

A LiDAR-Based Clustering Method for Automated Atmospheric Boundary Layer Height Detection Over Complex Terrain

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sensitivity analysis

To precisely pinpoint the PBLH from the optimal cluster, the top 15% of points characterized by the strongest negative gradients within the cluster are selected. The median altitude of this subset is then designated as the final PBLH. This strategy preserves the physical significance inherent in the traditional Gradient Method (GRD) while enhancing the robustness of the retrieval results through statistical refinement. Also it is not overly sensitive to small variations in the percentile threshold within this range (appendix A). Lower thresholds tend to overemphasize extreme gradients caused by noise, while higher thresholds may incorporate signals from non-boundary layer structures. Therefore, 15% was selected as a representative value within the optimal range, balancing stability and representativeness.

To identify an appropriate percentile threshold, a sensitivity analysis was conducted across the range from 5% to 25%. As shown in Fig. 15, the correlation coefficient (R) remained above 0.8 for all tested thresholds, with a local peak at 15%. This indicates that the method is not overly sensitive to small variations in the percentile threshold within this range.

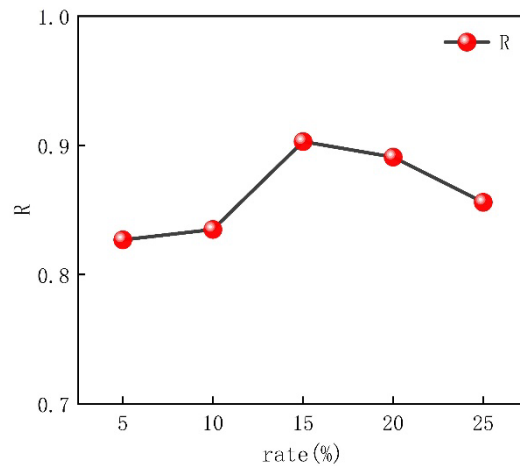


Figure S1: Correlation coefficient (R) as a function of percentile threshold rate (5%–25%).