

\*Comments are Noted as “Pg X Line X” following preprint pages and line numbers.

#### General Comments:

- Typically, figures need to be placed before they are discussed, would suggest this rearrangement.
- Overall, in the model comparison to land and ship-based measurements, the ways in which both are compared to the model should be addressed in more detail as well as the limitations that each observational dataset has, as observations in land and over water are not uniform so their comparison to the model is not directly comparable or please state how they are in more detail.

#### Line Specific Comments:

Pg 2 Line 4: would specify what is occurring for the first time here – the integration of on land, shipborne, and spaceborne measurements in a study has already occurred in previous studies, so would ask for specifics on what is first time

Pg 4 Line 35: Caution the use of “first attempt” here. I think you should be more specific on to what was truly novel about this study, be it the ship-borne data captured in Southern China, the suite of species observed, think specifics would be welcomed

Pg 5 Line 2: remove ‘also’

Pg 8 Section 2.2: Would be good to have that NO<sub>2</sub> and HCHO observed by TROPOMI are used for proxies of Nox and VOCs, would be good to have this mentioned here and state more explanation is in Section 3.2

Pg 8 Section 2.3: Would be nice to inform which resolution was sampled to the TROPOMI overpass time and scale? All resolution? May need to explain choice and why downgrading or upgrading was performed and what information may be lost in the choice

Pg 11 Line 3: well captures – captures well?

Pg 11 Line 32: Would be nice to explain how the matching occurred here? Is it a TROPOMI average or a single TROPOMI pixel for 1 or more in situ measurement? Is there a domain considered? Specifics like this are welcomed

Pg 12 Line 11: would be careful comparing a surface measurement to a column, since they are not measuring the same thing, and maybe state that this is a relative comparison looking for trends more explicitly (if this is the case). Many try to use the column as a proxy for the surface, so would be clearer if this is what is occurring or if its just looking for trends

Pg 12 Line 11: Given the correlation between the surface and columns are quite low for this region, maybe other reasons for the low correlation are at play, like number of available surface stations compare the breadth of TROPOMI? Has this been considered?

Pg 12 Line 15 – 18: Is having the cause of a local anthropogenic emitter is missing some causality for the disagreement, maybe it's the lower temperatures causing a less vertical mixing, etc.? Or it may be best to not speculate here?

Pg 12 Line 21: Where is the support for this correlation value? And the subsequent ones in the sentence? Related to a figure?

Pg 13 Line 4: same here? Where is the support for this? A figure?

Pg 13 Line 14: might be helpful to add if its land or ship or space-measure VOCs

Pg 13 Line 28- Pg 14 Line 10: This feel out of place here in Results. Could this paragraph could be incorporated into another section than here, but understand it was added for support for why HCHO can be used, but feels slightly out of place. Maybe just add line 28-30 as the concluding sentence and add the rest to the discussion?

Pg 14 Line 3: Do they really filter out areas with low NO<sub>2</sub> or just focus on urban areas for its relation to large populations?

Pg 14 Figure 3: Difficult to view names in circle plot, is there a better way to show this? Maybe external legend on side or something?

Pg 15 Line 3: again would emphasize that this region is southern China

Pg 15 Line 18: ozone pool? A short explanation might be helpful here, like just adding a “ozone pool (i.e., X) simulated by ...”

Pg 15 Line 30: Least – less?

Pg 15 Line 32: substantial positive or negative correlation?

Pg 16 Figure 4: I just wonder if there is a way to better display this data? Like reduce the latitudinal extent to see the data better?

Pg 17 Figure 5: Figure 5 is only discussed once in the paper and there is no discussion of its subplots, I wonder if more discussion of it could be included or if it can be condensed into a single plot?

Pg 17 Line 8: Specifics on which observations your using here would be helpful. And, information on how they are directly compare would be helpful too.

Pg 19 Line 6: Are propane (and the other species you directly compare) on land and on the ship measured using the same method? It might be helpful to identify the discrepancies between land and ship methods when having a direct comparison, as different measuring techniques can lead

to different measurements. Or state here again for the reader that they are measured in the same manner.

Pg 19 Line 12: Left out short name for Propane?

Pg 19 Line 12: No studies for China?

Pg 19 Line 13 – 15: I'm struggling to see this link to what was represented in the previous lines, I wonder if there is a better way to discuss this?

Pg 19 Line 17: Left out short name for Propane?

Pg 19: Line 20: struggling to see how this correlation related to the previous statement. Maybe more support in the specifics of how it relates can be added here?

Pg 19 Line 21: Land and ship observations? Might be helpful to add which observations for clarity

Pg 22 Line 13: any references for these studies?

Pg 23 Line 6: "background noise" what are you meaning here? Is this a point of magnitude or something else?

Pg 23 Line 9: Again may be helpful to share how the comparisons were done, in grid to point or area to point? And also again would ask for clarification on if these are relative comparisons?

Pg 23 Line 18: Which HCHO? TROPOMI or Model?

Pg 26 Line 11: would add what chemical transport model here for clarity, just as you do for spaceborne and TROPOMI

Pg 27 Line 32: May also be beneficial to add the limitations of the FNR? Souri et al, 2025 (<https://acp.copernicus.org/articles/25/2061/2025/>) has good descriptions on the limitations of the FNR

Pg 28 Line 28: model discrepancies in propane? Discrepancies in what? Specifics are desired