

Interactive comment on “Long-term measurements of carbonaceous aerosols in the eastern Mediterranean: evidence of long-range transport of biomass burning” by J. Sciare et al.

Anonymous Referee #2

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This article presents and discusses a 5-year data set for black carbon (BC) and organic carbon (OC) for a site on Crete Island. It indicates that there is a substantial impact of long-range transport of carbonaceous aerosols from biomass burning during certain times of the year (i.e., March–April and July–September). By combining air mass trajectories, fire maps, data for aerosol optical depth (AOD), and data for the fine non-sea-salt (nss) K^+ , convincing arguments are given for that impact. Besides that impact from biomass burning, also other interesting features are seen in the data, such as the enhanced levels of OC (but not of BC) in the months May and June. The cause of this increase in OC seems to be unclear, though. I can concur with most of the data analysis and interpretation made in the paper. Furthermore, this paper is definitely of

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interest to others, who are doing similar or related measurements at other sites. As discussed in detail below, the paper is on a number of occasions unclear and/or does not provide the necessary detail. The paper could also benefit from more correct wording and grammar.

Specific comments:

1. Page 6952, starting with line 24: It should be indicated how many trajectories per day (or per week) were calculated for arriving as Fig. 1.

2. Page 6953, Aerosol sampling: Although it may be indicated in the references given, it is strongly suggested that the authors specify here at which temperature and especially at which relative humidity (RH) the Nuclepore filters were weighed. The aerosol contains a number of hygroscopic components, which may pick up water, particularly at RHs above 50%.

3. Page 6953, Aerosol sampling: A common problem with stacked filter unit (SFU) sampling on Nuclepore filters is filter clogging, particularly for the fine filter. Considering the levels of the fine ($PM_{1.5}$) particulate mass (PM), it seems impossible to me to collect samples of 1 week at a flow rate of $1.5 \text{ m}^3/\text{h}$ without avoiding this problem. As a consequence of the clogging, the flow rate will decrease, the sample will not be representative anymore for the entire week, and the cut point between fine and coarse will increase. The increase in cut point may not be a major problem if most of the total PM is in the fine size fraction. I suggest that the authors provide a typical percentage for the ratio of fine to total PM.

4. Page 6954, Light absorption measurements: First, it should be indicated at which wavelength the aethalometer measurements were done. Secondly, the mass absorption efficiency (sometimes also called specific absorption coefficient) that was used to convert the b_{abs} data into BC data should be specified.

5. Page 6956, Chemical Mass Closure: The authors state here that Ca was used to

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obtain mineral dust. I presume that nss-Ca was used for this. Furthermore, the occasional reader may wonder how ss-sulfate, ss-K, and ss-Ca were obtained. Actually, they were estimated from aerosol Na and from the sulphate/Na, K/Na, and Ca/Na ratios in bulk seawater so that sea salt was actually calculated as $1.326 [\text{Na}] + [\text{Cl}] + [\text{Mg}]$. I suggest that this is clarified, for example by providing this formula.

6. Page 6957, from line 14 on, and Table 1: Based on the data given in that Table, thereby using an OC-to-OM conversion factor of 1.8, I arrive at other numbers for PM_{CMC} than those given in Table 1. For example for the month of January, I obtain 8.22 instead of 9.66 and for the Average, I arrive at 9.37 instead of 8.88. Furthermore, on line 4 of page 6958, a positive number is given for the difference between PM and PM_{CMC} . This is contrast with the data given in Table 1. Incidentally, the positive number also does not agree with the difference between PM and the PM_{CMC} that I obtain.

7. Page 6960, lines 18-20: It is far from sure that "this" fraction should be classified as "real" BC. The increase in light transmission could also be due to desorption of pyrolytic black carbon, i.e., to desorption of OC that was converted into BC by charring. Actually, it does not matter that the light transmission already increases during the part of the analysis in a pure He atmosphere. The distinction between "real" BC and "real" OC in the thermo-optical analysis is based on the setting of the OC/EC split point. It does not matter whether this split point already occurs at the end of the phase in pure He, as long as all "real" OC has been desorbed before the split point.

8. Page 6961, lines 5-6: I am confused by the fact that the authors state here that BC in the 2-STEP method is more sensitive to fossil fuel combustion aerosols than to biomass burning aerosols. It is possible that I do not catch what the authors want to say, but I thought that the percentage difference between BC data obtained by the 2-STEP method and those obtained by IMPROVE for fossil fuel combustion aerosols is smaller than the percentage difference between the two methods for biomass burning aerosols. When comparing the T2S (i.e., 2-STEP) and TOR (i.e., IMPROVE) data for

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the urban aerosols samples (which likely contained mostly fossil fuel combustion BC) in Figures 2 and 3 of the carbon shoot-out paper of Schmid et al. (2001) I see little difference [H. Schmid et al., Atmos. Environ. 35 (2001) 2111-2121].

9. Page 6961, lines 8-12: Some motivation should be given why weighed averages were calculated and why equation (4) was used for this. I understand that the data of all years were used for obtaining these weighed averages. This should be indicated and it is suggested that the periods used for obtaining them are indicated, as these periods are not the same for all species.

10. Page 6962, line 17: Acronyms and abbreviations should be defined (written full-out) when first used. Here for AOD.

11. Page 6964, line 8: I read from Fig. 3 a nss-K concentration of around 55 ng/m^3 for May and June instead of the 50 ng/m^3 given here in the text.

12. Page 6964, from line 12 on: Apparently, the BC* and OC* data are weighed monthly averages. It is unclear, though, whether *bb*-BC, BC(IMPROVE), *bb*-OC, and OC(IMPROVE) are also weighed monthly averages.

13. Page 6966, from line 1 on: The authors should not forget that OC and BC data are method-dependent and that one should be careful when comparing OC/BC ratios of various authors. A proper comparison is only possible when the data were obtained with the same method.

14. Page 6967, l. 15-17: The explanation that the authors give here is unclear for me. It seems to be in contradiction with what they wrote earlier in this paragraph.

15. Cases where wording and/or grammar should be improved and technical corrections:

p. 6950, l. 6: replace "have shown" by "were shown".

p. 6950, l. 11: replace "has shown" by "was shown".

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p. 6950, l. 12: there is something missing here; perhaps "expected a high" can be replaced by "expected to exhibit a high".

p. 6951, l. 17: replace "light properties" by "optical properties".

p. 6951, l. 24: replace "IMROVE" by "IMPROVE".

p. 6952, l. 24: replace "interferes in" by "interfere in".

p. 6953, l. 17: replace "made of" by "using".

p. 6956, l. 2, and also on other occasions later in the paper (e.g., p. 6959, l. 11): SFUs stands for Stacked Filter Units, thus for the samplers. One does not analyse SFUs, but instead SFU samples or SFU filters.

p. 6956, l. 22: replace "using" by "used".

p. 6957, l. 6: replace "were found" by "are present".

p. 6957, l. 25: replace "of the time from the condensation" by "of the time condensation".

p. 6959, l. 21: replace "air masses origin" by "air mass origin".

p. 6960, l. 1: replace "protocol" by "protocols".

p. 6960, l. 7: replace "were also" by "are also".

p. 6960, l. 10: I would not call a period of more than 3 years short.

p. 6963, l. 22-23: There is something wrong with this sentence.

p. 6965, l. 22-25: There is something wrong with this sentence.

p. 6966, l. 18: There is something wrong with this line and with the entire sentence.

p. 6968, l. 27: replace "Although, SO₂" by "Although SO₂".

p. 6973, l. 30-31: There is no reference to Zerefos et al. (2000) within the text, Tables

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or Figures.

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