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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Chemical composition of atmospheric aerosols between Moscow and Vladivostok" *by* S. Kuokka et al.

S. Kuokka et al.

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This paper presents aerosol physical and chemical data for samples collected aboard a train traveling from Moscow to Vladivostok and back. The results are useful as they provide some of the first data for this large, mostly unstudied, region and also identify both geographical and specific sources that influence the aerosol population.

1) Does the paper address relevant scientific questions within the scope of ACP? Yes- the paper presents data for aerosol physical and chemical properties.

2) Does the paper present novel concepts, ideas, tools, or data? The paper is largely descriptive. It presents field data collected aboard a train traveling between Moscow and Vladivostok, one leg in each direction. This region has received little attention and

for that reason alone, the data are valuable. While the study covers a rather broad range of chemical species, the results are quite limited in the sense that the study period is only several weeks long. The results are probably best considered a series of snapshots of the aerosol composition for a large, mostly unstudied, region.

3) Are substantial conclusions reached? The conclusions are reasonable, but nothing unexpected. The authors conclude that the aerosol concentrations are low away from major metropolitan areas and that there are impacts from sources in Asia as well as from forest fires. These results have implications that go beyond local interests, however, as they concern the long-range transport of pollutants and other important substances through the atmosphere.

4) Are the scientific methods and assumptions valid and clearly outlined? Yes. The study is straightforward-aside from sampling aboard a train, which is somewhat unusual, the methods used for sampling and analyses are mostly well established. The only issue I have over the analyses concerns the method used for preparing the samples for ICP-MS analyses. The method employed evidently did not make use of a microwave digester, and I have some concerns over the incomplete recovery of trace elements from refractory materials, especially geological materials, such as dusts, and coal fly ash. (This is in addition to the disagreement between the PILS and filter sample data, which is also a serious concern, but I think addressed adequately by the authors.)

The dissolution of aerosol samples in nitric and hydrofluoric acids work excellent. This has been shown by Jalkanen and Häsänen (Jalkanen L.M and Häsänen E.K., Simple method for the dissolution of atmospheric aerosol samples for analysis by inductively coupled plasma mass spectrometry, Journal of Analytical spectrometry, 11, 365-369, 1996). They showed that the recovery of elements from aerosol samples were good. The only one of the tested elements that showed low recovery was Cr (28%). However, the recovery of Cr analyzed from fly ash samples was 95%. The test in the above article were made using NIST SRM 1633a Coal Fly Ash and NIST SRM 1648 Urban Particulate Matter.

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5) Are the results sufficient to support the interpretations and conclusions? Yes, for the most part, but the authors were unable to account for a major fraction of the aerosol mass, attributing the missing mass to organic particulate matter and water. One component that was not included in the set of aerosol constituents used to reconstruct the aerosol mass is often referred to as Inorganic Oxidized Matter. The IOM mass in each sample, which is mostly mineral dust and coal fly ash, is typically calculated assuming that Al, Si etc exist as their most common oxides(See for example Quinn, et al., Aerosol optical properties aboard the Ronald H. Brown during ACE Asia as a function of aerosol chemical composition and source region, Journal of Geophysical Research 109, D19S01, doi: 10.1029/2003JD004010, 2004). Alternatively, the mass of mineral dust can be estimated from the data for a single element such as Al, using that the element as an indicator of dust and basing the estimate on a representative elemental composition of dust.

The measured concentration of aluminium was used to estimate the IOM mass. On average, the IOM fraction was 7.5% from the measured aerosol mass concentration and the range of the IOM fraction was from less than 1% up to 20%. A note that the IOM fraction was typically less than 10 % in the collected samples was added in the text (section 3.3). More detailed analysis about the IOM mass was not added to the manuscript. The soil composition may have varied during the journey because of the large distance where the samples were collected. Also it would not give much new information to the discussion in the manuscript. When the calculated IOM fraction was added to the analyzed matter, the amount of the missing matter was still on average 40% (5-65%). Especially in the sample collected during the forest fire episode, the amount of unidentified matter was 65 %.

6) Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? Yes, these descriptions are clear.

7) Do the authors give proper credit to related work and clearly indicate their own

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new/original contribution? Yes.

8) Does the title clearly reflect the contents of the paper? Yes, but it would be informative to reference the fact that the samples were collected from a train.

The title of the manuscript was modified, as suggested.

9) Does the abstract provide a concise and complete summary? Yes, but I think the abstract could be shortened without significant loss of content.

We think that there is no need to shorten the abstract.

10) Is the overall presentation well structured and clear? Yes, generally. The only organizational issue I have with the paper it that the discussion of the trajectories appeared without any earlier indication that this approach was going to be used in the data interpretation. It might make sense to at least mention that trajectories would be used to understand the trends in the data and/or to include the description of how they are calculated in the methods section.

The discussion about backtrajectories (section 3.1) was slightly modified in line with the suggestions by the referee.

11) Is the language fluent and precise? There are numerous, but mostly minor, mistakes in grammar, word choice, and usage throughout the paper.

The grammatic was checked out carefully.

12) Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? The mathematics and statistics in this paper are, for the most part, minimal and appropriate. One point of concern, however, is the reliance of correlations for demonstrating relationships among species. The R-squared values do show that the concentrations of the various species are related in some cases, but without some more detailed consideration of the data, this type of analysis can be misleading. That is, the R-squared values can be strongly influenced by a small number of extreme

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points. Some x-y scatterplots of key species would be informative (these could be included as supplementary material).

This is good point. Some scatterplots have been added to the manuscript as an additional material.

13) Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? The first three columns (sampling times and distance from Moscow) are repeated in Tables 1 and 2. I think these tables could easily be combined. Minor point, the column headers should be capitalized here, and depending on the journal's style, some of the abbreviations probably should be defined, too. Figure 5 presents almost exactly the same data as Tables 1 and 2. One or the other could be eliminated. Suggestion: The authors could simply refer to the samples by number (1 to n), and it would be helpful to show these numbers as a second x-axis in figures 2 and 4.

Tables 1 and 2 were corrected, but they still exist as separate tables. Figure 5 gives an overview of the distribution of different chemical species in each aerosol samples, while the tables give the numerical values for each samplings. Our opinion is that both the tables and Figure 5 should remain in the manuscript. The samples are not referred as numbers in the manuscript since the distance from Moscow is more informative for the reader.

14) Are the number and quality of references appropriate? Yes

15) Is the amount and quality of supplementary material appropriate? (See comment #12, above).

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 7473, 2007.