Comment on amt-2021-260

Anonymous Referee #1

Referee comment on "Inter-comparison of wind measurements in the atmospheric boundary layer and the lower troposphere with Aeolus and a ground-based coherent Doppler lidar network over China" by Songhua Wu et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2021-260-RC1, 2021

General comments:

Based on one year of simultaneous wind measurements acquired from 17 Doppler wind lidars across China, this manuscript by Wu et al. conducted a comprehensive comparison study against Aeolus wind products. Overall, this topic fits well the AMT. The instruments and data are reliable, and the analysis methods are scientifically sound. In my opinion, the manuscript is well organized except for some typos and grammar errors. The comparison results are of great importance to better understand the performance of Aeolus wind products in China, even though the measurements are obtained from coherent Doppler lidar (with 1550 nm wavelength) over China. However, before the manuscript can be recommended for acceptance for publication, I have several suggestions and comments here that need to be addressed.

Specific comments:

- Section 2.2.2: Line 128 says "The measurement heights selected for comparison are 50 m, 100m." Nevertheless, I only see the comparison results at 50 m in Figure 2. I am curious why not showing the results at 100 m AGL? 2 only compares the wind speed without considering the wind direction. I suggest the authors compare the u-component wind. Also, more details about the site Haiyang and the specification of the mast that is mounted cup anemometers and wind vanes at Haiyang needs to be added.
- My biggest concern is on section 3.2. In this section, the authors proposed an important result that the vertical velocity could impact the HLOS wind velocity retrieval from Aeolus. But there are neither references nor experimental demonstrations here,
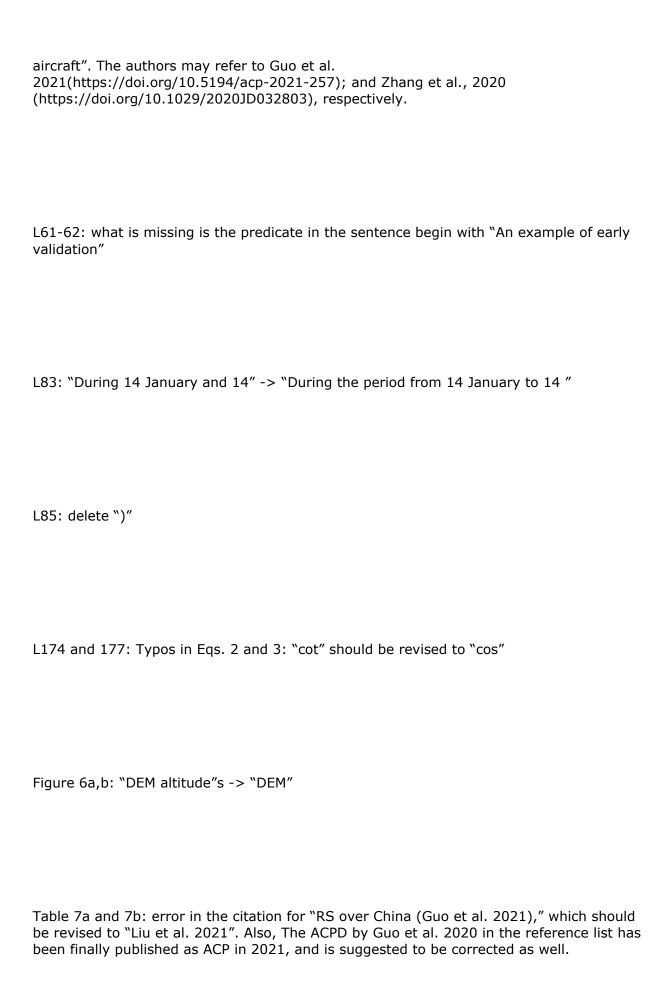
only theoretical derivation. I suggest authors add a result about the deviation of Aeolus and CDL HLOS wind varies with vertical velocity.

- The number of Mie-cloudy comparison pairs and 387 Rayleigh-clear comparison pairs were 52 and 387, respectively. In my opinion, the sample size is too small. Therefore, the significance test must be performed in Fig.10-12.
- L144: "For Aeolus, only observations with the corresponding "validity flag" of TRUE are considered." Please clarify what is the "validity flag" of Aeolus. Similarly, why the estimated errors threshold of Mie-cloudy and Rayleigh-clear wind velocities were set to 4 and 8 m/s? There are neither references nor experimental demonstrations here.
- 3 needs to be modified. In the case studies, the HLOS wind and vertical correction HLOS wind from CDL are both used to compare with Aeolus HLOS wind. It needs to express the data matching process in a clearer way.
- What conclusions should the reader make from Fig. 6. It is just an observation case by Aeolus and CDL. I suggest that the author remove this picture, or draw the wind profiles that needs to be compared.
- If my understanding is correct, Figs. 7 and 8 should be the case comparison. What do the error bars on the red and blue curves mean?

Technical corrections:

L18: "atmospheric boundary layer" and "planetary boundary layer" appear several times in this MS, if both have the same meaning, just keeping one expressing is more appropriate.

L27-28: It is not appropriate to say "better than" when describing MAD and bias.

L41-42: the second and third"from" are redundant and can be dropped. Reference supports are needed for the statement "wind profiles from global radiosonde network and

aircraft". The authors may refer to Guo et al. 2021(https://doi.org/10.5194/acp-2021-257); and Zhang et al., 2020 (https://doi.org/10.1029/2020JD032803), respectively.

L61-62: what is missing is the predicate in the sentence begin with "An example of early validation"

L83: "During 14 January and 14" -> "During the period from 14 January to 14 "

L85: delete ")"

L174 and 177: Typos in Eqs. 2 and 3: "cot" should be revised to "cos"

Figure 6a,b: "DEM altitude"s -> "DEM"

Table 7a and 7b: error in the citation for "RS over China (Guo et al. 2021)," which should be revised to "Liu et al. 2021". Also, The ACPD by Guo et al. 2020 in the reference list has been finally published as ACP in 2021, and is suggested to be corrected as well.

L332: grammar errors in "by used with" and needs to be corrected.

L341: "By" -> "Using"

L364: the article "the" is missing before "planetary boundary layer"

L364-365: The two sentence can be rephrased as "In the planetary boundary layer, the vertical velocity from convection and turbulence could influence the comparison, due to the impact of vertical velocity on the HLOS wind velocity retrieval from Aeolus."