Atmospheric Measurement Techniques Discussions

Atmos. Meas. Tech. Discuss., referee comment RC2
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Comment on amt-2022-63

Anonymous Referee #2

Referee comment on "Evaluation of Aeolus L2B wind product with wind profiling radar measurements and numerical weather prediction model equivalents over Australia" by Haichen Zuo et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2022-63-RC2, 2022

Since 22 August 2018, ESA's wind satellite Aeolus is circling the Earth at around 320 km altitude and capturing global wind profiles with its Doppler wind lidar ALADIN. To further improve the data quality and to use Aeolus observations in NWP models, the systematic and random errors must be understood. Besides global validations by means of NWP model comparison also regional/local validations with independent ground-based or in-situ reference measurements were already performed in several studies. This manuscript focuses on the validation of Aeolus wind measurements in the Australian domain with wind profiling radars as well as NWP model data and thus provides a useful contribution to the ongoing Aeouls Cal/Val activities.

The manuscript is well structured and written, presenting the obtained results with adequate figures. The paper deserves publication after some minor revisions.

General comments

- For quality control, error estimate thresholds of 8 m/s for Rayleigh-clear and 4 m/s for Mie-cloudy winds are applied. Did you try other values and check how this affects the number of data points and the determined random and systematic error of Aeolus wind measurements?
- A horizontal collocation radius of 75 km around the WPR sites was chosen. This is rather strict compared to other validation studies and recommendations which applied at least 100 km. The mentioned paper (Zhang et al.) focuses on aerosol comparison in the PBL were it can be quite variable. For wind this must not be the case. Did you try to increase the radius to a larger value (100 km or even higher) to check if this could

improve the statistics by using more data points?
- Have the authors included the random errors of the WPR measurements as well as an estimate of the representativeness error in the determination of the Aeolus wind observation errors? Otherwise the determined random error of Aeolus would be a combination of different errors. Or can this be assessed from the triple collocation?
- Range bin thickness has an influence on the random error especially for Rayleigh wind measurements. Although the altitude dependence of the random and systematic errors was investigated, this was not mentioned or analyzed. The applied regrouping as well as the different range bin setting for tropics and extratropics covered by the domain hide this fact. It would be interesting to show this in the analysis, for example by separating the two different range bin settings areas.

Specific comments

- L.14: Please include the data set time period in the abstract in addition to the baseline.
- L.37: You could cite the ADM-Aeolus Science Report here (https://www.esa.int/About_Us/ESA_Publications/ESA_SP-1311_i_ADM-Aeolus_i)
- L.56: Change to Rayleigh-clear to be consistent
- L.104: Please specify the latitude regions for both settings (30 deg S) to see which sites are affected by which range bin settings
- L.115: Change to WPR
- L.160: How was the temporal collocation performed for WPR-comparisons? These have 30 min resolution. Did you average consecutive WPR-profiles?
- L.180: On what is the spacing of these new groups based?
- L.195 Table 2: Where do the 90 km come from? You mentioned 3 seconds temporal resolution corresponding to about 21 km above.
- L.238: Change to WPR
- L.239: large -> larger
- L.246 Fig.4: plot axes could be made symmetrical; change desending to descending (also in Appendix)
- L.262: As pointed out above, range bin thickness has an influence on the random error especially for Rayleigh-clear observations. This should be mentioned here.
- L.270 Fig.5c: Do you have an idea why there is a larger bias between 6 and 7.5 km?
- L.290 Table 6: second Var(u) --> Var(v)
  L.290 Table 6: Does the wind variability has influence on the representativeness (random error) of Aeolus observations? For example, did you try to exclude times where the variability is high? Is the variability changing for ascending and descending orbits? (more convection for ascending orbits)
- L.306: Why only at 5 km over such a long time period? What is the reason for this peak?
- L.311: Smaller range bin thickness in the PBL region could also contribute to higher random errors
- L.349: Please shortly summarize the improvements of these processor updates (non-linearities are already mentioned in the Appendix...). Are only Mie-cloudy observations affected or also Rayleigh-clear?