Atmospheric Measurement Techniques Discussions

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Comment on amt-2021-54

Anonymous Referee #2

Referee comment on "Validation of Aeolus winds using ground-based radars in Antarctica and in northern Sweden" by Evgenia Belova et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2021-54-RC2, 2021

This manuscript presents a comparison of Aeolus HLOS wind observations by two ground-based wind profilers in Antarctica and Arctic that takes into account the uncertainty statistics of the collocation observations. It contributes to characterize Aeolus measurements in data sparse regions. This paper therefore is of added value to the community and it is expected that such analysis will be used in future comparisons of Aeolus instrument and impact study for numerical weather prediction in polar area. This work is relevant and timely, considering the spare measurements in polar area. The manuscript is well written, logically organized, and contains clear figures and tables that support the presentation of the analysis. I suggest minor revisions of current manuscript before publication.

Comment / questions:

- The agreement between Aeolus and radar winds is generally very good considering the spatial/temporal differences between two measurements. Some exceptions may need further investigation or discussions if it is not easy to clarify with limited comparisons. For instance, the systematic bias for Mie cloudy wind at MARA for ascending passes in summer. Scattered sunlight from ice-cap in summer can increase the background noise leading to the large random noise but not playing high impact on bias. Other point is why the systematic bias happens for ascending passes? Does the observation angle of the satellite affect it? Aeolus's off-nadir angle and the sun's altitude angle form an angle that approximately matches the incidence and reflection, which is the opposite of the situation when the orbit is descending, causing the sun background light scattered into the telescope to be stronger?
- Figure 4 also shows that the bias descending Rayleigh measurements at MARA is larger

than that of ascending orbit. It would be appreciated to see the analysis in discussion together with Mie winds.

- For ESRAD measurements, there is a larger bias for Mie/ascending/Winter that cannot be easily explained by the above-mentioned reasons. The authors explain a small negative bias for all Rayleigh winds, on average -1 m/s that might be the bias from the systematic offset for ground-base radar. According to P4. L14: "These show a systematic underestimate of wind speed by about 8% in zonal wind and 25% in meridional wind at ESRAD, most likely due to nonrandom noise which cannot be easily removed",
- For Table 2 MARA wind comparison, why the intercept and bias are larger in winter than winds in summer when skylight background is much lower? It is also interested to see the small random error in summer measurement, which is contrary to the above law. Could it be an instrument offset/drift of radar local oscillator due to the extreme low temperature in Antarctic?

Minor points:

Figure 2. It is better to indicate the ascending and descending orbit for Rayleigh wind as well, even though it can be guessed from Mie plots.