

The article presented a new approach combining gradient method and cluster analysis to distinguish multi-layers (i.e., the cloud layer, the evaluated aerosol layer, and the noise layer) and therefore retrieving NBLH based on lidar data. More information about such layers can also be obtained by the K-mean cluster analysis. However, the writing of the article needs to be further improved. And some doubts about your work are as follows:

1) Figure 2 should be described clearly. Is the red solid line the lidar signal profile averaged every 1h in figure 2(a)? And I'm confused about the weighted altitudes in figure 2(b), is hw equals h (the real height) minus h_{min} ? If yes, the maximum of hw is obviously lower than 1000 m, why a point exist higher than 1000 m in your figure?

2) Line145: "a dataset of three gradient minima of RCS". Do you mean three gradient minima of RCS at every 50 s within 1h are chosen to have a k-means cluster analysis?

3) From table 3, the altitude of NBL is always lower than that of EALs, Cloud, and Noise layers, so is there a simple top limiter works?

4) The word "starfield" appears many times in the article. Do you mean "stratified"? Please confirm it.

5) From figure 7-2 (c), the NBLH between 21:00 to 22:00 LST is about 640 m (hc_{center}). However, from Figure 7-1, the NBLH of that time period is much higher, why?

6) In your CA-GM algorithm, the cluster number is set as two in prior, that is, except NBL, assume that there is only one layer exist above NBL. So what if two or more layers (EALs, cloud layer, or noise layer) exist above NBLH? Besides, I'm concerned that if there is no EALs, cloud layer, or noise layer, does the cluster method affect the NBLH retrieval? Are the NBLHs from the CA-GM similar to that from the GM?

7) Lines 40-53: the authors have clarified some BLH retrieval methods; however, more previous evaluation works should be cited here, for example: McGrath-Spangler et al., 2012, Li et al., 2017. McGrath-Spangler, E. L., and A. S. Denning (2012), Estimates of North American summertime planetary boundary layer depths derived from space-borne lidar, *J. Geophys. Res.*, 117, D15101, doi: 10.1029/2012JD017615.

H Li, Y Yang*, X-M Hu, Z Huang, G Wang, B Zhang, T Zhang (2017), Evaluation of retrieval methods of daytime convective boundary layer height based on Lidar data, *J. Geophys. Res. Atmos.*, 122, doi: 10.1002/2016JD025620.

Meanwhile, there are some studies have worked to detect cloud or aerosol layers based on lidar data, like Winker et al., 1994, Wang et al., 2001, Li et al., 2017, Dang et al., 2019, should also be cited here, and explain why your work is needed compared to the others'.

Winker, D.M.; Vaughan, M.A. Vertical distribution of clouds over Hampton, Virginia, observed by lidar under the ECLIPS and FIRE ETO programs. *Atmos. Res.*, 1994, 34, 117–133.

Wang, Z.; Sassen, K. Cloud type and macrophysical property retrieval using multiple remote sensors. *J. of Appl. Meteorol.*, 2001, 40, 1665–1683.

H Li, Y Yang*, X-M Hu, Z Huang, G Wang, B Zhang. Application of Convective Condensation Level Limiter in Convective Boundary Layer Height Retrieval Based on Lidar Data. *Atmosphere*, 2017, 8, 79, doi: 10.3390/atmos8040079.

Dang, R., Yang, Y., Li, H., Hu, X.-M., Wang, Z., Huang, Z., Zhou, T. and Zhang, T.: *Atmosphere*

Boundary Layer Height (ABLH) Determination under Multiple-Layer Conditions Using Micro-Pulse Lidar, Remote Sensing, 11(3), 263, doi:10.3390/rs11030263, 2019.

Also, some minor revisions as follows:

Line 23: Change "continues" to "continuous".

Line 30: Change "on observation" to "based on various observations".

Line 34: coefficient between what?

Lines 51-52: The sentence is difficult to understand.

Line 55: The fluctuation of NBLH, such statement is not completed.

Line 63: Delete "in the experiment".

Line 87: the value of turbulence? Such statement is incorrect.

Line 127: Change "the noise from the GM" to "the NBLH from the GM".

Line 148: Please explain D_{sig} here.

Line 281: Change "influence " to "influencing".