

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

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Dear D. Philips:

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 author claimed that they use nighttime data of CALIPSO (0210LT), and calculate the BLH from RS following Liu and Liang (2010). Based on Liu and Liang’s paper, the majority of BLHs at 0200 LT is less than 500m (such results from 14 major field campaigns). Nonetheless, in this study, the BLHs at 0210LT from CALIPSO and Lidar are all above 500m (mostly higher than 1km).

The authors’ Answer: Thank you very much for your suggestion and guidance. As your

said, the nocturnal boundary layer height retrieved from RS should be less than 500m. It is due to the RS define the top of the inversion layer as the boundary layer height. In the nighttime, the structure of boundary layer is divided into a stable layer and a residual layer. The top of the inversion layer was close to the top of stable layer. But the Lidar system obtained the boundary layer height based on the aerosol scattering profile. If the aerosol loading in the residual layer is large, the top of residual layer would be identified as the boundary layer height by Lidar. After our experiment, we found that the CALIPSO system was hard to identify the top of stable layer in nighttime. Therefore, the top of residual layer was defined as the boundary layer height in CALIPSO and Lidar system. It leads to that the BLHs from CALIPSO and Lidar are all above 500m. About this question, more details would be added in the 3.2 section (Error analysis) to avoid misleading readers. Meanwhile, overcoming the effect of the residual layer on CALIPSO is our future work.

2. The reviewer's comment: This study shows that the R2 between the BLHs from CALIPSO at 0210LT and RS at 2000LT is 0.59 (i.e. Figure 9). As we known, the BLH has strong diurnal variances, and the BLHs at 2000LT (previous day) and 0200LT should have considerable differences. Although I am not sure about CALIPSO's performance, the R2 of 0.59 (R=0.77) between the BLHs at 2000LT and 0210LT may be questionable.

The authors' Answer: Thank you very much for your suggestion and guidance. About this point, we agree with your viewpoint that the correlation coefficient between the BLHs at 2000LT and 0210LT may be questionable. Due to the BLHs from CALIPSO at 0210LT was the top of residual layer, but the BLHs from RS at 2000LT was the top of inversion layer, which indicated the top of mixing layer in daytime. The high correlation coefficient between them could be a coincidence. Moreover, we have mentioned in the study that "Due to the mismatched time of RS data, the BLH estimated from RS measurements data cannot be regarded as 'truth'; thus, the estimated BLH is jointly used with the ground-based Lidar for validating CALIPSO results." Therefore, this compari-

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son is just a reference. If necessary, we would choose to compare with the RS data at 0800LT (indicated the top of stable layer in nighttime), or not compare with the RS data to avoid misleading readers.

3. The reviewer's comment: The authors claimed that the cycle time of CALIPSO is 16 days with removals of cloud cases. Given that the night cloud fraction is $\sim 60\%$ over central China (King et al., 2013), the available CALIPSO sampling for matching Lidar is limited. The author should describe the continuous observation period for Lidar, which may be longer than 2-year.

The authors' Answer: Thank you very much for your suggestion and guidance. I am very sorry that we did not describe clearly the time of data. The data collection time was from January 2013 to December 2017, which was only mentioned in the Conclusions. During this time, the total number of CALIPSO crossing Wuhan were 93. After removing the cloud cases, there were 49 valid samples. Moreover, the number of the ground-based Lidar and RS data matching CALIPSO data were 21 and 49, respectively. According to your suggestion, the descriptions about continuous observation period for Lidar and CALIPSO were added in the 2.2 and 2.3 sections.

All the lines and pages indicated above are in the revised manuscript. Thank you for the kind advice.

Sincerely

yours,

Boming Liu

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