**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "Relationships between submicrometer particulate air pollution and air mass history in Beijing, China, 2004–2006" *by* B. Wehner et al.

B. Wehner et al.

Received and published: 3 September 2008

Anonymous Referee 3

General comments (Reviewers comments are displayed in italic letters):

The authors present a large set of aerosol number-size distribution data from the Chinese capital city, Beijing. The data set consists of two years of continuous measurements of particles in the size range 3 - 10 000 nm in diameter. The long time period combined with the large size range and the fact that no long-time number-size distribution measurements have been conducted in this area make this data set very valuable for further analyzing. The data set is large and comprehensive enough for statistical analysis, covering roughly 80The English language used in the manuscript is good and

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

clear. All main points and conclusions are stated clearly making the manuscript easy to read. Previous work has been acknowledged properly, except for a few individual points. (See technical corrections)

Specific comments: The air mass history data was classified in two different ways, one being manual sector analysis and the other being cluster analysis of the back trajectories. Both approaches give roughly the same results, the latter being more quantitative and giving somewhat more information than the first one. I would like the authors to give reasons why the sector analysis should be included in the manuscript, as the cluster analysis gives all the same information, and more. Now most of the results are presented twice.

The manuscript reflects also the development of the whole analysis. However, we think that is worth to publish both. Maybe the arguments are not clear and strong enough in the present version, thus it was modified in the new manuscript. The point is that the sector analysis is the more obvious way which would be chosen by many scientists as a first try. And it shows that reasonable results are obtained, thus we can conclude the particle characteristics depend on the direction of backtrajectory. But it was a relatively subjective method, means we expected already a certain result before doing this analysis. Application of the second method is relatively objective, thus the method looks for similarities excluding any expectations of the user. From this we found that only the direction but also the length of the trajectory affects the particle characteristics. Thus, we try to demonstrate that such an objective method should be applied to get an unexpected result, which might be more obvious than the expected one, as in our case. The following paragraph was added to conclusions:

"Comparing the two methods can be concluded that the differences found by cluster analysis being the more objective methods are more significant than those by the simple air mass direction classification. Thus for such studies as many characteristics as possible should be included into analysis, not only the direction of backtrajectories. Overall results of both methods are in good agreement but this study should also illus-

trate potential differences obtained by the different methods. One major finding from the cluster analysis is that the pollution level in the Beijing region depends not only on the direction of arriving air mass but also on its transportation speed. This result could not be obtained from the first method alone."

On page 11330, line 6, the authors state: 8220;For the following analysis, measurement days have been classified according to the direction of their 72-hour back trajectories. 8221; This leaves open whether there were one or several trajectories/day, and what arrival time to Beijing do these trajectories correspond to. If there is only one trajectory per day, is that enough to represent the situation.

We used one trajectory per day which we think is representative. In this study we used the one at 12:00 local time where usually a well mixed boundary layer has been developed and thus ground based conditions are coupled to regional ones. During night time this might be different, i.e. ground based measurements do not reflect the regional conditions. Thus, we think the daily trajectory is reasonable to be used as representative one and the usage of more, i.e. also night time trajectories would not improve the quality of the results. This explanation, that one daytime trajectory was used and why has been added to the manuscript.

Page 11339, lines 12-13: 8220;The analysis suggests that variations of aerosol parameters along with the air mass history are more significant than the seasonal, weekly or even diurnal cycles.8221; I cannot make such a conclusion from the results presented in the manuscript. The diurnal cycle was very clear in most of the air masses, and seasonal or weekly cycles were not analyzed in depth in the manuscript. There should be more information given about those cycles before such conclusion can be made.

The statistical analysis of these data concerning seasonal and other variations was the subject of a different paper which is now accepted in Atmospheric Environment written by Wu et al. The conclusion can only be made with a close connection to this paper. The idea was to say that the variation in aerosol characteristic by air mass is more

significant than the variation by season or by day of the week; which is typically the dominating factor in cities in Europe. In Beijing there is no significant variation by the day of the week. When we submitted our manuscript the paper by Wu et al. was not accepted, thus we were not allowed to refer to this one. Now this comparison is added few times in the manuscript and the reader can take this other paper for more statistics.

Comments regarding the figures: There are several comments about the figures in the manuscript. I did not find any significant new information in figure 9 that wasn8217;t already in figure 7. The same applies for figures 11 and 12, respectively.

I think both figures are necessary: the contour plots illustrate well the development of the boundary layer and selected number size distributions show e.g. small differences in the accumulation mode between the different groups. It is not possible to see these differences in the contour plot. Also a comparison of peak number concentrations is difficult from the contour plots. Thus, I would prefer to keep both figures in the manuscript.

If figure 9 is to be kept in the manuscript, it might be better to present it in the same way as figure 11. I would also like to remind the authors, that some 8% of the worlds male population has a decreased ability to distinguish thin red and green lines (or small dots) from each other. (This is most problematic in figures 11 and 15.)

Figure 9 was changed and is now presented in the same way as figure 11. In addition two lines in figure 11 (cluster 1 and 2) were changed to dotted lines making their distinction more independent from red and green lines. In Figure 15 the symbols were modified for the same reason.

The information given in figures 2 and 15 is given in the text in sufficient detail. The figures do not bring much new information to the general picture.

Figure 2 was removed from the manuscript. The information is given briefly as text now. I would prefer to leave Figure 15 (old numbers) in because it illustrates the distribution

of individual PBL depths and corresponding particle volume concentration. Figure 14 is removed now, thus at least one figure showing this relationship should be kept in the paper.

Figure 14 might be better to present as a table, with the correlation coefficients.

Figure 14 has been removed from the manuscript. Table 3 presents now the most important averaged parameters for each cluster, i.e., not only those which were presented in Figure 14, but also meteorological ones.

Technical corrections: Page 11327, lines 10-11: 8220; The assumption of this density is based on previous measurements of particle chemical composition at Beijing.8221; A reference in this is needed.

This of course always difficult, parallel measurements of aerosol composition would be very helpful. However, previous measurements from Beijing state that sulfate, is the major component of submicrometer aerosol followed by nitrate and organic carbon, therefore here the density of 1.5 g cm-3 was chosen. There are not many publications about size resolved chemical composition in Beijing available. One paper Yao et al. (2003) shows the mass size distributions of inorganic species where sulfate dominates clearly the submicrometer range. In the same paper it can be found that crustal material dominates the mass size distribution above 1 micrometer, this motivates the assumption of the higher density. In the manuscript the publication of Yao et al.(2003) was added.

Page 11338, line 24: The unit of surface area should be square micrometers/cm3, not square meters/cm3.

Okay, this was corrected.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 11321, 2008.