

Review of “Five years of Aeolus wind profiling: global coverage and data quality” submitted by Lux et al. for publication in EGU sphere

Summary of Article & Recommendation

This paper presents an in-depth quality assessment of the evolution of Aeolus wind data during the first Aeolus mission. The full dataset has been reprocessed using Baseline 16 to provide, for the first time, a consistent dataset covering the entire mission period. The results presented will be used to provide guidance towards the enhancement of data processing and mission/system design for the follow-on mission Aeolus-2, which is currently in development. A significant result of this work is the error decomposition for both Mie and Rayleigh wind regimes, which will positively contribute to improved wind uncertainty characterizations in the Aeolus-2 mission.

I think the content is important and will be valuable to Aeolus-2 and other future wind lidar missions. The article text is very well-written with a few minor grammatical errors; I have indicated these and other thoughts/recommendations in my comments below. Once these have been addressed, my recommendation is that this article is accepted.

General Comment

1. Is a similar in-depth analysis on the L2A dataset (aerosols) forthcoming? I think such a study would be an important complement to this one.

Specific Comments

1. *Line 55*: “averaged L1B data onto the L2B grid”: Were the L1B data in fact averaged or were they interpolated to the L2B grid? The abstract states they were interpolated; if so, what scheme did you use? If they were instead averaged, how was this done? Were only valid obs used? Was any quality control applied to the L1B data beforehand?
2. *Lines 245-248*: Can you provide more detail about how exactly the “Mie-cloudy random error is more strongly affected by data processing algorithms and configuration changes than by the signal trend,” instead of just stating that it is? Is the Oct-Nov 2019 example referencing Fig. 2, or something else? How does this example support your claim here?
3. *Lines 249-251 (and Table 1)*: This seems out of place here, as the rest of this subsection seems to discuss the Aeolus mission in general and not the actual study presented in this article. I suggest starting a new subsection after line 248 and labeling it as “Dataset selection” or something similar. I further suggest the following:
 - a. Delete the subsection title “2.4 Horizontal bin length of the L2B wind results” and instead incorporate its contents into the new “Dataset selection” subsection.
 - b. In line 249, add “in this study” after “selected for analysis” for clarity.
 - c. Similarly, in line 255, add “in this study” after “wind result” for clarity.

4. *Line 370*: The phrase “increases throughout the troposphere” is confusing here as the next sentence also discusses the troposphere but presents a contradictory statement. I assume the next sentence discusses the *free troposphere* above the PBL? If so, I suggest changing the phrase to “increases throughout the PBL.”
5. *Figure 7*: Do the statistics in this figure include winds from both the NH and SH, or just the NH? It is not clear in the text nor in the figure caption. I would explicitly state this, otherwise the results can be confusing. For example, the Tropics panel could be assumed to include all winds south of 20°N (including the entire SH), and the Poles panel could be assumed to only represent the Arctic. Further, if the panels include regions in both hemispheres, have you examined each hemisphere separately? Does the wind coverage differ based on season in the poles/storm track regions, and if so, how?
6. *Figure 13*: A note on discussion order of this figure in the text: Why is panel (b) discussed before panel (a)? Convention dictates that (a) should come first; I recommend matching the discussion in the text to the figure panels, where (a) is discussed first, to be consistent with all other figure discussions.
7. *Table 2*: A note on discussion order of this table in the text: Why are the Rayleigh winds discussed before the Mie winds, when the Mie winds appear first in the table? Tables are typically read top-to-bottom; I recommend matching the discussion in the text to the table’s top-to-bottom contents, where the top section (Mie) is discussed first, to be consistent with all other figure discussions.

Technical Corrections

Text

1. *Line 40*: Past tense should be used: Change “vary” to “varied”
2. *Line 65*: To be consistent with predefined acronyms, I suggest replacing “Level-2B” with “L2B”
3. *Line 66*: See previous comment (*Line 65*).
4. *Line 77*: Define ALADIN here instead of in line 85.
5. *Line 85*: Don’t define ALADIN here (rather, define it in line 77).
6. *Lines 317-319*: This is one sentence and as such does not constitute a paragraph. Please move to the end of the previous paragraph.
7. *Line 350*: Is the comma after “coverage” needed?
8. *Line 373*: Replace the semicolon after “troposphere” with a comma.
9. *Lines 437-438*: Tense mismatch: Either pluralize “thickness” in line 437 and replace “was” with “were” at the end of line 438, or replace “were” with “was” in the beginning of line 438.
10. *Lines 490-491*: This is one sentence and as such does not constitute a paragraph. Please move to the end of the previous paragraph.
11. *Lines 560-561*: It looks like the July 2019 and April 2023 tails extend to 12 m/s. Therefore, I would either say “extends up to 12” or “exceeds 10” here.
12. *Line 561*: The low-SNR datasets well exceed 12 m/s in Fig. 13b. Please update the stated range accordingly.
13. *Line 648*: Delete the extra space before “70 %”.
14. *Line 690*: HLOS has already been defined in the main text. No need to redefine it here.
15. *Line 783*: DCO has already been defined in the main text. No need to redefine it here.
16. *Line 838*: I believe you mean six selected mission days? Please revise.

[Technical Corrections cont.]

Figures

1. *Figure 5 caption:* Please pluralize “red” and “blue,” as different shades of each are displayed.
2. *Figure 7:* The red and brown dashed lines are difficult to see in panels (b) and (c). And what I assume is the red line for clouds (that which somewhat outlines the Mie wind bars) is too close in color to the dark blue line representing molecules. Please replot with more distinct color choices for the dashed lines.
3. *Figure 15:* In the caption, you state that the grey horizontal lines indicate Aeolus mission requirements for two regions in the vertical. However, the grey horizontal lines I see in this figure are those that correspond to the y-axis grid tick marks. Are you perhaps referring to the lines labeled 2.5 m/s and 1.0 m/s? If so, please explicitly state that they are labeled as such in the caption. If not, please add to the panels the Aeolus mission requirement lines in some color other than grey.