

Dear Editors and Reviewers:

Thank you very much for your careful review and valuable suggestions with regard to our manuscript “Comparisons and quality control of wind observations in a mountainous city using wind profile radar and the Aeolus satellite” (Manuscript Number: amt-2023-152). The comments are helpful for revising and improving our paper. We have carefully studied these comments and made changes in the manuscript according to reviewers’ comments. The main corrections in the manuscript and responses to the reviewer’ comments are listed as follows, and also shown in the pdf file “amt-2023-152-revised-manuscript.pdf”. Besides, revision records can be found in the pdf file with revisions mode named “amt-2023-152-revised_manuscript_with_marks.pdf”.

Reviewer #1:

General comments

This study conducted data verification and quality control on wind profile radar and Aeolus wind products, trying to enrich the available wind observations in regions with complex regions. This kind of study is needed to provide more reliable wind observations for both related mechanistic studies and assimilation applications in numerical weather prediction. Generally, this work is quite meaningful and informative. Most results are pretty valuable to atmospheric measurement studies. I would recommend its acceptance for publication after some necessary revisions.

Response: We would like to thank the reviewer for the valuable and affirmative comments of our manuscript.

Specific comments

1. Line 85: “determining the movement of atmospheric components”, what determining the movement of atmospheric components? Please reorganize this sentence.

Response: Thanks for the careful suggestion. To make it clearer, we have reorganized this sentence as: “Owing to the unique terrain, the mechanism of extreme weather and movement of atmospheric components are intricate and complex”. Please see Lines 84-85 in the revised manuscript.

2. In “2.1 Data”, the location of wind profile radar, radiosonde station, and Aeolus tracks used in this study should be showed in a figure.

Response: Thanks for this suggestion. We have added Figure 1 to show the location of ground-based observation stations and Aeolus tracks, and rearranged the order of Figure 2-8. Please see figures in the revised manuscript.

3. Line 112: “Radar can operate almost automatically” should be “Radars can operate almost automatically”, as there are two radars.

Response: We are sorry for this clerical error and have made modification in Line 112 in the revised manuscript.

4. In “2.2 Methods”, The number labels of equations are missing in this manuscript. Please add the labels, so that the readers could find corresponding equations.

Response: We are sorry for the neglect and have added labels for Equation 1-7 in “2.2 Methods” of the revised manuscript.

5. In Table 1: how do the authors get these extreme climate wind values?

Response: Thanks for this comment. We get these extreme climate wind values referring to Zuo(2020). The detail of the reference is as below:

Zuo Q. M.S. 2020. Research on Quality Control Methods and Assimilation Application of Wind Profiler Radar Data. Nanjing: Nanjing University of Information Science and Technology.

We have added this reference in Line 173-174 when first mentioning the table and in Line 567-568 of the Reference part in the revised manuscript.

6. The resolutions of figures in this manuscript should be improved, especially for the label and legends.

Response: We appreciate this suggestion and feel sorry for the inconvenience in reading. We have re-plotted the figures in the revised manuscript. Please see figures in the revised manuscript.

7. In Figure 2, the red scatter plots and blue ones overlap to a great extent, not very clearly expressing relationships between data. The readers may want some objective statistical data on the figure, like the correlation coefficient, which could be more intuitive to illustrate the relationships.

Response: We are appreciated for this comment. We agree that the red scatter plots and blue ones overlap to a great extent that does not clearly express relationships between data. To show readers the objective statistical data of the figure and make it more intuitive to illustrate the relationships, we have added correlation coefficient in both sub-figures. Please see Figure 4 in the revised manuscript.

8. In 3.1, the authors should provide more in-depth analysis for data verification during different weather conditions, because as far as we know, wind profile radar observations may be influenced

largely by the weather, rainy or not.

Response: Thanks for the valuable comment. To clarify influences of weather on wind profile radar observation quality, we added Figure 3 that includes scatter plots and vertical distribution of statistical parameters for WPR versus RS during rainy days and no rainy days. Between 1.5 and 4.5 km, WPR deviations during rainy days exceeded a little that without rain, and the RMSE and MB between WPR and RS were slightly smaller during rainy days than that without rain below 1.5km and above 4.5km. The correlation coefficient between WPR and RS with rain was a bit lower than that without rain. Generally speaking, precipitation could affect WPR observation quality, but the deviation distributions were overall the same during rainy and no rainy days, with slight differences on different layers. For details, please see Figure 3 and the corresponding descriptions in Line 242-251 of the manuscript.

9. Line 213: “which drift more than 10 kilometers away from the releasing station”, the RS air balls may not always drift more than 10 kilometers away, but in the high levels with large winds, please modify the expression to make it more suitable.

Response: Thanks for this rigorous comment. We have modified the expression referring to Zeng et al. (2019) as “which can respectively drift as far as 0-90, 2-25 and <10km at 200, 500 and 850hPa away from the releasing station (Zeng et al., 2019)”. Please see Line 233-234 for corresponding description and Line 549-550 for Reference in the revised manuscript.

10. Line 227: “The number of dots ...”? The authors might want to say “large numbers of dot ...”. Please make correction.

Response: We are sorry for this mistake, and have modified the sentence as “large numbers of dots...” in Line 258 of the revised manuscript.

11. Line 324-325: “at a height of 1km, the mean difference between these data was maintained within ± 1 m/s”, but it showed large negative deviations below 1.5 km in the figure.

Response: We are appreciated for this comment. It should be “the mean difference between these data maintained within ± 1 m/s from the heights of 1.5 to 8km”. Please see Line 355-356 of the revised manuscript for corresponding modification.

12. The paper has some strange expressions and grammatical mistakes in writing, which should be corrected. For example, there are some mix uses of tense. On lines 211-213, the first sentence is past tense, but the second sentence is present tense. Please check throughout the manuscript about

this problem.

Response: Thanks for this valuable comments. We used past tense as the first sentence described a specific action, while present tense for the second sentence when it described an objective fact. However, there are some other mistakes in tenses. We have checked throughout the manuscript about this problem. Please see Line 237, 259, 265-266, 280, 295 and 329 of the revised manuscript.

Reviewer #2:

General comments:

The observation of three-dimensional wind is of importance to weather forecast, air quality and renewable energy. The wind fields in complex terrain like Chongqing are affected by a variety of factors and thus difficulty to be simulated or predicted. Ground- and space-based wind measurements, such as wind profiler radar (WPR) and ALADIN onboard Aeolus, provide an unprecedented opportunity to obtain the vertical profile of wind. Nevertheless, the data quality of Aeolus or WPR in Chongqing remains unknown. The authors conducted comparison analysis used one-year worth of WPR, Aeolus and radiosonde measurements, and revealed some interesting phenomena. The data processing methods, as well as the comparison analysis, are basically scientifically sound. The topic fits in the scope of AMT, and this work is worth of publication in AMT after the authors have fully considered the following comments:

Response: We earnestly appreciate for the reviewer's warm work, and have made modifications according to the valuable comments. The details are as below.

Major comments:

1. Apparently, only the wind profile measurements from one WPR station (i.e., Shapingba) is used for verification with Radiosonde observations. If my understanding is right, the comparison analysis between Aeolus and WPR are based on the wind measurements from both WRP stations. But I can not find any descriptions for the WPR at Youyang. For instance, does it have the same frequency? Besides, how far is the WPR station at Youyang from the radiosonde site? the readers are more willing to know the locations of both stations relative to the Aeolus tracks (daytime and nighttime). Therefore, the authors can add one figure in section 2 to illustrate this, and clarify or discuss the potential impact arising from the mismatch of station location.

Response: Thanks for this valuable comment.

First of all, the comparison analysis between Aeolus and WPR is based on Youyang station. According to studies of Zhang et al. (2016) and Guo et al. (2021), Shapingba Station was excluded

for comparison, because its distances to adjacent tracks of Aeolus exceeded 1°. The detail description was given in Line 146-149 in the revised manuscript.

Secondly, for the description of WPR at Youyang, we have followed the suggestion and added some detail description in Section 2.1.1 Ground-based wind profile data. The WPR in Youyang share same temporal and spatial vertical resolution of 5 min and 120 m with Shapingba. And the distance of Youyang from radiosonde site in Shapingba is more than 360 km. Please see Line 111-120 in the revised manuscript.

Finally, we have added Figure 1 to illustrate the locations of both ground-based stations and the Aeolus tracks, with Figure 1 in the revised manuscript. The discussion about the potential impact arising from the mismatch of station location was given in Line 146-152 of the manuscript.

2. Section 2.1.1 and 2.1.2 can be merged, and “Shapingba WPR is located at the same station as RS; therefore, the data verification of WPR wind observations was conducted based on RS data in this study.” can be incorporated to the original section 2.1.2.

Response: We are appreciated for this comment and have followed this suggestion. The original Section 2.1.1 and 2.1.2 have been merged to be Section 2.1.1 Ground-based wind profile data. The description in Section 2.1.1 in the revised manuscript has also been rephrased.

3. Figures: The X-axis and Y-axis scale in Figure 2 can be shortened to better show the details of scatters. For example, both axis can be adjusted to -20 to 40 m/s. Figures 2 – 5: only major ticks in both axes are shown. It is inappropriate for a high-quality figure not to show the minor ticks.

Response: We are thankful for the careful comment. Following this suggestion, we have adjusted the axis in original Figure 2 and added minor ticks in other figures. Please see Figure 3-8 in the revised manuscript.

Minor comments:

Line 12: “vertical wind” can be expanded to “vertical wind profile”

Response: Thanks for this kind remind. We have modified “vertical wind” to “vertical wind profile” in Line 12 of the revised manuscript.

Line 19-20: “Their root-mean-square deviation increased with height but decreased by 3 – 4 km.” is not clear to me. For example, grammar error exists in “decreased by 3 – 4 km.” Besides, I cannot find any figures in this manuscript can support this conclusion, and should be rephrased.

Response: We feel sorry for the unclear expression, and have rephrased this sentence as “Their root-mean-square deviation increased with height, but decreased at heights between 3 and 4 km.”

This conclusion is derived from Figure 6(a) in the revised manuscript, with the blue line illustrating vertical variation of RMSE between RS and the WPR. Please see the Line 19-20 for the rephrased sentence, Figure 6 and the corresponding description in Line 276-279 of the revised manuscript.

Line 27: “between ± 5 m/s” can be revised to “within ± 5 m/s” or “between -5 m/s to 5 m/s”

Response: Thanks for this kind comment. We have revised the expression as “within ± 5 m/s” in Line 27 of revised manuscript.

Line 28-29: Can you please clarify the specific characteristics in “the mean differences” ?? Otherwise, the sentence “the mean differences... below 1.5 km” makes nonsense.

Response: We are sorry for the lack of clarity and have rephrased the expression as “large mean differences of both Rayleigh-clean and Mie-cloudy winds versus WPR winds appeared below 1.5km”. Please see Line 28-29 in the revised manuscript.

Line 30: “, such that” can be modified to “. In this case” or similar expression.

Response: Thank you for the comment. We have followed it in Line 30-31 of the revised manuscript.

Line 31: “large mean differences of 4-8 km” can be rephrased to “Larger mean differences at the height range between 4 to 8 km” .

Response: We are thankful for this comment, and have rephrased the sentence following the suggestion in Line 32 of the revised manuscript.

Line 43-44: “to study” -> “for studying...and predicting extreme weather.”

Response: Thanks for the careful comment. We have modified “to study” to “for studying” in Line 43-44 of the revised manuscript.

Line 33: I wonder the logic behind “influenced by the topography of the Tibetan Plateau.” Chongqing (the elevation is less than 4000 m) is in the southwest China, lying far away from the Tibetan Plateau (TP). Besides, do you have any evidence for the connection between cloud liquid water in the middle troposphere and the topography of Chongqing (not TP)? If not, this conjecture can be deleted.

Response: We are appreciated for the rigorous suggestion and have deleted this expression in Line 33-34 of the revised manuscript.

Line 84: “and three-dimensional spatial structure” can be removed.

Response: We are thankful for the suggestion and have followed it in Line 84 of the revised

manuscript.

Line 103: How about the accuracy of the RS measurement in Chongqing, or China? The authors may refer to the following important papers:

<https://doi.org/10.1007/s00376-010-9170-8>

<https://doi.org/10.5194/acp-16-13309-2016>

<https://doi.org/10.5194/acp-21-17079-2021>

Response: Thank you for the recommendations. Referring to these papers, we have added some description about accuracy of RS measurement in China as:

“Shapingba station belonged to the network of the L-band sounding system by China Meteorological Administration. The operational radiosonde stations in China widely use GTS1 digital radiosonde as key components of L-band sounding system, which have high accuracy within the troposphere in detecting fine resolution profiles of meteorological factors (Bian et al., 2011; Guo et al., 2016; Guo et al., 2021).”

The corresponding references were also added in Reference. Please see Line 106-110, Line 459-461 and 483-491 in the revised manuscript.

Line 104: “Station Shapingba” -> “Shapingba”

Response: Thanks for the careful suggestion. We have made modification in Line 103 of the revised manuscript.

Line 156 and 174: “Where” should be revised to “where” and no indent before “where”

Response: We are sorry for the format errors and have corrected this kind of errors in Line 160, 168 and 187 of the revised manuscript.

Line 213: “which drift more than 10 kilometers away from the releasing station” , the drifting distance of RS balloons depends on the altitude, and this expression can be revised by referring to Figure 2 in Zeng et al. JGR 2019 (<https://doi.org/10.1029/2018JD029109>)

Response: Thanks for the recommendation. We have modified the expression referring to Zeng et al. (2019) as “which can respectively drift as far as 0-90, 2-25 and <10km at 200, 500 and 850hPa away from the releasing station (Zeng et al., 2019)”. Please see in Line 233-234 and 549-552 in the revised manuscript.

Line 67: Is the publication year in “Zhang et al. 2017” supposed to be 2015?

Response: Thanks for the kind remind. We have checked the publication year of the reference and correct it in Line 64 of the revised manuscript.