Interactive comment on "Sources and composition of urban aerosol particles" by M. Vogt et al.

Author's response
Anonymous Referee #1
Received and published: 3 November 2011
This manuscript presents atmospheric measurements of aerosols on three locations in urban locations in Stockholm. The data are valuable and well presented. The manuscript contains new novel scientific results. However, there are several issues the Author's need to address before potential publication.

Author's response

The Author's thank anonymous reviewer 1 for insightful comments on the manuscript. The reviewer provided several suggestions for improving the readability and quality of the manuscript. We have followed the suggestions in most cases, and our detailed response is outlined below

Major comments:
The fact that bothers me the most is that this manuscript is one more in the series of publications based on one data set. At this point it seems, that the manuscript would be much stronger if containing more comprehensive analysis. The Author's seem to optimise the data to publish many detailed investigations in separate papers. While I understand the reasons for this, I must say that it is somewhat bothering issue.

Author's response
If we were talking about a short campaign based data set, we would tend to agree. This is however long term measurements and the total data set is very large. Part of these data has been used before, but with totally different objectives. It is in no way unusual that long term measurements leads to several publications...it is actually one of the advantages of long term measurements. More precisely, the heated data in this manuscript has not been used in any other publication. Measurements with two OPCs running in parallel at two temperatures were only available for a shorter period, so the unheated data has not previously been averaged and presented for the period that exactly correspond to the measurements with heated air. For clarity it is of course necessary to publish unheated data again for these periods. It would be improper as well as less clear to ask the reader to bring out the previous publication and compare it with figures therein. As for the soot and aerosol composition data, it is true that Prof. Johansson has published similar data from Stockholm before, but again, this was with different objectives, and again, we need to pick the exact period (out of several years of data) to compare them with our measurements. All this considered, we must disagree with the referee.

AR1:"This specific MS has title, which is much too broad. The Author's need to focus the title more in order to give right impression for the reader.

Scientifically the main issue is the choice of the instruments. Much of the analysis is focusing on the number concentrations and number fluxes of aerosol particles. However, the instrument that is used is an optical counter that has the lower size limit of 0.25 µm. This means that most of the particles (in number) are not detected and included in the analysis. The Author's also noticed this issue. I am not sure whether the presented data is interesting enough for a separate publication. Definitely not, if the title is as written"

Author's response

The Author's agree that the title might be too broad. It was changed to " Heated submicron particle fluxes using an optical particle counter in urban environment".

In respect to the scientifically issue the OPC obviously don't cover the peak particle number. We published data using an OPC with a cut at 11nm already in 2006 (Mårtensson et al., 2006). The focus on the current project is instead larger particles where most of the mass is found. Which is most relevant? It depends on the objective. The OPC is for example more relevant for regulations since these are only concerned with mass, which is dominated by larger particles. Furthermore, this specific paper focus on particles of different volatility, which gives an indirect information of the chemical composition. To our knowledge, there exist no previous study heated particle fluxes (and hence of particles of different volatility) in an urban environment.

Secondly being the first study with heated aerosol fluxes it serve the purpose of testing if heated particle fluxes are possible, and what information could be obtained using the data.

Detailed comments

For the eddy flux analysis, it is essential to be able to determine the footprint area. Is there analysis on this matter?

Author's response

The footprint analysis was done in the same manner as in previous publications using the Kljun footprint model. A reference has been included in the text under section 2.3 Eddy covariance fluxes, corrections and errors.

"Reference: Kljun, N., P. Calanca, M.W. Rotach, H.P. Schmid: 2004, 'A Simple Parameterisation for Flux Footprint Predictions', Boundary-Layer Meteorology, 112, 503-523."

The experimental setup includes a heater before one of the counters. I wonder if the Author's performed any test using some standard aerosol to check the operation of the heater. The concerns I have are: is the residence time within the heater long enough?, is there a possibility that some of the compounds that evaporate from the particles, condense again on the particle surfaces after the heater?

Author's response

The efficiency was tested as stated in the manuscript at page 26116 "The heater efficiency of the commercial Grimm Model 265 was tested with Ammonium sulfate particles where it was found that the heater effectively removed all particles at temperatures of 300 °C, even for particle number concentrations as high as approximately 10 000 particles cm3"

Compared to many other applications with a semi-denuder that we have seen, this heater is unusually long (it is a special version custom made for us in only two copies). The length was chosen so that with the small sample flow of the OPC, the air should spend long enough time in the thermo-denuder to remove all particles, which was also confirmed by the laboratory tests with ammonium sulfate. The OPC is placed right behind the heater (a few cm distance) and the air entering the OPC is still warm enough that it should prevent re-condensation. Again, the lab tests confirm this.

In several parts of the manuscript the Author's should indicate: 1) the exact time periods of the data (e.g. line 260 and elsewhere) and 2) the number of observations (e.g. line 360 and elsewhere).

Author's response

Time periods and number of observations have been shown in table1; same periods apply for the BC and NOx measurements.

Line 124: Some symbols are not correctly printed.
This

This issue will be checked this with the assistance from APC.

Line 167: How was the 5 % losses determined?

Author's response

In our measurement setup the inlet of the tubing was bent downwards to prevent rainwater entering the sampling line. The sampling line was also slightly bent at two other points. For laminar flow, the inertial deposition of particles due to tube bends is given by the equation (Crane and Evans, 1977)
Bend loss = $Stk\frac{\Phi}{2}$ where *Stk* is Stokes number Φ and is the bend angle in radians.

Lines 237-238: Please discuss the possible explanations for values larger than 1.
Author's response

A short discussion has been included.

Line 264: The figure 7 appears before figure 6.
Author's response

The figure lineup has been changed according to the referee's suggestions.

Line 286: I am rather surprised of the low correlation coefficient. Is it really the correlation coefficient, not for instance the slope?

Author's response

It is the correlation coefficient; reasons for the low correlation might be due to the fact that the maximum peak concentration is below the size cut of 0.25µm.

Line 305: Why is this analysis done only for the heated aerosol?

Author's response

Among the objectives of this paper is to determine the emission factors for the heated particle fluxes; the non heated emission factors has been carried out in detail in Vogt et al., 2010b.

Figure 4: The plots do not present the concentration but the size distribution function.
It would be also interesting to know the time period for the data on each of the curves.

Author's response

AR: Time periods have been included in the figure caption.