

Response to Reviewer 1's Comments

Response: We thank the anonymous reviewer for his/her comprehensive evaluation and thoughtful comments. We have addressed the reviewers' concern one by one. For clarity purpose, here we have listed the reviewer' comments in plain font, followed by our response in bold italics.

The manuscript described and inter-compared performances of four methods (PM, RM, GM_{RH}, and GM_θ) which were widely used to estimate PBLH from RS data. In general, the study fit the scope of the journal and the manuscript was well organized. These results shown in the manuscript can be regarded as a useful reference when selecting boundary layer algorithms. Additionally, there are still several points that need to be clarified before it could be considered for acceptance.

Response: Thanks for the reviewer's positive comments on our manuscript.

1. In Abstract section, some sentences are not clear enough between Line 19 and Line 25 of Page 1, such as “PBLH from PM is the lowest under all and SBL classifications, and the highest under CBL and NBL classifications”. Please rephrase or clarify.

Response: We gratefully appreciate for your valuable comment. In Abstract section, we rephrase the following paragraph:

“Results indicate that SBL is dominant at nighttime, whilst CBL dominates at daytime. Under all and SBL classifications, PBLH retrieved by RM is typically higher than those retrieved using the other methods. By the contrary, PBLH result retrieved by PM is the lowest. Under CBL and NBL classifications, PBLH retrieved by PM is the highest. PBLH retrieved by GM_θ and GMRH is relatively low under all classifications. Moreover, the uncertainty analysis shows that the consistency of PBLH retrieved by different algorithms is more than 80% under CBL and NBL classifications. By contrast, the consistency of PBLH is less than 60% under SBL classification.”

2. The study focused on estimating the performances of four PBLH calculation methods. But, in the Introduction section, the description of the advance of the subject (namely, the various comparison and estimation of PBLH methods in existing research) is not sufficient enough.

Response: Per your kind suggestion. We have made a further comparative study on the existing PBLH inversion methods, which have been added to the Introduction section in the revised manuscript.

3. How much data were used in the study obtained from sites of Beijing, Wuhan, Changsha at 0600 UTC? Since the 0600 UTC is afternoon at local, there should be more CBL and NBL cases in these three cities (as shown in Figure 1 and Page 6 Line 1-2).

Response: We gratefully appreciate for your valuable comment. In this study, the RS data of Beijing, Wuhan and Changsha sites at 0600 UTC accounted for 13.17%, 2.15% and 2.16% of the data of their respective sites respectively. The proportion of RS data at 0600 UTC is very small, except at 0600 UTC, where CBL is dominant, and from other times as well as the overall time, SBL is still dominant, as shown in Figure 2.

4. In addition to the TIL, have any additional indicators been added to filter data in order to remove cases under extreme weather conditions? Will the extreme weather, such as rain, snow, fog and storms, impact on the estimation of the boundary layer for RS data?

Response: We gratefully appreciate for your valuable comment. This study focuses on comparing the performance of the retrieval methods. The presence or absence of cloud rejection and some weather extremes do not have a significant impact on the evaluation process in this study, as the evaluation is carried out under the same conditions. Zhang et al. (2020) compared the mean PBLHs under clear and cloudy conditions and found that the diurnal variation of PBLH is stronger under clear conditions than under cloudy conditions, but the trend of PBLH variation was consistent and the difference in PBLH was not significant.

Reference

Zhang, Y., Sun, K., Gao, Z., Pan, Z., Shook, M.A., and Li, D.: Diurnal Climatology of Planetary Boundary Layer Height Over the Contiguous United States Derived From AMDAR and Reanalysis Data, Journal of Geophysical Research: Atmospheres, 125, <https://doi.org/10.1029/2020jd032803>, 2020.

5. Whether the performance estimations and the OP method are affected by geographic location? I noticed that the mean value of PBLH obtained by OP method are lowest or nearly lowest among the four methods in some cities, such as 57494, 57687, 59758, and 59948.

Response: We gratefully appreciate for your valuable comment. The performance estimations and the OP method are valid for all geographic locations. The reason why the mean value of PBLH obtained by OP method are lowest or nearly lowest among the four methods in some cities is that in OP method, when TIL is present, the height of the temperature inversion top is defined as PBLH, but the other four methods do not take TIL into account. The PBLH of TIL is generally low, and the proportion of TIL in each time period is relatively large in the four cities of 57494, 57687, 59758 and 59948, as shown in Figure 2.

6. It is better to add a flow chart for the OP method as described in section of 3.4.

Response: Per your kind suggestion. We show a flow chart of OP method, as shown below. Due to this process is very simple, we did not add a picture in the paper.

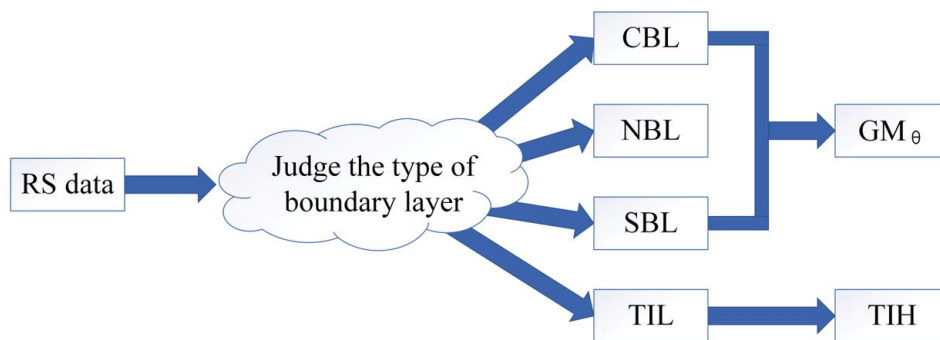


Figure S1. Flow chart of OP method.