Dear Editor,

Referee #2's comments are in italic and our answers to all comments of reviewer #1 are embedded in red. **Bold text** are manuscript additions and ~~strikethrough text~~ are manuscript deletions.

The authors evaluate the emission rate and lifetime of NO2 and HONO during the FIREX-AQ campaign. The authors use aircraft and GOES-16 and -17 observations to do the analysis. The following comments are provided to clarify the context for the reader's better understanding. Among the comments, one of the significant issues is the suitability of using GOES-17 observations in the study due to mechanical issues of ABI. Without evidence or references that GOES-17 FRP products are safely usable, erroneous signals from malfunctioning GOES-17 ABI may affect the study's results.

The authors thank Referee #2 for reading and evaluating our manuscript. Our responses to your comments are below.

Major comments

1. *In lines 104 – 115, the authors did not describe how to calculate the AMF. If it is the author's intent not to describe in detail, references are needed to give readers a proper way to calculate the values. In addition, in line 110, please indicate the bidirectional reflectance distribution functions are used to describe the surface. The optical properties of aerosols also weren't mentioned in the context.*

   To address the deficiencies in the descriptions of the AMF calculations, BRDFs, and aerosol optical properties, we have made the following additions to lines 102 – 111:

   "**As discussed in Lamsal et al. (2017), since the retrievals use average radiance from a clean background (reference location) due to the lack of solar irradiance measurements for normalization, the spectral fitting procedure provides differential slant column amounts which represent slant columns with respect to the reference location.**

   ~~A compound's SCD is transformed to a v~~**V**ertical column densit~~y~~**ies** ~~(VCD)~~ **below aircraft are calculated** ~~by dividing~~ **using** the **differential** SCD**s** ~~by an~~ and air mass factor**s** (AMF**s**) **following the approach discussed in Lamsal et al. (2017)**. …**Impact of aerosols is partially accounted for in the retrievals due to the use of average radiance measurements for the spectral fit as well as reference correction in the calculation of VCDs; retrievals are likely affected for high aerosol cases."**

2. *Section 2.3 describes FRP derived from GOES-16 and -17 observations. However, as mentioned in https://www.goes-r.gov/users/GOES-17-ABI-Performance.html, GOES-17 ABI has cooling system issues. Please provide evidence or references indicating GOES-17 ABI observations can be used to obtain FRP. In addition, in line 149, why choose 5 %?*

   While a research review could not find an article about the use of GOES-17 ABI during the time period of the FIREX-AQ campaign, J. V. Hall et al. published a paper on June 6, 2023 about validating geostationary active fire products from GOES-17 ABI, GOES-16 ABI, and Himawari AHI. They conducted their assessments during the winter and summer seasons and found comparable active fire pixel detection rates between the NOAA (GOES) ABI Fire Detection and Characterization product and the EUMETSAT FRP-PIXEL product. While this paper implemented a different algorithm than used during FIREX-AQ, it is based on the WFABBA algorithm used to derive the FRPs for FIREX-AQ.

Many papers covering the FIREX-AQ campaign use this GOES-17 FRP data in their research (Peterson et al., 2022; Warneke et al., 2023; Wiggins et al., 2020; Wiggins et al., 2021). Additionally, we use the same dataset in both Wiggins papers. To be consistent with the previous research concerning this field campaign, we are still opting to use the GOES-17 FRP data processed by the FIREX-AQ team. However, we have added a statement in the manuscript to acknowledge the GOES-17 ABI cooling system issues, presented below:

"FRP information was retrieved from both GOES-16 and GOES-17 using the WildFire Automated Biomass Burning Algorithm from the University of Wisconsin, Madison (Schmidt, 2020). **We acknowledge that the GOES-17 ABI has cooling system issues and thus impacts the FRP retrievals during this time period. We have opted to keep the GOES-17-derived FRPs to be consistent with previous FIREX-AQ analyses that use GOES-17 data (Peterson et al., 2022; Warneke et al., 2023; Wiggins et al., 2020, 2021).**"

We used 5% because we used the data hosted on the FIREX-AQ data repository (FIREX-AQ, 2019). This methodology detailing 5% is described in the FIREXAQ-Fuel2Fire-GOESDiurnaCycle_Analysis_R1_ReadMe.docx file found at this link: https://www-air.larc.nasa.gov/cgi-bin/ArcView/firexaq?ANALYSIS=1.

The following references were added to the References section:

"**Peterson, D. A., Thapa, L. H., Saide, P. E., Soja, A. J., Gargulinski, E. M., Hyer, E. J., Weinzierl, B., Dollner, M., Schöberl, M., Papin, P. P., Kondragunta, S., Camacho, C. P., Ichoku, C., Moore, R. H., Hair, J. W., Crawford, J. H., Dennison, P. E., Kalashnikova, O. V., Bennese, C. E., Bui, T. P., DiGangi, J. P., Diskin, G. S., Fenn, M. A., Halliday, H. S., Jimenez, J., Nowak, J. B., Robinson, C., Sanchez, K., Shingler, T. J., Thornhill, L., Wiggins, E. B., Winstead, E., and Xu, C.: Measurements from inside a Thunderstorm Driven by Wildfire: The 2019 FIREX-AQ Field Experiment, Bulletin of the American Meteorological Society, 103, E2140–E2167, https://doi.org/10.1175/BAMS-D-21-0049.1, 2022.**

Warneke, C., Schwarz, J. P., Dibb, J., Kalashnikova, O., Frost, G., Al-Saad, J., Brown, S. S., Brewer, Wm. A., Soja, A., Seidel, F. C., Washenfelder, R. A., Wiggins, E. B., Moore, R. H., Anderson, B. E., Jordan, C., Yacovitch, T. I., Herndon, S. C., Liu, S., Kuwayama, T., Jaffe, D., Johnston, N., Selimovic, V., Yokelson, R., Giles, D. M., Holben, B. N., Goloub, P., Popovici, I., Trainer, M., Kumar, A., Pierce, R. B., Fahey, D., Roberts, J., Gargulinski, E. M., Peterson, D. A., Ye, X., Thapa, L. H., Saide, P. E., Fite, C. H., Holmes, C. D., Wang, S., Coggon, M. M., Decker, Z. C. J., Stockwell, C. E., Xu, L., Gkatzelis, G., Aikin, K., Lefer, B., Kaspari, J., Griffin, D., Zeng, L., Weber, R., Hastings, M., Chai, J., Wolfe, G. M., Hanisco, T. F., Liao, J., Campuzano Jost, P., Guo, H., Jimenez, J. L., Crawford, J., and The FIREX-AQ Science Team: Fire Influence on Regional to Global Environments and Air Quality (FIREX-AQ), JGR Atmospheres, 128, e2022JD037758, https://doi.org/10.1029/2022JD037758, 2023.

Wiggins, E. B., Anderson, B. E., Brown, M. D., Campuzano-Jost, P., Chen, G., Crawford, J., Crosbie, E. C., Dibb, J., DiGangi, J. P., Diskin, G. S., Fenn, M., Gallo, F., Gargulinski, E. M., Guo, H., Hair, J. W., Halliday, H. S., Ichoku, C., Jimenez, J. L., Jordan, C. E., Katich, J. M., Nowak, J. B., Perring, A. E., Robinson, C. E., Sanchez, K. J., Schueneman, M., Schwarz, J. P., Shingler, T. J., Shook, M. A., Soja, A. J., Stockwell, C. E., Thornhill, K. L., Travis, K. R., Warneke, C., Winstead, E. L., Ziemba, L. D., and Moore, R. H.: Reconciling Assumptions in Bottom-Up and Top-Down Approaches for Estimating Aerosol Emission Rates From Wildland Fires Using Observations From FIREX-AQ, JGR Atmospheres, 126, e2021JD035692, https://doi.org/10.1029/2021JD035692, 2021."

Response References:

FIREX-AQ Science Team: Fire Influence on Regional to Global Environments and Air Quality, https://doi.org/10.5067/SUBORBITAL/FIREXAQ2019/DATA001, 2019.

Hall, J. V., Schroeder, W., Rishmawi, K., Wooster, M., Schmidt, C. C., Huang, C., Csiszar, I., and Giglio, L.: Geostationary active fire products validation: GOES-17 ABI, GOES-16 ABI, and Himawari AHI, International Journal of Remote Sensing, 44, 3174–3193, https://doi.org/10.1080/01431161.2023.2217983, 2023.

Peterson, D. A., Thapa, L. H., Saide, P. E., Soja, A. J., Gargulinski, E. M., Hyer, E. J., Weinzierl, B., Dollner, M., Schöberl, M., Papin, P. P., Kondragunta, S., Camacho, C. P., Ichoku, C., Moore, R. H., Hair, J. W., Crawford, J. H., Dennison, P. E., Kalashnikova, O. V., Bennese, C. E., Bui, T. P., DiGangi, J. P., Diskin, G. S., Fenn, M. A., Halliday, H. S., Jimenez, J., Nowak, J. B., Robinson, C., Sanchez, K., Shingler, T. J., Thornhill, L., Wiggins, E. B., Winstead, E., and Xu, C.: Measurements from inside a Thunderstorm Driven by Wildfire: The 2019 FIREX-AQ Field Experiment, Bulletin of the American Meteorological Society, 103, E2140–E2167, https://doi.org/10.1175/BAMS-D-21-0049.1, 2022.

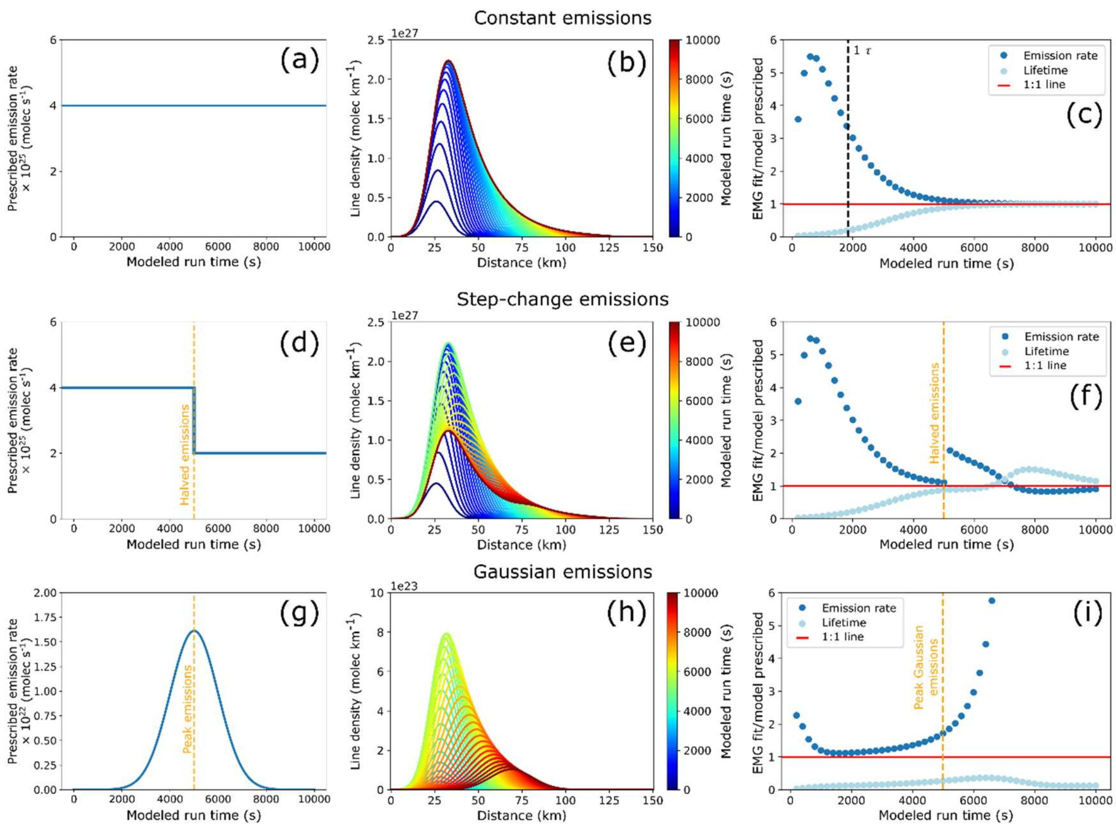
Warneke, C., Schwarz, J. P., Dibb, J., Kalashnikova, O., Frost, G., Al-Saad, J., Brown, S. S., Brewer, Wm. A., Soja, A., Seidel, F. C., Washenfelder, R. A., Wiggins, E. B., Moore, R. H., Anderson, B. E., Jordan, C., Yacovitch, T. I., Herndon, S. C., Liu, S., Kuwayama, T., Jaffe, D., Johnston, N., Selimovic, V., Yokelson, R., Giles, D. M., Holben, B. N., Goloub, P., Popovici, I., Trainer, M., Kumar, A., Pierce, R. B., Fahey, D., Roberts, J., Gargulinski, E. M., Peterson, D. A., Ye, X., Thapa, L. H., Saide, P. E., Fite, C. H., Holmes, C. D., Wang, S., Coggon, M. M., Decker, Z. C. J., Stockwell, C. E., Xu, L., Gkatzelis, G., Aikin, K., Lefer, B., Kaspari, J., Griffin, D., Zeng, L., Weber, R., Hastings, M., Chai, J., Wolfe, G. M., Hanisco, T. F., Liao, J., Campuzano Jost, P., Guo, H., Jimenez, J. L., Crawford, J., and The FIREX-AQ Science Team: Fire Influence on Regional to Global Environments and Air Quality (FIREX-AQ), JGR Atmospheres, 128, e2022JD037758, https://doi.org/10.1029/2022JD037758, 2023.

Wiggins, E. B., Soja, A. J., Gargulinski, E., Halliday, H. S., Pierce, R. B., Schmidt, C. C., Nowak, J. B., DiGangi, J. P., Diskin, G. S., Katich, J. M., Perring, A. E., Schwarz, J. P., Anderson, B. E., Chen, G., Crosbie, E. C., Jordan, C., Robinson, C. E., Sanchez, K. J., Shingler, T. J., Shook, M., Thornhill, K. L., Winstead, E. L., Ziemba, L. D., and Moore, R. H.: High Temporal Resolution Satellite Observations of Fire Radiative Power Reveal Link Between Fire Behavior and Aerosol and Gas Emissions, Geophys. Res. Lett., 47, https://doi.org/10.1029/2020GL090707, 2020.

Wiggins, E. B., Anderson, B. E., Brown, M. D., Campuzano-Jost, P., Chen, G., Crawford, J., Crosbie, E. C., Dibb, J., DiGangi, J. P., Diskin, G. S., Fenn, M., Gallo, F., Gargulinski, E. M., Guo, H., Hair, J. W., Halliday, H. S., Ichoku, C., Jimenez, J. L., Jordan, C. E., Katich, J. M., Nowak, J. B., Perring, A. E., Robinson, C. E., Sanchez, K. J., Schueneman, M., Schwarz, J. P., Shingler, T. J., Shook, M. A., Soja, A. J., Stockwell, C. E., Thornhill, K. L., Travis, K. R., Warneke, C., Winstead, E. L., Ziemba, L. D., and Moore, R. H.: Reconciling Assumptions in Bottom-Up and Top-Down Approaches for Estimating Aerosol Emission Rates From Wildland Fires Using Observations From FIREX-AQ, JGR Atmospheres, 126, e2021JD035692, https://doi.org/10.1029/2021JD035692, 2021.

3. *The Gaussian emission rate is shown in Fig. B1 and Figure 5 shows the results. These two figures can be put together, and the constant and step-change emission rates can be added to Figure 5 for better understanding.*

We have amended Fig. 5 to include the emission profiles and removed Fig. B5. The new figure is shown below:



“Figure 5: **(a) The emission profile used as input to the idealized 1-D constant emissions model.** (**b**~~a~~) Line densities of a hypothetical compound from ~~a~~**the** 1-D model with prescribed chemical lifetime of 30.8 minutes **(black, dashed line)** and constant emissions colored by model**ed** run time. (**c**~~b~~) EMG fit / model prescribed emission rate (blue) and lifetime (light blue) at every model output step through the course of the entire model**ed** run time. The model**ed** time equal to the model lifetime is indicated with a vertical, black dashed line. **(d) The emission profile used**

as input to the idealized 1-D step-change emissions model. (**e**~~c~~) Line densities ~~for a~~ **from the** 1-D model where the emission rate is halved halfway through the model**ed** run time, colored by model**ed** run time. (**f**~~d~~) Similar to (**c**~~b~~), but for the model in (**e**~~c~~). The vertical, gold dashed line indicates where the emissions were halved. **(g) The emission profile used as input to the idealized 1-D Gaussian emissions model.** (**h**~~e~~) Line densities ~~for a~~ **from the** 1-D model where the emissions are scaled to a Gaussian PDF with a mean of 5000 and standard deviation of 1000, colored by model**ed** run time. (**i**~~f~~) Similar to (**c**~~b~~), but for the model in (**h**~~e~~). The vertical, gold dashed line indicates peak Gaussian emissions."

4. *Figure 6 and lines 375 – 393 describe the results based on R^2 Since the authors compared the model and satellite observations, would it be better to compare results using biases, standard deviations, or root-mean-square errors?*
   We agree with the reviewer, as well as other reviewers that described this same issue. We now describe the results based on root mean square errors. Please refer to the response to RC1 major comments for the full list of changes to the figures and text.

Minor comments

1. *In lines 35 – 36, references are needed to the statement, "As the intensity of fires and burned area from fires are predicted to increase in the United States in the future."*

   We have rephrased this statement and added references to support this statement:

   "As the intensity of fires and burned area from fires ~~are predicted to increase~~ in the United States **and globally have had increasing trends over the past few decades and are predicted to increase** in the future **(Barbero et al., 2015; Burton et al., 2024; Cunningham et al., 2024; Dennison et al., 2014)**,…"

   The following references were added to the References section:

   "**Barbero, R., Abatzoglou, J. T., Larkin, N. K., Kolden, C. A., and Stocks, B.: Climate change presents increased potential for very large fires in the contiguous United States, Int. J. Wildland Fire, 24, 892, https://doi.org/10.1071/WF15083, 2015.**

   Burton, C., Lampe, S., Kelley, D. I., Thiery, W., Hantson, S., Christidis, N., Gudmundsson, L., Forrest, M., Burke, E., Chang, J., Huang, H., Ito, A., Kou-Giesbrecht, S., Lasslop, G., Li, W., Nieradzik, L., Li, F., Chen, Y., Randerson, J., Reyer, C. P. O., and Mengel, M.: Global burned area increasingly explained by climate change, Nat. Clim. Chang., 14, 1186–1192, https://doi.org/10.1038/s41558-024-02140-w, 2024.

   Cunningham, C. X., Williamson, G. J., and Bowman, D. M. J. S.: Increasing frequency and intensity of the most extreme wildfires on Earth, Nat Ecol Evol, 8, 1420–1425, https://doi.org/10.1038/s41559-024-02452-2, 2024.

   Dennison, P. E., Brewer, S. C., Arnold, J. D., and Moritz, M. A.: Large wildfire trends in the western United States, 1984-2011, Geophys. Res. Lett., 41, 2928–2933, https://doi.org/10.1002/2014GL059576, 2014."

2. *In lines 42 – 44 and 154 - 155, the way of citing references is confusing. Please put matched references after the name of the relevant inventories.*

The cited references are now listed after the inventory is named, as demonstrated below:

"Some examples of burned area inventories are the Global Fire Emissions Database (GFED**; Giglio et al., 2013)** and the Fire INventory from NCAR (FINN) (Wiedinmyer et al., 2011**)**~~Giglio et al., 2013)~~. Some examples of FRP-derived inventories are the Quick Fire Emissions Dataset (QFED**; Darmenov and da Silva, 2015**) and the Global Fire Assimilation System (GFAS) (~~Darmenov and da Silva, 2015;~~ Kaiser et al., 2012)."

"The derived emission rates from this work are compared to a set of commonly used biomass burning emission inventories, including GFED4s **(Giglio et al., 2013; van der Werf et al., 2017)**, FINNv2.5 **(Wiedinmyer et al., 2023)**, QFEDv2.5 **(Darmenov and da Silva, 2015)**, and GFASv1.2 (~~Darmenov and da Silva, 2015; Giglio et al., 2013;~~ Kaiser et al., 2012~~; van der Werf et al., 2017; Wiedinmyer et al., 2023~~)."

3. *In lines 76 – 78 and after, please provide references to GCAS and FIREX-AQ, and also provide references to TROPOMI and TEMPO instruments in line 93.*

The cited references are now included in the main text, as demonstrated below:

"These measurements were made using the GeoCAPE Airborne Simulator (GCAS**; Kowalewski and Janz, 2014**) instrument aboard the National Aeronautics and Space Administration (NASA) ER-2 aircraft for the Fire Influence on Regional to Global Environments and Air Quality (FIREX-AQ**; Warneke et al., 2023**) campaign."

"The GCAS instrument shares similar design specifications with the **TROPOspheric Monitoring Instrument (**TROPOMI**; Veefkind et al., 2012)** and **Tropospheric Emissions: Monitoring of Pollution (**TEMPO**; Chance et al., 2013)** instruments."

The references below have been added to the References section:

"**Chance, K., Liu, X., Suleiman, R. M., Flittner, D. E., Al-Saadi, J., and Janz, S. J.: Tropospheric emissions: monitoring of pollution (TEMPO), SPIE Optical Engineering + Applications, San Diego, California, United States, 88660D, https://doi.org/10.1117/12.2024479, 2013.**

Veefkind, J. P., Aben, I., McMullan, K., Förster, H., De Vries, J., Otter, G., Claas, J., Eskes, H. J., De Haan, J. F., Kleipool, Q., Van Weele, M., Hasekamp, O., Hoogeveen, R., Landgraf, J., Snel, R., Tol, P., Ingmann, P., Voors, R., Kruizinga, B., Vink, R., Visser, H., and Levelt, P. F.: TROPOMI on the ESA Sentinel-5 Precursor: A GMES mission for global observations of the atmospheric composition for climate, air quality and ozone layer applications, Remote Sensing of Environment, 120, 70–83, https://doi.org/10.1016/j.rse.2011.09.027, 2012.

Warneke, C., Schwarz, J. P., Dibb, J., Kalashnikova, O., Frost, G., Al-Saad, J., Brown, S. S., Brewer, Wm. A., Soja, A., Seidel, F. C., Washenfelder, R. A., Wiggins, E. B., Moore, R. H., Anderson, B. E., Jordan, C., Yacovitch, T. I., Herndon, S. C., Liu, S., Kuwayama, T., Jaffe, D., Johnston, N., Selimovic, V., Yokelson, R., Giles, D. M., Holben, B. N., Goloub, P., Popovici, I., Trainer, M., Kumar, A., Pierce, R. B., Fahey, D., Roberts, J., Gargulinski, E. M., Peterson, D. A.,

Ye, X., Thapa, L. H., Saide, P. E., Fite, C. H., Holmes, C. D., Wang, S., Coggon, M. M., Decker, Z. C. J., Stockwell, C. E., Xu, L., Gkatzelis, G., Aikin, K., Lefer, B., Kaspari, J., Griffin, D., Zeng, L., Weber, R., Hastings, M., Chai, J., Wolfe, G. M., Hanisco, T. F., Liao, J., Campuzano Jost, P., Guo, H., Jimenez, J. L., Crawford, J., and The FIREX-AQ Science Team: Fire Influence on Regional to Global Environments and Air Quality (FIREX-AQ), JGR Atmospheres, 128, e2022JD037758, https://doi.org/10.1029/2022JD037758, 2023."

4. *Please provide the full name of TROPOMI in line 93, as it is its first time mentioned in the main context.*

   We thank you for catching this error. We also realized that this sentence is also the first time TEMPO is mentioned in the main text. This sentence has been amended to the following:

   "The GCAS instrument shares similar design specifications with the **TROPOspheric Monitoring Instrument (**TROPOMI**)** and **Tropospheric Emissions: Monitoring of Pollution (**TEMPO**)** instruments."

   We also removed the full names of TROPOMI and TEMPO later in the main text:

   "One such approach relies on fitting an ~~exponentially-modified Gaussian (~~EMG~~)~~ to the line density of, for example, daily satellite observations of NO_2 columns from ~~the TROPOspheric Monitoring Instrument (~~TROPOMI~~)~~ (Jin et al., 2021)."

   "With the launch of **the** ~~Tropospheric Emissions: Monitoring of Pollution (~~TEMPO~~)~~ instrument in early April 2023, hourly daytime measurements of air pollutants are possible in the North American continent."

5. *Please provide references to VLIDORT in line 108.*

   We have added a reference to VLIDORT in line 108, amended as follows:

   "In this study, AMFs are calculated using the vector linearized discrete ordinate radiative transfer code (VLIDORT)**, version 7.2 (Spurr, 2006)**."

   The reference below has been added to the References section:

   "**Spurr, R. J. D.: VLIDORT: A linearized pseudo-spherical vector discrete ordinate radiative transfer code for forward model and retrieval studies in multilayer multiple scattering media, Journal of Quantitative Spectroscopy and Radiative Transfer, 102, 316–342, https://doi.org/10.1016/j.jqsrt.2006.05.005, 2006.**"

6. *Please provide references to Carnegie-Ames-Stanford Approach model in line 157.*

   We have added a reference to the Carnegie-Ames-Stanford Approach model in line 157, amended as follows:

   "…with the Carnegie-Ames-Stanford Approach model, which estimates fuel loads and combustion completeness **(Potter et al., 1993)**."

   The reference below has been added to the References section:

"**Potter, C. S., Randerson, J. T., Field, C. B., Matson, P. A., Vitousek, P. M., Mooney, H. A., and Klooster, S. A.: Terrestrial ecosystem production: A process model based on global satellite and surface data, Global Biogeochemical Cycles, 7, 811–841, https://doi.org/10.1029/93GB02725, 1993.**"

7. *Please check the units "-m" in lines 156 and 161.*

   The units in lines 156 and 161 now read as "500 m" and "375 m" respectively, removing the dashes.

8. *In lines 166 – 167, 180 – 181, and 229 - 232, please provide units to the variables.*

   While a combination of units is possible for these variables, we have provided the reader guideline units if they wanted to reproduce our methodology as follows:

   "where i is a specific compound, E is the emissions **(g)**, A is the area burned **(m^2)**, B is the amount of biomass **(kg m^{-2})**, FB is the fraction of biomass burned **(unitless)**, and EF is the emission factor with units of mass of i per mass biomass burned **(g kg^{-1})**."

   "…where E_i is the emission rate of compound i per unit area **(g m^{-2} s^{-1})**, α is a constant that relates time integrated FRP (fire radiative energy) to dry biomass burned **(kg J^{-1})**, EF_i is the emission factor of compound i **(g kg^{-1})**, and A is the area of the satellite pixel **(m^2)**."

   "From the EMG parameters, an emission rate (E_{EMG}**; molec s^{-1}**) and effective lifetime (τ_{EMG}**; s**)…"

9. *Please provide references to SAPRC99, MOZART, and GOES-Chem in lines 171 - 172.*

   We have added references to SAPRC99, MOZART, and GOES-Chem in the main text as follows:

   "Statewide Air Pollution Research Center Mechanism (SAPRC99**; Carter, 1999**), Model for Ozone and Related chemical Tracers (MOZART**; Emmons et al., 2020**), and Goddard Earth Observing System with Chemistry (GOES-Chem**; Bey et al., 2001**)."

   The references below have been added to the References section:

   "**Bey, I., Jacob, D. J., Yantosca, R. M., Logan, J. A., Field, B. D., Fiore, A. M., Li, Q., Liu, H. Y., Mickley, L. J., and Schultz, M. G.: Global modeling of tropospheric chemistry with assimilated meteorology: Model description and evaluation, J. Geophys. Res., 106, 23073–23095, https://doi.org/10.1029/2001JD000807, 2001.**

   Carter, W. P. L.: Documentation of the SAPRC-99 Chemical Mechanism for VOC Reactivity Assessment, University of California, Riverside, 1999.

   Emmons, L. K., Schwantes, R. H., Orlando, J. J., Tyndall, G., Kinnison, D., Lamarque, J., Marsh, D., Mills, M. J., Tilmes, S., Bardeen, C., Buchholz, R. R., Conley, A., Gettelman, A., Garcia, R., Simpson, I., Blake, D. R., Meinardi, S., and Pétron, G.: The Chemistry Mechanism in the Community Earth System Model Version 2 (CESM2), J Adv Model Earth Syst, 12, e2019MS001882, https://doi.org/10.1029/2019MS001882, 2020."

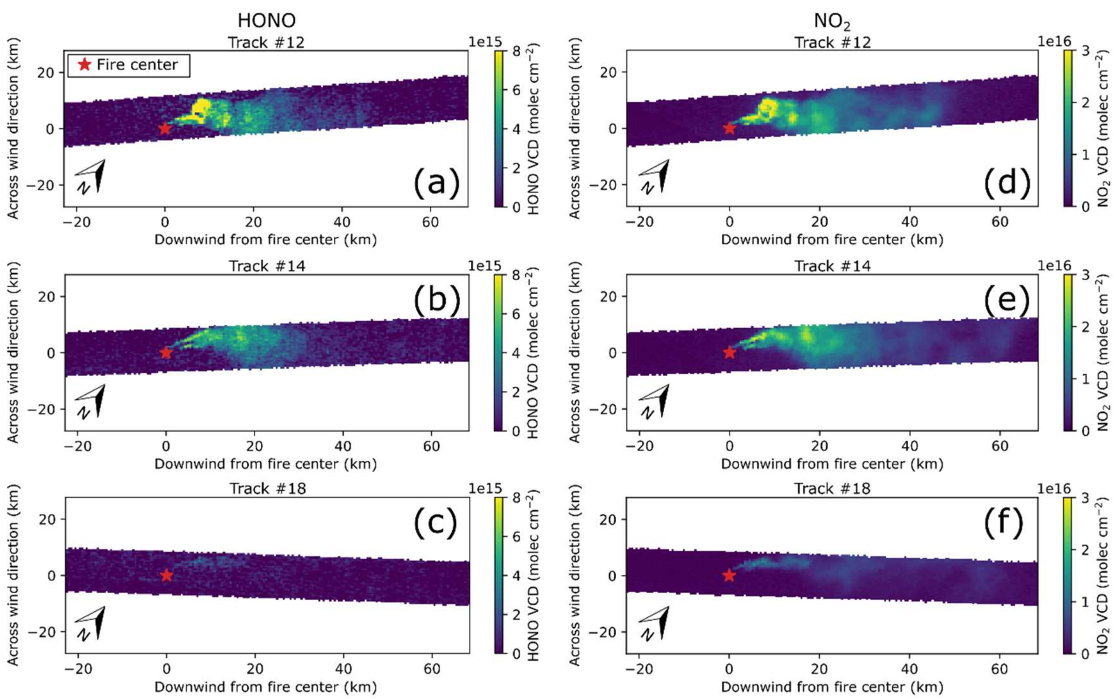
10. *In line 214, please define OMI.*

We thank you for catching this error. This sentence has been amended to the following:

"EMGs have been applied to satellite observations of **the Ozone Monitoring Instrument (**OMI**)** and TROPOMI NO_2 to estimate emissions and lifetimes from point sources and urban areas (Beirle et al., 2011; De Foy et al., 2015; Goldberg et al., 2019; Laughner and Cohen, 2019; Lu et al., 2015; Xue et al., 2022)."

11. *Please add the direction of North as Fig 1 to Fig 2 and indicate the flight track number for the corresponding Fig 2 Figures.*

We have amended Fig. 2 with requests from the reviewer. The updated Fig. 2 within the manuscript is shown below:



12. *In line 264, please describe what enhanced NO2 is.*

We have amended the main text to define enhanced NO_2 earlier in the main text, in Section 2.5.1. Calculation of HONO and NO_2 line densities as follows:

"We then subtracted from the entire scene the average HONO and NO_2 VCDs upwind of the fire**, called the background HONO and NO_2 VCDs, resulting in enhanced HONO and NO_2 VCDs solely from the wildfire. This process also removes any stratospheric component of HONO and NO_2.**"