

Interactive comment on “Assessment of the quality of TROPOMI high-spatial-resolution NO₂ data products” by Xiaoyi Zhao et al.

Anonymous Referee #2

Received and published: 11 February 2020

This paper presents an evaluation of the KNMI standard and ECCC TROPOMI NO₂ data products based on comparisons to Pandora NO₂ measurements at three sites located in the Greater Toronto Area. In addition to the traditional pairing of ground-based measurements with satellite observations closest in time and space, a wind-based validation technique making use of the TROPOMI pixels located upwind and downwind from the Pandora sites is also presented. With this technique, the number of coincident measurements can be significantly increased, allowing to reveal detailed spatial patterns of local and transported NO₂ emissions. This study also showed that the TROPOMI ECCC NO₂ research data product based on AMFs calculated from high-resolution regional air quality forecast model is in general in better agreement with Pandora measurements compared to the standard product.

C1

This paper is very well written and presents interesting results which fit well with the scope of AMT. I recommend the manuscript for final publication after addressing the following specific comments:

Title: The title should reflect the fact that this study is limited to three sites located in the Toronto area and is therefore not a global assessment of TROPOMI NO₂ data products.

Page 2, lines 21-24: It is written that the Pandora direct-sun NO₂ VCD products have been validated through...satellite validations. This is a bit weird and the sentence should be rephrased.

Page 3, lines 5-7: The formulation is also a bit odd here. Suggestion: ‘These AMFs were found to lead to a better agreement with aircraft. ...’. Also, have those new AMFs been also validated in other locations than the Athabasca Oil Sands Region, which corresponds to very specific conditions?

Page 5, lines 7-9: Why using two different albedo products for areas with and without snow ?

Page 6, lines 25-27: The three Pandora instruments have an alternate observation schedule (direct-sun/zenith-sky/multi-axis). Was there any attempt to use these three viewing modes synergistically, e.g. using the multi-axis tropospheric NO₂ columns to check those retrieved from the direct-sun mode or to evaluate the stratospheric columns based on the zenith-sky observations instead of using the TROPOMI stratospheric columns to correct for the contribution of the stratosphere ?

Page 8, lines 7-8: More details should be given here about the QA/QC selection criteria applied to the Pandora direct-sun NO₂ total column data used in this study.

Page 12, lines 32-33: the 240° peak is more influenced by some near-local NO₂ sources. Do you have any idea about those potential sources ? If yes, you should add them here.

C2

Page 17, lines 1-4: Using a high-resolution regional air quality forecast model in the TROPOMI AMF calculation improves the agreement with Pandora data in urban conditions but not at a rural site like Egbert. What could be the reason for that ? Is it an indication that the GEM-MACH model does not perform well in background conditions ? Could it be related to the albedo product used in the retrieval ? Maybe this point should be further commented in the Conclusion section ?

Technical corrections:

Page 1, line 23: in order to avoid the repetition of 'use', I would replace '(used in the air mass factor calculation)' by 'in the air mass factor calculation'.

Page 1, line 31: same remark as above ('Using this larger number...' -> 'With this larger number...').

Page 2, line 25: 'Funded by the European Space Agency (ESA),...'

Page 3, line 28: '...near full Earth' surface coverage...'

Page 14, line 9: 'TROMPOMI' -> 'TROPOMI'

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2019-416, 2019.