

### General comment:

The paper addresses an analysis of reprocessed GPS/MET data using a single frequency retrieval technique which is compared to the dual frequency processing product of CDAAC 2007 and the MERRA-2 analysis. With this new and partly not overlapping dataset they can extend the CDAAC 2007 dataset and hence can provide more (RO) measurement data for climate trend analysis and climate model validation in a time where globally even distributed measurement data is sparse.

The paper is structured in a good way, the title clearly reflects the contents of the paper, and the scientific methods and assumptions are valid and clearly outlined. The results are sufficient to support the interpretations and conclusions. Some minor questions, comments and typos I will provide in the specific comments.

We appreciate the reviewer's careful reading of our paper. We address every specific comment below.

### Specific comments:

1. Section 2 page 4 line 121: I would change "... and underwent reprocessing in 2007." to "and underwent **a first** reprocessing in 2007." since there were more than this reprocessing in the last years.

We have addressed this comment and also clarified that the previous sentence referred to GPS/MET data.

2. Section 2.1, page 5 line 143/144: I would add the cite to Liu et al. 2020 <https://doi.org/10.3390/rs12213637> ("New Higher-Order Correction of GNSS RO Bending Angles Accounting for Ionospheric Asymmetry: Evaluation of Performance and Added Value") on the bi-local higher-order RIE here and also in Section 4.1 page 15 line 466.

We appreciate the reviewer bringing this reference to our attention. We agree it is an appropriate reference and has been inserted.

3. Section 2.1 page 6 last paragraph: Which orbit/orbit processing software did you use? are there any updates to the CDAAC 2007 processing? Could you add a short sentence to specify this in your paper?

In that paragraph, we have added more specific details and references to the JPL and CDAAC processing.

4. Section 2.1 page 7 line 216ff: Could you please explain here a little bit more detailed what you mean by this sub-interval processing. What I think I understand from the

following paragraphs and Figure 2 you're doing this on each "ray" for the 1 Hz pseudo-range data and then interpolating this to the 50 Hz CA measurements. But I'm not sure that I've understand that correctly.

Thank you for the comment. We agree that the description was not sufficiently clear. We have attempted to clarify. Please let us know if questions remain.

5. Section 2.1 page 8 line 233: How do you extrapolate below 15 km? constant, linear, ...?

We have clarified that the extrapolation is linear.

6. Section 2.1 page 8 line 254/255: The sentence "The altitude range for the fits in 15-60 km, or whatever the upper altitude of the occultation happens to be." is finishing without being finished ...

Thank you for pointing out this awkward sentence construction. We have made changes.

7. Section 2.1 page 8/9 line 258 - 260: I think these two sentences can be removed since in the next paragraph you're telling the same only in more detail.

Done.

8. Section 2.1 page 9 line 275: typo: "...AS in on." -> "... AS is on."

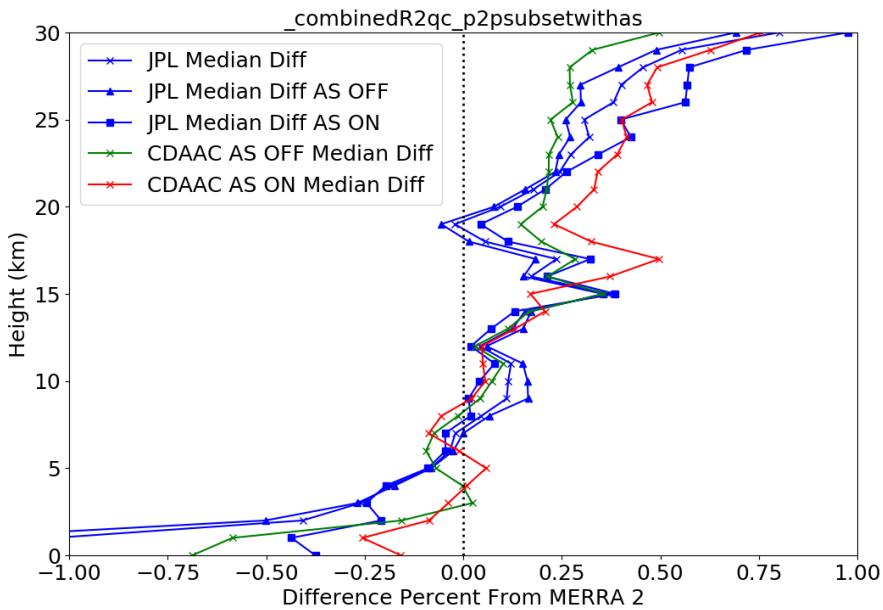
Done.

9. Section 3 page 11 line 331f: "Other climate-related work that ...": please add a cite which work you mean.

We have added references and clarified our meaning.

10. Section 3 page 12 360ff and Figure 6: To compare the CDAAC AS on AS off data with the new JPL data it would be good to separate the JPL data according to AS on and AS off too, although there is no difference in the processing in the JPL case.

Thank you for the suggestion. We did separate the JPL data into AS on and AS off and show the figure here. However, we don't believe that it adds significantly new material to the presentation, so we simply add some text in the paper to this affect.



Variation of Figure 6 with AS on (■) and AS off (▲) plotted for JPL data, along with AS ON and OFF combined (x).

11. Section 3 page 12 line 371: typo: remove the "." after 30 km.

We find a comma "," there rather than period. Please let us know if that is not appropriate.

12. Section 4 page 13 discussion on Figure 7 lines 406ff: The bias of the 12 km level is larger at higher (shown) latitudes (JPL dataset but also both CDAAC datasets). This could be a problem of the MERRA-2 analysis there. The approximate height of the mid-latitude tropopause should be there. Could these biases at this height level be related to the mid-latitude tropopause? You only mention the tropopause with respect to the lower latitudes and the tropical tropopause. Please discuss this. The 17 km level shows an opposite effect than the 15 km level for the JPL data. This could indicate that there is a possible mislocation of the tropopause.

Thank you for your thoughtful comments. The reason that we only discuss the lower latitude tropopause is because we are focused on differences greater than 0.25%, because we cannot claim that difference magnitudes  $\leq 0.25\%$  are significant (based on Figure 4). In reviewing this section and the figure, we noticed there is room for improvement. Our discussion focuses on biases that exceed 0.25%, as biases less than this magnitude may be due to measurement error. Therefore, we have redrawn the figures to emphasize the region where percent differences are

within 0.25%. We have changed the figure caption accordingly and modified corresponding text in the paper.

13. Section 5 page 16 line 503 typo/auto-correction error: "...radio **location** ..." -> "radio **occultation**"

Fixed.

14. Figure 4, Figure 5, and Figure 6: no x unit.

We believe the x-unit is properly labeled as "Percent difference from ...". We have added some detail in the caption to be clearer.

15. Figure 7: caption: you could interchange AS-on and AS-off in the caption since then it corresponds to the panel order.

Thank you. Done.