

Interactive comment on “Monthly-averaged anthropogenic aerosol direct radiative forcing over the Mediterranean from AERONET derived aerosol properties” by A. Bergamo et al.

A. Bergamo et al.

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Dear Reviewer,

Thanks for your stimulating comments. We have done our best to answer to them. A marked copy of the revised manuscript has also been sent to the Editor, to easily show changes introduced in the manuscript in accordance with your comments and the ones made by the other reviewer. Detailed answers to your comments are reported below.

Major Comments 1., 2., 3. :

In accordance with your suggestions we have written in the manuscript that the presented results rather provide a 1st order estimate of the anthropogenic aerosol DRE

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and we have avoided generalizing the conclusions.

We know that better methods than the two-stream radiative transfer model are available (we intend using them in the future). However, we believe that the used model is rather good to get a 1st order estimate of the anthropogenic aerosol DRE. A closure study reported in Tafuro et al.(J. Geophys. Res., 112, D20202, doi:10.1029/2006JD008265, 2007) supports last comment.

Specific comments, Title, Abstract, 1., 2.:

Done

3.

The sentence has been deleted.

1. Introduction

1.

Done

3. The two-stream radiative 1.

Thanks for your suggestions. However, it is worth noting that in our previous paper on aerosol DREs (Tafuro et al., J. Geophys. Res., 112, D20202, doi:10.1029/2006JD008265, 2007), in order to investigate the importance of meteorological parameters profiles (density, pressure, temperature and water vapor content) on the aerosol DRE, we replaced the local (Brindisi) radiosonde data with the AFGL mid-latitude (30 deg – 60 deg N) summer profile from April to September and with the AFGL mid-latitude winter profiles from October to March. We have found that aerosol DRE changes due to the switch to AFGL meteorological profiles have only a small impact. Changes to the solar aerosol DRE at the surface and the ToA did not exceed 5% of the reference case (with radiosonde data).

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2.

The sentence The infrared 0.96 has been replaced with: A surface emissivity of 0.96 (and an albedo of 4%) has been assumed in the far-infrared.

3.

The sentence for dust are used (Sokolik, I.), since any significant ToA direct radiative effect in the far infrared can be attributed to dust.

has been replaced with for tropospheric aerosol (Paltridge and Platt, 1976) are used.

As a consequence, new IR (4-200 μm) DREa values have been reported in the revised manuscript.

4.

The comparison of model AOD values with those available by AERONET has revealed that the differences are on average lower than 10%. However, on winter months, when AOD values are very low, the differences can go up to 30%.

5.

Done

6.

The sentence a rather strong pollution event that on March has affected all north Italy, being $\eta = 0.9$ at both sites that are ~ 300 km apart.

has been replaced with: a rather strong pollution event (being $\eta = 0.9$ at both sites) that on March has affected all north Italy.

7.

Done

8.

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The sentence The smaller SSA values retrieved at Ispra on winter months show the relative importance of absorption processes on these months.

has been replaced with the following ones:

The smaller SSA values retrieved at Ispra on winter months show the relative importance of absorption processes by anthropogenic particles on these months. We believe that winter house-heating emissions and meteorological conditions contribute to the Ispra-SSA seasonality.

9.

The sentence characterized by a seasonal trend similar to that of Ispra.

has been replaced with:

smaller on winter months.

10. and 11.

Done

12.

The sentence : f-values are based on the comparison of the LMDzT3.3 (Reddy et al., 2005) global model-simulations with emission scenarios for the years 2000 and 1750 (Schulz et al., 2006). Inventories for global emissions of aerosols and pre-cursor gases for the years 2000 (current conditions) and 1750 (pre-industrial conditions) (Dentener et al., 2006) were used in the General Circulation Model LMDzT3.3

has been replaced with:

f-values are based on LMDzT3.3 (Reddy et al., 2005) global model-simulations (Schulz et al., 2006). In particular, inventories for global emissions of aerosols and pre-cursor gases for the years 2000 (current conditions) and 1750 (pre-industrial conditions) (Dentener et al., 2006, Stier et al., 2007) were used in the General Circulation Model

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LMDzT3.3 to calculate f-values.

13.

represent is the word used in the paper by Kaufman et al., 2005. However, we have replace the sentence : Kaufman et al. (2005) represented the total aerosol optical depth by its anthropogenic with:

Kaufman et al. (2005) considered the total aerosol optical depth made by its anthropogenic

14.

Done

15.

The following sentence has been added at the end of paragraph 3.5

Cloud optical depth (COD) and cloud cover values as a function of the months of the year are plotted in figure 9a and 9b, respectively for each site.

4. Anthropogenic

1.

Done

2.

Your findings have been determined by the fact that we have made round figures in Table 4. We have solved the problem in the revised paper.

3.

Your findings have probably been determined by the fact that we have made round figures in Table 4 and 5.

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4.

Yes, at least within ± 1 std.dev.. We have added last sentence in the text.

5.

The sentence : However, Table 5 data appear to over estimate the anthropogenic-aerosol impact over the Central Mediterranean, if compared to corresponding has been replaced with:

However, they are larger than corresponding

6. Conclusion

Several studies (e.g. Hatzianastassiou et al., ACP 2008) report data on all aerosol DREs and as a consequence, we believe that the 1st-order estimate of the contribution of anthropogenic to all aerosol radiative effects in the Mediterranean will depend on the chosen data-set. Therefore, we believe that it is convenient not to report further comments. However, at the end of Section 4.1, we have added the following sentence:

We mention that IPCC (2007) provides a summary of the principal atmospheric components responsible for DREs, which can be rather useful to compare the results of this paper with those provided by other authors both for the aerosol and other atmospheric components.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 12769, 2008.

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