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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Size distributions of non-volatile particle residuals (D_p<800 nm) at a rural site in Germany and relation to airmass origin" *by* C. Engler et al.

Anonymous Referee #3

Received and published: 25 July 2006

The manuscript presents highly relevant experimental data on the size distribution of non-volatile particle residuals for aerosols of various origins. The data analysis is based on a one-year record of aerosol measurements at the station Melpitz in Eastern Germany which is operated by the Institute of Tropospheric Research, Leipzig. Volatility Tandem DMA data were analysed in terms of total aerosol size distributions, non-volatile particle size distributions and air mass origins from back trajectory cluster analyses and synoptic chart analyses (Berliner Wetterkarte). The manuscript compiles size distribution information and aerosol shrinking factors for 11 air mass types which are identified according to their origin and stratification. The presented data will make a substantial input to long-range transport studies and model evaluation studies.

The paper is scientifically sound and well written. The organisation of the paper, however, requires some revision. From my opinion, the authors can even increase the information content of their paper compared to the present version. Publication in ACP is recommended after the following comments have been considered.

GENERAL COMMENTS

1/ Section headings do not reflect the content of the sections. In Section 3, Methodology, also first results are presented and discussed. Section 4, Effects of Air Mass History, may act as the main section on the discussion of results. I recommend to better separate method description and presentation as well as discussion of results.

2/ Please add quantitatively key aerosol properties like median number concentration, count median diameter and size distribution width, modal structure (mono-modal or bi-modal) or effective radius etc. for the identified air mass types in a separate table or as part of Tables 3-4. In the present form the size distribution information is only given in the graphs which does not allow for quantitative comparison with, e.g., data from other observations.

3/ The justification of the applied data analysis scheme is based on the statement that the average ratio between number concentrations of non-volatile residuals vs. total aerosol is on average 1.16, see page 5514, lines 11-18. Ideally, it should be 1.0 or below. However, an even more relevant question is whether the maximum number concentration of non-volatile residuals is for all cases less or equal to the total number concentration. If the peak number density of non-volatile residuals exceeds the peak number density of total particles, then particle formation must have been occurred during the volatilisation step. Such cases, however, can still fulfil the criteria of N(residuals) $<$ N(total aerosol).

4/ In Figures 8 and 9, the size distributions for cluster#1 (Fig. 8) and clusters #1, #9, and #10 (Fig. 9) show considerably higher peak number concentrations for the non-volatile residuals compared to the respective total aerosol. These data require serious

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discussion, since the observations can only be explained by particle formation during volatilisation.

SPECIFIC COMMENTS

1/ I suggest to adding these references to the manuscript:

Clarke, A.D.: A thermo optic technique for in situ analysis of size-resolved aerosol physico-chemistry, Atmos. Environ., 25A, 635-644, 1991.

Smith, M.H., and O'Dowd C.D.: Observations of accumulation mode aerosol composition and soot carbon concentrations by means of a high-temperature volatility technique, J. Geophys. Res., 101, 19583-19591, 1996.

Both papers describe early applications of the volatility method for the determination of aerosol physico-chemical properties.

2/ Figures 5 - 7: Rearranging the panels in 2 columns and 3 rows would help the reader to catch all contained information.

3/ Please specify particle number segment in Section 3.3

4/ Please comment on your observation stated in the abstract, that almost all ambient particles in continental background air contain a non-volatile core. Is this true for the entire size range including nucleation mode particles or is it limited to particles of the Aitken mode and larger?

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 5505, 2006.

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