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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Technical note: Boundary layer height determination from Lidar for improving air pollution episode modelling: development of new algorithm and evaluation" *by* Ting Yang et al.

Anonymous Referee #1

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Review of "Boundary layer height determination from Lidar for improving air pollution episode modelling: development of new algorithm and evaluation" by Ting Yang et al.

The boundary layer height (BLH) is one of the most important parameters in studying atmospheric boundary-layer problems. Measuring and determining the BLH are crucially important for predicting vertical exchange and transportation of air pollution. Lidar can be used to monitor the temporal and spatial variations of BLH over urban areas. However, the existing BLH retrieval algorithms are still limited due to the complexity of atmosphere conditions. This study presents a new algorithm based on gravity

wave theory to determine the BLH from Lidar and intercompare it with three existing algorithms. The result shows that the new algorithm has better performance than other three, especially for polluted episodes. This study will contribute to improve the accuracy of air quality modelling and forecasting systems. The quality of this manuscript can be improved (as detailed below). I recommend the publication of this paper in ACP after the following comments are properly addressed.

Major comments (1) The authors stated that the existing retrieval algorithms are only suitable to deal with the aerosol profiles like the "textbook" boundary layer development and the new one can be considered as a robust technique for BLH determination by Lidar. However, all the samples of aerosol vertical distribution presented in this manuscript are monotonous decrease of RSCS with increase altitude. In fact, the multi-layer aerosol structure is common in the ambient atmosphere, especially for polluted episodes when the long-distance transportation of aerosol pollutants is suspended in the low troposphere and entrained into PBL by vertical mixture process. In addition, the residual layer will usually appear in afternoon till midnight due to lacking turbulence driving force from ground heating, which will also entangle the aerosol vertical distribution. This multi-layer aerosol structure is just the difficulty and emphasis for BLH retrieval from Lidar profiles, just like the impact of cloud in BLH retrieval. It is better that the authors show some more cases of retrieval result for the multi-layer aerosol to verify the availability of new algorithm. A case shows that the new algorithm seems fail to distinguish residual layer from boundary layer from about 18:00-21:00 in Jul 24, 2008 (Figure S4). More discussions should be done to analyze the reason of fault retrieval result. (2) The three algorithms used for comparison are all "Gradient" based methods, the core of which is to find 'local' largest gradient, therefore, their performance are more likely to be impact by data's vertical resolution compare to algorithms focused more on the entire RSCS profile, such as ideal curve fit (Steyn et al. 2000) and wavelet method (Davis et al. 2000). I suggest the authors to do comparisons between CRGM and such algorithms, at least for several cases, to enrich the proof of CRGM's reliability.

Minor comments 1. P2, L4. “Duo to” should be “Due to”. 2. P2, L24. “BHL” should be “BLH”. 3. P7, L22. More states about cloud and rain mask method should be done in Section 2.

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