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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.

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Dear Referee $\neq$2,

Thanks for your comments/suggestions. Referring to your "General Comment", we agree with you that published data must be based on solid ground. However, as you know, sometime it is convenient in scientific studies to leave out some terms (effects) if it is believed that they do not significantly affect the results but, mainly contribute to lengthen the numerical solution of the problem or in some cases avoid getting a solution. We believe that Dubovik and co-workers have left out the inclusion of particles with diameters larger than 15 micron in the AERONET inversion procedure, since probably the benefits of large particle's inclusion would have been responsible for benefits smaller than troubles. Hence, at present, we are not able to get AERONET products

that take into account particle sizes up to 30-40 micron, as you certainly will know. However, the main problem left out is: how much the main results of this paper are affected by an inversion procedure that neglects particles up to 30-40 micron? These large particles are certainly present over Lecce mainly when dust particles are directly advected to Lecce, but we believe that they are so small in number that probably do not significantly affect the fine mode retrieval. We will use previously published data to support our conclusion.

A) In the paper "Characterization of African dust over southern Italy" by Blanco et al. (Atmos. Chem. Phys., 3, 2147-2159, 2003), some of the authors have analyzed by scanning electron microscopy dust samples from rainfall residues collect over Lecce during different Sahara dust outbreaks. The results presented in that paper (Fig. 6) reveal that the contribution of 30-40 micron particles is negligible even if some large particles were found.

B) In the recent paper by Chou et al. (J. Geophys. Res., vol. 113, doi: 10.1029/2008/2008JD009897, 2008) results on the characterization of dust samples collected over Niger are reported. We observe from the paper that particle size distributions determined by the electron microscopy and optical counting techniques provide data for dust particles with diameter smaller than 10 micron.

C) In the paper "In Situ Samplings and Remote Sensing Measurements to Characterize Aerosol Properties over Southeast Italy" by V. Bellantone et al. (J. of Atm. and Oceanic Tech., vol. 25, 1341-1356, 2008), some of the authors have used lidar measurements, AERONET products, ground-sampled PM, and PM chemical analysis in a closure study, to get a vertical profile of mass concentration during the dust outbreak of 30 June 2005. The paper shows that the retrieved mass concentration profile, which is based on the AERONET columnar size distribution, is in satisfactory accordance in the lowest altitude with ground measurements. It is also shown in the paper that the AOTs retrieved by lidar measurements are in satisfactory accordance with AERONET AOTs. So, probably, paper's results can allow inferring that the contribution of large particles

(up to 30-40 micron) does not significantly affect the tested parameters. We wish also mentioning that the results on the chemical composition of the ground PM, collected during the dust outbreak analyzed in the above mentioned paper have pushed the authors to investigate the anthropogenic contribution during dust outbreaks.

D) It is also worth noting that Fig. 10 of our submitted paper provides the scatter plot of simulated- and measured-net-flux values. We believe that both the linear correlation coefficient (r = 0.96) and the slope of the fitting line (b = 1.07$\pm$ 0.04) may allow inferring that large size particles (> 15 micron) that are not considered in the model and/or the AERONET overestimation of fine mode particle contribution, do not significantly affect net flux values.

In conclusion, probably paper's results overestimate the DRE by anthropogenic particles during dust intrusion events, nevertheless we believe that paper's results can be of interest to the quite large scientific community that use AERONET products either in climate and radiative transfer models and to validate satellite retrievals. However, a sentence regarding your comment will be added on the revised paper.

In relation to "Some further comments:"

1. "I found the paper very long, and the results (there are too many) are described just one after another. A clear summarizing, concluding discussion is missing. In the conclusion section they state: . . ...the paper highlights for the first time to the best of our knowledge, the significant role of anthropogenic particles during dust intrusion events in the Mediterranean. . .....Especially this sentence finally forced me to make this clear statement above."

We would like pointing out that in the "Summary and conclusion" section (Section 5) we have done our best to provide an overview of main paper's results. In fact, in addition to the above reported sentence, the following comments are also reported:

page 57, lines 10- 21: . . ..." Aerosol optical and microphysical properties are

quite dependent on dusty day for the different contribution of anthropogenic particles and probably for the different soil properties of source regions and transport pathways. . .. . These last results are in accordance with previous results (Tafuro et al., 2006) and contribute to the characterization of the mean optical properties of the Mediterranean aerosol significantly affected by Sahara dust particles."

page 57, lines 22-28 : . . ." The instantaneous solar-DRE. . .. . Hence, the importance of taking into account the aerosol IR-DRE during dust intrusion events is demonstrated. . ."

page 58, lines 2-7: "..The anthropogenic aerosol contribution is associated with. . .. . and allows inferring the significant role of anthropogenic particles in Mediterranean dust events."

2. "The authors use a depolarization ratio that will confuse many readers if they are familiar with depolarization ratios. Usually (90% of the lidar people) use the ratio of cross polarized to parallel-polarized signal as depol- ratio. They use cross-polarized signal by total polarization preserving signal. Is that cross-polarized divided by parallel-polarized signal?

Please note that depolarization measurements require linear polarized laser radiation i. e.: " the total polarization preserving signal ". Hence, our definition is equal to:" the ratio of cross polarized to parallel-polarized signal"

3. "Now they present (volume?) depolarization ratios of 0.35 to 0.4 for dust. This means for the dust-alone depol. ratios values above 0.5, this is much too high. What is wrong?

A discussion regarding this point is reported in " Sahara dust properties over the central Mediterranean" by Tafuro et al. (Atm. Res. 81, 67-93, 2006): "It is worth mentioning that laboratory measurements performed with different types of pure mineral aerosol

samples report depolarization ratios in the range 42-62%.....(Volten et al., 2001)." Depolarization ratios up to 50% were reported in that paper. Depolarization ratios were retrieved by a lidar system different than the one of this paper.

A sentence regarding this last point will be added in the revised paper.

4. "A rather long Table 1 is presented! Reason? Table 1 does not contain values for 22 July, listed in Table 2. Or do you mean 22 June in Table 2."

We believe that the list of all dust events analyzed in our paper with corresponding aerosol parameters could be of some interest to some readers. We mean 22 June in Table 2. Thanks. We will change the month in the revised paper.

Sincerely, Maria Rita Perrone on behalf of the authors

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