objective.

"Important" has been replaced by "non-negligible".

line 8: The -> On

The sentence has been corrected.

line 17: peak at 3.0. Not in range of figure

line 19: "the retrieved models" -> the retrieved radii

line 27 "ones" -> ones,

These modifications have been made.

25549

lines 1-3: Can you explain this? Do they have a different origin? Or different pathway/history?

This is most likely explained by the difference of age between the two plumes. Back trajectories suggest that air masses left inland Russia 3 days before arriving to the Southern area while it took only 1 day to arrive in the Northern part of the plume. This explanation has been added to the manuscript.

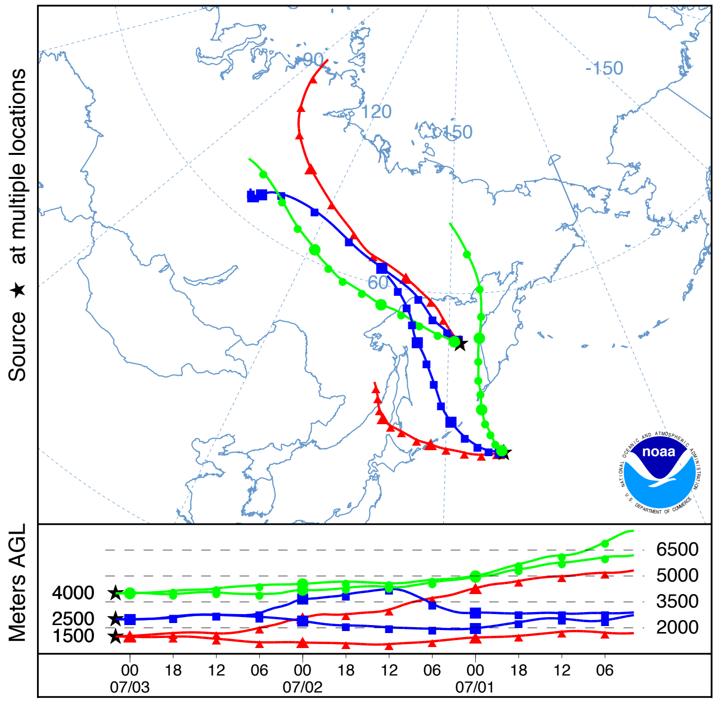

Figure 4. Air mass backward trajectories calculated for altitudes equal to 1.5 km, 2.5 km and 4 km and ending the 3 July 2008 on the area where aerosols above clouds have been detected by POLDER.

line 8: "bias up to +12". Max in Figure is 4. line 9: "bias up to -10.7" Min in Figure is -4 lines 12 and 14: Max and minimum DRE values are not in the Figure.

lines 13-14: "Again, the approximate expression (Eq. 1) can clarify both situations." I think clarification should be a physical explanation, e.g. the one that Eq 1. is based on. Please, rephrase.

The sentence has been rephrased:

As shown in Eq. (1), the sign of the perturbation depends on the balance between the up-scattering and the absorption of the aerosol layer.

lines 15-20: the values are not in the figure

25550

line 8: "southern area" -> "western part", to be consistent in the text.

lines 11-12: "closely look alike" -> are close

line 12: a lot -> strongly

The manuscript has been modified as suggested by the reviewer.

lines 12-14: Add a reference to Haywood et al (2004), who first evaluated this.

The reference has been added, thank you.

line 14: overestimate -> overestimates

line 22: noticed -> notice

25551

lines 17-20: the values given are not in the figure.

25552

line 2: "between the 9 and the 17 August." -> between 9 and 17 August.

lines 7-8: the values are not in the plot.

line 12: observed -> observe.

These corrections have been done.

line 13-15: This point should be stressed more. The data selected for this manuscript are cloud with COT > 3 and CF=1, which will give a high bias of DRE values. Therefore, the results cannot readily be compared to the results of e.g. De Graaf et al. (2012) who used CF<1 and COT < 3.

The end of the paragraph has been rephrased to accentuate this point and the captions of Fig. 10 and 11 have been completed:

However, it has to be noted that these two estimations cannot be directly compared because the SCIAMACHY aerosol DRE has been determined for AAC scenes with a Cloud Fraction (CF) larger than 0.3 while the method developed here is restricted to optically thick clouds (COT > 3) with CF = 1. Thus, these selection criteria of the AAC scenes lead to a high bias of the DRE. Also, the two satellite instruments do not observe the scene at the same time. Changes of the scene between the two measurements [Min et al., 2014] and the difference of solar zenith angles can explain the remaining discrepancies.

Figure 10. Direct Radiative Effect of aerosols above clouds averaged through August 2006 (a) and number of associated events (b). The DRE has been processed over scenes with a Cloud Fraction (CF) equal to 1 and COT ≥ 3.

Figure 11. Frequency distribution of the aerosol Direct Radiative Effect above clouds for August 2006 for the South East Atlantic Ocean. Only scenes with COT ≥ 3 and CF = 1 are considered.

25553

line 5 thanks to -> using

line 10 choose -> choosen

line 15: RT -> Radiative Transfer (RT)

line 16: has -> have

The manuscript has been corrected as suggested by the reviewer.

line 27: "11%". Do you mean at 490 nm, and about 14% at 865 nm? Please, be clear and concise.

The sentence has been rephrased:

On average, the plan-parallel cloud (i.e. 1D) produces 9.2% at 490 nm and 12.6% at 865 nm more signal than the heterogeneous cloud field.

25555

line 3: "impact of aerosols." -> impact of aerosols, in case of cloud heterogeneity.

lines 3-4: "The values presented in this paper can be seen as a lower bound for ACA DRE." This is only true for the cloud heterogeneity argument. E.g. the selection criterion of COT>3 will select high values of ACA DRE. Please, rephrase.

The sentence has been rephrased:

For the scenes presented in this paper (i.e. which meet our selection criteria), the obtained values can be seen as a lower bound for the ACA DRE.

Conclusion.

line 20: "The algorithm has shown its ability to accurately retrieved aerosol and cloud properties". This statement is unfortunately untrue, although this would be the desirable conclusion for this manuscript. But the accuracy assessment is missing, so this cannot be concluded.

“Accurately” has been removed of this sentence.

line 23: very -> strongly

25556

line 6: has -> have

line 13: very -> highly

line 19: on -> to

These corrections have been made.

line 23-24: Please, repeat here in the conclusion section that there is a difference between the results of this manuscript and those in the literature, and that those are mainly caused by selection criteria of the clouds.

This part of the conclusion has been rephrased:

The monthly averaged value over the scene is estimated at 33.5 $W.m^{-2}$, which is of the same order of magnitude as the estimation of De Graaf et al. [2012] (i.e. 23 $W.m^{-2}$). Let us point out that differences between the result of this study and the literature are expected and are mainly due to the selection of the AAC scenes: this analysis does not include thin clouds (i.e. COT < 3) and scene with fractional cloud coverage which leads to biased high the DRE.

line 24-25: "This analysis shows how important the studies of ACA are for the climate understanding." I don't agree. I think this study shows in three case studies how ACA radiative impacts on clouds can be studied. This will help, climate studies.

This sentence has been removed.

25557

line 10-12:"On the other hand, 3-D effects cause bias on our estimation of the COT. Finally, the homogeneous cloud assumption leads to a slight underestimation of the DRE of aerosols." I think this is an important new conclusion. The effect of homogeneous cloud assumption on the estimation of the DRE should be quantified.

The sentence has been rephrased:

Finally, the homogeneous cloud assumption leads to an underestimation of the DRE of aerosols. This bias remains small in this study because scenes with too heterogeneous clouds are rejected. However, a thorough analysis of the effect of the homogeneous cloud assumption on the estimation of the DRE would provide a significant contribution to the scientific field.

Figure 2: The inset is not explained.

The figure caption has been replaced by:

Figure 2. Simulated polarized radiance at 865 nm plotted against the scattering angle. Black line corresponds to the cloud only (COT = 10, r_{eff} = 10 µm). Colored lines are for an aerosol layer above clouds. The effective radius of aerosols is 0.10 µm. Several absorption AOT (i.e. various k) have been considered but the scattering AOT is fixed at 0.18. The inset focuses on polarized

radiances of aerosols above clouds for scattering angles between 100° and 130°. Complementary information about vertical distributions and properties of aerosols and clouds can be found in Table 1 (cf. polarized LUT).

Figure 3:

-This figure is very similar to Fig. 3 in Jethva et al (2013). This reference should be added, and in the text the similarity should be noted.

-It is not clear from the text or the figure caption and/or the text in the figure which parameters have been used to generate this plot. In order to understand, compare (e.g. with Jethva et al, 2013) and reproduce the results, it is imperative that all necessary information is available in the paper. Missing are e.g. size distribution, viewing angles, atmospheric parameters, etc.

Lines 21-22 page 25539 have been rephrased:

In the same way as Figure 3 in the study of Jethva et al. [2013], Figure 3 highlights the color ratio effect. The radiance ratio (L_{490}/L_{865}) is plotted against the SWIR radiance (L_{865}) for several Cloud Optical Thicknesses (COT) and for aerosols with an effective radius of 0.1 µm.

The caption of Figure 3 has been completed:

Figure 3. Radiance ratio L_{490nm}/L_{865nm} as a function of the radiance at 865 nm. Signals have been simulated for aerosols with an effective radius of 0.10 µm, an effective radius of cloud droplet of 10 µm (for more information about aerosol and cloud properties and vertical distribution, cf. Table 1, total radiance LUT column). The scattering AOT is set and several absorption AOT as well as several COT are considered. Calculations have been carried out for a solar zenith angle $\theta_s = 41.3°$, a viewing angle $\theta_v = 41.3°$ and a relative azimuth $\phi_r = 180°$.

Figure 4: The annotations are illegible.

Figure 4 has been reconsidered.