Review of manuscript "Correction of wind bias for the lidar on-board Aeolus using telescope temperatures" by Fabian Weiler et al

General comments

The manuscript is well structured and addresses an important issue, i.e. systematic error, in the view of improving the impact of Aeolus HLOS winds in NWP. With this it is found as an important contribution to the Aeolus special edition and is as well in the scope of the AMT. The methods applied are well designed. Especially, apart from the very positive response of the bias correction methods presented, the potential weaknesses are discussed as well. Such is the usage of NWP winds, which inherently are biased. The addition of the ZWC based bias correction method is very appreciated in that regard. I don't have any major comments, although, below I list some minor questions and suggestions.

Specific comments

I have a question regarding the usage of O-B for computation of bias correction factors. I can not find in the manuscript if any quality control of O-B is provided before usage in the MLR method. Not all HLOS observations are valid, and also some might not be inconsistent with the model, which can affect the bias correction methodology. So my question: could you add what kind of QC is done before using O-B in MLR? For example it could be add in line 215.

In Line 225 you justify the usage of model as a reference for computation of bias correction factors. In particular you compare the model with radiosondes. This is of course meaningful only where radiosondes are present. It is more difficult to justify that over tropics, South hemisphere or even over oceans. These are exactly locations where we would like learn more from Aeolus. Maybe it would be valuable to mention this issue in the discussion section or conclusions?

Bias correction factors (AUX_TEL_12) are computed every 12h. How degraded is the bias estimate if estimated from data 12h in the past, i.e. how degraded is the bias correction estimate at the last 12h of this window? If you maybe estimated this? Line 382.

In the Summary section I suggest to provide explanations for abbreviations again (i.e. for MLR, ZWC, …). Since many readers will first read conclusions.

How fast is the reaction of heaters in M1 mirror, compared to the satellite ground speed? How this delay effects the bias correction factors?

How far (in days for example) in the future can bias correction still be used, if estimated by regression today?

Technical corrections

I noticed that in many cases articles "a", "an", "the" are missing, especially in combination with "as" (several are listed below).

Line 13/14: "at a global scale" could be replaced with "globally from space". In addition in Line 14, "into space" could be removed.

Line 17: It reads a bit confusing. Is "small" related to temperatures or fluctuations?

Line 21: The "short- wave radiation" is probably meant as a reflection of the sun shortwave radiation, not earth?

Line 22: "response" could be replaced with "related response", it reads better. In this regard the "to that" in Line 22 could be removed.

Line 23: "as bias reference" is a bit confusing, I would suggest replacing it with "as a reference to describe …"

Line 28: "However" is not appropriate. I would suggest replacing it with "Furthermore"

Line 29: "as" → "as a"

Line 30: "has" → "has a"

Line 47: I suggest to replace the order a bit: "The operational ... was started on 9 January 2020, followed by …"

Line 53: "This issue could …" should probably be: "This issue was successfully mitigated on ..."

Line 55: "unexpectedly large systematic error" maybe it would be valuable to explain that this is independent of the first source of error explained in the previous lines?

Line 85: Maybe it should be explained what is "terminator"? People from NWP (who are certainly interested in this study) may not be familiar with this term.

Line 99: I suggest splitting the sentence in two smaller sentences. "Thus ...determined. Afterwards, a projection …"

Line 99: "… plane the horizontal …" could be replaced with "… plane, the so-called horizontal ..."

Line 107: I suggest removing this sentence. It provides an additional complexity not needed anywhere in the manuscript.

Line 115: "and the wave front error" it reads as that telescope is made of wave front error? I don't understand.

Line 116: "the integration" what do you mean, what kind of integration?

Line 117: "specification" what does this specification mean? How does this affect the wind retrieval on Aeolus?

Line 125: "for each observations", what do you mean with observations?

Line 126: "TC-TC-23" → "TC-23"

Line 130: "the distance", but also the angle of the M2 in respect to M1 can be changed?

Caption: Figure 1. There should be a date/time of the last access present with the url.

Line 145: The Table 1 is not referenced anywhere in the text (I can not find it)? Also, since all of these are already described in the text, I don't see the need for adding a table.

Line 151: "fast cycle", what exactly is this cycle?

Line 159: maybe to replace "…" with "etc."?

Line 165: "as" → "as a"

Line 179: "9700 …", In line 174 it is stated that thresholds are set to 0. I don't understand how the 9700 LSB is associated with that thresholds? It should be better explained.

Line 196: "… of better quality", here I would suggest to add in addition, that "Mie-clear" winds are physically not really meaningful. These are mainly a result of the classification methodology.

Line 205: "Tco1279": maybe it would be valuable to add the meaning of this, i.e. cubic-octahedral spectral transform with spectral truncation of n=1279 (https://www.ecmwf.int/sites/default/files/elibrary/2016/17262-new-grid-ifs.pdf). Since many readers of this paper might not be from NWP.

Line 206: "0 h and 12 h": Isn't this up to 30 h, for situations when AUX_MET is missing (I think this information is present in L2B ATBD)?

Line 207: "interpolated", it is valuable to add the kind of interpolation.

Line 206: "The nearest neighbour": is this regarding the last sentence?

Line 209: Regarding the sentence "These differences … at a global scale". Here a reference on https://amt.copernicus.org/articles/14/2167/2021/ might be add, since there this is already thoroughly discussed.

Line 211: "… assimilation …" → "… data assimilation …"

Line 217: How exactly is this averaging done. Is this meant for Mie, since for Rayleigh the maximal accumulation is already 86.4 km? For Rayleigh accumulation length of observations can be of course smaller than 86.4 km, but I don't understand how can you average this back on the 86.4 km? Is this like some kind of interpolation along the track every 86.4 km?

Line 230: "as" → "as a"

Figurre 3: It would be more natural to invert x and y axes, so that altitude is on y axes. If possible? As well, is this before or after the quality control?

Figure 4: Is this globally? Meaning everywhere where radiosondes are present?

Line 241: "as" → "as a"

Line 248: "as" → "as a"

Line 253: I think there is one space too much in "360"

Line 272: "HISR" → "HIRS"

Line 365: "This is shown …." Is this consistent when repeated on other days?

Line 372: "… from to 2.89 m/s …" → "...from 2.89 m/s …"

Line 384: "As next step …" → "As a next step …"

Line 394: "To avoid large …" Is this part of the scheme presented in Figure 10 or is done separatelly? Maybe to clarify this here.

Figure 9. In caption. "… dots indicates …" → "...dots indicate …"

Line 426: I suggest to remove "potential"

Line 429: "as" → "as a"

Line 436: "as" → "as a"

Line 440: The offset of 3 m/s. Is this consistent in time? How can this be removed, if it is not consistent in time?

Line 458: "confirm" → "to confirm"

Figure 11: caption. " … winds (green) and without …" → " … winds (green) without …." As well "as" → "as a".

Line 468: What do you mean "… with different temperature set point conditions …"? What are set point conditions?

Line 476: What is "control law coefficients"? I don't understand.

Line 496: "… series …" → "… series, …"

Line 496: "The top plot shows the standard deviation …". Here I suggest to mention that this standard deviation is now statistics of daily averages.

Line 497: "… before and the after .." → "… before and after .."

Line 507: "… with more smaller …" → "...with smaller …"

Line 536: "as" → "as a"

Line 540: "reduced" → "reduces"?

Line 555: "… and ZWC (green) …" this can be removed, since it is explained in the first sentence of the caption.

Line 568: "of" → "of about"

Line 572: "… over the seasons …" → "… over seasons …"

Line 585: "STD(E(O-B))-value" probably there is some spaces missing here?

Line 587: Like above, it is not clear what the law coefficients stands for?

Lines 590-560: many cases of "as" → "as a"

Line 623: Maybe to change CNRS to CNRS/Météo-France