Atmos. Chem. Phys. Discuss., 8, S5926–S5929, 2008
www.atmos-chem-phys-discuss.net/8/S5926/2008/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Size distributions, sources and source areas of water-soluble organic carbonin urban background air" *by* H. Timonen et al.

H. Timonen et al.

Received and published: 13 August 2008

Anonymous Referee #1

General comments Ref: The size distributions of water-soluble organic carbon (WSOC), inorganic ions and gravimetric mass of particulate matter over one year presented here are datasets rare and valuable for understanding aerosol occurrence and impacts in the troposphere. This paper is complementary to the one by Saarikoski et al in the same journal is more chemistry than physics oriented paper and deserves to be cited by this one and vice versa.

I will agree with the two other reviewers that although the database is worth publication in ACP, the interpretation and discussion of the results is not at the same level with the

data. Improvements in order to better justify the conclusions will be of large benefit for the manuscript before publication in ACP. The use of English has also to be improved and typos detectable by careful reading have to be corrected.

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

Specific comments 1.Ref: The use of a fixed mass to carbon ratio of 1.6 (p 7848, l 11) to convert WSOC to WSPOM may be critical for the discussion of results. This ratio has been reported in literature to vary from 1.4ś0.2 for fresh primary aerosol (for instance samples collected in Asia and the Caribbean; Russell, Environ. Sci. Technol., 37, 2982-2987, 2003), up to 2.1´s0.2 for non-urban aged aerosol (for instance Turpin and Lim, Aerosol Sci. Technol., 35, 602-610, 2001). Thus higher ratios are related to atmospheric processing. How is this counted in the present study? What is the uncertainty that the adopted fixed ratio introduces to the results of this study? In particular with regard to the importance of WSPOM with regard to inorganic ions in the PM mass.

1. Author: This is true. We do not know the exact ratio to convert the carbon to organic matter. We have chosen the minimum value, which is suitable for WSOC. The ratios presented (WSPOM/mass and WSPOM/ions) are then the minimum ratios.

2. Ref: p7851, l 21: Blank controls are mentioned without indications on the detected levels. How large is the applied corrections compared to the measured concentrations?

2. Author: In each MOUDI run (total 45 runs) includes three blanks and the average value of these blanks was subtracted from each stage of the corresponding impactor. The average WSOC blank value for all Al-foil substrates was 3.6ś0.4 μg/Al-foil (averageśSD). The maximum and average standard deviation of three blank values in one impactor run was 1.3 and 0.4 μg/Al-foil, which equals depending on the sampling time (96-24 h) 0.007-0.03 and 0.003-0.01 μg m-3, respectively. The concentrations in the

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MOUDI stage collecting particles above 5.6 μm (highest stage) were about the same as blank values (stage/BL 1.4ś0.4), but for other stages the concentration were on average over threefold of the blank values except for some stages during short 24 h sampling.

The particulate WSOC and OC concentrations from filter samples were calculated by subtracting the back up filter value from the front filter value to correct the positive gaseous artifact. The average ratios of backup filter to front filter were 0.12ś0.05 and 0.27ś0.15 for OC and WSOC, respectively. The blank value for OC was 0.08ś0.03 μg m-3 for 24 h sampling time. The average ratio of WSOC blank to WSOC back-up was 0.95ś0.23.

3. Ref: p 7855, l 15-19: Provide number of samples used for this analysis.

3. Author: OK, done

4. Ref: p. 7858, l27. The large WSPOM/ions-ratios observed in the coarse mode (Figure 3) need to be explained to increase confidence to the experimental results.

4. Author: The ratios for particles above 5.6 μm (highest stage) had to exclude from the interpretation because of the relative high blank concentrations of WSOC. The values of other stages were verified to be acceptable.

5. Ref: p. 7859, l 10: Please, explain how the mean WSOC/OC ratios are calculated? Do the authors calculate the average of the individual ratios? Also clarify how Table 2 is derived why WSOC/OC (PM1) does not have standard deviation?

5. Author: the average of individual ratios Standard deviation can be added

6. Ref: p. 7860, section 3.5.1 this part can and has to be linked to the Saarikoski et al. ACPD, 2008 paper that provides information on the source apportionment procedure applied by the authors for organic carbon.

6. Author: Following sentences are added: In a recent study of Saarikoski et al. (2008)

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one year PM1 data set from the location of this study was analyzed for sources. Contribution of SOA was found to be very high during summer months, and wood combustion was most significant source during winter.

7. Ref: p. 7861, l 2-8: Table 1 presents criteria or observed average levels? Why elemental carbon or nss- potassium have not been used in this procedure?

7. Author: 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.

Potassium and oxalate have been used also as biomass combustion tracers but the only specific tracer of biomass combustion particles is levoglucosan. Combustion of aerosols increased the black carbon (BC) concentrations, but the BC concentrations are also affected the diurnal variation of local traffic emissions and thus are not taken into account.

8. Ref: p. 7861, l27 and p7862 l 4: Provide the numbers for max and min ratios and explain how they are derived.

8. Author: The WSOC to OC ratio has been calculated in each run. WSOC has been taken from MOUDI-impactor (sum of stages 1 to 5) and OC has been taken from PM1 filter sample. Each ratio has been categorized to source areas. The largest WSOC/OC originated from continental Europe and from wild fires areas were 0.83ś0.07 and 0.64ś0.06 and lowest from small-scale wood combustion 0.49ś0.13.

9. Ref: To avoid miss-understanding in the captions of Figures 1, 3, 5, 6 and 7, where WSPOM is used, the adopted factor 1.6 has to be mentioned since this affects the results presented in the figures.

9. Author: OK, this will be done.

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

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