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Discussions

Interactive comment on "A novel Mie lidar gradient cluster analysis method of nocturnal boundary layer detection during air pollution episodes" *by* Yingchao Zhang et al.

Anonymous Referee #3

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General comments:

The manuscript "A novel Mie lidar gradient cluster analysis method of nocturnal boundary layer detection during air pollution episodes" presented a new algorithm to retrieve the nocturnal boundary layer height (NBLH), based on cluster analysis of gradient method, using 39 days lidar observations. The radiosonde data were used to evaluate its performance of NBLH retrieval, and results show that the presented algorithm had a better agreement than the other 3 methods (GM, WCT, CRGM). A comparison of this new methods with the other 3 methods were also analysed and discussed, using a 256 hours data set.

C1

The presented method is promising for improving the NBLH retrieval, and results look interesting. However, I don't think the current form can clearly deliver the information, and a number of point must be clarified. Major changes are needed, and the writing of the paper must be improved, before the manuscript can be considered for publication. Please see my comments below.

Specific comments:

1. The presented method can only be applied for the BIT-lidar or can be used for other elastic lidars? Why you used "Mie lidar" in the title? I think this method is not only valid for Mie lidar. The conditions/constraints of using such method should be discussed.

In this study, the raw data resolution is used to get a high time & vertical resolution, any comparison with other methods? Have you used any vertical smoothing? What is the final time & vertical resolution? If reader want to apply this method to another lidar system, what's the limitation? Some discussions are need.

2. No uncertainty/error study is presented. Such information should be added.

3. The description of methodology is not clear, please revise it.

L88, explain more about the assumption.

Fig2, add legend for red line, grey lines, colour circles etc. are GM peaks from the red line? More description needed.

L122, "three minima peaks", and L145 "three gradient minima", do they refer to the same information? Please clarify which minima criterion you used, the 3 minima gradient values of RCS? Or the peaks with minima values? You can also add these minima by the markers in figure 2.

L144, describe more about the reference height.

Fig4, you can put all other methods using different colour/marker.

C2

L225, Are you sure it is a cloud layer? RCS looks very weak for this layer. It could be a lofted aerosol layer. If it is not a cloud layer, another case should be presented in this section.

Technical corrections:

L12, 39 days is not a "long-term", maybe another expression.

L32-33, rephrase the sentence.

L67, provide the vertical resolution of radiosonde.

L73, add "gradient" for PTG

L76, is BIT-lidar rotational Raman–Mie lidar, but in this study you only use the elastic channel?

L79, after the overlap correction, what's the lower limit for BIT-lidar?

L89, NBL top. Add "top" here.

L115, change hw to hnor

L127, "the noise . . . be affected" do you mean the accuracy can be affected.

L130, add "layers" for EALs.

L170, what do you means here "with all algorithm"?

L206, any value for this "low SNR condition"?

L208, please specify which "improvement".

L282, "was automatics developed"?

L283, "high time resolution", please specify it. is it equal to the lidar vertical resolution?