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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Radiative signature of absorbing aerosol over the Eastern Mediterranean Basin" *by* A. K. Mishra et al.

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This paper combines remote sensing data on aerosol properties and radiative calculations in the eastern Mediterranean basin to in order to classify aerosol types encountered and ultimately derive respective atmospheric heating rates. Authors have followed my methodological suggestions made on an earlier version of their ms. for using abundant AERONET data from the Mediterranean region rather than from distant regions. I find the paper sound, clear, and appropriate for publication in ACP. I recommend publication with a minor revision, and I also suggest attachment of this paper to the recently opened ChArMEx special issue focused on chemistry and aerosols in the Mediterranean. My detailed comments are listed below.

In reply to anonymous referee #1, I need to say that in my initial evaluation I have recommended authors who were addressing all season to rather focus on the summer season, because there are much less AERONET level-2 absorption data during other seasons (see Fig. 5 in Mallet et al., ACP, 2013). In any case, this point is worth to be mentioned. I guess that only Spring might possibly offer reasonable enough statistics for further seasonal computations.

Main issue:

My main critical comment results from the fact that radiative computations are made in the 0.25-20 μm domain when AERONET observations used cover only the visible and near-infrared wavelength range (roughly 0.4-1 μm): it should be clarified how aerosol properties are defined outside of the AERONET spectral range. This lack of observations in the infrared probably adds significant uncertainties, especially for large dust particles that both significantly scatter and absorb in the infrared. In another coming paper of the ChArMEx special issue, Sicard et al. (Estimation of mineral dust longwave radiative forcing: sensitivity study to particle properties and application to real cases over Barcelona, ACPD, 2014) compare the few existing papers describing the spectral dependence of the complex refractive index of mineral dust in the infrared (Volz, 1973 and 1983, Hess et al., 1998) and show that there are significant differences in the IR atmospheric window.

Minor comments:

-Surface albedo is an important parameter in radiative forcing computations, which seems not addressed here: some details should be provided.

-Clarification of the aerosol classification methodology would be welcome (top of p.2409). I suggest:"[...] over the Mediterranean. We have classified aerosol events based on individual (or daily?) AERONET observations. Our classification [...]. For aerosol classification as dust, we used [...]. For classification as polluted dust [...] we included [...] other dust dominated sites and selected AERONET data with 0.7<EAE<1.1.

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Pollution[...]".

-I recommend an additional figure S1b showing the polluted continental aerosol case (0.7<EAE<1.1).

-Section 3.1, p.2410: I do not think that it can be reasonably argued that the difference in AOD between MODIS and MISR is due to a difference between their respective wavelengths of 550 and 555 nm (item 3): even with an EAE as high as 2.2, the difference in AOD would only be of 2%.

-Section 3.1, p.2411: the (by far) highest value of AAE at Lampedusa Island (2.24) is questioning since Blida in North Africa shows a lower value of 2.02. To my knowledge, a value of 2.24 is unusually high, even for sites in dust region: explanation deserves to be left more open.

-Section 3.1, p.2412, 1st paragraph: you might comment the summer means (Table 2) compared to overall means (Table S1) and the role of dust in summer.

-Section 3.1, top of p.2416: you might also consider Ramanathan et al. (JGR, 106, 28371-28398; see plate 18), who report computations of seasonally averaged heating rates over the Indian Ocean due to anthropogenic carbonaceous aerosols, and Zhu et al. (JGR, 112, doi:10.1029/200JD008427; see Fig. 11), who report heating rates of mineral dust over various marine regions.

-Section 3.3: you might wish to discuss the fact that the temperature lag between 925 and 850 hPa is constant whatever the AOD.

-Some figures are difficult to read, see relevant technical comments hereafter.

Technical points:

-General: check the occurrences of a double f within words throughout the text (affect, effect, difference...): they have all been put in italic style, likely due to the use of the symbol ff for the aerosol fine fraction. -Introduction, p.2405, line 8: remove "by".

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-Introduction, p.2406, line 22: “there has been no direct measurement” (singular) -Methodology, p.2407, line 10 and p.2408, line 22: “Derimian” with two i. -Methodology, p.2407, lines 20-21: reorder references by chronological order. -Methodology, p.2408, line 3: replace “board on” by “on board”. -Methodology, p.2410, line 3: provide reference for the model atmosphere used. -Methodology, p.2410, line 24-25: specify that the spring peak is in April and that the winter minimum is more exactly from November to January. -Methodology, p.2410, line 3: provide reference for the model atmosphere used. -Results and discussion, p.2411: specify “also manifested by larger SSA440 values”. -Results and discussion, p.2412, line 3: should be “Mallet et al. (2013) consider the”. -Results and discussion, p.2412, line 1: specifiy “0.2-0.5) with a maximum in the SW part of the basin, whereas”. -Results and discussion, p.2412, line 7: stop sentence after “variability”. -Results and discussion, p.2413, line 18: add “over the period 1983-1994” at the end of 1st paragraph. -Results and discussion, p.2415, line 4: correct “the probability [...] is found to reach”. -Results and discussion, p.2415, line 11: change “from the lowest bin (0.07) to the highest (0.58)”. -Results and discussion, p.2415, lines 19-20: change to “(AOD $\sim$0.08) between 1000 and 850 hPa is significantly [...] for 1400 m). This indicates the stable”. -Results and discussion, p.2416, lines 7-8: change “to be comparable to” by “to interact with”. -Results and discussion, p.2416, line 15: “integrate the effect of” might be better than “represent the average measure of”. -Results and discussion, p.2416, line 20: remove “;” within the parentheses. -Results and discussion, p.2418, line 23: “region” rather than “regime”. -Results and discussion, p.2418, line 24: “produces” rather than “produced”. -Implications, p.2420, line 1: you might refer to Ackerman et al. (Science, 2000) who describe this effect for absorbing soot particles. -Implications, p.2420, line 8: add article in “of a pollution pool”. -Conclusion, p.2420, line 18: add article in “with a radiative transfer model”. -Conclusion, p.2421, line 8: specify “In summer 2010, the daytime average forcing is found [...]”. -References: Marconi et al. (2013) cited p.2408, Omar et al. (2009) cited in p.2409, and Xiao et al. (2009) cited in p.2410 are missing in the list. -Table 1: in the legend, specify “MODIS and MISR summer-time mean AOD at 550-555 nm ($\pm$standard

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deviation) within". -Table 3: in the legend, specify "over the ROI in the eastern Mediterranean Basin"; add a column with average AOD. -Fig. 5 is hardly readable; please use bold lines and may be a dotted line for the green or blue line which colours are close, and enlarge to maximum size in the page. -Fig. 7: filling rectangles would be helpful to the reader. Fig. 10: in the legend, specify "into equally spaced bins of 0.05 AOD550; enlarge to maximum size for the page; rescale the right axis of the bottom right plot to fit the left axis so that you can remove green symbols for plotting the numbers of occurrences. Fig. 10b and fig. 11b: use the plural for "occurrences" in the legend of the right axes.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 2403, 2014.