**Atmospheric
Measurement
Techniques
Discussions**

Interactive comment on "An improved tropospheric NO$_2$ column retrieval algorithm for the Ozone Monitoring Instrument" *by* K. F. Boersma et al.

Anonymous Referee #2

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The manuscript presents several important improvements of the TEMIS OMI NO2 retrieval. It is well written and should be published on AMT after minor revisions.

General comments:

- I propose to change the order throughout the paper: As the de-striping algorithm is applied to the slant columns, it would make more sense to discuss it first (since it is also applied first).

- Section 3.3.1: An updated O2-O2-cloud product is presented. Is this an update of the operational OMCLDO2 product? Is it available for the public? If not, is this planned? Or was the new O2-O2 product just processed for the NO2 product? If so, was the

algorithm identical to that of the OMCLDO2 product except for albedo? Please give more information and provide an introduction to this section. Furthermore, to achieve full consistency between the O2-O2 and the NO2 retrieval, also the topography should be updated for the cloud product.

- Section 6: The aspect of a (partly) intrinsic aerosol correction within the cloud correction is interesting. However, it is quite different and independent from the improvements presented before. I thus propose to deal with this topic in a different paper (with additional case studies) and remove section 6 from this paper. This would strengthen the focus on the algorithm improvements in the current work. If the section is kept here, it has to be pointed out that the situation is probably different for strongly absorbing aerosols!

Specific comments:

2330/3: "a correction" -> "an empirical correction"

2332/15: "The AMFs of the current OMI retrievals are based on external datasets which have coarse spatial resolution compared to the OMI ground pixels".

2339/15: "but the absolute reduction"

Section 3.2: Please discuss the effect of the terrain height on the cloud product as well. Acarreta et al. applied ETOPO, thus the OMCLDO2 cloud product has systematic errors over terrain with structured topography.

2340/23-24: I am quite surprised that such a small change of 30m in terrain height can affect the AMF that strongly, and I am skeptical that this is actually real. Could it be that there are remaining/combined effects of the treatment of the lowest layer in the old version (section 3.1)? Or is there a possible interference with the cloud product which uses another topography? In any case, more information should be provided, which effect in detail actually leads to such a strong change in the AMF; from my experience, the (box-)AMFs for a typical tropospheric profile over 0m or 30m are more or less the

same.

2342/14: Why is the difference so small (in contradiction to 2341/18)?

2349/19: New aspect raw anomaly -> new paragraph. Please provide an update of the performance of the de-striping after 2007.

Figures: Some figures (e.g. Fig. 2) have strange grey stripes.

Fig. 2 upper panel: I would expect that, on average, positive and negative deviations of terrain height should cancel each other out, but I have the impression that red dominates the picture. For instance, the mountains in northern Chad show up as red spots without any blue around.

Fig. 8: The three displayed corrections are very similar and could lead to the impression that one universal correction would be sufficient for the whole timeseries, which is in contradiction to the text on 2349. So please skip 15th and 31st, and instead add the patterns for other days (e.g. 1st of January for all available years).

Fig. 14: Caption last sentence: replace "July 2005" by "the respective month".

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