

## ***Interactive comment on “Near-real time retrieval of tropospheric NO<sub>2</sub> from OMI” by K. F. Boersma et al.***

**K. F. Boersma et al.**

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Author comment on Anonymous Referee #2

"General comments:

This manuscript presents an algorithm for the near-real time retrieval of tropospheric NO<sub>2</sub> from OMI. The algorithm is carefully designed and presented. The manuscript is exceptionally well written, with detailed and useful quantitative information. The analysis includes effects of clouds on the retrieval, and includes a comparison with SCIAMACHY. The manuscript should be of considerable value for the atmospheric chemistry community. I urge publication after minor revisions."

We thank the reviewer for his/her kind words.

"The effect of aerosols on the retrieval and the associated retrieval error should be

discussed. Aerosols should be included in Table 1."

We now discuss the effect of aerosols in Section 5.2.3. We have added that "We do not explicitly correct for aerosols as these influence cloud retrievals. Modified cloud parameters indirectly account for the effect of aerosols on the retrieval (Boersma et al., 2004)". Therefore we decided not to include them in Table 1.

"Section 5.1: Is a masking scheme employed to remove areas dominated by tropospheric NO<sub>2</sub> prior to assimilation of the total column? If so, please describe. If not, please comment on the potential error."

As mentioned in Section 5.1 (second bullet): "Observed columns are attributed a low weight in regions and times with large tropospheric model columns." This has a similar effect as a masking scheme.

"Section 5.2.3 and Table 1: It would be useful to comment on the dependence of the error budget depends on the NO<sub>2</sub> profile. What type of NO<sub>2</sub> profile was assumed in this calculation?"

Actually this is discussed in 5.2.2 and 5.2.3. In both sections TM4 is discussed as the source of the a priori NO<sub>2</sub> profiles for times and locations of OMI observations. The estimated  $\sim 10\%$  error in the AMF due to uncertainty in the a priori profile shape has been established by Boersma et al. (2004), and we have added that reference.

"Questions continue to arise about the instrument sensitivity of GOME/SCIAMACHY/OMI to NO<sub>2</sub> near the ground. "E.g. How well does OMI observe NO<sub>2</sub> in the boundary layer?" It would be useful to include a statement about the vertical sensitivity of OMI to NO<sub>2</sub>."

We have added a statement on the vertical sensitivity to NO<sub>2</sub> in section 3.1.

"Section 4.1: The weak change in absolute fitting error with latitude is surprising. I expected a weak change in relative fitting error that would translate into a latitudinal dependence in absolute fitting error."

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The fitting error is determined by random noise in the OMI reflectance measurements and by the apparent strength of the NO<sub>2</sub> signal along the average light path from the Sun through the atmosphere to the satellite. Both depend on viewing angles and atmospheric conditions (e.g. clouds). In section 4.1, we averaged over a great number of conditions (n=2893), and this likely smears out the change of fitting error as a function of latitude, if any. Additionally, Mark Wenig (Ph.D.-thesis, University of Heidelberg) found a comparable weak dependence of fitting error as a function of latitude for GOME NO<sub>2</sub> retrievals.

"End of section 5.2.1: The "best" cloud pressure will depend on the true profile. However, the NO<sub>2</sub> profile will vary with region. Suggest add "weighted by the NO<sub>2</sub> profile" after (in the 405-465 nm range)."

The individual best estimates of the forward model parameters cloud fraction, cloud pressure, surface albedo and a priori profile shape determine the accuracy and precision of the AMF. In that sense the best cloud pressure does not depend on the true NO<sub>2</sub> profile.

"Section 5.2.2: Please specify the time of day at which the TM4 model NO<sub>2</sub> profile is sampled."

13:30 local time, added.

"Top of page 12324: suggest add "spatial" undersampling."

Done.

"Page 12308: What is a.o.?"

Amongst others but this has been removed.

"Page 12318: The model NO<sub>x</sub> species. Do the authors mean NO<sub>y</sub>?"

This has been corrected.

"Page 12322: for cloud fractions larger than 0.1. Do the authors mean smaller?"

Wang et al. (2006) found that the taking into account Rayleigh scattering in the GOME FRESCO retrieval on average increases cloud pressures by 60 hPa for cloud fractions larger than 0.1. For cloud fractions smaller than 0.1 the effect was even stronger, i.e. 100-200 hPa.

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Interactive comment on Atmos. Chem. Phys. Discuss., 6, 12301, 2006.

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