Review of the manuscript "**On the capability of UV-VIS limb sounders to constrain modelled stratospheric ozone and its application to the ALTIUS mission**" by Errera et al. 2021

This paper describes and discusses an OSSE experiment designed to assess the impacts of ozone assimilation from ESA's ALTIUS instrument scheduled for launch in 2024. The experiment consists of an MLS ozone analysis performed with a version of the BASCOE system as its nature run, a no-assimilation control and several simulated ALTIUS assimilation runs, where different configurations of bright limb, solar, and stellar occultations are used. The results show that ALTIUS (or a similar) sensor can provide sufficient data to constrain ozone in systems such as CAMS and other reanalyses. This is a very encouraging result.

Performing OSSEs prior to new satellite missions is a standard (in some cases even required) practice that allows one to assess the usefulness of these missions and helps scientists and decision makers plan ahead. That makes the topic an important one and in line with the scope of AMT. It is great to see that our community will have an alternative ozone data source in addition to the OMPS series in the dreaded but inevitably approaching post-MLS era. The paper is a pleasure to read. The science is sound, the manuscript is clearly and logically written; the figures are legible, and the supplementary information and plots are helpful. I have only a handful of specific and technical comments and suggestions for minor revisions. Once these are addressed the paper should be ready for publication.

Specific comments

L41. "limb-scattered solar light during daytime" is what's called "bright limb observations" below, right? If that's the case, I'd suggest introducing this term here and using a consistent terminology throughout the paper.

LL79-82. There have been more solar occultation sensors than the ones mentioned here: HALOE, POAM, ILAS. I feel it should be mentioned here that solar occultation is a well-established measurement technique for ozone.

Table 1. Please explain what threshold uncertainty is. I take it to mean the worst but still acceptable uncertainty. Is that correct?

L101. There's a new paper now in ACPD that discusses this scheme (at least I think it's the same one): https://acp.copernicus.org/preprints/acp-2020-1261/#discussion ; the authors may want to consider citing it if the new Monge-Sanz paper is accepted by ACP before this one is.

L108. How well are the effects of polar heterogeneous chemistry on ozone represented?

L126. I take it that observation uncertainties are assumed to be uncorrelated (which is fine). Is that correct?

L141. “15 days later”. Is it because that way the initial condition has sufficiently departed from the assimilated state in NR?

L151. The latest version of the V4.2 data quality document is from 2020 (Livesey et al., 2020). I don’t believe the recommendations of estimated uncertainties for ozone changed between 2015 and 2020. If they didn’t it would be better to cite the latest available document (https://mls.jpl.nasa.gov/data/v4-2_data_quality_document.pdf). Same applies for all the other instances this document is cited.

L168. In the upper stratosphere the chemical time scales for ozone drop rapidly with altitude making data assimilation a particularly hard problem. Can you explain the decision to assimilate ozone at those pressures, vis a vis Errera et al. 2019 who imposed a cutoff pressure at 4 hPa for ozone despite using a much more advanced chemistry model? I’m not saying I disagree with that decision, I’m just curious if the authors find the results in the upper stratosphere meaningful.

L174. Uncorrelated with each other or with the NR?

L185. It would make sense to re-emphasize that CR is also driven by ERA-Interim so that the meteorology is consistent with NR.

LL217-252. I like it that the authors provided this extensive explanation. It really helps if the reader knows what was done and why. It looks like you found the right balance between what needs to be done in the way of simulating ALTIUS and what can be done. I appreciate it.

LL240-243 and Figure 7. The MLS data quality document also contains accuracy estimates (reported as 2-sigma). The plot only shows precisions. Is it because the estimated ALTIUS error standard deviations also represent precision? Is there anything we can say (perhaps the answer is “no”) about the expected accuracy of ALTIUS ozone data?

L272 and Fig. 9. This harkens back to my question about the ability of the chemistry scheme to represent polar ozone loss. It looks like CR misses it completely. Can you explain? I understand that this is somewhat tangential to the topic of this paper, so just a couple of sentences of explanation will be enough.

~L292. While the difference standard deviation is reduced nicely for the most part in AR compared to CR, there is a patch of values <5% in CR-NR between 30^{o}S and 60^{o}N at p<~20 hPa that becomes slightly worse (>5%) in AR-NR. Can the authors comment on that?

L294-296. Why not add hatching to the plot to show the regions of significance? Or is the improvement significant everywhere?

LL302-304. Even though AR sits within or not too fat from the NR envelope, it shows a lot more variability than NR on daily-to-weekly scales, especially in MS md TLS. I’m looking at the jagged blue line compared to the red line. Can the authors explain what’s happening there?

LL307-308. Would it be possible to test this? One could run an additional short experiment with double the number of simulated "ALTIUS" observations, e.g. by also simulating observations along the descending night node. Those wouldn't, of course, literally make sense as simulated ALTIUS data but looking at what this does to the spread could help substantiate this claim.

L355. I would be more specific here: "to constrain **ozone** in chemical **data assimilation** systems such as"

Suggestions for technical corrections

L10 and below. I would replace the word "weight" with "impact" ("impact on the analysis"). I reserve "weight" to situations where we talk about different weights given to different data sources in data assimilations, etc. It's just my preference. Up to the authors.

L18 "signature". I think something like "signing" or "implementation" would sound better.

L24 "limb-looking"; I suggest "limb-viewing" instead.

L25. I suggest avoiding using ellipses ("…") in a scientific text. This sentence (causes affecting the ozone layer and their consequences) doesn't read well. Please, revise.

L38. Nearly polar → near polar

L40 part → part**s**

LL67-71. Please use either "Section" or "Sect." consistently; I would opt for the full word "Section".

L100 "throughout" → "through" or "via"

L112 "consists in" → "consists of"

L93. In the interest of being concise, I don't think it's necessary to repeat what the three geometries are, given they were just discussed in detail. I suggest deleting the text in the parentheses.

L286. "reduced below" → "reduced **to** below"

L334. Again, I don't think "weight" is the best word here. Perhaps "capability" would work better, or "impact on ozone analyses" or something like that.

Kris Wargan