

Interactive comment on “Size distributions, sources and source areas of water-soluble organic carbon in urban background air” by H. Timonen et al.

H. Timonen et al.

Received and published: 13 August 2008

Anonymous Referee #2

General comments: Ref: The manuscript presents a year-long study of water-soluble organic compounds in aerosols in urban background air, and the results are supported by measurements of other relevant aerosol components. The results are interesting since very few studies have been published with such an extensive number of continuous measurements of WSOC. Generally the results are presented well, but in some sections the results on influence of biogenic SOA are over-interpreted. The manuscript is written fairly well, but grammar and style should be checked again by a native English speaking person, e.g. to avoid errors with use of prepositions (ex-

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amples: 7849 line 12: can be further divided to (should read in), line 21: a fossil fuel combustion sources (no plural)). It was surprising to discover that the paper has a companion paper in ACPD by some of the same authors about some of the measurements also presented here (S. Saarikoski et al. acpd, 7805-7846). The papers have separate data analysis, but they should at least state a reference to each other and describe the difference.

Author: the interpretation and discussion of the results have been tried to improve. Also founded typos and errors of grammar have been corrected. The paper Saarikoski et al has been sited in section 3.5 and discussed the results of that paper.

Specific comments: Ref. Introduction: The section presents the background within the area with references to a fair number of relevant papers, but the style and grammar of the presentation should generally be improved by e.g. using fewer brackets containing fewer words.

Author introduction: The suggested corrections have been done

Ref. P7850 line 7-11: Please rephrase the sentence to give a more meaningful description of different techniques, preferably with some references. What is rotating extraction?

Author P7850 line 7-11: The sentence has been rephrased.

Ref. p7850 line 19-20: The papers referred to here do not form a basis for the argument that the boreal forest has been recognized as one of the most effective emitters of biogenic volatile compounds (BVOC). A more precise statement would be that this region has considerable emissions of BVOC.

Author p7850 line 19-20: The reference to Tunved et al has been deleted.

Ref. line 21: should read : The paper presents

Author line 21: Ok, done

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Ref. Experimental: Measuring OC is a difficult task due to possible artefacts from adsorption or loss of semivolatile components. Using impactors for sampling of OC may be especially problematic due to low pressures and possible higher loss of the most volatile components. This effect may be very difficult to quantify, so please at least describe possible problems related to this. This should also be reflected in the uncertainty of the analyses.

Author Experimental: The MOUDI was chosen because it has much higher absolute stage pressures than the low pressure impactors. This is expected to reduce though not necessarily eliminate losses of semivolatile organic material.

Ref. 7851 line 15: Do the cut-off diameters refer to the 50% cut-off diameters? Please state.

Author 7851 line 15: The cut-off diameters (aerodynamic particle diameter corresponding 50% collection efficiency) of the impactor

Ref. line 19: what was the foils washed with?

Author line 19: The MOUDI samples were collected onto 47-mm Al-foil substrates which were washed prior to the sampling with deionized water, which was generated from Milli-Q gradient system with TOC monitor.

Ref. 7852 line 19-20: At what temperature and RH were the filters conditioned and for how long?

Author 7852 line 19-20: The relative humidity (RH) and temperature was not controlled, but was recorded for each weighing session. RH had a range of 8-64%, and was most of the time below 40%. For the mass of major inorganic ion at the measurement site, ammonium sulfate, the effect of relative humidity is therefore minor, but the effect cannot be completely ruled out for the total mass. The stabilization time was 30-60 min at room temperature.

Ref. 7853 | 3 “: using the Millexr-LCR. Please state that this is a type of filter

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and remove THE.

Author 7853 I 3 “: Ok, done

Ref. I 16: What does the NPOC method mean?

Author I 16: non-purgeable organic carbon method (NPOC) (added into the text)

Ref. 7854 I 4: Explain the acronym LC-MS.

Author 7854 I 4: Liquid Chromatograph coupled to a mass spectrometer

Ref. Results and discussion 7855 I 3-5: Please clarify this sentence.

Author 7855 I 3-5: Ok, done

Ref. I 23: Large variations in the particulate concentration levels were observed. Do you mean variations during the year or?

Author I 23: PM10 concentration levels varied between 3.4-55 $\mu\text{g}/\text{m}^3$ during the MOUDI collections.

Ref. 7857 paragraph I 3-12: This paragraph should be clarified, improved and shortened. I generally advice to exclude some of the eight (!) references to the paper of Tunved et al. in this paragraph I think one is enough.

Author 7857 paragraph I 3-12: The paragraph has been rewritten.

Ref. 7860 I23: - residential wood combustion may be a locally important problem, but on a regional level this is probably not quantified enough to form a basis for the statement.

Author 7860 I23: We have daily levoglucosan data for two winter seasons, and never (although air masses are from different directions) during the winter levoglucosan is low. In Helsinki only 3% of the residents are heated by wood. This means that in winter we have high regional background from wood combustion.

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Ref. 7862 line 7-8: please give the range of WSOC/OC measured by Frey et al.

Author 7862 line 7-8: Ok

Ref. I 9-10: Please describe in more detail the statement that the WSOC size distributions were clearly different since it is not so clear to me. How were the distributions normalized?

Author I 9-10: The differences were discussed in the following sentences in the paper. Normalized size distribution? The highest concentration in each run was equal to 1 and the concentration of each stage was calculated again (concentration in stage x / max concentration in that run). The clean arctic and marine size distributions were calculated wrongly in Fig 4. The Fig 4 has been redrawn.

Ref. I 14-15: I assume that this refers to the normalized distributions and not the actual concentrations in Table 2, since the concentration of WSOC is smallest for the arctic air masses please correct.

Author I 14-15: the normalized amount

Ref. I 15-20: It would be more correct to say that this MAY be caused by condensation of biogenic secondary aerosol.

Author I 15-20: Ok, changed

Ref. 7863 I 0-9: Please write that the data are not shown.

Author 7863 I 0-9: Ok, done

Ref. I 10:- Figure 5 shows the WSPOM ratios not WSOC. Please correct throughout the paragraph.

Author I 10: Ok, done

Ref. 7864 last paragraph: The data on biogenic influence are over-interpreted. Please modify the discussion to reflect the actual data in a more exact way. The results

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indicate an association with seasonal variation in biogenic emissions and probably also SOA formation, but since terpene oxidation products were not analysed it is only an indication.

Author 7864 last paragraph: The discussion has been modified as follows; it is possible that the oxidation products from the biogenic VOCs contribute largely to the WSOC concentrations in the ultrafine particle size range during clean arctic air masses. However, at an urban background site, there are also several interfering anthropogenic sources, and strict conclusions of the role of natural sources are not possible without additional measurements.

Ref. 7865 I 24:- The statements concerning influence of biogenic VOC are much too strong compared with the results presented.

Author 7865 I 24: In summer the oxidation products of biogenic VOCs may increase WSOC concentrations, especially in the ultrafine particles, but at the urban measurements site also VOCs from other sources, and subsequent secondary aerosol formation are important contributors.

Ref. Table 1: The description is not precise. It seems that the table shows average concentrations for the different air masses, not criteria, which is somewhat confusing to the reader. Please clarify and add standard deviations to the average concentrations. If this is actually the criteria, I would like a description of how the numbers were selected.

Author Table 1: As the reviewer says, the table is confusing. It presents the observed levels. The selected criteria are added to the text and the text in the table has been changed.

Ref. Abstract: The abstract should of course be corrected according to the above recommendations.

Author Abstract: Ok

Ref. p. 7848 I 9: gravimetric mass of what? PM1? or individual filters?

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Author p. 7848 | 9: gravimetric mass concentration varied during the MOUDI samplings

Ref. | 16: Describe shortly how the sources were identified.

Author | 16: Categories were identified using levoglucosan concentration level for wood combustion and air mass backward trajectories for other groups.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 7847, 2008.

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8, S5919–S5925, 2008

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