Comment on amt-2022-63

Anonymous Referee #1

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-RC1, 2022

We appreciate the constructive comments and suggestions by the reviewer, which are valuable for us to improve the study and the manuscript. All comments and concerns have been addressed item by item. The responses are highlighted in blue, and the changes are in orange below. Changes are also made within the manuscript accordingly.

General Comments

Overall well presented and useful comparison of Aeolus / wind profiles / NWP wind measurements

Response: We are pleased to hear these positive comments.

Specific Comments :

Bias' is discussed in several places (e.g. Line 59 / Sect. 3.1, Table 3) but no confidence limits are given for these biases. This makes it impossible to understand if they are significant or if differences between 'bias' in different cases are significant. Please add confidence limits for the biases.

Response: Thank you very much for this suggestion. We have added the confidence limits for biases in Table 3. We also added a table (Table A1) in Appendix A to show the confidence limits for biases of corrected Mie-cloudy winds in the revised manuscript. The confidence limits are defined at a 95% confidence interval. Since the distributions of wind differences are not always Gaussian, confidence limits are estimated by using the bootstrap method.

Table 1 (Table 3). Results of intercomparison with ground-based WPR measurements.

	Orbit	BIAS [m s^{-1}]	SD [m s^{-1}]	Scaled MAD [m s^{-1}]	R	N
Rayleigh	All	-0.48 [-0.86, -0.09]	6.22	5.81	0.92	1011
	Ascending	-0.06 [-0.73, 0.61]	6.59	5.76	0.89	368
	Descending	-0.71 [-1.18, -0.26]	5.99	5.73	0.88	643
Mie	All	0.69 [0.08, 1.33]	4.77	4.14	0.90	224
	Ascending	1.35 [0.57, 2.19]	4.76	4.11	0.86	132
	Descending	-0.24 [-1.23, 0.67]	4.64	3.63	0.90	92

Table 2 (Table A1). Results of intercomparison with ground-based WPR measurements for corrected Mie-cloudy winds.

	Orbit	BIAS [m s^{-1}]	SD [m s^{-1}]	Scaled MAD [m s^{-1}]	R	N
Corr. Mie	All	0.67 [0.03, 1.31]	4.90	4.10	0.89	227
	Ascending	1.33 [0.52, 2.20]	4.96	4.39	0.85	134
	Descending	-0.29 [-1.28, 0.61]	4.68	3.72	0.90	93

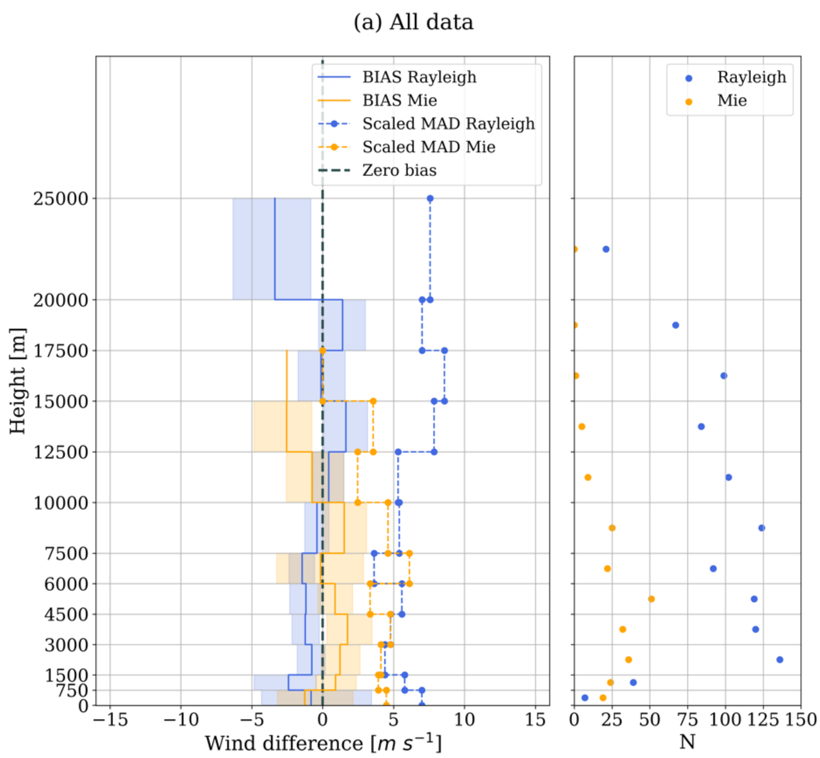
In Figs 5 and A2, Fig. 5. ‘uncertainty’ in bias for different height bins is shown by shaded areas - these look surprisingly small given the very low number of samples in the height bins in many cases. How is ‘uncertainty’ defined ? 95% confidence limits or something else ?

Response: Thank you for these questions. The uncertainty was defined in Eq.(6) in the original manuscript.

$$Uncertainty = \frac{SD}{\sqrt{N}} \tag{6}$$

where SD is the standard deviation of the biases with degrees of freedom of N-1, and N is the size of match-up samples. When there is only one match-up sample in a height bin, we did not calculate its uncertainty. This is why in some cases, the shading areas look extremely small.

In the revised manuscript, we re-defined the uncertainty (confidence limits) of biases at a 95% confidence interval, which was estimated by using the bootstrap method when the sample size is larger than 2. We re-generated all related plots, which can be seen in Figures 5 and 6 and Figures A2 and A3 in the revised manuscript.



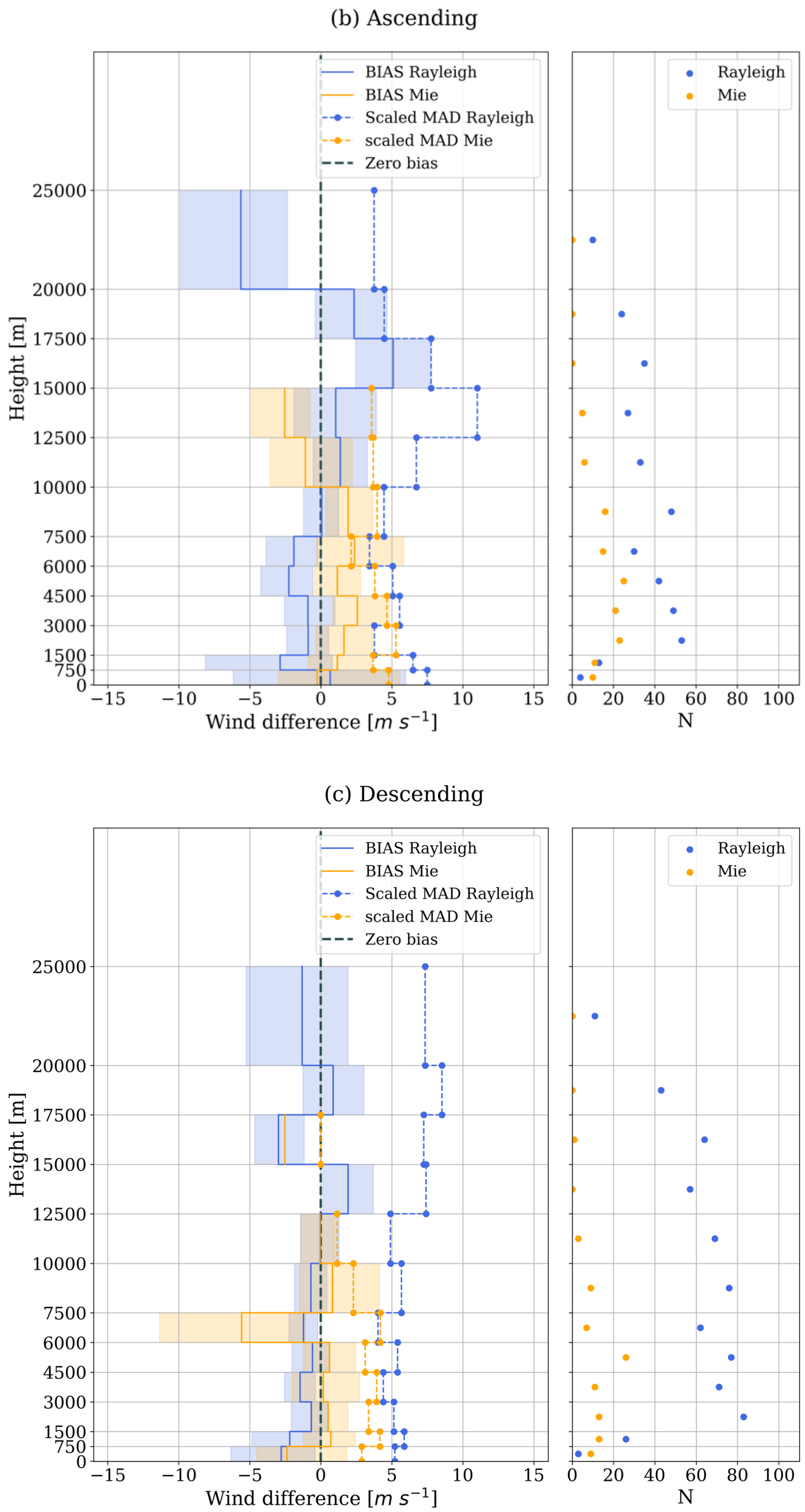


Figure 1 (Figure 1). Wind differences (Aeolus-WPR) with height for (a) all data, (b) ascending orbits and (c) descending orbits. Left: BIAS and scaled MAD of wind differences as a function of height with shading areas representing the uncertainty. Right: the number of available match-ups at each height. Blue and orange colours indicate the results for the Rayleigh and Mie channels, respectively.

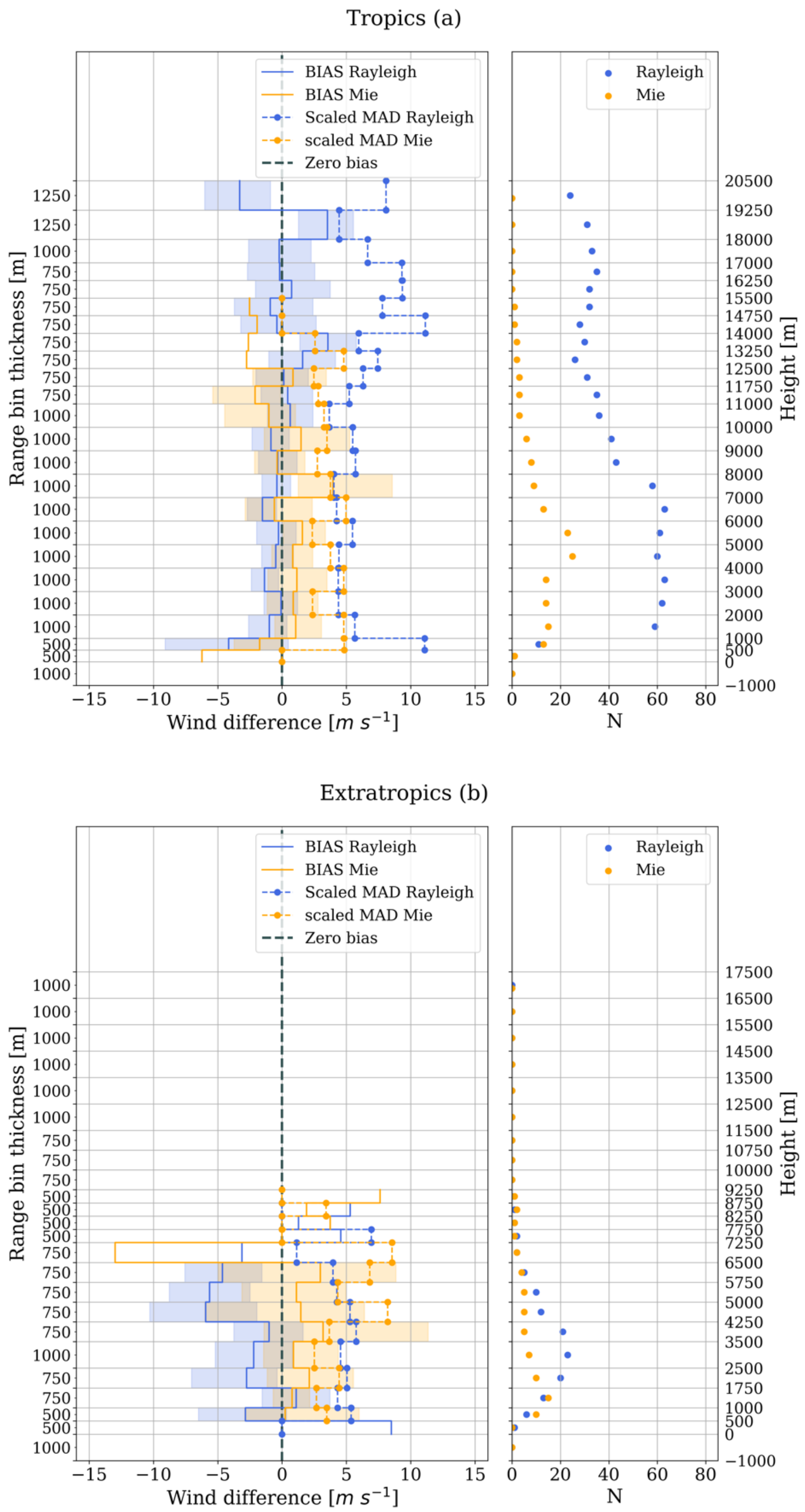
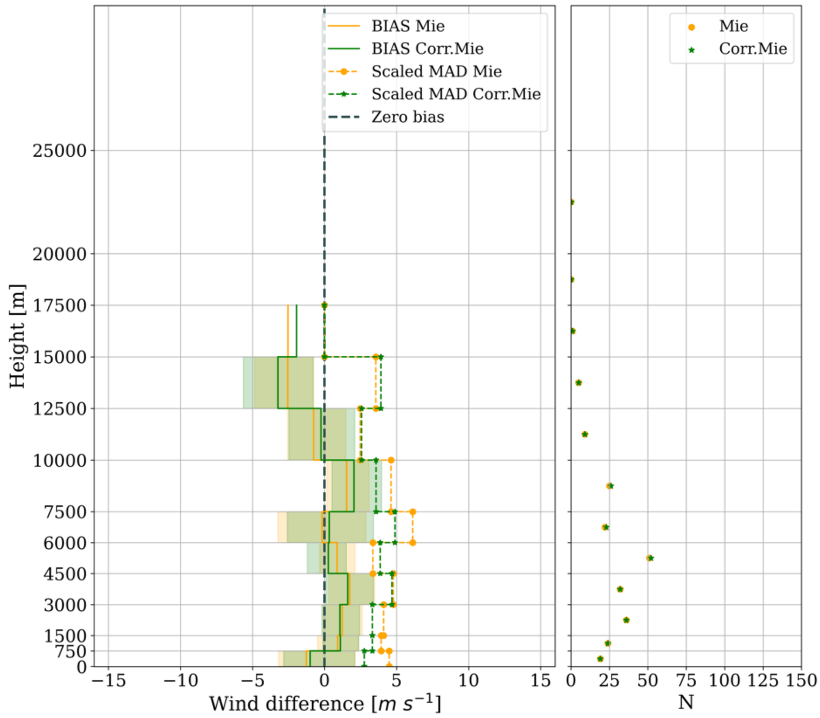
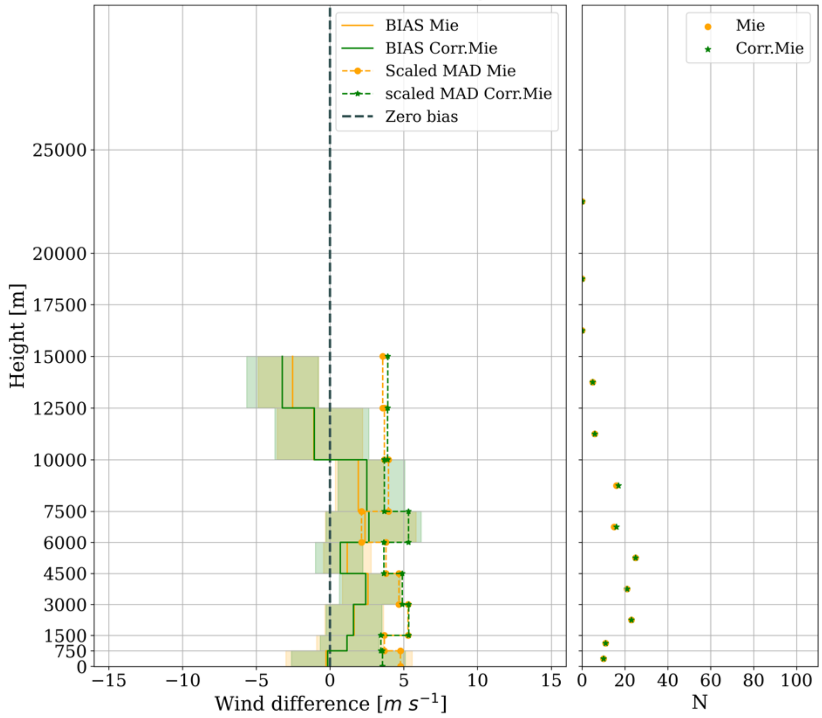


Figure 2 (Figure 2). Wind differences (Aeolus-WPR) with range bins for (a) tropics and (b) extratropics. Left: distributions of BIAS and scaled MAD of wind differences over different range bins with shading areas representing the uncertainty. Right: the number of available match-ups at each range bin. Blue and orange colours indicate the results for the Rayleigh and Mie channels, respectively.

(a) All data



(b) Ascending



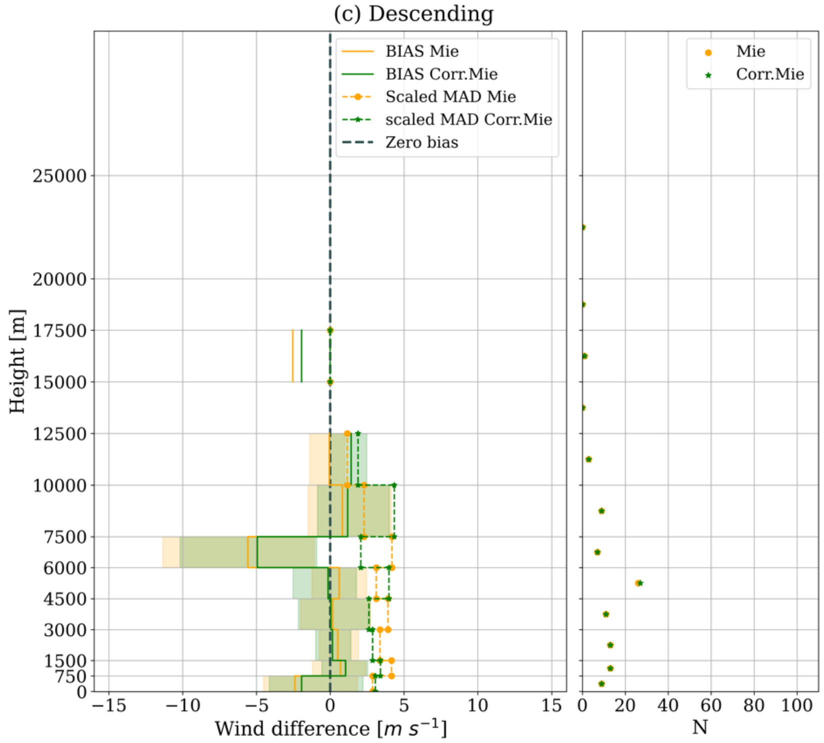
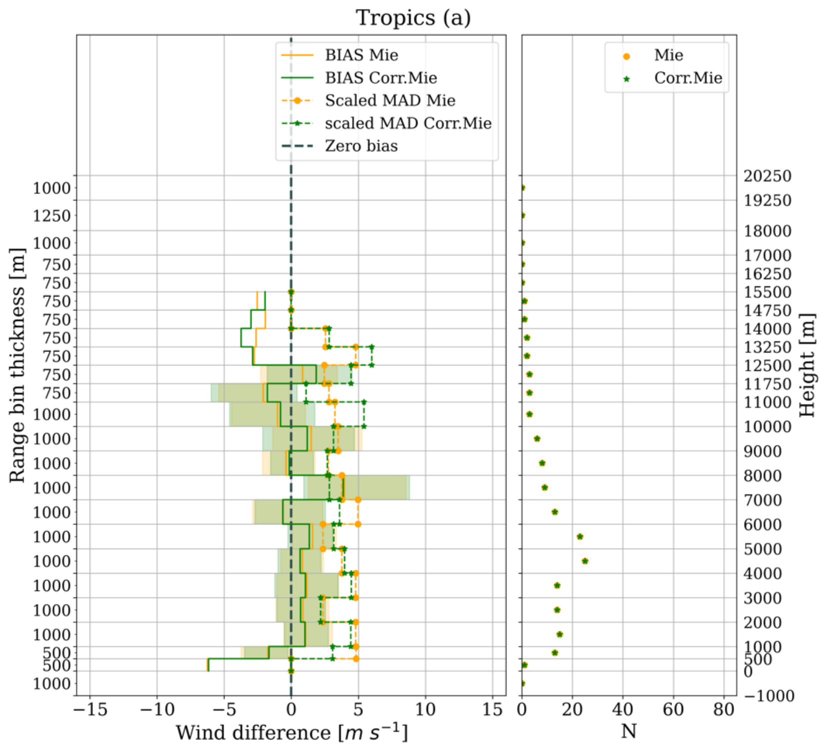


Figure 3 (Figure A1). Wind differences (Aeolus-WPR) with height for (a) all data, (b) ascending orbits and (c) descending orbits. Left: BIAS and scaled MAD of wind differences as a function of height with shading areas representing the uncertainty. Right: the number of available match-ups at each height. Orange and green colours indicate the results for Mie-cloudy and corrected Mie-cloudy winds, respectively.



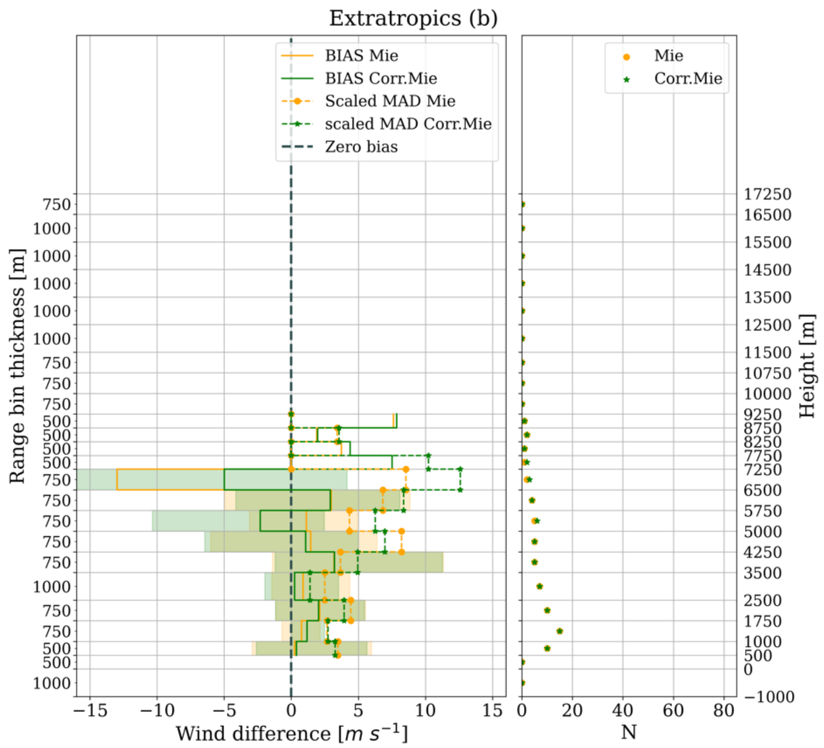


Figure 4 (Figure A3). Wind differences (Aeolus-WPR) with range bins for (a) tropics and (b) extratropics. Left: distributions of BIAS and scaled MAD of wind differences over different range bins with shading areas representing the uncertainty. Right: the number of available match-ups at each range bin. Orange and green colours indicate the results for Mie-cloudy and corrected Mie-cloudy winds, respectively.

The conclusions (Lines 361-364) say : "When comparing with the ground-based radar measurements, no significant biases (absolute mean bias < 0.7 m s^{-1}) and good agreements (R > 0.9) were found for both Rayleigh-clear and Mie-cloudy winds. For the Rayleigh channel, the wind detection during ascending orbits has higher accuracy than during descending orbits, while for the Mie channel, a large bias was obtained during ascending orbit. "

This says first there are 'no significant biases' and then 'a large bias was obtained'. Which is it ? Adding the confidence limits for the biases should help with getting this right.

Response: Thank you for your questions and suggestions. After adding the confidence limits, we have been able to improve the conclusions. The revised text can be seen in the second paragraph in Section 5 of the revised manuscript.

"When comparing with the ground-based radar measurements, no obvious biases (absolute mean bias < 0.7 m s^{-1}) and good agreements (R > 0.9) were found for both Rayleigh-clear and Mie-cloudy winds for all match-up samples, but the bias for Mie-cloudy winds has a larger uncertainty. Moreover, the error characteristics are different between ascending and descending orbits. For the Rayleigh channel, the wind detection during ascending orbits has higher accuracy but larger uncertainty than during descending orbits, while for the Mie channel, larger bias and random error were detected during ascending orbits."

Minor points :

There are numerous small grammar / language errors which are distracting - probably a copy editor can take care of most of these, although any co-authors who are proficient in English should also check.

We are very sorry for these small grammar mistakes. We tried our best to correct them, and the proofreading has been done carefully. We believe now the language is acceptable for publication.

For example : Lines 36-38

“Wind retrievals of ALADIN are based on light scattering by atmospheric molecules and particulates (aerosol, cloud droplets, and ice crystals) which move with the ambient wind and the Doppler effect (Ingmann and Straume, 2016). “ - this says particulates ..move with ... the Doppler effect. It needs changing to

“Wind retrievals of ALADIN are based on light scattering by atmospheric molecules and particulates (aerosol, cloud droplets, and ice crystals), which move with the ambient wind, and on the Doppler effect (Ingmann and Straume, 2016). “

Response: We have corrected the sentence.

In Line 56 “Ray-clear “ is used - everywhere else it is not shortened so it should be “Rayleigh-clear”

Response: We have fixed the error.

Note:

In addition to addressing all concerns from the anonymous reviewers, we re-plotted Figure A2 and added Figure A3 in Appendix A based on the Mie-cloudy winds (rather than Rayleigh-clear winds) and the corrected Mie- cloudy winds, thus making the improvement of Mie winds after correction more detectable.