

**Review for manuscript “Evaluating WRF-GC v2.0 predictions of boundary layer and vertical ozone profiles during the 2021 TRACER-AQ campaign in Houston, Texas” by X. Liu et al.**

The manuscript presents a thorough comparison of WRF-GC PBL heights and ozone profile predictions with respect to observations obtained with different remote sensing and in situ instrumentation. The study identified some model limitations which have relevant implications for further modeling, especially for applications related e.g. to human or vegetation health. Therefore, I clearly agree that this study fits within the scientific innovation, quality and the scope of Geoscientific Model Development.

The manuscript presents high scientific level, and significant results. It is mostly well written and well structured, the objective is clear and the approach is technically well justified and validated. The abstract is accurate and concise, the introduction properly presents the topic background, previous works on the subject are properly cited and the new points are clearly indicated. To my view, the description of the observations (section 2.1) is less properly addressed and organized and should be revised by the authors. Description of the used model configurations (section 23) is very clear and the results sections (4 and 5) are well structured and present the relevant information.

I propose that this article is accepted for publication, after improving some aspects that, to my view, will make the work more robust:

-Title: it would be better to specify “boundary layer height”, since this is the BL parameter that authors are evaluating.

-Pag. 2 Line 38 – Pag. 3 Line 3: they are actually more types of measured variables used to calculate PBL height. For example, please refer to the recent review of Kotthaus et al. (<https://doi.org/10.5194/amt-16-433-2023>) and references therein, where different systems and atmospheric variables are discussed, e.g. thermodynamical variables (with MWR, IRS, Raman lidars, RASS) and aerosol profiles (with aerosol lidars, ceilometers), but also gases (e.g. with DIAL), wind and turbulence (with DWL, RWP, Sodar). Please update the information.

-Throughout the whole text, authors use “PBL” (e.g. Page 3 Line 39, Page 4 Line 3, Page 12 Line 14, Page 12 Line 17, Page 14 Line 7) when they refer specifically to PBL height (PBL could be also evaluated referring to other parameters, not only height). Please use “PBL height” or “PBLH”.

-Page 4 Line 10: please specify what “semi-continuous” stands for.

-Page 4 Lines 19-22: why is LMOL and University of Houston site mentioned? The measurements are not used for the presented study, but only included in the supplement. If the measurements are relevant for the study (i.e., for the comparison with the model), they should also be discussed in the main manuscript results sections, and the observations should be better explained in the in 2.1 section. If not, they should be removed from the supplement.

-Page 5 Line 7: why there is a distinction between “aerosols” and “aerosol optical properties”?

-Page 5 Lines 14-16: this information is redundant here.

-Page 5 Line 18: here “boats” is very general and not enough information is given previously to identify what the authors mean. There is only a mention to shipborne platforms in Page 3, but there seemed to be related to a different study. Since the shipborne in situ data are used in this study, please include the description also in this section 2.1.

-Page 7 Line 12: “Other schemes adopted...”, do you mean in this paper or in the literature?

- Figure S3: are the time series spatial averages? Please specify in the caption
- Table S3: are the values in column “OBS” the spatial and temporal averages? Please specify.
- Figure 3(i) and (j): a lower y-axis scale maximum, e.g., 2 or 2.5 km would make the variability clearer.
- Page 12 Line 26: “0.01-0.02 km<sup>-1</sup>sr<sup>-1</sup>” are not the values shown in Figures 4 and 5

Other corrections or typos:

- Page 4 Line 26: “(RCS) are shown”
- Page 9 Line 23: “i.e.” instead of “e.g.”
- Page 12 Line 5: “examined”
- Figure 8 (a), (b), (d), (e): please specify the units of the color scale
- Page 23 Line 20: “underestimated”