

Atmos. Meas. Tech. Discuss., referee comment RC1
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Comment on amt-2021-366

Anonymous Referee #1

Referee comment on "Retrieval improvements for the ALADIN Airborne Demonstrator in support of the Aeolus wind product validation" by Oliver Lux et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2021-366-RC1>, 2021

Review of "Retrieval improvements for the ALADIN Airborne Demonstrator in support of the Aeolus wind product validation" by Oliver Lux et al. submitted to Atmospheric Measurement Techniques Discussions.

Summary:

This manuscript describes the improvements made to the ALADIN Airborne Demonstrator (A2D) instrument's wind retrieval algorithm for both the Rayleigh and Mie winds. A novel quality control (QC) scheme is implemented to filter Rayleigh wind measurements that are impacted by telescope alignment. This new QC scheme makes some of the data in the near field region (higher altitude) available for the ALADIN wind validation. This is an improvement since all data in the near field region were previously filtered out. Quality of A2D Mie winds are improved by vertically averaging Mie wind results with large bias of opposing sign in adjacent range bins. As a consequence of Fringe skewness, presence of strong scatterers (e.g. clouds) in the range gate overlap region results in winds with opposing sign in those adjacent range bins. The authors very clearly demonstrate the improvement to the retrieved A2D winds with the new retrieval algorithm by comparing them with the concurrent wind measurements made by the 2 um coherent Doppler lidar. Improved applicability of the A2D data for ALADIN winds validation is also shown. These retrieval improvements made to the A2D algorithm also informs potential improvements that could be made for the ALADIN wind retrievals as well as inform future lidar developments especially Doppler lidar using Fabry-Perot and Fizeau interferometers. Overall, the paper is very well written and it should serve as a good reference for future Doppler lidar retrieval algorithm. I recommend this manuscript for publication following the authors addressing my minor comments and edits listed below.

Minor Comments and edits:

QC scheme for the Rayleigh winds is also applied to the Mie winds. This is stated in the paper (line 399-402) but is buried among all the details. While its effect on the Mie winds comparison might be minimal, it does remove 30-60% of data so, I think the authors need to include a statement in the abstract or summary to highlight this.

Please consider adding mean bias (μ), standard deviation (σ) and scaled median absolute deviation (k) symbols to description in text to make it easier for reader to go between figure and text.

There is no details about the ECMWF comparison. Only the results are presented. I think the authors need to provide some details on how ECMWF model data were interpolated for comparison. While it is out of the scope of the paper, have you compared ECMWF and ALADIN winds over the AVATARI region over an extended period to test the significance of the A2D results? Have you compared ECMWF model background winds against 2 um coherent Doppler lidar winds to assess its accuracy? This would be of relevance to results presented in Table 5.

Please consider replacing the phrases "vanishing bias", "wind error vanishes". It just seems like bias magically disappeared. Consider "bias decreases to near zero" or "wind error =0".

Figure 6: Please define wind error. Is it the difference compared to 2 um winds? Please clarify.

Figure 5d, e: Consider using a different color scale for greater readability. Something like Fig 5a. Same with Fig 8d, 8e, 10d, 10e, 12.

Figure 5e: The lines are grey not green as mentioned in the text.

Line 217: Just curious what are range gates # 1, 3, and 5 used for.

Line 405: Define MAD when first used. Also include how scaled MAD is calculated.

Line 451-455: Does this mean the new algorithm artificially smears wind in case of strong

vertical wind gradients?

Line 635: delete "both"