First of all, we than the reviewer for all his/her comments and suggestion. We are certainly grateful for any offer to improve our English. In the discussion below, we provide a summary of each question or comment.

1/ Just because mixed and unmixed cases occur in the same geographical location on different days does not mean that the meteorology is the same at that location on the different days. […] References to the incorrect interpretation of similar meteorology start from line 8 of the Abstract, and continue on line 14 of page 14201and line 19 of page 14218.

For simplicity, I report below the three concerned statements:
Line 8 of the Abstract : "*This strategy allows, to a certain extent, to isolate real aerosol-induced effect from meteorology*"

Line 14 of page 14201: "*the analysis of MODIS-CALIPSO coincidences provide a unique possibility to isolate (to a certain degree) aerosol-induced effects from meteorology and obtain more reliable estimates of aerosol impact on clouds, than simple relationships only based on vertically integrated measurements*".

Line 19 of page 14218: "*The observed differences in mixed and unmixed case statistics can be reliably interpreted as resulting from a real aerosol-induced effect, and not from changes in local meteorology.*"

The distinction between mixed (presumably interacting) and well-separated cloud and aerosol layers in not possible using only vertically integrated measurements (e.g. those from MODIS instruments). We argue that the combination of MODIS and CALIPSO data provides some additional information to identify whether the observed aerosol-cloud relationships are real or derive from co-variation of meteorological parameters. Indeed, the CALIPSO products provide the information whether there is, or not, a physical interaction between the aerosol and cloud layers.
We do not expect to have completely eliminated the co-varying meteorology from the statistical relationships, but it is probably a step forward from similar analysis that have been done based in passive satellite observations alone.
As the South-Atlantic region is relatively large, however it would be possible that various areas (distant hundreds and hundreds of kilometres from each other) are dominated by completely different meteorologies. The fact that mixed and unmixed layer cases with significant aerosol loads are mostly distributed over similar areas, almost homogeneously distributed over the South-East Atlantic, lead us to believe that we are observing true aerosol effects.
The reviewer argues, and we agree, that the lack of a temporal resolution in our analysis may hide temporal co-variations of aerosol and meteorology. A given geographical area can be affected by radically different meteorological conditions during a whole year, leading to statistical co-variation of cloud and aerosol parameters. An obvious way to resolve this would be to analyse the various relationships at the monthly scale. However, this leads to a coincidence dataset that gets too small to obtain meaningful or statistically reliable relationships.
Nevertheless, cloud parameters mostly vary with increasing aerosol load only in case of cloud-aerosol interaction. Unmixed case statistics do not show globally any significant dependence on aerosol variability. This result provides evidence that the observed relationships are driven by aerosol-cloud interactions rather than a spurious meteorological effect.
One may argue that mixed and unmixed statistics belong to two different meteorological conditions leading to different respective positions of aerosol and cloud layers. Similarly, cloud microphysics may be dependent on the cloud altitude. Hence, mixed and unmixed cases can be representative of cloud population at different elevation. This is a second source of uncertainties intrinsic to our analysis. A possible solution would be to sort data by pressure levels and compare mixed and unmixed statistics of clouds at the same altitude. We did that only for the CLF-AI analysis, which is

particularly difficult as meteorological forcing is particularly strong. Again, the limited number of valid coincidences do not allow for a systematic analysis sorted by cloud pressure. We nevertheless did attempt such analysis (i.e. plot the CDR-AI, COT-AI, LWP-AI relationships as a function of cloud pressure) and could not evidence a significant difference with the mean relationships that are presented in the paper. Only CLF-AI relationship showed the peculiar dependence on CTP that has been shown and discussed in our paper.

If the explanation above provide useful information for the understanding and support of the approach, it may be added to the text, in the discussion or conclusion sections.

2/ I have always thought that absorbing aerosol above a cloud will indeed create a negative bias in retrievals of COT. Wilcox et al., (2009) supports my understanding. […] If the MODIS product is affected by absorbing aerosols above clouds, then several results found in >this paper need re-examination.

In the paper we based our conclusion on the results of Haywood et al. (2004) over the South-East Atlantic, according to which aerosol can be responsible of an error on retrieved COT up to 10-20% in the case of smoke (i.e. within the variability observed for mixed and unmixed COT with AI). We were not aware that the results of Wilcox et al. (2009) contradict this earlier result.

Anyway, the main idea of this work is to compare mixed and unmixed statistics and infer aerosol effect by the difference between the two statistics. Even though the "absolute" values of CDR and COT can be more or less realistic, more or less affected by several sources of uncertainties, both mixed and unmixed cloud retrievals are characterized by aerosol located (at least partly) above clouds. Cases of aerosol below clouds are not considered and mixed case is defined as the case where aerosol bottom layer is closer than 200 m to cloud top layers. A priori a huge number of mixed retrievals refer to cases of aerosol layers partly mixed with cloud and partly above it. In this way, MODIS retrieval errors from aerosol above clouds do not seem it can be a leading factor in determining a substantial difference in COT (and hence LWP, directly dependent on COT) and AI covariation in case of mixed and unmixed statistics.

3/ There is no plot of LWP vs. COT, although that relationship is referred to several times through Section 4.5.

We agree that this figure is missing. It is shown below and will be added to the revised version of the paper.

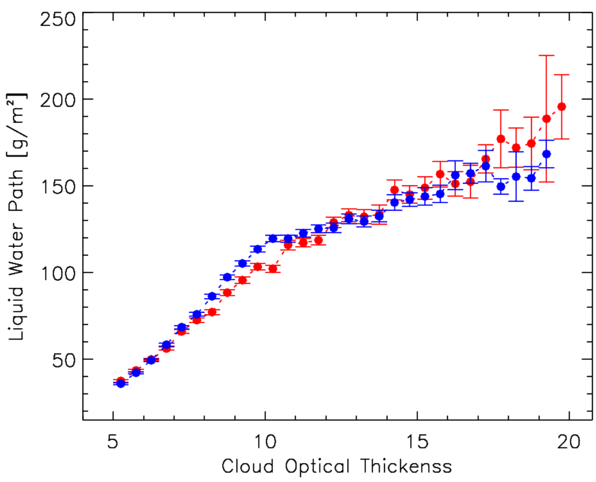

Figure. Liquid water path retrievals averaged over constant bin of optical thickness. Data are representative of low clouds (top pressure lower than 600 hPa) over South-East Atlantic, within

[4N,-30N;-14E,18E], selected according to screening criteria of MMC methodology (Chapter 6). In case of mixed cloud and aerosol layers only retrievals with AI > 0.09 have been selected, in order to consider mixed clouds as representative of polluted cloud type.

4/ Section 4.5 the authors transition from using the terms mixed and un-mixed to the terms polluted and clean. This is counterproductive. Mixed and unmixed span the AI range from 0.03 to 0.5.

This is not completely true. In case of CDR-COT analysis mixed statistics are only representative of AI that ranges between 0.09 and 0.5. We only select data with AI larger than 0.09 to avoid very low aerosol regimes (when CDR values of interacting layers converge to those of un-mixed ones) and consider mixed statistics as representative of *polluted* cloud properties (a relatively high concentration of aerosol mixed with the clouds).

On the other and, in case of unmixed layers, we consider all AI. In the hypothesis that layer are well separated clouds are considered to be representative of *clean clouds*. Cases of multilayer aerosol are excluded. If a mono-layer aerosol is located above the cloud, we consider that such cloud has probably formed (below it) in a clean environment.

5/ Why couldn't the aerosol embedded in the clouds themselves be dark enough to decrease the visible reflectance, which in turn would decrease the retrieval of COT? This was Kaufman and Nakajima (1993)' s explanation when they found signal in the CDR but not the COT for clouds in the Amazon.

This is indeed one of several potential explanations for observed LWP variations that are associated to retrieval errors (the so called artefacts) or to physical processes.

For example local inhibition of precipitation means more water lofted to cloud top, with subsequent liquid evaporation that may cool the atmosphere and destabilize the local atmosphere. Such effect can help conditions to the growth of deeper clouds ("deepening" effect) that produce more rains, compensating for the initial suppression of precipitation and decreasing LWP. In such cases, aerosol enhancement is expected to produce more rain, not less (Stevens and Feingold, 2009). However, we find some evidence of precipitation suppression in marine stratocumulus clouds mixed with aerosol particles with AI larger than 0.09, suggesting that Ackerman's hypothesis of droplet evaporation due to aerosol intrusion seems more appropriate (qualitatively and quantitatively) to explain the observed LWP loss of the order of 35 g/m^2.

The idea that aerosol embedded in the clouds themselves is dark enough to decrease the visible reflectance has been excluded, when interpreting the difference in mixed and unmixed case LWP variations, as we consider cloud retrievals quite independent from aerosol presence or, similarly, mixed and unmixed statistics both affected (and in the same measure) by this artefact. Again there is no indication that such effect could lead to the observed difference between LWP-AI relationships in case of mixed and unmixed layers.

6/ The discussion of 'cloud lifetime effect' (p 14222) should be handled with great caution. [..] At least there should be acknowledgement that the cloud lifetime effect is highly speculative.

We do agree with the reviewer that more caution should be used on this interpretation. We should stress that we do not dispose of observations describing the entire cloud life-cycle necessary to make a clear distinction between causes and effects. This is to say 'cloud life' speculations even if consistent with experimental data, cannot be considered as definitive evidence of a certain LWP and CLF response to aerosol perturbation.

In conclusion, we would principally stress the fact that while droplet radius variation is mostly governed by microphysical interaction between cloud droplet and cloud-active aerosol, dynamical and/or specific meteorological conditions may also buffer the LWP response and let deviate locally from the expected behaviour (Albrecht Hypothesis). This will be done in the revised version.

7/ I cannot manage to derive Eq. 9 from Eqs. 6, 7 and 8. CDR proportional to COTˆ0.2 and Nˆ-0.4

Yes!, absolutely, cdr is proportional to N^-0.4 . This is a typo that will be corrected

8/ The 0.47 µm channel is not used.

Yes, absolutely, over ocean MODIS data processing uses six spectral channels (0.55, 0.66, 0.86, 1.24, 1.64, 2.12 µm).