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Atmospheric Chemistry and Physics Discussions

Interactive comment on "MAX-DOAS tropospheric nitrogen dioxide column measurements compared with the Lotos-Euros air quality model" *by* T. Vlemmix et al.

Anonymous Referee #2

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This paper compares nitrogen dioxide measurements from a ground based MAX-DOAS instrument to the Lotos-Euros air quality model. Potential sensitivities and biases of MAX-DOAS and the model are investigated and discussed, using data from De Bilt and Cabauw, the Netherlands. In particular, the potential impact of partial cloud cover on MAX-DOAS measurements is explored using air mass factor calculations, cloud height measurements, modelled boundary layer heights, and long-term datasets. Through an investigation of comparisons over varying temporal ranges and meteorological conditions, the ability of MAX-DOAS to accurately measure nitrogen dioxide concentrations in semi-polluted environments is explored.

Overall agreements between the MAX-DOAS measurements and the LOTOS-EUROS model are impressive, with credible explanations given for discrepancies. The methodology overall is robust and the paper well-written. This work merits publication in ACP, with the following recommended amendments:

It would be good to define the “urban” nature of the De Bilt measurement site. Many of the conclusions drawn in this paper depend on the definition of urban or semi-urban measurements, implying the extent to which local emission sources are mixed into the polluted boundary layer. For example, are there any major emission sources near the instrument, or its line of sight? Presumably not, and the lack of variable and major local emission sources may be necessary for such close agreements between large scale models and MAX-DOAS measurements. A mention (or map) of local emissions near measurements (or lack thereof) would be beneficial, and would inform conclusions of the applicability of the agreements found in this analysis.

For analysis of cloud bottom height - please add an explantion of why was the minimum hourly height used rather than the average.

Use of ECMWF boundary layer height is key to a part of the analysis within this paper, and yet no error estimate on this data product is mentioned. Please include one if it is available.

The conclusion of line fitting on page 28912 is an interesting one. If this has a statistical or mathematical foundation, please reference it. This may perhaps be an artefact of the particular mathematical line-fitting routine used in this case.

Minor typographicals

p28898 - line 11 - replace “one-sidedness” with “bias”

line 24 - run at 7 x 7 km resolution for the Netherlands and surrounding area.

line 29 - are determined and used to convert.

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p28901 - line 23 - In this study a 3rd order polynomial was used.

p28902 - please add a suitable reference for the 30 degree viewing elevation angle parameters discussed.

p28904 - line 8 - I would recommed that the word “always” is replaced by “typically” - as there have been a few examples of data retrieved using non-zenith reference spectra.

p28907 - line 8 - remove the word “in” - and often over many days.

p28908 - line 16 - given by the boundary layer height

line 24 - the cases was more than 10% of the NO2 found above

p28909 - line 21 - equivalent to the resolution of the emission inventory.

p28910 - line 4 - use “significant” instead of “striking”

p28912 - line 7 - the impact of processing different subsets.

p28913 - line 19 - Figure 7 shows monthly averages of tropopsheric NO2 concentration.... etc.

line 20 - The observations show..

line 24 - (and other places) - repace “less” with “fewer”

p28915 - line 1 - emission of NO2 due to

p28917 - line 4 - replace “quite some” with “considerable”

line 8 - It is hypothesized that the loss in tropospheric... is compensated by the NO2 added..

p28920 - line 29 - leading to larger..

Figure 3 caption - High emission in the North Sea are a dominant feature, however it should be noted that these have a large.. De/The MAX-DOAS The map on the right

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does not show elevations, and is therefore not topographical.

Figure 5 caption - left panel (not pabel)

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 28895, 2011.