Atmospheric Chemistry and Physics Discussions
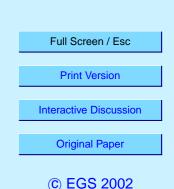
Interactive Comment

Interactive comment on "Long term measurements of submicrometer urban aerosols: statistical analysis for correlations with meteorological conditions and trace gases" *by* B. Wehner and A. Wiedensohler

Anonymous Referee #1

Received and published: 22 November 2002

Regarding nucleation You interpretation regarding nucleation mode is somewhat unclear to me.

There is a high correlation between global radiation and nucleation mode particles and the concentration peaks at noon during summer. You point out that particle surface area may be very important for the nucleation but you have not actually shown that particle surface area is lower during these episodes as compared to other periods. Actually you are contradictory regarding the influence of surface area since the peak nucleation mode concentration was roughly the same on weekdays and weekends, whereas one would expect the surface area to be much higher during weekdays.

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No nucleation mode peaks are found in winter (page 1705) and on page 1713 you say that this mode is not correlated with NO, indicating that these particles do not come from exhaust emissions. Where do these particles come from during winter? I think it would be useful also to see the relative contribution of different particle sizes to the total particle concentration during different times of the year and different day types.

It would also be useful if you could identify the new particle formation episodes, give a more thorough quantitative description of these episodes in relation to global radiation, particle surface area, temperature, relative humidity and gaseous pollutants. How often are they observed? Are these periods associated with specific air masses? You state that "potential precursor gases was always high enough". But which gases do you mean, I guess that the time scale for local emissions of NOx to form new particles is too short? How about the levels and emissions of sulphuric acid, which is the most potent nucleation precursor? How about comparing winds coming from the city centre area as opposed to other directions with lower primary sources upwind?

It would be interesting if you in some way could categorise the data into nucleation type and non-nucleation type periods and actually present the mean and range of different parameters that you have measured for these two types of episodes. Do you have any information on the background aerosol size distribution during such periods?

Comments and questions in relation to some qualitative statements: p. 1705, line 24 "Only during summer was the afternoon number concentration higher on Sunday's" Is the difference significant? You need to provide some mean and confidence intervals. Also when you say that there is a lower peak during summer Sundays than on summer weekdays you need to proved confidence intervals. Does this occur every Sunday or just during some occasions. Error bars in Fig 4 would make it easier to see significant differences.

Regarding the PCA Your main objective with the PCA is to identify sources of aerosol particles and explain the variation. But already in the presentation of the data proceed-

ing the PCA, you have "explained" most of the variation and which sources affect the particle size distribution, so I am not sure what the PCA really adds to the paper.

That global radiation correlates with N10 - N30 during summer has already been shown without the PCA. The interpretation of the PCA gives very little information. PC1 has high loadings of N10 to N100, NO and NO2 indicating combustion sources, which was already seen before.

Despite the fact that you extract 14 components in the PCA analysis you only explain somewhat more than half of the variance. What could be the cause of the unexplained variability? Perhaps you are missing some fundamental parameter.

Why didn't you include temperature and relative humidity? How sensitive are the results for the way you normalise the variables? Why did you take the square root of concentrations of O3, NO and NO2 and windspeed?

Time series analysis This section could possibly be shortened since it to some degree repeats what has been said before. The diurnal variation is obvious from the Figures. The correlation of global radiation and nucleation mode has been discussed earlier. The interpretation of persistence is not clear. For N3 you obtain 59 minutes. What does this actually mean?

You haven't showed if there is a long-term time trend in the data set. Would you expect a trend in particle concentrations due to changing vehicle emissions in this period? In some countries, eg in Scandinavia, the introduction of new diesel fuels may have reduced the emissions of ultrafine particles substantially during the last few years. For the PCA you say that you have de-trended the data so obviously you do see a trend?

Interactive comment on Atmos. Chem. Phys. Discuss., 2, 1699, 2002.

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