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Atmospheric Chemistry and Physics Discussions

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

Anonymous Referee #2

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General

This is an interesting study presenting anthropogenic aerosol optical and radiative properties over 6 selected sites in the central Mediterranean (Italy) and in Crete island. It makes use of a synergy between AERONET, MODIS, and ISCCP databases, a two-stream radiative transfer model (RTM) and data from aerosol models to solve the problem of estimating the anthropogenic aerosol forcing. The applied methodology is valid and the data used ensure the quality of the obtained results. The tools utilized are quite adequate although not always state of the art (concerning the RTM, see comments below). Despite the limits of the study (spatial and temporal coverage,

see comment below) the obtained results are informative, useful and consistent providing the scientific community new knowledge on the investigated topic. I suggest the publication of the paper provided that the following major issues are addressed before.

Major comments

1. Only six (6) specific sites can hardly be representative of the entire region of central Mediterranean. Therefore, I suggest that the authors slightly modify accordingly the parts of the text referring to this and avoid generalizing the conclusions drawn.

2. The one-year temporal coverage (2003) limits the value of the study. It is quite short and thus the presented results rather provide a 1st-order estimate of the anthropogenic aerosol forcing given the year by year variability of aerosol (and other physical parameter) properties in the Mediterranean (see e.g. Papadimas et al., JGR, 2008).

3. The use of a 2-stream radiative transfer model may also be problematic to some extent. There are better methods (e.g. Delta-Eddington or Discrete Ordinate Method) to solve the radiative transfer equation.

Specific comments

Title

Replace "... from AERONET derived aerosol properties" by "... based on AERONET aerosol properties".

Abstract

1. Page 12770, Lines 10-11: Replace "... from global modelling." by "... from global aerosol models."

2. Page 12770, Line 16: Replace "... seasonal dependent ..." by "... seasonally dependent ...".

3. Page 12770, Lines 27-28: "Last data further more ... by anthropogenic particles."

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Interactive Comment

Awkward sentence.

1. Introduction

1. Page 12772, Line 27: Replace "... to illustrate ..." by "... to quantify ...".

3. The two-stream radiative transfer model and input data

1. Page 12775, Lines 10-15: Temperature and humidity profiles (and also ozone) could have been taken from other databases. For example, temperature and humidity profiles could be obtained from the NCEP/NCAR or ECMWF Reanalyses. Even though such data are representative for geographical cells they should be better than the US standard atmosphere. Furthermore, they provide a realistic seasonal variation, which is much preferable than the highly uncertain method of interpolating between winter and summer values.

2. Page 12776, Lines 3-4: "Note that with ... set to 0.96": I do not see it in Figure 2.

3. Page 12776, Lines 14-15: "since any significant ToA ... dust": provide a reference for this.

4. Page 12776, Lines 23-25: AERONET also provides AOD and SSA values. Have you really compared your own derived AOD values to those available by AERONET?

5. Page 12777, Lines 27-28: Replace "... origin being both sites rather close ..." by "... origin both sites being rather close ...".

6. Page 12778, Lines 1-2: "... being n equal to about 0.9 at both sites that are about 300 km apart": I do not understand what does this sentence means.

7. Page 12778, Lines 9-10: Replace "... being both sites surrounded ..." by "... both sites being surrounded ...".

8. Page 12778, Lines 23-25: "The smaller SSA ... on these months": more has to be said about this. What is the larger absorptivity of aerosols due to during winter?

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9. Page 12778, Lines 25-26: "Venice SSA values ... similar to that of Ispra": it does not seem to be similar. It has maximum values in spring.

10. Page 12779, Line 16: "... on SS ...": only summer not spring.

11. Page 12779, Line 26: you better replace "... is first considered ..." by "... is first used ...".

12. Page 12780, Lines 3-10: better introduce/explain where the f data have been taken from.

13. Page 12781, Lines 7-8: "... represented ...": obviously this is not the right word.

14. Page 12783, Line 5: Replace "... ICSSP ..." by "... ISCCP ...".

15. Page 12783, Line 8: please, also provide the monthly variation of cloudiness.

4. Anthropogenic aerosol direct radiative effect estimates

1. Page 12786, Line 22: "... less negative ...": better use the word "larger" instead.

2. Page 12787, Lines 4-15: I have a problem with the values of DRE given in Table 4. They do not seem to provide a radiative closure. Normally, DREa at ToA should be the sum of DREa at surface and DREa in the atmosphere, but this does not seem to be satisfied. For example, for Ispra the Table 4 reads DREa-sfc=-5 W/m2 and AFa=4 W/m2, which should rather lead to DREa-ToA=-1 W/m2. Nevertheless, the values in Table 4a is equal to -2 W/m2. How do you explain this?

3. Page 12787, Line 18: "... are reported in Table 5.": Why the values of Table 5 do not seem to agree with those of Table 4? They rather should be the same.

4. Page 12787, Lines 20-22: "Table 5 data appear ... for the Mediterranean basin.": This is not the case for DREa-sfc (-5 against -9 W/m2).

5. Page 12787, Lines 22-25: "However, Table 5 data ... Stier et al., 2007.": Is there any explanation for this overestimation?

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Interactive Comment

6. Conclusion and summary

You may also provide estimates from other studies of all (natural plus anthropogenic) aerosol DREs. Thus, by comparing this paper"s values with those of all DREs, you can also provide a 1st-order estimate of the contribution of anthropogenic to all aerosol radiative effects in the Mediterranean.

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