

Interactive  
Comment

***Interactive comment on “Validation of urban NO<sub>2</sub> concentrations and their diurnal and seasonal variations observed from space (SCIAMACHY and OMI sensors) using in situ measurements in Israeli cities” by K. F. Boersma et al.***

**Anonymous Referee #2**

Received and published: 16 April 2009

**GENERAL COMMENTS:**

The authors present a concise study of NO<sub>2</sub> variability in Israel, using ground and satellite measurements. As such it is useful for validation of the SCIAMACHY and OMI instruments. It also provides qualitative support for model predictions about tropospheric NO<sub>2</sub> amounts over a region with a unique weekly cycle.

The paper is well-organized and well written. However, I have reservations about the derivation of the column measurements from the ground data, along with a few lesser

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concerns. If these can be fully addressed, I'd recommend publication in ACP.

#### SPECIFIC COMMENTS:

(1) The biggest issue I have regards the conversion of surface measurements to columns. Martin et al [2002] do correctly point out that most of NO<sub>2</sub> over land is in the BL, and the assumption of a well mixed BL is probably reasonable. However, the amount of NO<sub>2</sub> above the BL is not negligible.

A quick calculation with a model (eg GEOS-Chem) NO<sub>2</sub> profile for Israel, using the BL depths given in your paper indicate that on the order of 1/3 (sometimes more) of the tropospheric NO<sub>2</sub> column lies above the BL. Neglect of this may or may not qualitatively change the surface-derived seasonal and diurnal effects in this study, but it certainly would affect the comparisons to satellite data.

(2) The method used to derive the corrections to the surface measurements is different than that of Lamsal et al. [2008], and the amount of NO<sub>z</sub> interference inferred in the present study seems smaller than that of Lamsal et al., although it is hard to estimate from the information given.

It would be useful to know the magnitudes of your corrections, any seasonal dependence they might have and why they might be different from those of earlier studies.

(3) In the Ensemble Validation section, does a data point (ie, one of the n=542) consist of exactly one satellite pixel and one surface measurement? Are any pixel centers ever within the threshold distance of more than one city?

(4) Satellite data for a large (off-nadir) pixel would not be representative of a surface measurement at a point. Since you imply this as a reason to exclude the cities of Haifa and Ashod (near strong sources), please be explicit about what sizes of satellite pixels are being excluded and discuss the implications.

(5) The caption for Table 1 states that pixels were restricted to viewing angles within 35 deg of nadir. I don't understand how this ensures satellite and surface measurements

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coincide within 15 min, as stated in the table caption.

#### TECHNICAL CORRECTIONS:

P 4308, L 11 reword: "( $0.30 \times 10^{15}$  and  $0.59 \times 10^{15}$  molecules  $\text{cm}^{-2}$ , respectively)"

P 4309, L 11 reword: "Figure 2 compares tropospheric NO<sub>2</sub> columns..."

P 4309, L 13 reword: "As seen in the left panel, BL NO<sub>2</sub> columns show similar correlation..."

P 4309, L 18 reword: "...a slightly lower negative intercept..."

P 4309, L 21-22 "r=0.53" does not match "r=0.54" in the Fig 2 caption

P 4309, L 22-25 Please be more specific in identifying the five stations e.g. you could add in parenthesis "(all except Haifa, Ashod and Afula)"

p 4311, L 5 By "Israeli stations" do you mean all except Afula?

P 4311, L 18-19 reword: for example, "...did not show the same diurnal cycle..." This seems a less ambiguous way to phrase it, since you later present evidence for a slight increase from SCIA to OMI in winter.

P 4312, L 10 reword: "The top panel of Fig. 7 shows..."

P 4312, L 14 reword: "...as shown in the bottom panel of Fig. 7..."

p 4314, L 9 slope=0.93 0.07 does not match 0.06 on p 4309 L 15.

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Interactive comment on Atmos. Chem. Phys. Discuss., 9, 4301, 2009.

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