

Interactive comment on “High spatial resolution measurements of NO₂ applying Topographic Target Light scattering-Differential Optical Absorption Spectroscopy (ToTaL-DOAS)” by E. Frins et al.

Anonymous Referee #2

Received and published: 12 July 2008

General Comments:

This paper describes application of ToTaL-DOAS to the measurement of atmospheric pollutants, namely NO₂, over relatively short distances for high temporal and spatial measurements of pollutants. I would describe this method as a hybrid of classical DOAS (active DOAS), and passive DOAS (utilizing sky scattered sunlight), in the sense that the method does not use an active light source; it depends on scattered sunlight off targets, but it does have a well defined pathlength. The method has the advantage that it could be used in areas with high concentrations of pollutants with minimal in-

S4716

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper



frastructure (no retroreflector, low power use do to absence of active light source), but suffers from the disadvantage that measurements can only be made during periods of adequate solar light. The paper as such, discusses the methodology necessary to make such measurements, and presents a small data set of measurements in an urban area.

Specific Comments:

My largest objection I have with the manuscript as presented, is the relatively small (and selective?) data set that has been presented in a paper that has largely been presented as an application paper of a technique that can obtain high temporal resolution data. The small number of data points (8 total) that have been presented are problematic. Three far targets were chosen and the instrument can sequentially switch between the different targets and a zenith measurement (not utilized in the end). And yet the data presented in Figure 4 show only 1 data point each from targets T2 and T3. Certainly a statistical comparison of measurements from T1, T2, T3 or the discussion of comparison between these measurements should have relied on more than 1 measurement from each of the alternate targets.

Section 2 Line 12 - "three small pieces of concrete". The orientation of these reference pieces of brick, with respect to the sun and the far targets, is not described and would be welcome. Are they oriented in the same plane as the walls of the buildings in order to reflect light from sky and sun in the same direction? One brick was chosen? Why? Is there any difference between them? The distance from instrument to brick is ~ 0m. Was it placed directly in front of the mini DOAS for the reference measurement, or was the DOAS turned 90o to collect light from it. Not enough experimental details are given. A more explicit description of the color of the reference brick would be useful. Was it painted. Was it the same color as the target walls, etc, etc.

Section 2 Line 26 - "Assuming a detection limit of" How was this arrived at? One should not assume a detection limit for SCD obtained from an alternate method. The

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper



authors have described that the residuals for fits using these artificial targets were very large. The detection limit should be derived from the data generated in this measurement method, which could be much higher. The assumption should be supported.

Figure 3 and discussion thereof: The 4 options shown in the figure are simplistic and arbitrary. The underlying assumption is that a well defined emission cloud (plume) exists in a predetermined shape and it is homogeneous. Stating that no error arises for case a) and d) is only true for a homogeneous emission cloud, and if the NO₂ concentration outside the cloud is the same at the instrument and the building. In reality the plume will be inhomogeneous. The assumption on line 26 (maximum difference = 20m) is unsupported, and apparently arbitrary. It is not clear how an error of 13% and 8% are arrived at. Are we meant to compare these to the actual measurements made on Target 1 and Target 3?? The authors are making an attempt to communicate a real problem....that errors will arise from inhomogeneities within the measurement region, especially if the solar light radiating the reference material and target material do not encounter the same column of pollutant material on approach. Since the plumes will never be homogeneous and well defined, I believe the only way to estimate this error is through experimental measurement under a variety of measurement conditions (wind directions, using all three targets, possibly with a co-located point source measurement of NO_x, etc).

Section 3 Line 6. One cannot obtain standard deviations for target 2 and target 3 if only a single measurement is available (as Figure 4 would suggest). Do the authors really mean standard deviation of separate measurements, or do they mean standard error of DOASIS fit? Please clarify. If more measurements are available for T2 and T3, they certainly should be presented.

Technical Corrections:

Throughout - please remove the word "basically" throughout the manuscript. It is redundant.

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)

Section 2 Line 24 - reword. Was the reference brick also painted white?

Figure 2: the figure caption or y-axis labels do not adequately describe what is being shown in the figure. There are two lines for each sub figure, and the composition of each line is not described. The difference between a, b, c components of the figure are not defined adequately; they are not simply expansions of the same data, as I originally thought. Which target, which reference were used to generate the figures?

Figure 3. One caption is needed, not two. Caption for 3c has a typo. Should be instrument (S).

Figure 4. Incertainties are not shown for the single points for T2 and T3.

Section 3 Line 25 . Change to "several tens of meters".

References - I cannot find where Frins 2006b is referred to in the text??

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 10257, 2008.

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

