

Interactive comment on “Underestimation of Column NO₂ Amounts from the OMI Satellite Compared to Diurnally Varying Ground-Based Retrievals from Multiple Pandora Spectrometer Instruments” by Jay Herman et al.

Anonymous Referee #1

Received and published: 31 May 2019

General comments

The manuscript presents an evaluation of the OMI NO₂ columns against ground-based observations at different sites using Pandora measurements. The authors find that OMI underestimates as expected the GB measurements and they attribute this underestimation to retrieval issues and differences in field of view. They also discuss the effect of NO₂ daily cycle. The results are a good addition to the existing literature but their presentation and the way they reach the conclusions might be improved quite a bit as I suggest below.

C1

Specific comments

1. Abstract: L8-15 Should this description of the sites be here in the abstract? Maybe you could write in a more concise way and focus on the results here instead. . .
2. L33 Perhaps a reference here, e.g. Krotkov et al. (2016) Krotkov, N. A., McLinden, C. A., Li, C., Lamsal, L. N., Celarier, E. A., Marchenko, S. V., Swartz, W. H., Bucsela, E. J., Joiner, J., Duncan, B. N., Boersma, K. F., Veefkind, J. P., Levelt, P. F., Fioletov, V. E., Dickerson, R. R., He, H., Lu, Z., and Streets, D. G.: Aura OMI observations of regional SO₂ and NO₂ pollution changes from 2005 to 2015, *Atmos. Chem. Phys.*, 16, 4605-4629, <https://doi.org/10.5194/acp-16-4605-2016>, 2016.
3. L36 you mean “OMI TCNO₂ underestimation”?
4. L42 Maybe you can rewrite this more specifically e.g. mentioning that OMI does not capture higher values occurring after the overpass time and thus cannot be used alone for estimating the hazard related to bad AQ.
5. L116-117 Are these overpass files based on the minimum distance between pixel center and the GB site? There is also the possibility to use the pixel actually including the GB site; this might be not the same than the one with the minimum distance from the pixel center. Did you check that? You might also want to analyse the large pixels separately (the ones on the sides of the swath are significantly larger than in nadir) and see if the underestimation is actually related to the size of the pixel and how.
6. Fig. 3 first panel: Because of the long time period this plot is really busy and doesn't add much to the one with the monthly data on the right side: maybe you could think to replace it with a scatterplot instead? Same for fig. 4 and 5.
- 7, L245-249 and L261-267 There seems to be a repetition here
8. Fig. 6 Could a similar picture be done for the rel.dif. as a function of the OMI pixels size? This might help supporting your conclusion that the underestimation is due to the large FOV of OMI. (see also point 5)

C2

9. Fig. 6 and 9 Can you explain why do you expect from these trend plots? Why do you think the rel. difference should change?

10. Fig. 7-8 These 3D plots are maybe not so clear if you want to compare the daily cycles in different months: maybe you could replace them with a pcolor or contour -type of plots or even better adding a 1D plot with the mean daily cycles for each month. You could be able to better visualise seasonal differences in the daily cycle. Again, about the daily cycle, you could compare your results with this paper by Boersma et al. 2009, where the seasonal changes in the NO₂ daily cycle were analysed in details.

<https://www.atmos-chem-phys.net/9/3867/2009/acp-9-3867-2009.pdf>

11. Summary: You could add a couple of sentences on the potential of the new retrievals from TROPOMI (much smaller pixel) as well as TEMPO higher (hourly) temporal resolution.

Technical comments

L30 foe -> for

L169 PANDRA -> PANDORA

L209-211 This is a bit of a repetition

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2019-123, 2019.