Dear Dr. Dulac,

First of all, we wish to thank you for the very careful attention brought to our manuscript at every stage of its processing, and apologize for the long delays on our side. We are now finally able to submit a revised manuscript, hoping that you could consider it for publication in Atmospheric Chemistry and Physics.

The Reviews were very useful and allowed us to improve the manuscript in many aspects :
- Providing a figure of the Nox emissions on the simulation domain (Fig. 2 in the revised manuscript) which is actually very useful for the interpretation of the effect of aerosols on ozone concentrations : from these two maps (Fig. 2 and Fig. 15C in the revised manuscript), it appears very clearly that screening by aerosols results in weaker ozone concentrations in Nox-rich regions, and stronger ones in NOX-poor regions.
- Provide a more quantitative analysis of the bias and correlation of the simulated vs. Observed AOD at 12 locations, showing that the performance of the model is rather satisfying in Africa and the Mediterran basin, but not so in continental Europe. The addition of this new table for statistical scores allowed us to replace many qualitative evaluations by quantitative statements.

The answers to your questions and comments are given below : the questions are reproduced in black, bold font, the answers in blue, and the description of the corresponding changes made to the manuscript, in green.

Best regards,

S. Mailler

1. The backplume calculation methodology seems original : it is then expected to discuss in the methodological section its relevance and possible advantages and limitations compared to other classical trajectory toold very frequantly used in the literature (namely HYSPLIT and FLEXPART)

We actually use this homemade backtrajectory model mostly for historical reasons. We think that it is based on reasonable hypotheses of laminar advection in the free troposphere, and random mixing within the boundary layer. However, we are not able to discuss the advantages and limitations of this model compared to other widespread tools as HYSPLIT or FLEXPART.

We added the following paragraph in the revised manuscript :
« Particles launched at the same initial position can have distinct evolutions back in time in time : therefore, the initial sample of 100 particles have distinct backtrajectories depending on their random vertical movements inside the convective boundary layer, and their parlty random vertical movements within the free troposphere. Even though this backplume model is possibly not comparable to state-of-the-art models such as HYSPLIT or FLEXPART, this model has been chosen for its simplicity of use, for a study in which backtrajectories are not a critical part. It does not necessarily imply that such a simplified formulation would be adequate for studies in which accuracy of the backplume simulations is critical. ». This states explicitly the possible limitations of the model we used.

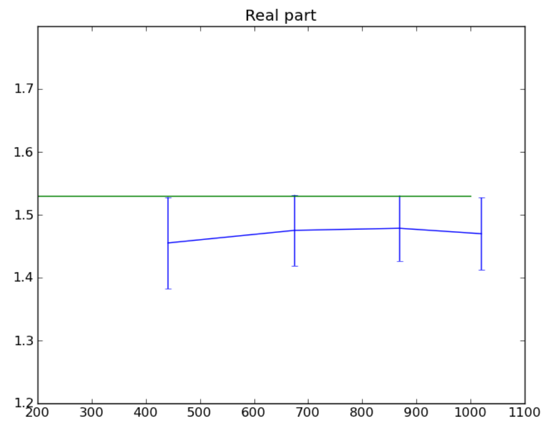
2. [Select additional AERONET stations] including Gozo, Potenza, Tamanrasset, Tizi-Ouzou and a few others in Spain, as well as the two stations of Cagliari (Sardinia Isl.) and Cap d'en

Font (Minorca island) especially set-up as part of the ChArMEx/ADRIMED campaign effort

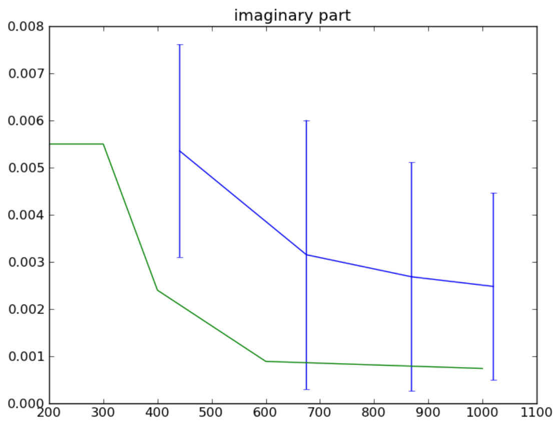
In Spain : Murcia, Malaga

These stations have been added to the study except Cagliari for which the data was not available on the AERONET database. Also, two stations have been added to the study in Northern Europe as requested by a Reviewer : Palaiseau and Mainz. The results of these new comparisons are sum up in Tab 3 in the revised paper and discussed in the text.

3. I would expect that you check with AERONET values retrieved in case of high dust episodes (i) the range of variability in the dust particle refractive index found at Lampedusa and (ii) how the values used by the model are appropriate. I find that we miss a sensitivity study to the dust refractive index.



Real part of the refractive index as assumed for dust particles in Fast-JX (green) and as given by AERONET inversion (blue). Error bars correspond to the minimum values given by AERONET during the periods of strong dust content. X-axis : wavelength (nm).



Imaginary part of the refractive index as assumed for dust particles in Fast-JX (green) and as given by AERONET inversion (blue). Error bars correspond to the minimum values given by AERONET during the periods of strong dust content.

This comparison has been performed (see above). The values assumed for dust particles in Fast-J are at the limit of the uncertainty range (for the real part) and within this uncertainty range for the imaginary part. It is worth noting that the uncertainty on the AERONET values for the refractive index is much stronger than reflected by the minimum and maximum measured values.

Dubovik et al. (2000) mention that a typical error of 1° on the pointing of the photometer yields « measured values » varying from 1.45 to 1.60 if the real value is of 1.53.

Regarding the imaginary part, a pointing error of 1° results in an uncertainty range yields « measured » values varying from 0.005 to 0.012 if the real value is of 0.008.

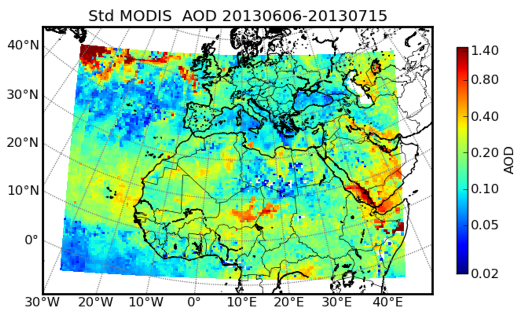
This very large sensitivity to pointing errors is due to the fact that due to their large diameter, the measurements of refractive indices for dust particles rely strongly on data from the solar aureole, which are particularly sensitive to pointing errors.

Therefore, the assumed value lies within the uncertainty range of the AERONET values (cumulating the variability of the mesured values and its possible biases due to pointing errors), but this result is not a very strong one since the uncertainty range of the measured values is so large.

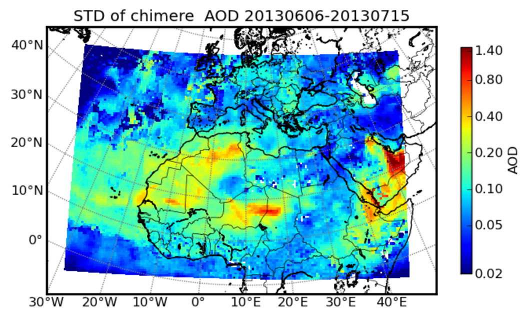
4. I would like to stress that the new daily daytime average AOD (630 nm) product from MSG/SEVIRI (...) originally produced for the SOP1a of ChArMEx offers a better spatial coverage than MODIS (...) offers a better spatial coverage. The daily product of AOD (550 nm) over ocean surfaces from MSG/SEVIRI (...) also offers a better coverage than MODIS, although limited to ocean surfaces and possibly biased by -35% (Chazette et al., in prep for ACPD). (...) limited areas in the North Sea and English Channel are visible on 21 June which do not really support the very high AOD values from CHIMERE in this area.

The use of MSG/SEVIRI would actually be an alternative to MODIS, and it is good to see that it has a better spatial coverage than MODIS. However, for the present study, we prefer to stick with the original choice of MODIS data, for practical reasons. However, it is worth noting that the presence of strong AOD in the North Sea on June 19 is confirmed by MODIS. The manuscript notes explicitly that we have no MODIS measurement that would confirm the persistence of this feature on June 21.

5. About Figure 3 : you might provide a figure showing the number of MODIS data in the period in order to document their reliability/significance ; additional maps comparing standard deviations from CHIMERE and MODIS would be useful information.



Std of MODIS AOD at 550 nm



Std of CHIMERE AOD at 550 nm

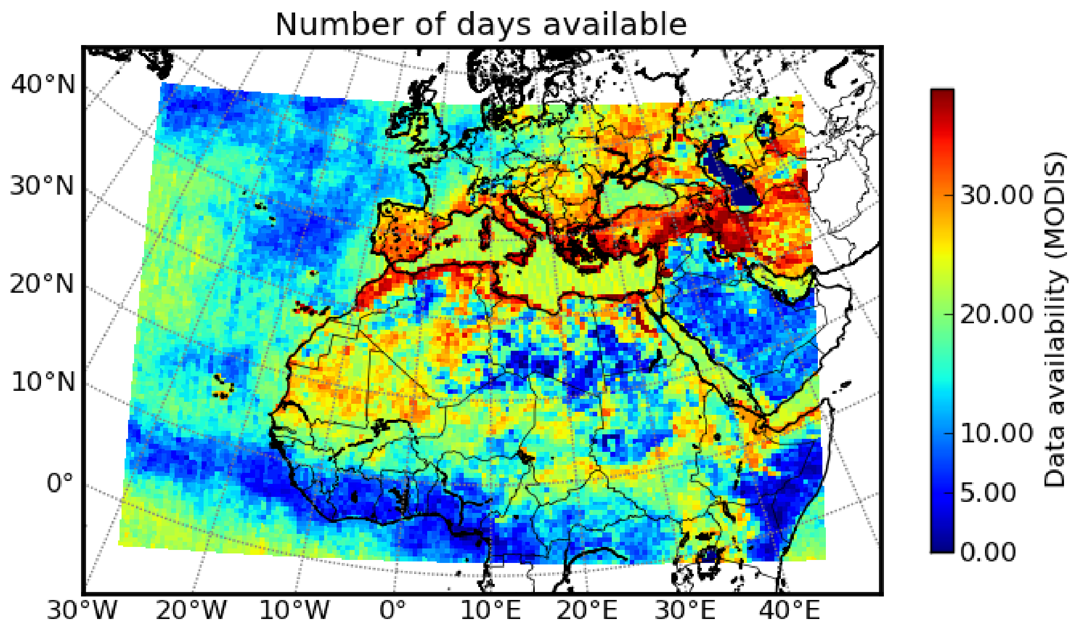
(Fig. 3 is Fig. 4 of the revised manuscript). The plots of the standard deviations are reproduced above. Qualitatively, they give the same information as the plots of mean values, with comparable results above northwestern Africa and the Saharan area. The standard deviation of MODIS is very high near the northwestern edge of the domain, but this high value is obtaine with only a few datapoints. Therefore, not too much confidence can be given to these results.

As with a small number of data values (less than 5 on many areas) the standard deviation depends a lot on the number of data points and is not representative to the real variability of the dataset, we prefer not to present these plots in the article.

The figure representing the number of available measurement points in MODIS is shown below.

This number varies greatly, and is notably very small over areas such as the ITCZ (due to strong cloud cover) and the northern Atlantic, probably due to the same reason. Also, data availability is very weak above the Arabian Peninsula and over northwestern Europe.

No data is available above the Caspian Sea. On the contrary, data availability is of more than 50% (20 days) on the Mediterranean Sea and the neighbouring continental areas



Number of days with an available measurement in MODIS during the simulation period.

6. A plot of Nox emissions might be useful to complement Fig. 15c and its discussion.

Such a plot has been included in the revised version as Fig. 2. As you suggested, including this plot strengthens the discussion of the twofold effect of aerosol screening on ozone concentrations. Comparing Fig 2 and Fig. 15c in the revised manuscript permits to verify that the patterns of both maps coincide very well : in areas with (or close to) significant NOx sources, the effect of aerosol screening is to decrease ozone concentrations by enhancing photochemical ozone production. On the contrary, in areas very far away from NOx sources, the effect is to increase ozone concentrations by decreasing the photodissociation and ozone. As discussed in the manuscript, this result is totally in line with the results of Bian et al (2003).