Atmos. Chem. Phys. Discuss., 10, C670–C673, 2010
www.atmos-chem-phys-discuss.net/10/C670/2010/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Aged organic aerosol in the Eastern Mediterranean: the Finokalia aerosol measurement experiment-2008" *by* L. Hildebrandt et al.

Anonymous Referee #2

Received and published: 17 March 2010

This paper presents results from AMS measurements at a remote site on the island of Crete as a part of the EUCAARI campaign. It was found that the organic aerosol at this remote site is highly aged regardless of the source. Factor analysis was applied to the organic aerosol data. Unlike many other locations, no HOA factor was found. While the two OOA factors have different O:C, they appear to have similar volatility. The authors attributed these two OOA factors to different levels of atmospheric aging.

One major issue is that the authors would have to expand their discussions on the thermodenuder data and PMF results to link them together in a clearer way. The authors found that the MS of the non-denuded and denuded aerosol are very similar, which

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leads them to suggest that aerosol appears to be comprised of compounds of similar O:C but different volatilities. However, factor analysis resulted in two OOA factors with different O:C but similar volatility. At a first read the discussions regarding these two observations seem contradictory. The authors can clear this up by expanding their explanations and better connect these two observations together (please see detailed comments below).

Overall, this paper is well-written and the content is original. I recommend the paper to be published in ACP after the following comments are addressed.

Specific comments:

1., Page 1850, lines 19 and 20. According to Jimenez et al. (2009), SV-OOA should be semi-volatile OOA (not higher-volatility OOA), and LV-OOA should be low-volatility OOA (not lower-volatility OOA).

2. Page 1855, line 26. C3H7O+ should be C3H5O+.

3. Page 1859, section 2.3.8. I assume PMF is applied to the non-denuded data? This should be made clear.

4. Page 1862, line 1. It is not clear at this point how the authors get an OM:OC of 2.2. Later in the paper (page 1863, line 2) the authors wrote "the average f44 of 18.2% corresponds to an O:C ratio of 0.8 and an OM:OC ratio of 2.2 using the correlations introduced in Sect. 2.3.1. This sentence should be mentioned earlier in Page 1862.

5. Page 1864, line 10 onwards. The authors suggested that the fractional changes in f43 and f44 appear to be close to zero throughout the campaign (possible exception 19-21 May). However, by looking at Fig. 6, once could almost argue that there are some variations in the changes in f44 and f43 between the non-denuded and denuded aerosol. For instance, from the data points in Fig. 6, it almost looks like on average the change in f43 would be negative. Also, towards the end of the campaign it appears that on average there would be a roughly -5% change in f43. The data points in Fig.6

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do not have error bars, so it is difficult to judge whether these changes are statistically significant. Error bars should be added in the revised manuscript. If the change in f43 towards the end of the campaign is significant, what may be causing this?

6. Page 1865, line 23. Based on the thermodenuder results, the authors suggested that the aerosol sampled is composed of compounds of similar O:C but different volatilities. While fragmentation provides an alternative mechanism for changing O:C and volatility that is different from the "typical" inverse relationship between the two, it does not necessarily support the observation that O:C is the same but volatility changes.

7. Page 1865 and page 1866. The arguments in these two pages should be better laid out, as it almost sounds like two contradictory conclusions are being presented. On page 1865, the authors argued that the aerosol appears to be composed of compounds of similar O:C but of differing volatilities. On page 1865, however, two OOA factors were obtained and these two factors have different O:C but similar volatility. Both arguments are solid on their own, but the authors need to explain things more clearly to link these two together.

On page 1866, line 26. The authors stated that "however, OOAa is not less volatile than OOAb according to the thermodenuder data". How did the authors come to this conclusion? This should be explained in more detail.

a) According to the authors, the MS of the denuded and non-denuded aerosol are similar. If the denuded aerosol corresponds to the more oxidized OOA (i.e OOAa), one would expect the MS of the denuded aerosol to have a higher f44. Since this is not the case, it suggested that the PMF factors and the denuded and non-denuded aerosol do not directly correspond to each other. This should be stated explicitly in the manuscript.

b) The OOAa and OOAb have a big difference in f44 but the denuded and non-denuded aerosol appears to have very similar MS. One possible explanation is that OOAa and OOAb have similar volatility AND the relative fractions of OOAa and OOAb in the denuded and non-denuded aerosol are the same. However, it is not obvious from the

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data that the relative fractions of OOAa and OOAb in the denuded and non-denuded aerosol are the same. The authors should do some calculations to evaluate this. Is the PMF analysis performed on the denuded or non-denuded data? If it is done on the non-denuded data, one can easily calculate the fractions of OOAa and OOAb in the non-denuded aerosol based on the PMF factor time series. One can also express the denuded data as a linear combination of these two factors and determine the time series and relative fractions of these two factors in the denuded data.

8. Fig. 4: Can add a legend with slope and intercept of the fit.

9. Fig. 5: I assume these are the non-denuded data? This should be made clear.

10. Fig.8: I suggest the authors to show the time series of the two factors over the whole campaign (Fig.9 only shows the times series for selected time periods). For instance, it would be useful to see how the time series of OOAa and OOAb look like for the time periods when there seem to be larger differences in f43 between the denuded and non-denuded aerosol (Fig. 6, towards the end of the campaign).

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 1847, 2010.