

Interactive comment on “Near-real time retrieval of tropospheric NO₂ from OMI” by K. F. Boersma et al.

K. F. Boersma et al.

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Author response to Anonymous Referee 1

"Conclusion: This paper presents a new retrieval algorithm for the near-real time analysis of tropospheric NO₂ columns observed from Ozone Monitoring Instrument (OMI). The manuscript is both clearly written and organized logically. In contrast to off-line retrievals, where a priori information concerning the stratospheric column and distribution of NO₂ in the troposphere are acquired from model analyses following the observation, the near real-time method uses a priori information retrieved from a model forecast enabling calculation of the tropospheric column immediately following the observation. This paper represents an exciting addition to the growing literature of NO₂ satellite observations and should be published with minor revisions."

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We thank the reviewer for his/her kind words.

"General Comments: 1. The authors argue that the utility of the near-real time approach is in the ability to produce daily maps of NO₂ for potential application in air quality management practices. However, the discussion is focused primarily on monthly averaged data. Including at least one figure showing the quality of the daily image or a series of 2-3 days over a region where daily variations are significant, would be most interesting."

Agreed. We now included a sequence of observations in the introduction, demonstrating the capability of OMI in observing day-to-day variability.

"2. While the comparison of OMI NO₂ to SCIAMACHY NO₂ is highly valuable, it would be particularly insightful to see a comparison of the OMI near-real time and OMI standard NO₂ profiles as well, to assess the errors in the forecasted stratospheric contribution and the AMF. If this is complicated by differences in the across track variability correction method, is it possible to compare forecasted and standard a priori directly to obtain an estimate of the uncertainty of the near-real time method as compared to a best case scenario standard method?"

The issues brought up by the reviewer are all relevant and interesting. We think that prior to comparing the two OMI algorithms that each have their separate (some similar, some completely different) error terms, a separate algorithm description and thorough error characterization based on the individual retrieval(s) itself such as presented here is in order. Furthermore, these issues are reason enough for a separate paper, that is actually in preparation in the framework of the EOS Aura validation special issue of JGR (Bucsela et al., priv. communication).

"Specific Comments: 1. page 12308 line 13: Is it possible to estimate the magnitude of these errors in geolocation? Are they smaller than the OMI pixel size? Can you estimate this from known locations of NO_x sources?"

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Comparison by random sampling of predicted and definitive altitude and ephemeris data shows that differences between the two are so small, that they may be neglected.

"2. Page 12310 line 2: At what time is the standard product available?"

NRT data is available at 16:00 local time in hdf format, as a single file for one day that is updated for every orbit. These data files are available for and in use by specific users such as NOAA and ECMWF through ftp-connections.

"3. Page 12314 line 17 extra word is"

This has been removed.

"4. Page 12314 line 17 The authors provide a method for correcting a significant amount of across-track variability, is it possible to provide an estimate of the error induced by making this correction?"

The purpose of the across-track variability correction is to reduce rather than induce systematic errors in the slant columns. The orbital corrections are on the order of $0-2 \times 10^{15}$ molec.cm⁻² in the example given in Fig.4. The corrections remove most if not all of the systematic errors. Visual inspection of across-track variability corrected columns provides evidence that most variability is indeed suppressed. Perhaps a more meaningful way to look at across-track variability related errors is to look upon the estimate of the OMI slant column error of 0.67×10^{15} molec.cm⁻² as the combined error from fitting noise and from any residual across-track variability. We added a sentence similar to the last one to section 4.2.

"5. Page 12325 line 18 10:00 h instead of 10:00 hr"

Done

"6. Page 12326 In the comparison of OMI and SCIAMACHY NO₂, it would be helpful to include a reference to the diurnal shape of column NO₂ in an urban environment from surface measurements. This would give confidence to both the magnitude and

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direction of the disagreement in urban areas."

Good point. A reference to Petritoli et al. (2006) who demonstrate a similar effect from ground-based column observations in Bologna, Italy, has been added.

"7. Table 2, define 61555;s, 61555;Sst and 61555;Mtr in the figure caption."

Done.

"8. Figures 5 and 6 should read top and bottom panel, instead of left and right."

This will be corrected if the paper is accepted in ACP.

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

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