

Interactive comment on “Sources of organic carbon in PM₁ in Helsinki urban air” by S. Saarikoski et al.

Anonymous Referee #1

Received and published: 17 May 2008

Review of acpd-2008-0018

This paper explores the sources of organic carbon (OC) aerosols in Helsinki using one year of filter-based and online measurements. These measurements were analyzed using Positive matrix factorization (PMF) in order to determine the sources of OC. The PMF data was investigated to try to understand the seasonal and diurnal patterns of these sources.

Overall, I fell this is a good paper. As we all know OC is not very well understood. This work tries to help in increasing our understanding by trying to explore the sources and seasonal behavior of organic aerosols in a northern European urban area, which is unique since it is an urban area surrounded by boreal forest.

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The majority of my comments are really just for helping with clarity and flow of the paper, which is perhaps the only minor weakness of this manuscript. In particular, the authors should pay special attention to Figure 6 and its associated text. In my comments below I have included some suggestions/comments for this part of the paper as well as other specific comments that need to be addressed before this paper can be considered for publication.

Specific Comments:

Abstract:

Page 7806, Line 8- Suggest removing the word method

Page 7806, Lines 15-16- Suggest moving phrase may result to after sources so reads as sources may also result

Page 7806, Line 16- Define what VOC stands for

Page 7806, line 19- Suggest changing of traffic to from traffic

Page 7806, line 20- Suggest changing of long-range transport to from long-range transport

Page 7806, line 21- Suggest putting also before influence and removing on

Page 7806, line 22- Suggest changing to WSOC to for WSOC

Page 7806, line 23- Suggest removing to before OC

1.Introduction:

Page 7807, line 3- Order of first two references should be reversed

Page 7807, line 10- Suggest adding of OC after sources

Page 7807, line 25- Suggest changing the mass basis to a mass basis

Page 7808, lines 2-5- I am not exactly sure I understand the point the authors are trying

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to make with this sentence. Is it that OC from SOA cannot easily be distinguished from regionally transported primary OC? If that is the case then maybe it would be better if part of the sentence read as but also 70% of primary OC may originate from regional transport

Page 7808, line 7- Suggest adding the before boreal region

Page 7808, line 15- Suggest adding the before case

Page 7808, line 21- Suggest adding an before annual basis

Page 7808, lines 25-26- Suggest changing the paper to a paper

Page 7808, line 26- Suggest changing of the size to on the size

Page 7808, line 27- Suggest adding currently after knowledge, removing until now, and changing of the sources to on the sources

2.Experimental:

2.2.1.Sampling system:

Page 7809, line 16- Where the quartz filters pre-baked? This is come practice for organic sampling in order to remove background carbon, but it is not mentioned.

2.2.2.Chemical analyses:

Page 7811, line 3- Add in the name for the chemical formulas

Page 7811, lines 4-5- Suggest changing sentence after similar so reads as with the exceptions of using a different anion column (AS17) and eluent (KOH)

Page 7811, line 5- Add in name for chemical formula

Page 7811, line 9- Since the concentrations for most of the various species measured off the filters using IC are being reported or were not determined because they were below the detection limits, then the actual limit of detections for these various species

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should also be provided.

Page 7811, line 16-17- Suggest moving the phrase on average to before in the range

2.3.Online measurements:

2.3.1.Semicontinuous OC/EC analyzer:

Page 7811, line 24- Suggest changing also to even

Page 7821, line 1- How was the blank performed? When I think of collecting a blank for an online aerosol instrument it usually means putting a filter on the inlet to remove particles. Since the blank was done at 3:00 I suspect this was not the case. It is fine for the authors to say that they are referring to whatever they did as an instrumental blank. However, just stating a two-minute sample blank was collected is perhaps not the best way to express this.

Page 7821, line 2- Suggest adding the before semicontinuous

Page 7821, line 5- Suggest adding the before semicontinuous

Page 7821, line 28- Suggest adding a before three-hour sample

2.3.2.PILS-IC:

Page 7813, line 16- Add in name for chemical formula

Page 7813, lines 17-18- Is the time resolution for the PILS-IC system really 15 minutes? Or is it that a new chromatogram is recorded every 15 minutes? The time resolution is actually the time it takes for the sample loops to fill. Did the sample loops really fill in 15 minutes?

Page 7813, line 18- Suggest adding in after described

2.4.Gas-phase components and meteorology:

Page 7813, lines 21, 22, and 24- Suggest adding a before TEI (occurs three times) and

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2.5.Data analysis:

Page 7814, lines 7-8- Order of references should be reversed

Page 7814, line 10- Suggest adding a comma after data set

Page 7814, line 16- Suggest adding the before range and of after range

3. Results and discussion:

3.1.PM1 filter measurements:

3.1.1.Annual concentrations:

Page 7814, line 22- Suggest changing of biomass burning smokes to when smoke from biomass burning was intercepted

Page 7815, lines 5, 8, 10, 11- Should the units be micrograms C/m³? It is usually convention that the units are in terms on carbon unless they have been converted to account for the oxygen and hydrogen associated with the carbon (i.e., organic matter rather than organic carbon). If this is the case, then what factor has been used for the conversion?

3.1.2.Seasonal variation:

Page 7816, line 11- Suggest adding the after variation of

Page 7816, line 22- What is meant by carbon content of levoglucosan? I believe that Figure 3a is essentially showing the ratio of levoglucosan to OC as a function of temperature. However, saying when the carbon content of levoglucosan was compared to OC would mean to me that the concentration of levoglucosan has been converted to a carbon mass basis using the molecular weight of levoglucosan and carbon and this carbon mass basis levoglucosan was then plotted versus (or compared) to OC.

3.1.3.Sources of OC by PMF:

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Page 7817, lines 26-27- Suggest moving the phrase associated with this factor to after percentages

Page 7818, line 10- Suggest adding the before time-series

Page 7818, line 21- Suggest adding the before four sources

Page 7818, line 22- Suggest adding the before OC

Page 7819, line 9- Suggest removing the before 38 percent

Page 7819, line 17- Suggest adding a before seasonal pattern

Page 7819, line 18- Pittsburgh is misspelled

3.1.4.Characterization of sources:

Page 7820, line 13- Suggest adding a before high

Page 7820, line 15- Suggest adding a before relatively

Page 7820, line 25- Suggest adding a before significant

Page 7821, line 17- Suggest changing another to other

Page 7822, line 2- Suggest adding the before PMF

Page 7822, line 4- Suggest adding the before case

Page 7822, line 20- Suggest changing of the depletion to for the depletion

Page 7822, lines 20-26- This section seems to be suggesting that there was no change in the potassium concentration from season to season whereas the levoglucosan concentration changed leading to the trend in the levoglucosan/potassium ration shown in Figure 6. Did the potassium concentration really not change? It would be very useful to the reader if the time series of potassium and levoglucosan were both added to Figure 6.

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Page 7822 starting at line 20 to Page 7823 ending at line 8- I find this section a bit confusing. The authors at first seem to suggest the trend seen in Figure 6 is due to levoglucosan being photochemically oxidized. However, right after that the authors say the PMF analysis indicates that it is due to loss of levoglucosan during transport. The authors need to work on this section. Perhaps showing the trend and then directly stating the reason for this trend would be the best approach.

3.2. Online measurements:

Page 7823, line 11- Suggest adding the before OC

Page 7823, line 12- Suggest adding the before filter

Page 7823, line 16- Suggest adding a before one year

Page 7823, line 18- Suggest adding the before PM1

Page 7823, line 20- Suggest adding the before PM1

Page 7824, line 1- Suggest adding a before low boundary

Page 7824, line 2- Suggest adding a before stable

Page 7824, line 7- Suggest changing in Saturday to on Saturday

Page 7824, lines 16-21- I am not totally sure I understand what the authors are saying here about the OC concentration peaking in the daytime. Generally the OC should peak in the morning. What could potentially peak in the afternoon would be the ratio of the WSOC (or SOA) to OC.

Page 7824, lines 17-18- Order of first two references should be reversed

Page 7825, line 2- Suggest changing weekday to weekdays

3.3. Contribution of traffic to OC:

Page 7825, line 4- Suggest adding the before low

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Page 7825, line 6- Suggest adding the online before OC

Page 7825, line 7- Suggest adding online before EC

Page 7825, line 9- Suggest adding a before larger and online before OC

Page 7825, line 10- Suggest adding filter-based before EC

Page 7825, line 12- Suggest adding the before two

Page 7825, line 19- Suggest changing At weekends to On weekends

Page 7825, line 21- Suggest changing Sunday to Sundays

Page 7825, line 23- Suggest changing at weekends to on weekends and at 03:00-06:00 to from 03:00-06:00

Page 7825, line 26- Suggest changing at weekdays to on weekdays and at weekends to on weekends

3.3.1.The influence of biomass combustion (Case study):

Page 7826, line 11- Suggest removing comma after situation

Page 7826, line 11-12- Suggest changing at that weekend to on that weekend

Page 7826, line 16- Suggest adding a before fireplace

Page 7826, line 17- Suggest adding the before chloride and with after closely

Page 7826, line 27- Suggest removing the before Saturday

4.Summary and conclusions:

Page 7827, line 17- Suggest changing biomass smokes to smoke from biomass burning

Page 7827, line 20- Suggest adding an before annual

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Page 7828, line 7- Suggest changing to transport into Helsinki

Page 7828, line 12- Suggest making a new paragraph starting with the sentence that begins as Biomass combustion

Page 7828, line 16- Suggest adding an before annual

Page 7828, line 17- Suggest adding the before case

Page 7828, line 18- Suggest changing to WSOC to for WSOC and removing to before OC

References:

Page 7832, line 11- Turpin is misspelled in the Polidori et al. reference

Page 7834, line 4- Page numbers are listed as 00-00 in the Timonen et al. reference

Table 1: -Should the units be micrograms C/m³ for OC, EC, and WSOC?

Figure 1: -Should the units on the y-axis be micrograms C/m³?

Figure 2: -Should the units on the y-axis be micrograms C/m³? -In caption, suggest changing for the PM1 to from the PM1 and adding a before daily basis

Figure 4: -There are no charges for the ions or subscripts for the species listed on the x-axis

Figure 5: -Should the units on the y-axis be micrograms C/m³? -In caption, suggest adding the before four

Figure 7: -Should the units on the y-axis be micrograms C/m³?

Figure 9: -Should the units on the y-axis for OC and EC be micrograms C/m³? -There are also no charges listed for the various ions plotted

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 7805, 2008.

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