Atmospheric
Measurement
Techniques

Discussions

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Interactive comment on "Graphics Algorithm for Deriving Atmospheric Boundary Layer Heights from CALIPSO Data" by Boming Liu et al.

Boming Liu et al.

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Dear teacher:

Thank you very much for your guidance and advice. We carefully read your suggestions, and revised the manuscript in accordance with your comments.

1. The reviewer's comment: The biggest concerns of mine is the sounding time for RS is 2000LT, which is roughly 6 hours before the CALIPSO nighttime overpass at Wuhan. The inter-comparison of BLH between CALIPSO and RS (Fig. 9) seems flawed. I guess that the authors hypothesize the PBL does not vary considerable over time during nighttime. At the very least, however, the authors should discuss this issue in detail.

The authors' Answer: Thank you very much for your suggestion and guidance. As your said, due to the time of RS is not matched with the time of CALIPSO, the inter-comparison of BLH between CALIPSO and RS was unreasonable. Another reviewer also pointed out this issue and suggested we delete this comparison. Therefore, we delete the inter-comparison of BLH between CALIPSO and RS to avoid misleading readers. In addition, we increased the inter-comparison of BLH between CALIPSO and Lidar. The horizontal smoothing numbers of 1, 3, 6, 9, 12, and 15 (i.e., 1/3, 1, 2, 3, 4, and 5km in the along-track direction) are add to test the GDM algorithm. It can be seen in P, line (Fig.9).

2. The reviewer's comment: In section 2 or section 3: Clarification for the averaging scheme for CALIPSO profiles by taking various horizontal smoothing number (i.e., 1, 3, 15 and 30) should be added. Also, to make the results more robust, the horizontal smoothing numbers of 1, 3, 6, 9, 12, 15, 18 and 30 (i.e., 1/3, 1, 2, 3, 4, 5, 6 and 10km in the along-track direction) are suggested to take. As a result, Fig. 9 can be expanded to take into account more sensitive results.

The authors' Answer: Thank you very much for your suggestion and guidance. Due to the section 3 was used to describe the process of the GDM algorithm, we did not add the various horizontal smoothing number (i.e., 1, 3, 15 and 30). According to your suggestion, the horizontal smoothing numbers of 1, 3, 6, 9, 12, and 15 (i.e., 1/3, 1, 2, 3, 4, and 5km in the along-track direction) are add to test the GDM algorithm. The new Fig.9 was shown below. Due to the correlation coefficient tends to be stable when the horizontal smoothing numbers was 12 and 15. So we did not analyze the comparison results when the horizontal smoothing numbers was 18 and 30. The modification can be seen in the P6, line37-40 and P7, line 1-6. "Fig. 9 show the correlation coefficients between the BLH derived from CALIPSO and ground-based Lidar under the horizontal smoothing numbers of 1, 3, 6, 9, 12 and 15. The red and blue points represent the BLH calculated by GDM algorithm and MSD method, respectively. Figs. 9a, 9b and 9c show the comparison of BLH between CALIPSO and Lidar under the

horizontal smoothing number of 1, 3 and 6. The correlation coefficients between the BLH derived by GDM algorithm and ground-based Lidar were 0.12, 0.14 and 0.47, respectively. Meanwhile, the correlation coefficients between the BLH derived by MSD method and ground-based Lidar were 0.1, 0.27 and 0.33. Figs. 9d, 9e and 9f show the comparison of BLH between CALIPSO and Lidar under the horizontal smoothing number of 9, 12 and 15. The correlation coefficients between the BLH derived by GDM algorithm and Lidar measurements were both 0.72, and the correlation coefficients between the BLH derived by MSD method and Lidar measurements were 0.54, 0.62 and 0.7, respectively."

3. The reviewer's comment: Page 1 Line 17-24: It will be better to move "The algorithm provided a reliable result when the horizontal smoothing number was greater than 5." Before "This finding indicated...". In addition, what is the logics for the threshold (i.e., 5) of horizontal smooth number claimed here, since you only analyzed the results by assuming "1, 3, 15 and 30" instead of "5". From my understanding, Figs. 7 and 9 are not enough to draw this conclusion, and thus necessary clarification will be necessary.

The authors' Answer: Thank you very much for your suggestion and guidance. According to your suggestion, we move the sentence to the specified location. In addition, we did more experiments and reanalyzed Fig.9. Based on the new results, the GDM algorithm can provide a reliable result when the horizontal smoothing number was greater than 9. Therefore, we modified the descriptions in the P1, line 23-25. "The algorithm provided a reliable result when the horizontal smoothing number was greater than 9. This finding indicated that the proposed algorithm can be applied to the CALIPSO satellite data with 3 and 5 km horizontal resolution."

4. The reviewer's comment: Page 1 Line 28-35: The literature review seems in disorder, which can be improved only be rewriting. For example, the authors emphasized twice the role of BLH in environmental health, but I did not find any references supporting it. On top of this issue, the role of PBL is well recognized to be associated with aerosol pollution, which should be mentioned here. Towards this end, the review paper

by Li et al, 2017 can be cited here.

The authors' Answer: Thank you very much for your suggestion and guidance. According to your suggestion, we rewrite the literature review in the P1, line 30-35. Moreover, the review paper by Li et al, 2017 was add in P1, Line 35. "Therefore, the boundary layer height (BLH) is essential to atmospheric aerosol pollution and must be accurately and continuously monitored (Li et al. 2017)." "Li, Z., Guo, J., Ding, A., Liao, H., Liu, J., Sun, Y., ... & Zhu, B. (2017). Aerosol and boundary-layer interactions and impact on air quality. National Science Review, 4(6), 810-833."

5. The reviewer's comment: Page 2 Line 2: The acronym for "RS" refers to radiosonde? Given its first appearance in this manuscript, its full name should be spelled here.

The authors' Answer: Thank you very much for your suggestion and guidance. In here, the RS refers to radiosonde. According to your suggestion, its full name was given in the P2, line 3.

6. The reviewer's comment: Page 2 Line 7: ...is usually TOO sparse...

The authors' Answer: Thank you very much for your suggestion and guidance. According to your suggestion, we add the "too" in the P2, line 8. "Moreover, the spatial coverage of RS sites is usually too sparse to capture BLH spatial variability."

7. The reviewer's comment: Page 2 Line 10: ...can CONTINOUSLY detect...

The authors' Answer: Thank you very much for your suggestion and guidance. According to your suggestion, we add the "continuously" in the P2, line 11. "Lidar systems can continuously detect the BLH from the aerosol vertical profile."

8. The reviewer's comment: Page 2 Line 28: Guo et al. 2016 only focuses on the BLH retrieval from radiosonde in China rather than that from satellite measurements. This citation can be replaced with Zhang et al. 2016. Accordingly, Guo et al. 2016a can be considered to move to Page Line 7 "(Seibert et al. 2000; Sawyer et al. 2013; Guo et al., 2016a)"

The authors' Answer: Thank you very much for your suggestion and guidance. According to your suggestion, this citation was replaced with Zhang et al. 2016. Moreover, Guo et al. 2016a was moved to P2, Line 1. "(Seibert et al. 2000; Sawyer et al. 2013; Guo et al. 2016a)"

9. The reviewer's comment: Page 3 line 9: Liu et al. 2018a is missing in references. The authors can consider citing the following reference here:

The authors' Answer: Thank you very much for your suggestion and guidance. According to your suggestion, we add the reference in the P3, line 4. "Liu, L., Guo, J., Miao, Y., Li, J., Chen, D., He, J., & Cui, C. (2018c). Elucidating the relationship between aerosol concentration and summertime boundary layer structure in central China. Environmental Pollution, 241, 646-653."

10. The reviewer's comment: Page 3 Line 12: not completely coincide WITH ground-based Lidar station? How about the distance between CALIPSO track and radiosonde site? The track of CALIPSO shown in Fig.1 should be for the nighttime, which deserves clarification.

The authors' Answer: Thank you very much for your suggestion and guidance. About the matching principles of ground-based Lidar and CALIPSO, we have explained it in two aspects. First, the distance between CALIPSO and ground-based Lidar stations is within 50 km. Moreover, the ground-based Lidar data were obtained within 30 min of CALIPSO overpass times. According to your suggestion, we add the descriptions in in the P3, line "7". "About matching principles of ground-based and space-borne Lidar, the distance between CALIPSO and ground-based Lidar stations is within 50 km. Meanwhile, the ground-based Lidar data were obtained within 30 min of CALIPSO overpass times."

11. The reviewer's comment: Page 3 Line 29: Necessary justification is required for the authors only applying nighttime CALIPSO measurements to estimate BLHs. One reason is that there is higher SNR in nighttime relative to daytime SNR (Winker et al.

2009; Guo et al., 2016b).

The authors' Answer: Thank you very much for your suggestion and guidance. As your said, there is higher SNR in nighttime relative to daytime SNR. According to your suggestion, we add some descriptions in the P3, line 28-29. "Due to the nighttime data have a higher SNR relative to daytime data (Winker et al. 2009; Guo et al., 2016b)."

Many grammatical or typographical errors have been revised.

All the lines and pages indicated above are in the revised manuscript. Thank you for the kind advice. Sincerely yours, Boming Liu

Please also note the supplement to this comment:
https://www.atmos-meas-tech-discuss.net/amt-2018-155/amt-2018-155-AC2-supplement.pdf