Atmos. Chem. Phys. Discuss., 11, C880–C883, 2011
www.atmos-chem-phys-discuss.net/11/C880/2011/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Elevated aerosol layer embedded with aged soot particles in a polluted urban atmosphere" *by* G. Shi et al.

Anonymous Referee #2

Received and published: 16 March 2011

General comments:

This manuscript presented a special vertical profile of aerosol particles - layered structure in the Megacity Beijing. Several methods (OPC, TEM and SEM, etc) were implemented in the analysis. The author focused on the description of soot particles, its coating process and interaction with the boundary layer.

The soot particles are undoubtedly important considering its role in the climate change. Though several ground-based measurements of soot particles had been reported in the same area, there was no study addressing its vertical structure with comprehensive analytical methods. Therefore, this study should attract many readership in the aerosol sciences, and is suitable for publication in ACP.

I recommend publication after the authors have considered the comments listed below:

(1) The description about experiments and discussions seems too brief to me, especially how the author defined the "soot particles", and how they did the statistic analysis on TEM results. It would be more precise and less misleading to say "particles with soot inclusions or soot cores" instead of "soot particles".

(2) The absorption effect of soot particles were claimed to be the explanation for the inversion and decrease of lapse rate. However, during the observation period, an anticyclone was sitting over a large area, as also mentioned by the authors in the manuscript. The anticyclonic high-pressure systems often lead to a subsidence inversion even without the presence of soot particles. By a glance of the back trajectories, one could also find this period was characterized with a strong subsiding air mass. I suggest the authors to discuss about these absorption effects if they could provide more solid and comprehensive proofs.

(3) The key issue about EAL is why its aerosol concentration was remarkably larger than those in the lower and upper layers. Though there is a section called "formation of the EAL", this issue seems to be not specifically and fully discussed.

In all, I think the authors could think about strengthening the aerosol and soot characterization parts, giving more component information from TEM and SEM, and making Sect 4.1 more concise.

Specific comments:

1. Abstract: "The lapse rate in the lower part of the EAL had an obvious decrease", "in which the aerosols, as a feedback, enhanced the stability of the layer by absorbing solar radiation."

As in the general comments.

2. Introduction:

Several studies on soot and its optical properties in Beijing should also be mentioned, e.g. (Wehner et al., 2009) et al.

3. p1645, l15: “Several observations on the vertical distribution and the structure of the boundary layer were carried out in Beijing, the capital city of China, with tethered balloon flights.”

It is a pity that only one day data were presented in this paper making it difficult to judge if the elevated layer is representative or not. I am not sure if “the several observations” here means there are additional measurements on other days.

4. p1646, l6: “At the site, wind profiles were monitored with a wind profiling system (CFL-16, China Aerospace Science & Industry Corp.), which provided the horizontal and vertical wind from 150m to about 6000m with a vertical resolution of 150m every 6 min.”

I suggested showing the wind profiles explicitly either in the manuscript or supplement

5. p1656, l20: “. . . could not be simply attributed to the formation of new particles in accumulation mode”

This is misleading because the new particle formation never happens in accumulation mode.

6. p1656, l24: “Aging had caused the original soot particles to shrink into aggregates and their size shifted to smaller range . . .“

Maybe cite the paper of (Zhang et al., 2008), in which the shrinking was also addressed.

Reference:

Wehner, B., Berghof, M., Cheng, Y. F., Achtert, P., Birmili, W., Nowak, A., Wiedensohler, A., Garland, R. M., Pöschl, U., Hu, M., and Zhu, T.: Mixing state of nonvolatile aerosol particle fractions and comparison with light absorption in the polluted Beijing region, J.

Geophys. Res., 114, 10.1029/2008jd010923, 2009.

Zhang, R., Khalizov, A. F., Pagels, J., Zhang, D., Xue, H., and McMurry, P. H.: Variability in morphology, hygroscopicity, and optical properties of soot aerosols during atmospheric processing, Proceedings of the National Academy of Sciences, 105, 10291-10296, 10.1073/pnas.0804860105, 2008.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 1641, 2011.