Interactive comment on "Photoacoustic optical properties at UV, VIS, and near IR wavelengths for laboratory generated and winter time ambient urban aerosols" by M. Gyawali et al.

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Reply to Anonymous Referee #2 (Atmos. Chem. Phys. Discuss., 11, C11044–C11046, 2011 www.atmos-chem-phys-discuss.net/11/C11044/2011/)

We would like to thank Reviewer #2 for his/her comments on this paper.

Reviewer comments are given in bold typeface. Our replies are given in plain text.

The authors present photoacoustic, integrating nephelometer and extinction measurements at UV, visible and near infrared wavelengths for laboratory and ambient aerosols. Salt, incense, and kerosene soot aerosols were used in the laboratory as surrogates for purely scattering and for absorbing aerosols with weak and strong spectral dependence. Ambient aerosol measurements were performed at an urban site during 4 weeks in winter. The absorption and scattering measurements were accompanied by PM2.5 and PM10 mass analyses as well as by the measurement of different gaseous pollutants. In addition to these measurements the authors present results of t-matrix calculations for the spectral optical properties of aggregated black carbon particles. Although the presented UV photoacoustic method and the collected data might represent a contribution to the field, the scientific discussion in the context of related work is poor and the drawn conclusions are mostly speculative. I agree with Reviewer #1 that the paper lacks a relevant story and needs a major revision before it can be recommended for publication.

Reply:
We revised the manuscript to include most of the suggestions made by both reviewers. We feel this comment is unclear about which part of the drawn conclusion is speculative. We believe we presented a story that connects the meteorology with the temperature inversion (polluted days) and highly mixed events (clean days), and its effect on the gaseous concentration, aerosol size distribution, and PM speciation. Eventually, aerosol extensive and intensive properties are connected to the aerosol source, size and chemical composition. Even though the connections are made with the data, some speculations are always necessary to make the story complete.

In the following I will give some suggestions how to improve the manuscript.

1. The lab study was meant to calibrate and validate the new 355 nm PA instrument. A presentation of the results of this laboratory study in terms of instrument precision, accuracy and detection threshold is important to value the ambient measurements. This also requires a detailed instrument description. So, I suggest to move the supplementary material (instrument description and calibration) to the main paper. Instrument accuracy and the detection threshold of the instrument should be given in this new section.

Reply:
Agree and done in the revised manuscript.

2. I totally agree with Reviewer #1 that the T-matrix section should be removed from the paper since it does not give any useful result for the interpretation of neither the laboratory data nor the ambient measurements.

Reply:
We agree too and have removed this section.

3. The first sentence of the Abstract claims that first laboratory and field PA measurements are presented in the paper. This statement is obviously not true as it has already mentioned in the short comment by Tibor Ajtai. Ajtai et al. (2010) presented a novel photoacoustic instrument with two absorption measurements in the UV (at 266 nm and 355 nm). The instrument was calibrated and validated in a laboratory study with black carbon aerosol in a very similar fashion as it was done in the present work. Ajtai et al. (2011) then applied this instrument in a field study, and interestingly, also at an urban site under wintry conditions. The authors should relate their laboratory calibration work and ambient measurement results to these papers.

Reply:
We addressed this issue in the revised manuscript. We made clear that photoacoustic aerosol absorption measurements at 355 nm have previously been published. In the revised manuscript we also make comparisons with other published data (e.g., Sandradewi et al., 2008a, 2008b; Schnaiter et al., 2006) including Ajtai et al. (Ajtai et al., 2010, 2011).

4. The extend in length due to the addition of a more detailed instrument and calibration section can be saved by confining the ambient data representation to the most relevant results, i.e. the spectral optical data and their diurnal variations.

Reply:
As stated above we moved the instrument description and calibration to the main paper. Of course, spectral optical data are the most relevant but to make the story complete, we also revised and augmented the gaseous section.

References:

Ajtai, T., Filep, À., Schnaiter, M., Linke, C., Vragel, M., Bozóki, Z., Szabó, G., and Leisner, T.: A novel multi-wavelength photoacoustic spectrometer for the measurement of the UV-vis-NIR spectral absorption coefficient of atmospheric aerosols, Journal of Aerosol Science, 41, 1020-1029, 2010.

Ajtai, T., Filep, À., Utry, N., Schnaiter, M., Linke, C., Bozóki, Z., Szabó, G., and Leisner, T.:
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Sandradewi, J., Prévôt, A. S. H., Szidat, S., Perron, N., Alfarra, M. R., Lanz, V. A., Weingartner, E., and Baltensperger, U.: Using aerosol light absorption measurements for the quantitative de- termination of wood burning and traffic emission contributions to particulate matter, Environ. Sci. Technol., 42, 3316–3323, doi:10.1021/es702253m, 2008a.

Sandradewi, J., Prévôt, A. S. H., Weingartner, E., Schmidhauser, R., Gysel, M., and Baltensperger, U.: A study of wood burning and traffic aerosols in an Alpine valley using a multi-wavelength Aethalometer, Atmos. Environ., 42, 101–112, 2008b.

Schnaiter, M., Gimmler, M., Llamas, I., Linke, C., Jäger, C., and Mutschke, H.: Strong spectral dependence of light absorption by organic carbon particles formed by propane combustion, Atmos. Chem. Phys., 6, 2981–2990, 2006, http://www.atmos-chem-phys.net/6/2981/2006/.