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Comment on amt-2022-26

Anonymous Referee #1

Referee comment on "Intercomparison of wind observations from ESA's satellite mission Aeolus, ERA5 reanalysis and radiosonde over China" by Boming Liu et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2022-26-RC1, 2022

The manuscript by Liu et al. reports a validation study of the Aeolus wind product over China in the time frame between April and September 2020. The horizontal line-of-sight (HLOS) wind speeds provided in the Aeolus L2B product are compared against the wind data from radiosondes as well as the ECMWF atmospheric reanalysis ERA5. Based on a statistical analysis, the systematic errors of the Rayleigh-clear and Mie-cloudy winds are determined separately for ascending and descending orbits. The results are compared to those from previous validation studies.

General comments:

Although the manuscript was resubmitted multiple times, it still contains several inaccuracies and shortcomings. First of all, the structure of the study is not plausible. The Aeolus validation is performed for two different periods, corresponding to different approaches and datasets to be compared with each other (as depicted in Fig. 2). Consequently, there is a multitude of statistical results from the individual cross-comparisons done for the two periods, which are additionally split into ascending and descending orbits. Furthermore, the comparison of the radiosonde and ERA5 zonal winds, which is mixed with the actual validation of the Aeolus wind results in the text and figures, distracts the reader from the main purpose of the work. Hence, for the sake of clarity and concision, it is suggested to perform a consistent investigation of a single period for which all three datasets are available, while focusing on the validation of the Aeolus HLOS winds.

The study periods covered in the analysis are rather short and should be extended to obtain more robust results. Otherwise, the outcome of the work does not go much beyond the results from the authors' previous publication which is based on radio wind profiler data (Atmos. Chem. Phys., 21, 2945–2958, 2021, https://doi.org/10.5194/acp-21-2945-2021).

Also, a very similar study was meanwhile published by Chen et al. in ACP (Atmos. Chem. Phys., 21, 11489–11504, 2021, https://doi.org/10.5194/acp-21-11489-2021) which compares Aeolus winds to radiosonde and ERA5 data in four Chinese regions over the period from July to December 2019 to October 2020. Given the fact that the study by Chen et al. is more comprehensive and scientifically sound than the present manuscript, the latter represents no substantial contribution to the Aeolus validation in terms of applied methods, concepts or investigated data. Moreover, the scientific quality is not sufficient for being published in AMT. Therefore, I recommend to reject the manuscript.

Individual comments:

Many aspects are addressed only very briefly and several statements made in the text lack substantiation. In particular, the following points should be considered before potential re-submission of the manuscript:

- In Sect. 2.1, the telescope temperature correction is mentioned without providing references. I propose citing the following articles which describe the correction scheme and its impact on the Aeolus data quality:
  - Weiler, F., Rennie, M., Kanitz, T., Isaksen, L., Checa, E., Kloe, J. D., Okunde, N., and Reitebuch, O.: Correction of wind bias for the lidar on-board Aeolus using telescope temperatures, Atmos. Meas. Tech. 14, 7167–7185, https://doi.org/10.5194/amt-14-7167-2021, 2021.
  - Rennie, M. P., Isaksen, L., Weiler, F., Kloe, J., Kanitz, T., and Reitebuch, O.: The impact of Aeolus wind retrievals in ECMWF global weather forecasts, Q. J. R. Meteorol. Soc., https://doi.org/10.1002/qj.4142, 2021.
- The authors should clarify what is meant by "It should give only a small quality improvement for Aeolus wind products" (p.5, l. 12) – the change in the update rate of the AUX_TEL or the implementation of the telescope temperature correction? Both measures have improved the global average wind bias, while the latter one had a much higher impact.
- The information on the deployed radiosondes provided in Sect. 2.2 is too sparse to evaluate the validation capabilities of the acquired wind data used for the comparisons. In particular, the authors should add details on the vertical resolution and accuracy.
- The authors often use the term "similar" when discussing the results of the wind comparisons, particularly in Sect. 3.3. These qualitative statements should be substantiated with numbers. In this context, Fig. 8 is also only of qualitative nature and does not allow conclusions to be drawn. I suggest to plot the wind speed differences versus latitude instead.
- Page 15, l. 16: The mean difference of the Rayleigh-clear winds compared to the radiosondes should read "0.19±0.71 (0.13±1.01) m/s" in accordance with Fig. S7.
- I strongly suggest to add a summarizing table which provides an overview of the statistical results from the comparisons of the different datasets, periods, ascending/descending orbits.
- In Sect. 4, the authors compare their results with previous studies which reported much higher systematic errors of the Rayleigh-clear and Mie-cloudy winds. However, an explanation for these discrepancies is not given. The authors should consider that previous studies were based on preliminary Aeolus data, whereas they validated re-

processed data from baseline 10 which, most importantly, includes the telescope temperature correction which strongly reduces the wind biases. This should be clarified.