

Interactive comment on “Spatially resolved measurements of nitrogen dioxide in an urban environment using concurrent multi-axis differential optical absorption spectroscopy” by R. J. Leigh et al.

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The paper by Leigh et al. reports on observations of nitrogen dioxide (NO₂) using ground-based MAX-DOAS measurements in the urban environment of Leicester, United Kingdom in 2004. The study focuses on two different applications of the whole data set: 1) Observed differences of slant column densities of NO₂ are converted to trace gas concentrations based on simple geometrical assumptions and compared to in situ measurements. 2) Selected data sets from a few days have been investigated in more detail in order to illustrate the ability of MAX-DOAS measurements to image

and quantify plumes. These applications have already been shown in previous studies (e.g. Heckel et al., 2005) but for different trace gases and/or in remote environments. The innovation of this manuscript is to demonstrate the possibilities of MAX-DOAS measurements for air quality monitoring on a city-wide scale. The paper is in general clearly written and I recommend it for publication in ACP. But the authors should address for some revisions/corrections as detailed below.

General comment:

- I agree with referee 2, that information on the uncertainties of data presented here is needed. It is also not clear to me, why the extra absorption path for 5 deg elevation angle is always 2 km. One might expect both, a seasonal (due to a higher PBL in summer than in winter) and a diurnal variation of this extra light path. If the authors argue, that most of the NO₂ is in the lowest part of the PBL close to the sources and the last scatter happens before the rays enters the NO₂ layer (which might be a reasonable assumption), they should illustrate this in more detail. One possibility is for example to calculate the concentration also with the differences of slant column densities at 10 or 15 deg elevation angle assuming the same NO₂ layer height of approximately 200 m. The agreement between these data sets should be within the uncertainty of the DOAS retrieval itself. What is the reason, that the authors did not use complementary observations of O₄ to better characterize the radiative transfer / viewing conditions? At least those days with very low and/or broken clouds or hazy days could be excluded using these data. Than it might be possible to extend the comparison to the in situ data to other months than May and August.

Further corrections/comments:

- Experimental: Some basic information on the instrument and the DOAS retrieval is needed here: estimated detection limit (using zenith background and/or back-

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ground from the same viewing direction, wavelength range (instrument and retrieval), aperture angle, elevation angles (only given in some figures), reference spectra, Not every reader is willing or able to read the paper in Applied Optics.

- Is the data set (124 days) well distributed throughout the year or is there a shift towards summer? An overview plot showing daily averages in 2004 might be useful.
- Results: This section should be splitted into two or three subsections (e.g. 1. Comparison to in situ measurements and 2. Observations of NO₂ plumes)
- The primary quantities for ground-based DOAS measurements are differences of slant column densities (DSCD or DSC). Please rephrase the relevant paragraphs and figure captions making this more clear.
- Table 1: Not sure, that this table is necessary but units should be given.
- Figure 1: Nice figure. No 2004 data available from ADMS?
- Figure 2: Wrong units for O₄. I would prefer a very clear day to illustrate the instrumental performance. Please add also information on the SZA.
- Figure 3: typo: “tropospheric”. Not very lucky with this sketch. X is not X but 200 m for 5° elevation angle. The last scatter is not only due to clouds.
- Figure 5: Again, if data are selected for reasonable weather conditions (high or no clouds, no haze), this might lead to a more impressive result. Not sure about the high values in the evening. Is there some remaining SZA dependency or stratospheric contribution?
- Figure 6: Very nice. Give unit for NO₂ concentration.

- Figure 10: Date?
- Figures 7,10,11: Differences of slant columns are shown here. See above.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 12671, 2006.

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