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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Aerosol direct radiative forcing during Sahara dust intrusions in the central Mediterranean" *by* M. R. Perrone et al.

M. R. Perrone et al.

antonella.bergamo@le.infn.it

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Dear Referee #1,

Thanks for your comments/suggestions. Answers to "Specific Comments" and "Other specific comments" are reported below. The marked copy of the revised manuscript has also been posted.

1. For the infrared region the model uses refractive indices for tropospheric aerosols taken from the book of Paltridge and Platt 1976. These properties would certainly not be representative of the actual study site. Have the authors looked into more recent measurements or estimates?

Please note that the following sentence has been added at the end of page 4 of the

Full Screen / Esc

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Interactive Discussion

Discussion Paper

revised manuscript:

. . . "For the near-infrared region of the solar spectrum, the AERONET refractive indices extracted for the wavelength at 1.02 μm are applied. For the far-infrared spectral region the refractive indices for mineral aerosol are used (Sokolik and Toon, 1998)."

The IR refractive indices for tropospheric aerosols taken from the book of Paltridge and Platt 1976 have been used in the work by Tafuro et al., 2007.

2. The model uses AFGL standard atmosphere vertical profiles for temperature and water vapor, parameters that play a crucial role in determining atmospheric infrared radiation. These atmospheric properties are highly variable in space and time. How reliable are the infrared calculations given this fact.

Please note that on page 22544 lines 6-14 of the manuscript it is written:

"..Then, radiosonde measurements (see also http://raob.fsl.noaa.gov) at the meteorological station of Brindisi that is 40 km north-west of Lecce are used to define vertical profiles of density, pressure, temperature, and water vapor from 1 up to 20 km altitude. Density, pressure, temperature, and water vapor values retrieved by the Brindisi radio-sondes at the surface are replaced with corresponding values more appropriate for Lecce (Tafuro et al., 2007). Above 20 km of altitude, vertical profiles of density, pressure, temperature, and water vapor are extended with corresponding mid-latitudes standard atmosphere data provided by the Air Force Geophysics Laboratory (AFGL) for autumn-winter and spring-summer months."

3. Table 2 gives about 10 Wm-2 for the DRE on net infrared flux at the surface and about 2 Wm-2 at TOA. I presume that this is extra thermal emission by the aerosol layer? If so, it would depend on the emissivity of the layer, which of course depends on the data from Paltridge and Platt.

We believe that the answer to comment 1 fulfills comment 3.

4. The simulated net all-wave and solar fluxes shown in Fig. 10a & b, show that the

solar (10b) is well modeled, but the all-wave shows a lot of scatter, which presumably is the scatter in the infrared surface net flux. Why not plot the net infrared flux separately? Given that net infrared flux at the surface is small, about 50 Wm-2 , the uncertainties in the infrared flux are masked by adding them to the larger solar component.

Please note that Fig. 10a shows the scatter plot of simulated net-fluxes values versus net fluxes measured by a net radiation transducer that only provides net flux values (solar+IR). In fact, on page 22547, lines 17-21 of the manuscript it is written:

"...A net radiation transducer (p056 RADNT, by SIAP+MICROS S.r.l., Italy) characterized by 1.5% accuracy, is routinely used at the ISAC-CNR Department of Lecce (www.basesperimentale.le.isac.cnr.it) to monitor broadband net-fluxes for the 0.3-30 μm spectral range, with two hemispheric (up and down) sensors. The net radiation transducer is located few hundred meters away from the AERONET sun/sky radiometer site...."

On the contrary Fig. 10b shows the scatter plot of model net fluxes at solar wavelengths. Both solar net fluxes are based on the same aerosol properties (AERONET products) but, have been retrieved from different radiative transfer models.

5. The computation of aerosol radiative effects, and also of the radiation fluxes themselves, is done using a two-stream radiative transfer model. Probably, this is not the most adequate tool for aerosol radiative effect studies.

We believe that the results plotted in Fig. 10a and 10b demonstrate the appropriateness of input and output data of the used radiative transfer model, even if more sophisticated model are available that probably we intend to use in the near future.

6. The applied methodology to identify dust events during the period 2003-2006 is not explained. Although it is not the primary subject of this study, it should be done. Moreover, the applied methodology may be problematic, since it results in aerosol Angstrom values as high as 1.5 (e.g. Fig. 5b) which are certainly not indicative of coarse dust

aerosols. Probable problems with the methodology could affect the magnitude of computed aerosol AOD and DREs.

We believe that the contribution of anthropogenic particles of local origin and/or long-range transported are responsible for Angstrom values as high as 1.5 even during dust events. This mainly occurs when air masses from different source regions are advected over the monitoring site (e. g. Pavese et al., 2009). An Avantes radiometer was used in Pavese et al. (2009) to monitor a dust event over Lecce. In addition, as we have outlined in section 3 (page 22545, lines 22-29):

"7-day analytical back trajectories by NASA GSFC (http:// www.aeronet.gfsc.nasa.gov/), true-color satellite images by the MODerate Resolution Imaging Spectroradiometer - MODIS (http:// modis.gsfc.nasa.gov/; King et al., 1992), AERONET products as the Angstrom coefficient (Å) and the fine mode fraction, and polarization-sensitive lidar measurements have all been used to detect Sahara dust intrusion events over the Mediterranean and in particular at the monitoring site (e.g. Tafuro et al., 2006; Tafuro et al., 2008).

Then, the following sentence has been added:

"In particular, SeaWiFS true-colour images, Angstrom coefficient values and depolarization lidar measurements have been used by Tafuro et al. (2006) to detect on the second half of July 2003, dust intrusion events occurred at different Mediterranean sites. Hence, dusty days have been selected in this study in accordance with different dust event markers, as it is better outlined in section 3.1."

7. Section 3 seems to be unreasonably placed before section 4. It refers to a unique dust event in 22 June 2006, and it is less important than sect. 4, which refers to the total number of identified dust events. The importance of sect. 3 probably consists in explaining the methodology applied on every event, but if this is the case, then sect. 3 should be renamed pointing to the Methodology. On the contrary, the use of term "methodology" in the name of sect. 4 should be avoided.

ACPD

9, C9184–C9200, 2010

Section 3 and 4 have been renamed as follow:

3 Methodology and study of the dust outbreak of June 22, 2006

4 Results of 2003-2006 dust outbreaks

In addition, the following sentence has been added at the beginning of Section 3.

" The dust outbreak of June 22, 2006 is analyzed in detail in this section in order to highlight the methodology applied to infer dust events and to calculate DREs by all and anthropogenic particles.."

8. The most interesting contribution of the paper is the separation between natural and anthropogenic aerosol optical depth (AOD), and mainly of aerosol DREs. Formulas are derived and given, which are claimed to be representative for the Mediterranean. However, the possibility of the more generalized application of these formulas to other sites as well, should be assessed and discussed.

The following sentence has been added at the end last paragraph:

"Last but not least, we believe that the used methodology can generally be applied to all AERONET sites to evaluate the DRE contribution by fine and coarse mode particles."

Other specific comments

Abstract

1. Page 22540, Line 11: Replace "to intialize radiative transfer simulations : : :" by "to perform radiative transfer simulations : : :".

Done

2. Page 22540, Line 13: The range of values of AOD "0.2-0.7" has an upper limit (0.7) which seems to be somewhat low for dust outbreaks in the Mediterranean according to the existing literature. This is likely due to the use of AERONET AOD data. During dust events, the ground sun photometers become saturated so that larger AOD values

ACPD

9, C9184–C9200, 2010

Interactive Comment

are missing from time series. On the contrary, corresponding satellite-based estimates (e.g. MODIS-based) report quite larger values. Thus, the reported here AOD, but also DRE values are affected and bounded. Even larger values are possible.

As it is well know uncertainties of AERONET AODs are smaller than uncertainties associated to MODIS AODs. In addition, several studies have recently revealed that MODIS AODs are affected by cloud contamination (e.g. Gupta and Christoher, Atm. Chem. Phys. 8, 3311-3324, 2008; Schaap et al., Atm. Chem. Phys. 9, 909-925, 2009). Finally, some studies have revealed that AODs retrieved from lidar measurements were in good accordance with the ones provided by AERONET (e.g. Bellantone et al., 2008).

1. Introduction

1. Page 22542, First paragraph: Why the range of values of aerosol DRE at TOA given by Haywood et al. (2003) and Meloni et al. (2003) are so much different? (-44 to -129.2 W m-2 against -1.2 to -6.2 W m-2). There is difference by an order of magnitude.

The different values of AODs play a significant role, even if aerosol optical properties and model procedures can be significant. The AOD values have been inserted in the revised manuscript:

"……by Haywood et al. (2003) to calculate the instantaneous Direct Radiative Effect (DRE) by dust. They found that the DRE at the top of the atmosphere (ToA) ranged from -44 to -129.2 Wm-2 in the solar spectrum as the AOD at 0.55 μm varied from 0.48 to 1.48."

"………They found that the instantaneous DRE over the 0.29-0.80 μm spectral range varied within the – (1.2 - 6.2) Wm-2 and the – (12.3 - 25.0) Wm-2 range at the ToA and surface, respectively for AODs at 0.42 μm spanning the 0.23-0.26 range."

2. Page 22542, third paragraph: Why so much emphasis is given to a specific aerosol event (22 June 2006)? An entire section (sect. 3) is devoted. This has to be explained in the Introduction.

ACPD

9, C9184–C9200, 2010

The sentence " Section 3 provides a detailed analysis of the dust outbreak monitored at Lecce on June 22, 2006."

has been replaced in the revised manuscript with:

. . ."Section 3 provides a detailed analysis of the dust outbreak monitored at Lecce on June 22, 2006, in order to highlight the methodology applied to infer dust events and to calculate DREs."

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

1. Page 22542, Lines 25-27: How accurate is the use of 2-stream models for computing aerosol radiative effects? More sophisticated models are a better choise (see general comment).

We believe that the results plotted in Fig. 10a and 10b demonstrate the appropriateness of input and output data of the used radiative transfer model, even if more sophisticated model are available.

2. Page 22543, Lines 5-6: Are the numbers given the centers of the spectral bands? It should be specified. Also, 8 solar and 20 infrared bands seem to be unbalanced in terms of aerosol optical properties and forcings. A larger number of bands in the solar is more suitable, since aerosol properties and effects are highly variable in the solar, and especially in the ultraviolet-visible wavelengths. The sentence:

.." In particular, eight solar (0.35 μm, 0.45 μm, 0.55 μm, 0.65 μm, 1.00 μm, 1.6 μm, 2.2 μm, and 3.0 μm) and twelve infrared (4.25 μm, 5.35 μm, 6.25 μm, 7.35 μm, 8.75 μm, 10.30 μm, 11.75 μm, 13.90 μm, 17.20 μm, 24.30 μm, 37.00 μm, and 80.00 μm) subbands are considered to properly account for the spectral dependence of atmospheric particle properties: the optical properties (extinction, single-scattering albedo, and asymmetry factor) of the atmospheric particles remain constant in each of the 20 subbands."

has been replaced in the revised manuscript with:

ACPD
9, C9184–C9200, 2010

Interactive Comment

Full Screen / Esc

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Interactive Discussion

Discussion Paper

..” In particular, eight solar and twelve infrared subbands are considered to properly account for the spectral dependence of atmospheric particle properties: the optical properties (extinction, single-scattering albedo, and asymmetry factor) of the atmospheric particles remain constant in each of the 20 subbands. Centers of the eight solar subbands are at: 0.35 μm, 0.45 μm, 0.55 μm, 0.65 μm, 1.00 μm, 1.6 μm, 2.2 μm, and 3.0 μm. Centers of the twelve IR subbands are at: 4.25 μm, 5.35 μm, 6.25 μm, 7.35 μm, 8.75 μm, 10.30 μm, 11.75 μm, 13.90 μm, 17.20 μm, 24.30 μm, 37.00 μm, and 80.00 μm.”

We intend to use in the future a new model with a larger number of solar and IR spectral bands.

3. Page 22543, Lines 8-9: “: : : the optical properties : : : of the 20 subbands”: do they remain or are they set constant, and why?

Please note that optical proprieties are set constant in each subband: i.e. does not vary within a subbands.

4. Page 22543, Lines 16-17: “: : : Sahara dust intrusion : : : to 2006 year”: how these events have been identified over the study period? It should be specified. What are the criteria that have been applied in order to derive the 26 dust events listed in Table 1?

On page 22544, lines 22-29 it is written:

..” 7-day analytical back trajectories by NASA GSFC (http://www.aeronet.gfsc.nasa.gov/), true-color satellite images, AERONET products as the Angstrom coefficient (Å) and the fine mode fraction, and polarization-sensitive lidar measurements have all been used to detect Sahara dust intrusion events over the Mediterranean and at the monitoring site, in accordance to Tafuro et al. (2006) and Tafuro et al. (2008). In particular, SeaWiFS true-colour images, Angstrom coefficient values and depolarization lidar measurements have been used by Tafuro et al. (2006) to detect on the second half of July 2003, dust intrusion events occurred at

ACPD
9, C9184–C9200, 2010

different Mediterranean sites. Hence, dusty days have been selected in this study in accordance with different dust event markers, as it is better outlined in section 3.1."

In addition on section 4 it is written:

" 7-day analytical back trajectories, true-color MODIS images, AERONET products, and polarization-sensitive lidar measurements have been used to infer dust intrusion events over Lecce, as we have outlined in the previous paragraph. In fact, analytical back trajectories indicate the origin area of the air masses advected at the monitoring site. True-color MODIS images provide some indication of the geographical extension of the dust event. AERONET products such as the Angstrom coefficient and the fine mode fraction can allow inferring the presence of dust and polarization-sensitive lidar measurements provide some indication of the vertical displacement of the dust plume. "

5. Page 22543, Lines 28-29: ": : : are averaged : : : spectral range": How are they averaged? Why to average over 0.3-0.7μm? It is reported above that there are 4 solar subbands around 0.35, 0.45, 0.55 and 0.65 μm. This is inconsistent with this band (0.3-0.7) reported here. Do you assume constant surface albedo values over the entire solar range of wavelengths?

0.35 – 0.65 μm represent centers of spectral subbands as it is specified in the revised manuscript. In addition, we have decided to assume constant surface albedo values from 0.3 to 0.7 μm.

6. Page 22544, Line 1: ": : : are averaged : : :": similarly to the previous comment.

The surface albedo is also constant from 0.7 to 5 μm.

7. Page 22544, end of sect. 2: What about clouds? It should be specified that aerosol DREs are computed under clear-sky conditions.

At the beginning of the Abstract it is written:

ACPD
9, C9184–C9200, 2010

Interactive Comment

“The clear-sky, instantaneous. . .” In addition at the beginning of Section 4.4 (page 22552, line 19) it is also written “The clear-sky, instantaneous. . .”

3. Dust outbreak of 22 June 2006 and aerosol DREs

1. Page 22544, sect. 3: Although references are given, a few sentences about the methodology will be helpful to the readers of this study.

Done

2. Page 22545, sect. 3.1: The introduction of this section here seems unreasonable or at least not justified. The aim of the paper is to evaluate aerosol DREs at Lecce over the period 2003-2006. Why focus on a specific dust event and study it separately?

The following sentence has been added at the beginning of sect. 3:

The dust outbreak of June 22, 2006 is analyzed in detail in this section in order to highlight the methodology applied to infer dust events and to calculate DREs by all and anthropogenic particles.

3. Page 22546, Lines 28-29: Similar bi-modal structures have been reported for other Mediterranean sites as well (e.g. Fotiadi et al., ACP, 2006).

The work of Fotiadi et al. (2006) has been mentioned.

4. Page 22547, Lines 1-2: “0.87 : : : over Lecce. : : :”: The coarse mode in the bi-modal distribution could be also attributed (at least to some extent) to maritime sea-salt aerosols (see e.g. Fotiadi et al., 2006). This is also supported by the back-trajectories (Fig. 1).

The suggested sentence has been added in the revised manuscript.

5. Page 22547, Lines 13-15: The results of Table 2 are discussed later on. They should be discussed here.

Done

ACPD

9, C9184–C9200, 2010

Also, how does one explain that the surface DRE decreases in magnitude from 15:31 to 16:27, while it increases at TOA?

The following sentence has been added:

It is also worth noting that the surface DRE decreases in magnitude from 15:31 to 16:27 UTC, while it increases at the TOA. The larger contribution of fine mode particles and the smaller k value found at 16:27 UTC contribute to this last result.

6. Page 22547, Lines 22-25: Comparison-validation for two points only is a problem.

The word "demonstrate" has been replaced with "support".

7. Page 22548, Line 6: It would be interesting to examine the role of the IR DRE during night.

Thanks for the suggestion, but we believe that it is not within the main paper's objectives and it will not be discussed to not lengthen the paper.

8. Page 22549, Lines 2-3: ": : : A discussion : : : Bergamo et al. (2008a)": Is this assumption valid, since we generally know that the refractive index depends on wavelength?

Yes. Refractive index also depends on size, being the size a parameter that can be used to characterizes particles of different type: e.g. natural and anthropogenic.

4. Methodology and results of 2003-2006 dust outbreaks

1. Page 22549: see general comment about the name of this section.

Done

2. Page 22549, Line 19: "The dust events that have been selected : : :": Again, how was this achieved?

Done

ACPD

9, C9184–C9200, 2010

3. Page 22549, Lines 22-25: ": : : Analytical back trajectories : : : previous paragraph": Authors must be more specific.

The following sentence has been added in the revised manuscript:

" In fact, analytical back trajectories indicate the origin area of the air masses advected at the monitoring site. True-color MODIS images provide some indication of the geographical extension of the dust event. AERONET products such as the Angstrom coefficient and the fine mode fraction can allow inferring the presence of dust and polarization-sensitive lidar measurements provide some indication of the vertical displacement of the dust plume."

4. Page 22550, Line 8: "black line in Fig. 5a : : :": the curves cannot be distinguished between themselves. Symbols or different colors could be used together with lines.

Done

5. Page 22550, Line 14: ": : : However, along with : : : aerosol burden": To what extent? It can be computed.

The following sentence has been added in the revised manuscript:

" In fact, the fine mode fraction η, i.e. the ratio between the fine-mode and the total optical depth at 0.55 μm spans the 0.34-0.79 range on the selected dusty days."

6. Page 22550, Line 16: "plotted in Fig. 5b.": it would be useful to relate the points in Fig. 5b to the curves of Fig. 5a, at least, the points corresponding to fine aerosols in Fig. 5b (black circles and red rectangles).

Done μ 7. Page 22550, Line 18: ": : : span the 1.5-0.23 range. : : :": dusty days with Angstrom values as high as those shown in Fig. 5b are hard to believe. Probably, this reflects the problem with the selection procedure of dusty days.

High Å values refer to dusty days with high contribution of fine mode particles. As we have clearly stated in the revised manuscript different dust event markers have been

ACPD

9, C9184–C9200, 2010

used to select each dusty days.

8. Page 22551, Line 1: ": : : of n and k is: <n>=1.48ï′C ′s0.01": values of <n> could be also given separately for fine and coarse aerosols.

No. The complex index of refraction is the same for particles of all sizes in accordance with AERONET inversion assumptions.

9. Page 22551, Line 11: "Instantaneous AODt, SSAt, and gt values : : :": how do these properties compare with those directly given by AERONET?

We have found that the relative differences with corresponding parameters given by AERONET are on average 9%, 1% and 6% for AODt, SSAt, and gt values, respectively.

10. Page 22552, Line 9: ": : : of the AOD fraction used : : :" (also in caption of Fig. 9): explain clearly what is AOD fraction.

The sentence:

" retrieve the vertical profile of the AOD fraction "

has been replaced in the revised manuscript with

" retrieve the aerosol vertical profile normalized to the AOD at 0.351 μm. Then, the vertical profile of the AOD fraction is used "

11. Page 22552, Line 12: replace "lidar on 24 June 2003 : : :" by "lidar on 24 July 2003 : : :". Done

12. Page 22553, Line 5: According to the two Figures, the differences in the net flux between model and measurements (Fig. 10a) are due to the IR fluxes. Differences as much as 50 W m-2 can be seen.

No. See the answer to comment 4 of "Specific Comments".

13. Page 22553, Line 12: replace "increase : : :" by "decrease in magnitude : : :". Attention should be made to avoid confusion, since the values are negative.

ACPD

9, C9184–C9200, 2010

Done

14. Page 22553, Line 19: replace ": : : smaller than that : : :" by ": : : larger than that : : :". It is better to talk about magnitude.

Done

15. Page 22553, Lines 20-27: "The solar : : : on monitoring time": It is better to remove Figure 12a (it does not add much to the information already given) and incorporate Fig. 12b into Fig. 11. Also, the IR and net DREs are not discussed at all.

Figure 12a has been deleted and Fig. 12b has been left as Fig. 12. The discussion on the IR-DRE that was at the end of the paragraph (pg 22554) has been moved here.

16. Page 22554, Lines 1-10: The entire discussion of Fig. 13 (dependence on solar zenith angle, z) has a problem and merits further discussion. It s well known that AOD (and hence DRE) depends on the atmospheric optical mass, i.e. solar zenith angle. However, other factors like the suspended amount of particulate matter and the associated scattering and absorption properties are also responsible for AOD and DREs, so they have to be discussed in order to explain the features shown in Fig. 13. For example, note the changing dependence of AOD and DREs on z in some cases (e.g. solar DREt,TOA in 22 June 2006).

The following sentences:

"The AODt on average increases with θ (Fig. 13a). In addition, we observe that the aerosol DRE has a minimum within the 60°-70° range at the ToA (Fig. 13b). Whereas, the aerosol DRE has a minimum within the 55°-65° range at the surface (Fig. 13c). "

have been replaced in the revised manuscript with the following ones:

"The AODt on average increases with θ for the increase of the atmospheric optical mass (Fig. 13a). However, the AODt dependence on θ varies from day to day, since aerosol optical and microphysical properties and their evolution with the time of the

ACPD
9, C9184–C9200, 2010

Interactive Comment

day, affect aerosol scattering and absorption properties and hence AODt values. The dependence on θ of aerosol DREs also varies from day to day. However, on average, aerosol DREs reach a minimum values within the 60°-70° range at the ToA (Fig. 13b) and within the 55°-65° range at the surface (Fig. 13c)."

17. Page 22554, Lines 15-16: "The variability range : : : of large dust particles": Here it is claimed that n does not affect significantly AFE, opposite to what happens with DRE. An explanation for this should be given.

The sentences:

"ToA- and sfc-AFE values span the – (81-45) Wm-2 and – (156-79) Wm-2 range, respectively. The variability range of both parameters is not significantly affected by θ and hence, by the contribution of large dust particles. Figure 14c-d shows the AFE as a function of the solar zenith angle, at the ToA and surface, respectively. We observe that AFE values are quite dependent on θ mainly at the surface. Hence, the high variability of the AFE revealed by Fig. 14 is due to the solar zenith angle and to the variability of the aerosol microphysical properties during dust intrusion events."

have been replaced in the revised manuscript with:

"ToA- and sfc-AFE values span the – (81-45) Wm-2 and – (156-79) Wm-2 range, respectively and appear to not be significantly affected by θ values. The large dependence of the AFE on the solar zenith angle that is shown in Fig. 14c-d, probably masks the AFE dependence on ïĄĺ. In fact, Fig. 14c-d reveals either that AFEs are quite dependent on θ mainly at the surface and that they significantly vary from day to day."

18. Page 22554, Lines 17-18: "We observe that : : : at the surface": similar to the previous comment.

Done, see previous answer.

19. Page 22554, Lines 20-22: "It is worth noting : : : ToA and surface.": A reason for this should be given. What are the differences between the two studies?

ACPD

9, C9184–C9200, 2010

Interactive Comment

The differences could be due to the different aerosol properties and to the used radiative transfer model. However, we have decided to take away the sentence ("significantly larger than the ones reported by Meloni et al. (2003) . . .surface) and to compare our data with more recent data provided by the same research group for Lampedusa, which are measurement based.

20. Page 22554, Lines 23-29: "Figure 11b,e : : : dust intrusion events": this discussion should be moved to the previous page (22543). Concerning the percentage 47%, what are the cases (conditions) in which the IR aerosol DRE becomes comparable to the solar DRE? It might be worthy to examine and discuss this, before the conclusion in the following (last) sentence. Also, concerning the last sentence of the paragraph, it is not valid generally, r at least at the same significance level. It should be more specific, taking into account what was noted just before.

Done. In addition the following sentences have been added in the revised manuscript:

" The largest offset percentage at the surface has been found on July 17, 2003. The AODt and η reached the largest (0.71) and the smallest (0.34) value, respectively on this day (Fig. 7a). The largest offset percentage at the ToA has been found on June 19, 2006. Rather high and small AODt and η values, respectively have also been found on this day (fig. 7a). These last results clearly show the importance of taking into account the IR-DRE mainly during dust intrusion events leading to η<0.5. "

21. Page 22555, sub-section 4.5: This section contains the most interesting finding of this work. It provides derived equations relating the anthropogenic and total aerosol DREs based on linear regression fits.

22. Page 22555, Line 22: A comment should be made about the validity of the given formulas to other locations in the Mediterranean basin as well, or even outside of the Mediterranean.

Done

ACPD

9, C9184–C9200, 2010

Interactive Comment

5. Summary and conclusion

1. Page 22557, Lines 10-12: “Aerosol optical and microphysical : : : transport pathways”: This sentence is vague and should be rephrased.

Done

2. Page 22558, Lines 4-7: “In particular : : : Mediterranean dust events”: This seems to be in contradiction with the range of the reported values in the 2nd paragraph of this section (34-85%).

No! 34-85% represent the contribution of fine-mode particles. On the contrary, 27-65% represent the contribution of anthropogenic particles

3. Page 22558, Lines 8-9: “To a first approximation : : : of aerosol present”: This sentence should be rephrased.

Done

4. Page 22558, Lines 25-27: “Nevertheless, we believe : : : to Bergamo et al. (2008a).”: Why would they not be representative for other sites (affected by local pollution) as well?

The words “..not highly affected by local pollution” have been deleted.

Table 1 The title of Table 1 is incomplete. Here, sets of values are given for a series of specific days corresponding to dust events at Lecce from 2003 to 2006. This should be specified.

Done

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 22539, 2009.