

Reply to Reviewer #2.

We thank Reviewer #2 for the review and thorough work in finding issues and providing feedback on the readability of our manuscript. The efforts that will help us address any weaknesses in our manuscript are greatly appreciated, and we hope our revised manuscript meets the reviewer's expectations.

In my opinion this is an excellent paper summarizing the comparison of an extensive data set of radiosonde and surface-based lidar observations with Aeolus wind estimates. The paper is quite comprehensive in its analysis of the data set. I especially like that the authors have compared their results with results from other groups carrying out similar investigations at different locations and using different instruments. This work is quite important for evaluating Aeolus performance and assessing the potential utility of the Aeolus observations.

Most of my comments are minor and editorial in nature, and I leave it to the authors and editor to decide on whether or not to include them in a revised manuscript.

Specific comments

Line 32: It seems that there should be an "is" inserted after "wind profiling".

Corrected.

Line 56: Perhaps I missed it, but it's a bit unclear whether the work described in the paper is investigating total bias or residual bias. As noted, bias correction schemes were implemented to the Aeolus data at different times in the mission. Although a fully bias-corrected data set is being developed for Aeolus, this analysis seems to be using data that may have included intermittent changes to the bias. A sentence or 2 to perhaps discuss bias correction in the Aeolus data set and which data are being used for comparison could be helpful to the reader.

From our understanding, total bias is a measure of the overall accuracy of a measurement. In contrast, residual bias measures the remaining error after accounting for known sources of error. Both are important in understanding the reliability and accuracy of a measurement. However, the bias discussed in this paper is the residual bias, since it considers the many corrections put into place in the baselines, such as hot pixel and mirror temperature correction. Your remark considering intermittent changes to the bias is perfectly valid, and a new table (Table 3) has been added to reflect and document changes in the baselines, through the display of the residual bias and MAD for every given baseline, including reprocessed and real-time. We also added additional context in the text, where you suggested : "The Aeolus instrument settings and ground processing have significantly changed during its mission. These will affect statistical properties like bias and standard deviation/MAD. In addition to the combined statistics, we provide

in table 3 a splitting of the results, presenting them separately for the different baselines. Also, near-real-time and reprocessing results are separated, i.e., baseline 11 (introduced in near-real-time processing on 8-Oct-2020) and the baseline 11 results before that date (based on reprocessed Aeolus data). The split is needed since the reprocessing used different calibration data than the near-real-time processing."

Line 79: Is LIOvent an acronym? If so, please define.

LIOvent is not an acronym, it is just a name, similar to other lidar systems at OHP, e.g. LIO3S for the stratospheric ozone lidar.

Line 93: Does the LIOvent lidar measure only Rayleigh winds?

The LIOvent instrument senses the Doppler shift from both Rayleigh and Mie backscattering thanks to the spectral configuration of its double-edge FPI. Nevertheless, the Mie-type measurements are prone to larger error increasing with the backscatter ratio. The following sentence has been added: "The spectral configuration of the LIOvent FPI enables sensing the Doppler shift not only in clear air but also in the presence of thin clouds or aerosol layers, however the measurement error increases with the backscatter ratio (Souprayen et al., 1999)"

Line 230, Figure 1 caption: I think that the caption could use a bit more explanation. Although I think that the straight colored trajectories represent lidar measurements from Aeolus and the ground-based lidar, this isn't described in the caption so it required some scrutiny on my part to discern what they represent. The same is true for the Figure 2 caption.

After re-evaluating the description thanks to your comment, we decided to add another sentence to the description of the figures: "The straight colored strokes represent lidar measurements from Aeolus and the ground-based lidar".

Line 244: Looks like a word is missing after "however".

Corrected.

Line 300 (Figure caption): It would be useful for the caption to differentiate between the lighter and darker shading and c and relate them (presumably) to the orbit.

Thank you for your suggestion. We have taken your remark into account and have added the following sentence to the description: "The lines represent the average bias of each bin altitude, and the red (black) shading is the standard deviation of the bias in each range bin for ascending (descending) orbits."

Line 319: I find the paragraphs beginning at line 305 and line 320 to be unclear. Does paragraph 305 refer to the radiosonde comparisons while 320 refers to the lidar

comparisons? Also the text beginning on line 305 refers to figures 3a, 3c, (wind measurement differences), while the text beginning on line 320 refers figures 3c(wind measurement differences) , 3d (data count), but seem to be doing an equivalent comparison. These two paragraphs seem to require some clarification or correction.

Thank you for pointing out this issue. We mistakenly said “Figure 3a, 3c”, where we meant “3a, 3b”. Each paragraph should correspond to just one instrument and its data count, meaning it is a figure meant to be read horizontally, line by line. We hope that this small change helps clarify the paragraphs' arguments and their readability.

Lines 345 and 347: I think the authors mean “4a” instead of “5a” here.

Yes, indeed, this issue was corrected.