

Atmos. Meas. Tech. Discuss., referee comment RC1
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Comment on amt-2021-223

Anonymous Referee #1

Referee comment on "Biomass burning nitrogen dioxide emissions derived from space with TROPOMI: methodology and validation" by Debora Griffin et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2021-223-RC1>, 2021

This paper investigated fire NO_x emissions using TROPOMI NO₂ observations. The authors also explored the impact of aerosol on TROPOMI NO₂ observations and thus emissions by comparing against results derived from aircraft measurements. They concluded that a correction factor of 1.3 to 1.5 shall be applied to correct NO_x emissions inferred from satellite NO₂ observations. I would recommend some revisions before the publication.

General comments:

- AMF calculation. Is there any specific reason to use both GEOS-Chem and GEM-MACH to calculate AMF? The authors mentioned that free tropospheric NO₂ is not well represented in GEM-MACH. If so, does it make more sense to use GEOS-Chem for all layers? I'm worried that the usage of two models will introduce additional uncertainties.
- Uncertainties of EMG method by assuming constant λ and σ . Please clarify the uncertainties in the manuscript.
- "the difference of the lifetime between the model and the TROPOMI observations are expected, since the chemical lifetime of NO₂ is shorter in the model compared to reality." I'm concerned about the robustness of this conclusion. It's likely that the winds in the model and reality differ significantly, which also causes the different plume shapes.

Specific comments:

- Page 2, line 31, I suggest reorganizing this paragraph, since the key message is not clear. I'm not sure whether the authors would like to emphasize the advantage or limitation of satellite observations.
- Page 3, line 13. The 2011 work is based on OMI observations.
- Page 3, line 19. Are there any differences between biomass burning investigated by Jin et al. (2021) and wildfire in this study? If not significantly, I would recommend a discussion or comparison with Jin's work in the manuscript since both studies use

TROPOMI NO₂ to infer NO_x emissions. I notice the authors tries to do the comparison in the introduction by listing the topics covered by both studies. But I would appreciate some descriptions/clarification about differences, because it may be difficult for readers who are not familiar with Jin' work to understand the differences by just reading the list.

- Page 4, line 5. please correct the typo of " the he".
- Page 4, line 30. What is the resolution after 6 Aug, 2019?
- Page 5, line 17. Is RPRO for the whole year of 2018? Please clarify here.
- Page 5, line 27. What does the under script of EC stand for? Is it Environment Canada? It will give readers the impression that these are the official NO₂ products from Environment Canada. Please consider renaming the products if it is not the case and the products are investigational. But this is just my feelings. Other readers may have different opinions about this. I would suggest ask around and make the final decision about the name.
- Page 5, line 33. please correct the typo of ". hourly".
- Page 6, line 12. It is not clear to me how the model setup simplifies determining the accuracy of emissions estimation method.
- Is there any specific reason for only showing the flight track for AOSR, but not other three campaigns?
- Figure 4. Please make the sizes of panels consistent.