

Atmos. Meas. Tech. Discuss., referee comment RC1
<https://doi.org/10.5194/amt-2022-331-RC1>, 2023
© Author(s) 2023. This work is distributed under
the Creative Commons Attribution 4.0 License.

Comment on amt-2022-331

Anonymous Referee #1

Referee comment on "Long-term validation of Aeolus L2B wind products at Punta Arenas, Chile, and Leipzig, Germany" by Holger Baars et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2022-331-RC1>, 2023

General comments

The manuscript addresses the comparison activities between Aeolus wind products and analogous data at two distinct locations: Punta Arenas (Chile) and Leipzig (Germany). A scanning Doppler cloud radar was placed in Punta Arenas, while radiosondes were systematically launched in Leipzig. Thus, Aeolus winds were compared to Leipzig radiosonde winds and to Punta Arenas Doppler cloud radar winds in different stages of the satellite mission. The dataset includes a significantly large period of time, providing consistency to the results. Furthermore, a significant effort was done in order to obtain a significantly large database of radiosonde measurements.

The comparison methodology applied is robust, and is analogous to the one applied in previous related studies. On the other hand, interesting case studies were presented and a relevant long-term study is performed. The results are correctly presented, and relevant conclusions are raised about Aeolus performance and the processing algorithms. However, the large number of plots makes the manuscript not easy to follow for the reader. Additionally, some figures should be reformatted in order to make them clearer to read and interpret.

The manuscript should be then accepted and susceptible of minor revisions.

Specific comments

The abstract is well written and structured. The concepts are well handled and a good overview of what has been done is provided. However, more precise information about the period used for each validation should be provided. Additionally, some concepts are not properly introduced (e.g., baselines, Mie cloudy, Rayleigh clear). On the other hand, some minor rephrasing could be performed to improve the understanding of the text.

The introduction section is equally well written. The manuscript is well referenced and this review is significantly valuable. However, again the period considered in the validation activities is not totally clear, as it is specified when they start but not when the end. Additionally, the satellite is introduced in this section, but no information is given about the scene classification, quality flags, Aeolus errors, for example. This information is

partially lacking also later in the text. More information about the satellite should be included in the introduction or in Section 2, together with the detailed description of the locations and the instrumentation. On the other hand, this description is very well presented and detailed. In fact, Section 3.1 is overly detailed and it is not clear why this much details are needed for this specific study when so few details were given about Aeolus measuring technique and data processing.

The methodology used for the validation is robust and has been widely tested in previous studies. However, more information about the overpasses is lacking (e.g., mean distance, impact of the orbit shift), which can be easily introduced. The presented case studies help to clarify the procedure followed. Nevertheless, the editing of Section 4 should be improved.

Regarding Sections 5 and 6, mainly the editing of the figures should be improved. Some plots are hard to interpret, and the information is difficult to read, given the amount of tiny text included. All of the plots are interesting for the manuscript discussion. However, the authors should think of a better way of including that large number of plots. Additionally, given the number of plots, it is difficult to link the text with the figures while following the discussion.

On the other hand, there is not a clear criterion about when to use "Mie", "Mie cloud", "Rayleigh" or "Rayleigh clear". For example, "Mie cloudy" is used in the figures, while "Rayleigh" (and not "Rayleigh clear") is used, and while "Mie and Rayleigh winds" are used in the discussion. Some standardization should be performed or at least it should be made clear. Nevertheless, the discussion of Section 5 and 6 are valuable and interesting results were raised.

Technical corrections

- Line 5. Specify when does the validation activities end. For Leipzig the orbit mode of the overpass considered was specified. But not for Punta Arenas.
- Line 12. Specify what is meant with "the era of the first laser". Indicate this period.
- Line 16. The concepts of "clear" and "cloudy" should be previously introduced.
- Line 22. This sentence should be rephrased.
- Line 25. What is meant with "concept" in this line? Please, rephrase.
- Line 37. Indicate in some way that "the technology" refers to Aeolus. Although Flament et al. (2021) and Siomos et al. (2021) provide an interesting address of Aeolus optical products at an earlier stage (presented in conferences), there are other relevant studies which entail a more in-depth study and validation of Aeolus optical products (published in the same Special Issue as the present work). Please, consider including the works of Abril-Gago et al. (2022) (<https://doi.org/10.5194/acp-22-1425-2022>) and Gkikas et al. (2022) (<https://doi.org/10.5194/amt-2022-205>), although the later is still in review.
- Line 68. Indicate when the radiosondes stopped being launched. Also indicate that for Punta Arenas, ascending and descending mode orbits were considered.
- Line 71. Indicate when did the campaign end and whether the occasional radiosondes were considered in the validation or not. These radiosondes were not mentioned in the abstract.
- Line 84. Figure 1 is not referred anywhere in the manuscript. Please, consider mention it and include some discussion or remove it.
- Line 93. Include also the radiosonde models here.
- Line 101. What is meant with "primarily". Were the radiosondes used or not?
- Line 114. Then, the Doppler cloud radar provides one horizontal wind profile each hour (of the PPI considered)? Provide more details about this. How was ensured the temporal collocation of this measurements with Aeolus products? At which time were they performed (i.e., every hour on the hour o'clock)? Discuss about the temporal

representativeness of the measurements.

- Line 115. Discuss the reliability of the measurements for winds larger than 10.56 m/s, specially given one of the case studies provided.
- Line 120. Give the information somewhere in Section 2.2.2 about when the radiosondes where launched (i.e., how much time before or after the overpass). A deeper discussion about the spatiotemporal collocation of the radiosondes is lacking in the text. Was the horizontal drift considered? Discuss about the representativeness of these measurements.
- Line 131. Rephrase the information about the Lockheed Martin LMS6 radiosondes.
- Line 133. The radiosondes where launched, but where they used? After reading the manuscript it is not clear at all. In several places it is stated that Aeolus products were validated with radiosondes in Punta Arenas, but no statistical results are given. Line 133 is a good place to make this clear.
- Line 135. Please, consider rephrasing Section 3.1 to be more concise. A detailed description is given about how the Doppler cloud radar obtains the horizontal winds, but few or no information is given about how Aeolus or the radiosonde obtain these winds.
- Line 136. Please, rephrase. Mention TROPOS here gives the wrong idea that the instrument was placed in Leipzig for the activities.
- Line 180, subscript. A 100 km criteria was mainly used, except for Punta Arenas during the period after the orbit shift. Please, discuss this fact and how this could affect the representativeness of the winds captured by each instrument. Also mention and discuss the 100 km criteria recommended by ESA for Aeolus wind product validation activities.
- Line 182, Figure 3. Specify that the zoomed in products are the ones within the 100 km criteria. Also specify which classification they belong: cloudy or clear.
- Lines 182 and 183. Indicate the mean distance between the overpass and the station and their orbit mode. This information will provide an interesting discussion about the representativeness of the comparison results. Also discuss how does this mean distance and the overpass times change (or not) with time, and specially with the orbit shift. Two overpasses are mentioned for Leipzig, but only one is used. Mention this in the manuscript.
- Line 184. Provide more details about the scene classification.
- Line 185. Discuss if the 87 and 15 km horizontal resolution has been constant during the satellite mission. This could be linked to the new baseline releases.
- Line 192. Give more details about the "before the resolution was 87 km". This comment is related to the previous one.
- Line 194. Provide more details about the temporal collocation of the profiles. Additionally, this sentence should be rephrased.
- Line 200. This sentence needs rephrasing. Specify that the HLOS wind was averaged in heigh. Additionally, more information should be provided about Aeolus bins and bins thickness.
- Line 201, Table 1. Please, check if the start date for the operational processing of B12 is in May. Additionally, why were the subscripts not included in the "Additional info" column? If they are kept as subscripts, they should be numbered in some way.
- Line 214. Type "Laser" with lowercase letters.
- Line 219. Discuss here about ESA's recommended 100 km spatial criteria.
- Line 242. Please, rephrase.
- Line 243. The profile was taken at 09:35, but it is not specified how much time it covers. Are these profiles always taken around half past? This temporal collocation of the Doppler cloud radar should be discussed before.
- Line 244, Figure 4. The presentation of this figure should be improved. The arrow indicating the east direction of the middle plot is overlapped with a line and is barely visible. Additionally, the wind direction included in that plot is hard to interpret. In the left plot, the Doppler cloud radar can not be distinguished from the others. It should be specified which "Distance to lidar" the authors are referring to: distance to ground-track, distance to observations... In addition, it "lidar" should be replaced with "radar".

It is not clear which time is given as "Ground-based instruments". The caption states "How are winds retrieved from the Doppler cloud radar", which is not really what Figure 4 presents. Furthermore, "Resulting winds retrieved with the Doppler cloud radar scans in regions cloudy occurrence" should be rephrased.

- Line 248. Which frequency is that?
- Line 250. Please, rephrase.
- Line 251. Some values should be provided in stead of only stating "excellent agreement". If GDAS data is going to be used, then some previous introduction should be given.
- Line 252. I recommend to change the tense of "have been" to "were".
- Line 255. The discussion is very valuable. However, I would not make reference to the 87 km averaged Aeolus observation rather to the 100 km radius used, as that distance average is different for the Mie channel. Additionally, I would say that an optically thin cloud scenario could be also the case, so that Aeolus light could still penetrate.
- Line 262. It is not true for all the cases that the Rayleigh clear winds agree within the uncertainty range above 15 km.
- Line 264. Some observations are significantly lower than the GDAS, so the information is not totally true.
- Line 265. The following discussion gives the wrong idea that only cloud region could be analyzed. However, this is not true, as several radiosondes were launched and could be compared to both Aeolus Mie and Rayleigh winds. Then, it is worth mentioning here that the radiosondes could address the comparison in the other regions.
- Line 274. Information about the time when the overpass, Doppler cloud radar profile and radiosonde launch took place is lacking in Section 4.2.
- Line 277. Please, rephrase "considerable normal" or the whole sentence. Why using km/h now and not m/s as in the whole manuscript?
- Line 280. Is there any evidence about the polar vortex shift over the region?
- Line 285. I would recommend not to use "perfectly", especially because some points do not fit perfectly.
- Line 287. More information is lacking in the manuscript about how the radiosonde horizontal drift was solved, especially for the analysis in Leipzig. Please include this discussion in Section 3.2, for example. It could be interesting to include here a discussion with ESA's specifications of Aeolus performance under high wind conditions.
- Line 288. Give an approximate tropopause height here. Again, I would recommend not to use "perfectly".
- Line 291. How can this be possible? Each Aeolus profile takes around 87 km, so how could two profiles fit in 100 km? It seems so simple that I might be wrong. I am especially concerned about the word "full" here.
- Line 298, Figure 5. The Doppler cloud radar profile is barely visible. Again, why using km/h and not m/s? Lidar should be replaced with radar as well.
- Line 298. I understand the limitation raised in this line. However, how can you be confident about it?
- Line 314, Figure 6. A homogenization of the criteria used to name the channels is needed: use "Mie" or "Mie cloudy", but not both without any explanation before. Also rephrase (or not) "Rayleigh" accordingly. Additionally, including the error bars makes the plot harder to read. However, they could be kept, but further editing should be done to make the plots easier to interpret. Moreover, the units of the different coefficients and errors should be included. The same can be said to Figures 7, 9, 10, 11, 12, 13, 14 and 15. Especially Figures 9 to 15 need to be edited to make them easier for the reader to interpret.
- Line 313. Specify "Mie wind" and do not use "that wind". Additionally discuss the comment about the slope and the mean bias.
- Line 356, Figure 7. Replace "Ground Doppler" with "Radiosonde" in the figure caption.
- Line 356, Table 2. Why was omitted the uncertainty of the Punta Arenas' slope?
- Line 356, Figure 8. It should be described what the different rectangles mean. Additionally, a reference here to each of the following sections would be appreciated.

- Line 358. In line 352 it was stated that the comparison with radiosondes (for Punta Arenas) was not worth it, thus it was not included. Why mentioning radiosondes here? In the following sections no results of the radiosonde comparison are given.
- Lines 360 to 364. Although the information is more or less clear, this sentence should be rephrased to ease the understanding.
- Line 373, Figure 9. Using the same axis limits for all of the plots would help to compare the plots and interpret the results. At least, the axis should be symmetric, in order to make the 1:1 slope easier to observe. On the other hand, the font size is really small and most of the text in the plots is difficult to read. The same can be said for Figures 10, 11, 12, 13, 14 and 15.
- Line 375. Please, make reference to the square drawn in Figure 8 which corresponds to this period.
- Line 379. Why is it obvious? Please, discuss. Also discuss why it indicates an improvement in the quality flags and error calculations.
- Line 393. Please, discuss why the Mie winds were already much more reliable for B05 and B06.
- Line 399. Specify when does this decrease took place?
- Line 408. Please, make reference to the square drawn in Figure 8 which corresponds to this period.
- Line 412. It is not clear why the Leipzig data was not used here.
- Line 425. Please, make reference to the square drawn in Figure 8 which corresponds to this period. Also, rephrase the sentence, please.
- Line 436. Why was Leipzig data discarded?
- Line 447. Please, rephrase.
- Line 458. Given the intercept value and the biases obtained, no significant differences were really obtained? Please, discuss.
- Line 477. Is there any specific reason why a 28-days moving average was used?
- Line 478. "The most recent available baseline ..." can be understood, but rephrasing would be appreciated.
- Line 504. Please, rephrase.
- Line 526. It would be really interesting if you discuss further about the fact that the Doppler cloud radar only captures the wind within clouds. How does this affect the representativeness of the results? Are they representative to all vertical regions of the atmosphere? You will not find much cloudy regions in the stratosphere, for example.
- Line 530. Specify that the occasional radiosondes were launched in Punta Arenas. However, if these radiosondes were not used in the comparison, I would omit the information from the Conclusions.
- Line 554. Please, make reference to the availability of the Doppler cloud radar and radiosonde data from Punta Arenas.
- Line 695. The DOI link should be corrected.