Response to Reviewer #1

General Comment:

I enjoyed reading this paper. The results are relevant and interesting, and most of the figures are clearly labelled and easily interpretable. However, the authors should address a few points to improve the manuscript.

Reply: We greatly appreciate your constructive comments that have been carefully addressed and the point-by-point responses are in blue.

Comments:

Figure S1 and Table S1 should be moved to the main text. The reader needs to have an overview of the satellite instruments used in the study.

Reply: Thank you very much for your suggestion! Now we have moved Table S1 into the main text as Table 1 along with a description of the satellite data we used. As for Figure S1, it is the GEOS-Chem simulated surface ozone concentration from the benchmark experiment that can be publicly downloaded from https://ftp.as.harvard.edu/gcgrid/geoschem/1mo_benchmarks/. So we only described it in the introduction and did not move it into the main text.

We added the description of the satellite data in Lines 142-149: "The OMI sensor observes the globe once a day and is capable of obtaining the column concentration distributions of a variety of tropospheric trace gases (e.g., NO_2 and O_3). The TROPOMI sensor is a troposphere-specific observational instrument, and Wang et al. (2020) have compared the NO_2 concentrations of OMI and TROPOMI with observations. As for MODIS AOD, Shi et al. (2019) compared observations from 400 stations of the Aerosol Robotics Network (AERONET) with the MODIS AOD, and demonstrated that the MODIS was able to better capture the spatial and temporal variations of AERONET AOD (Zhang et al. 2024). MOPITT was launched in December 1999 on board the Earth observation satellite Terra with a 10:30 am equator crossing time (Kopacz et al., 2010)."

Table 1: Satellite and surface observations used in this study.

Species		Spatial resolution/ site locations	Observation period
O_3	OMI	1 ° × 1.25 °	July-August 2019
NO_2	OMI	0.25 ° × 0.25 °	2019-2020
HCHO	OMI	0.05 ° × 0.05 °	July-August 2019
NO_2	TROPOMI	0.125 ° × 0.125 °	2018-2023
AOD	MODIS	1 ° × 1 °	July-August 2019
CO	MOPITT	1 ° × 1 °	July 2019
$PM_{2.5}$	Humpata	(14 °34' S, 13 °26' E)	June-August 2023
	Luanda	(8 °48' S, 13 °14' E)	
	Luena	(11 °45' S, 19 °54' E)	
	Lusaka	(15 °24' S, 28 °17' E)	
NO_2	Humpata	(14 °34' S, 13 °26' E)	June-August 2023
	Luanda	(8 °48' S, 13 °14' E)	
	Luena	(11 °45' S, 19 °54' E)	
O_3	Ascension Island	(7 °58' S, 14 °24' W)	July-August 2017-2019

The results and discussion section should be reformulated to avoid starting the paragraphs/sentences with Figure X (for example, on lines 205, 212, …). The explanation of the figures should be integrated into the text.

Reply: We made some changes in the manuscript to avoid this issue.

Figure 11 should be changed to make the text in the figure more readable.

Reply: Thanks for the comment. We have removed numbers for the relative changes in Figure 11.

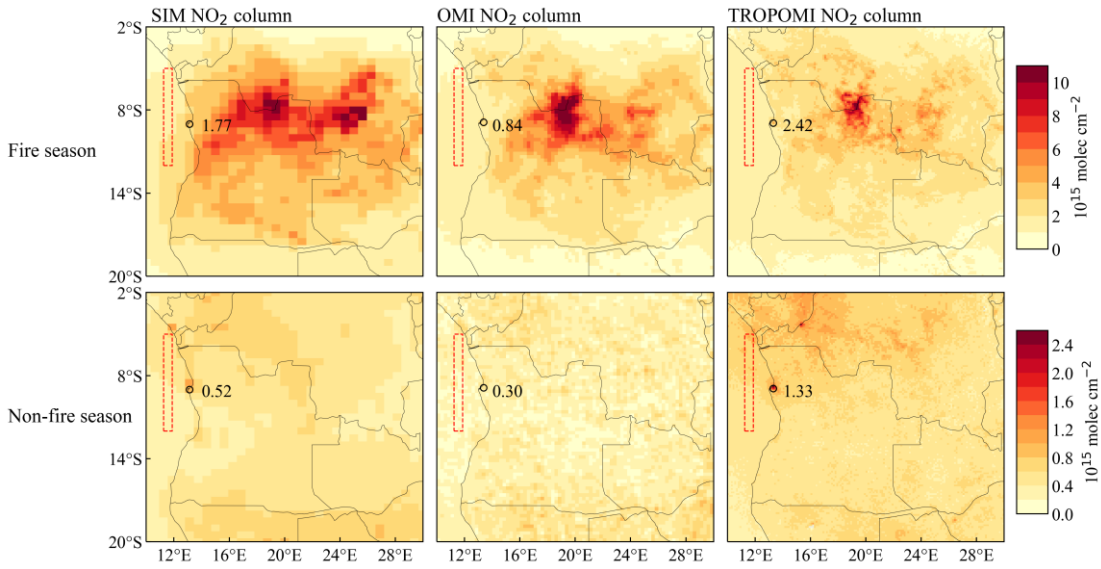

Figure 11. Spatial distribution of NO_2 columns from the model, OMI, and TROPOMI during the fire season (top, July-August 2019) and non-fire season (bottom, January-February 2020). Circles indicate the Luanda city and numbers around them indicate NO_2 column enhancement in the Luanda city. The dashed boxes indicate the downwind ocean region whose concentrations were subtracted to obtain the NO_2 column enhancement in Luanda.

References:

Kopacz, M., Jacob, D. J., Fisher, J. A., Logan, J. A., Zhang, L., Megretskaia, I. A., Yantosca, R. M., Singh, K., Henze, D. K., Burrows, J. P., Buchwitz, M., Khlystova, I., McMillan, W. W., Gille, J. C., Edwards, D. P., Eldering, A., V. Thouret, and Nedelec, P.: Global estimates of CO sources with high resolution by adjoint inversion of multiple satellite datasets (MOPITT, AIRS, SCIAMACHY,TES), Atmospheric Chemistry and Physics, 10, 855–876, 2010.

Shi, H., Xiao, Z., Zhan, X., Ma, H., and Tian, X.: Evaluation of MODIS and two reanalysis aerosol optical depth products over AERONET sites, Atmospheric Research, 220, 75-80, 10.1016/j.atmosres.2019.01.009, 2019.

Wang, C., Wang, T., Wang, P., and Rakitin, V.: Comparison and Validation of TROPOMI and OMI NO2 Observations over China, Atmosphere, 11, 10.3390/atmos11060636, 2020.

Zhang, L., Wang, X., Huang, G., and Zhang, S.: Comprehensive Assessment and Analysis of the Current Global Aerosol Optical Depth Products, Remote Sensing, 16, 10.3390/rs16081425, 2024.