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Supplement of

Best estimate of the planetary boundary layer height from multiple remote sensing measurements

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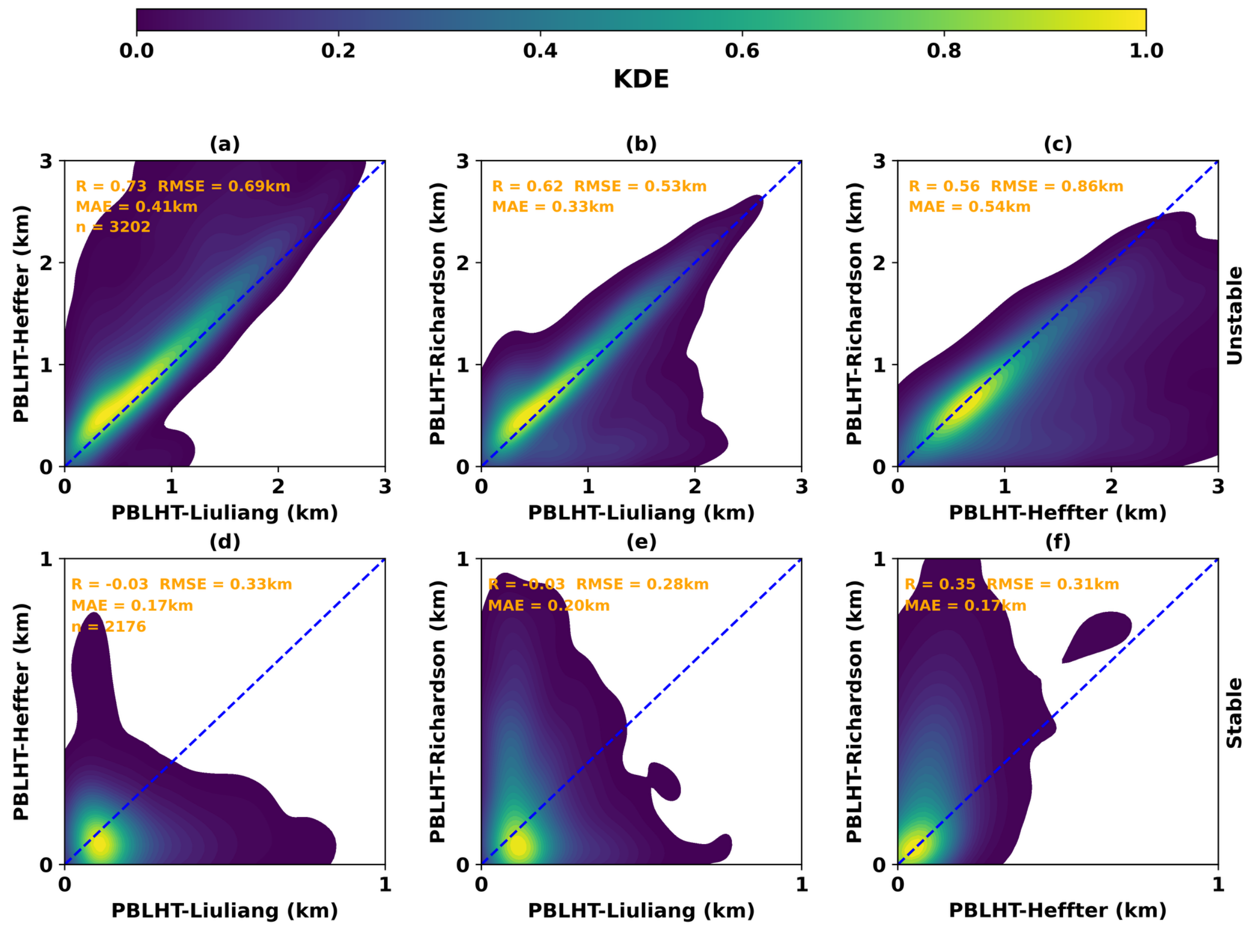

Figure S1. Intercomparisons of PBLHT estimates from the three methods in the PBLHT-SONDE VAP using kernel distribution estimate (KDE) under unstable (a-c) and stable (d-f) PBL conditions. R is the correlation coefficient. RMSE is the root mean square error. MAE is the mean absolute error. n is the number of samples. Since the two PBLHT estimates from the bulk Richardson method use the same approach but with different Ri_c values, only the estimate with Ri_c value of 0.25 is used.

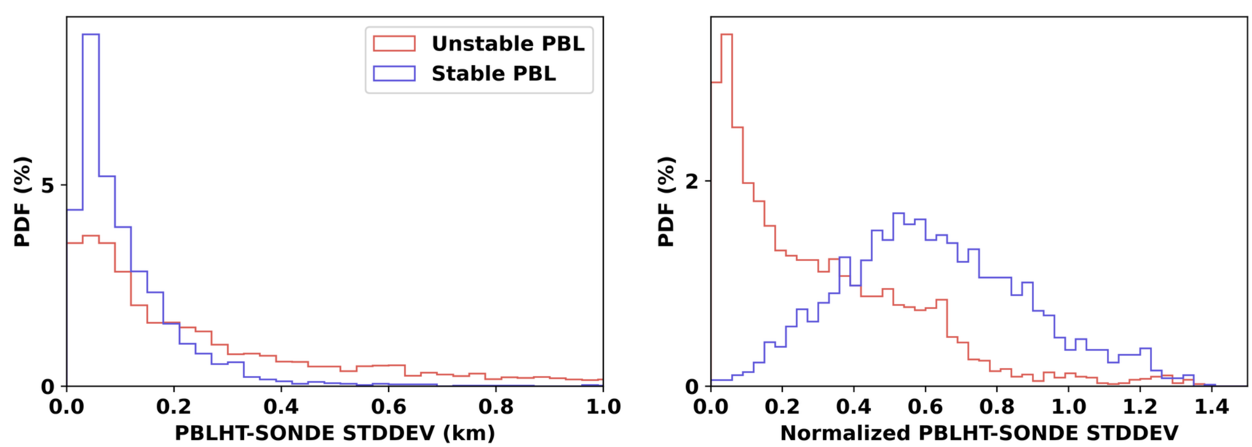

Figure S2. Probability Distribution Functions (PDFs) of (a) standard deviation and (b) normalized standard deviation with their mean values among the PBLHT estimates from the three methods in the PBLHT-SONDE VAP under both unstable and stable PBL conditions.

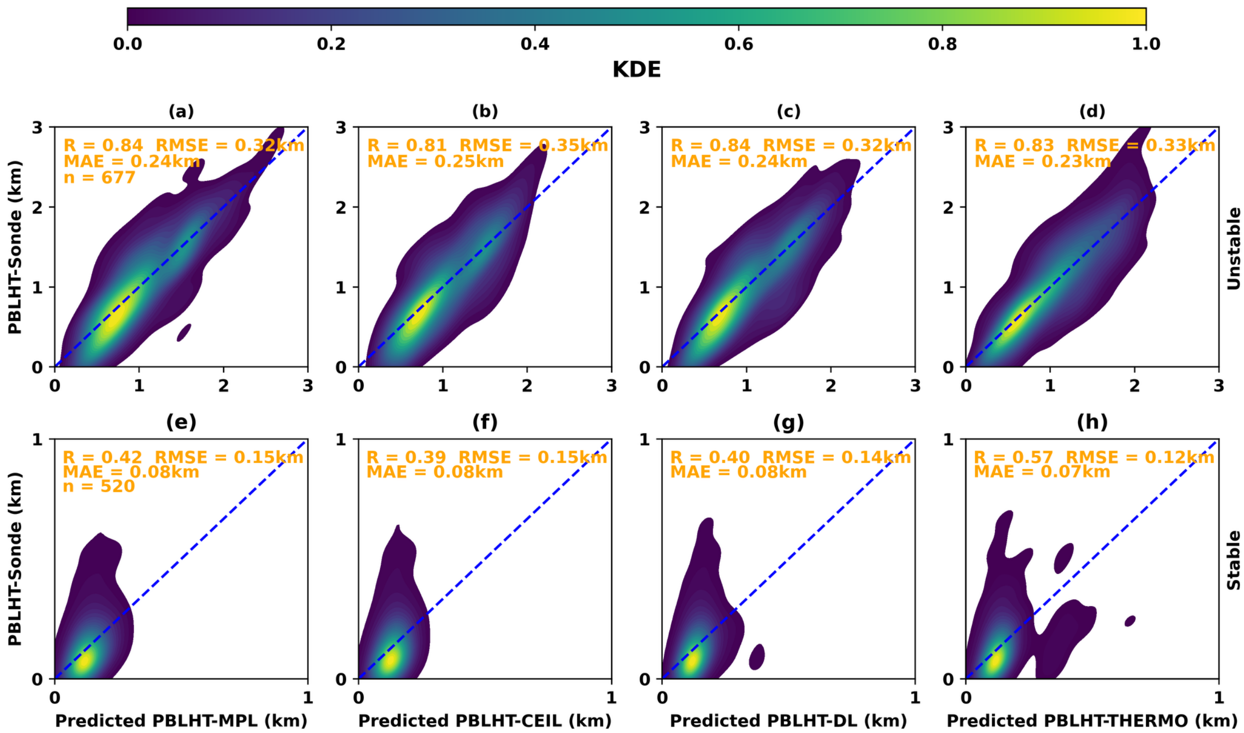

Figure S3. Similar as Figure S1, but for comparisons of predicted PBLHT using a Random Forest Regressor model based on individual remote sensing PBLHT estimates of: (a and e) PBLHT-MPL; (b and f) PBLHT-CEIL; (c and g) PBLHT-DL; and (d and h) PBLHT-THERMO under unstable and stable PBLH conditions.

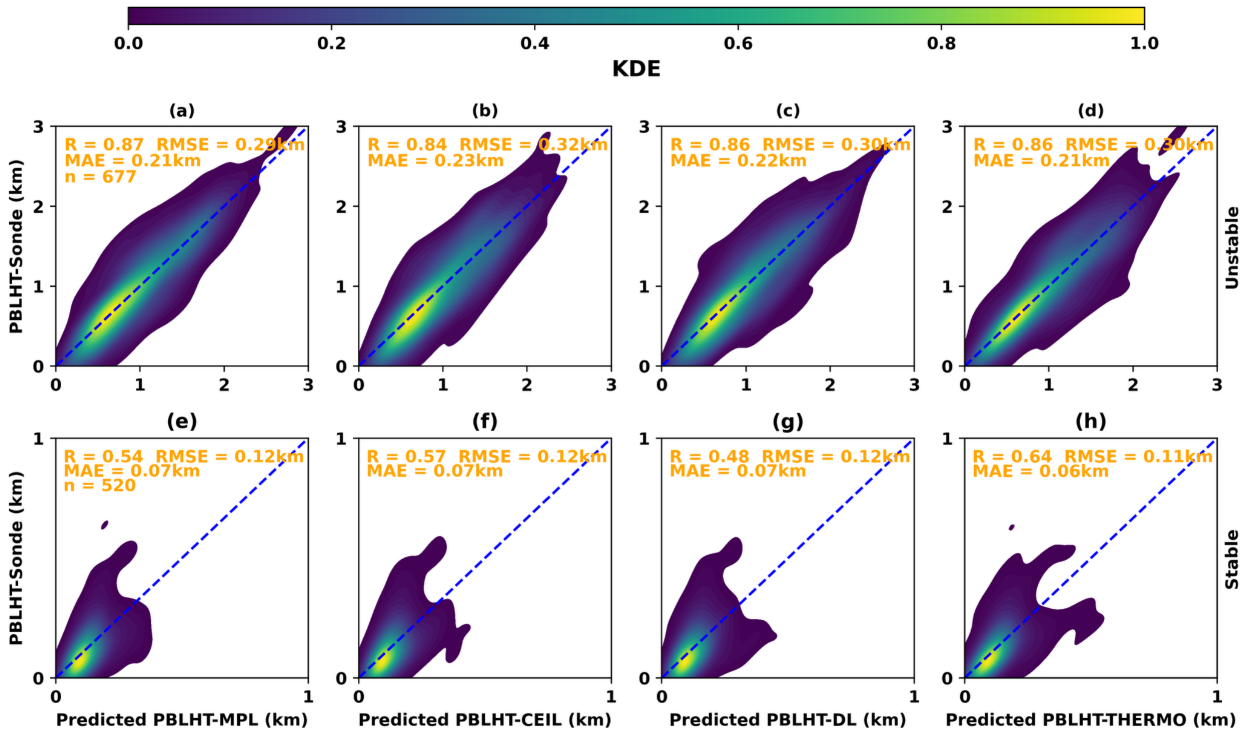

Figure S4. Similar as Figure S3, but for using the LightGBM model.

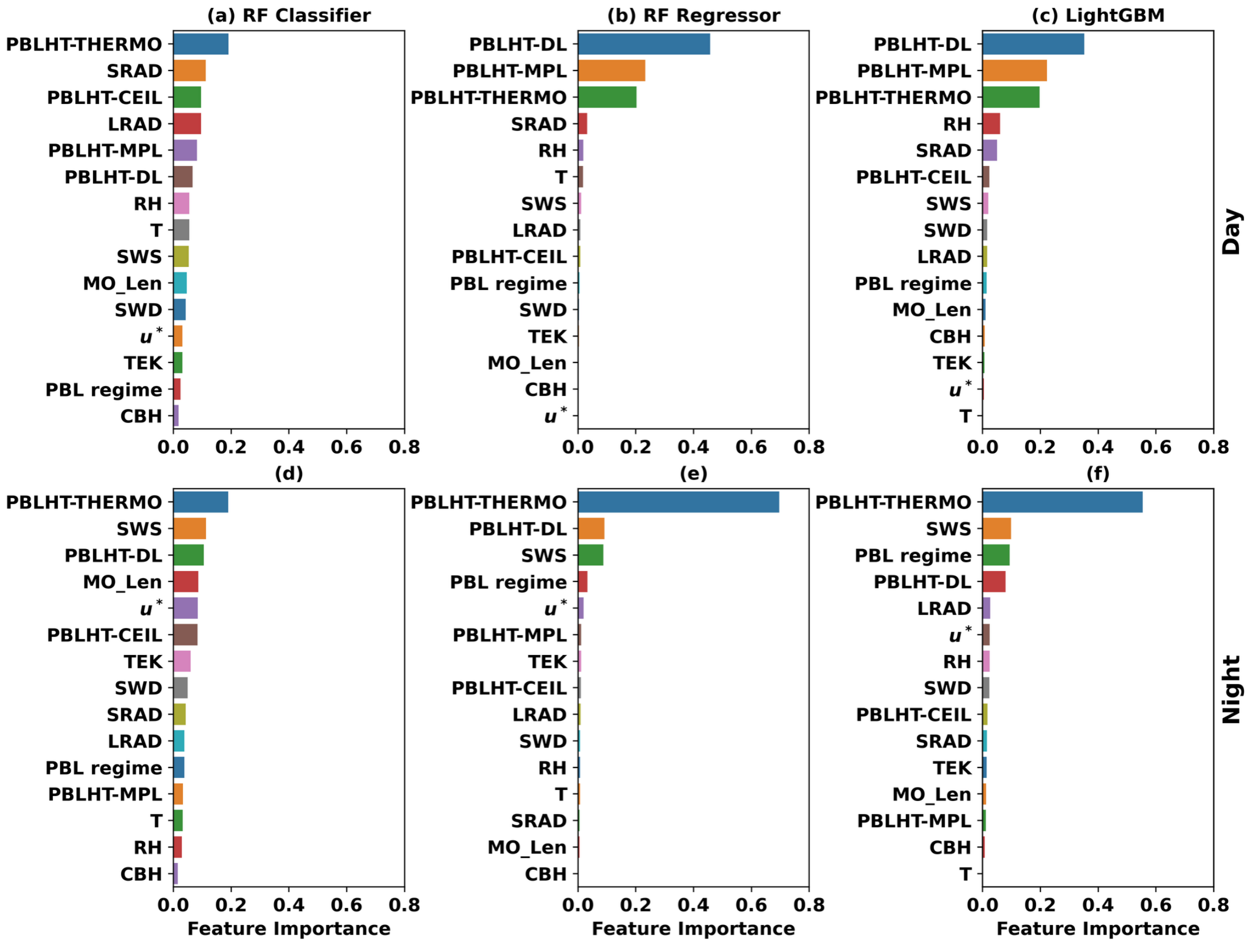

Figure S5. Feature importance for the three ML models at the training stage: a) and d) RF Classifier; b) and e) RF Regressor; c) and f) LightGBM during day (upper panels) and night (bottom panels) time periods. Feature importance scores are normalized so that they sum up to 1.

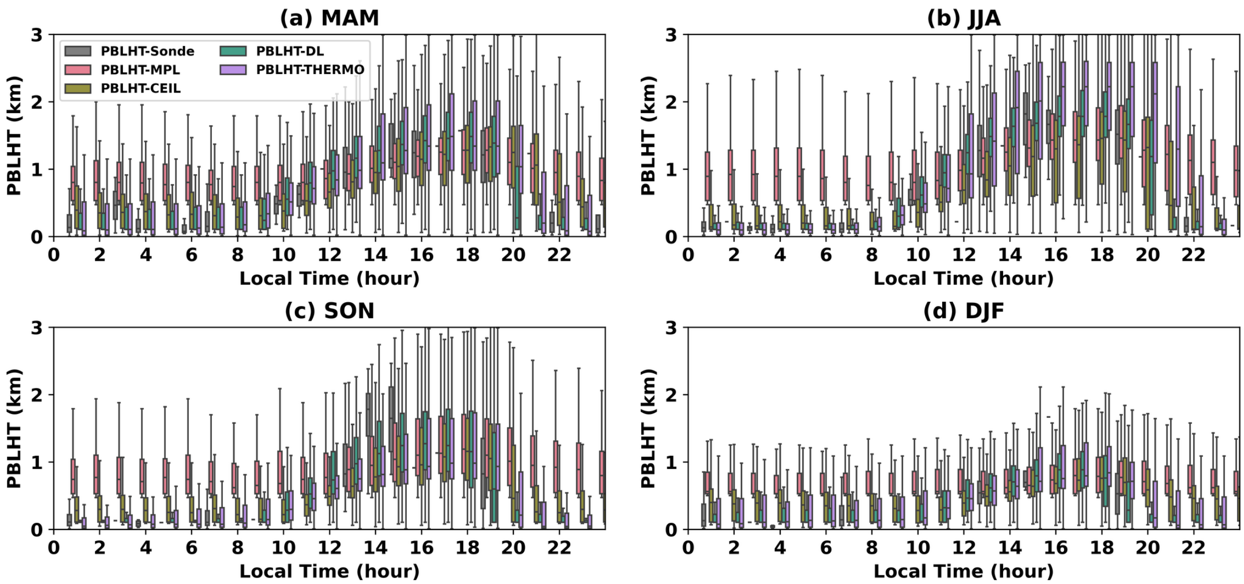

Figure S6. PBLHT diurnal cycles and their seasonal variations from PBLHT-MPL, PBLHT-CEIL, PBLHT-DL, PBLHT-THERMOD, and PBLHT-Sonde at the ARM SGP observatory. MAM (March-April-May) represents the Spring season, JJA (Jun-July-August) for Summer, SON (September-October-November) for Fall, and DJF (December-January-February) for Winter. Horizontal bars, boxes and whiskers represent the median, interquartile range and range of the data.

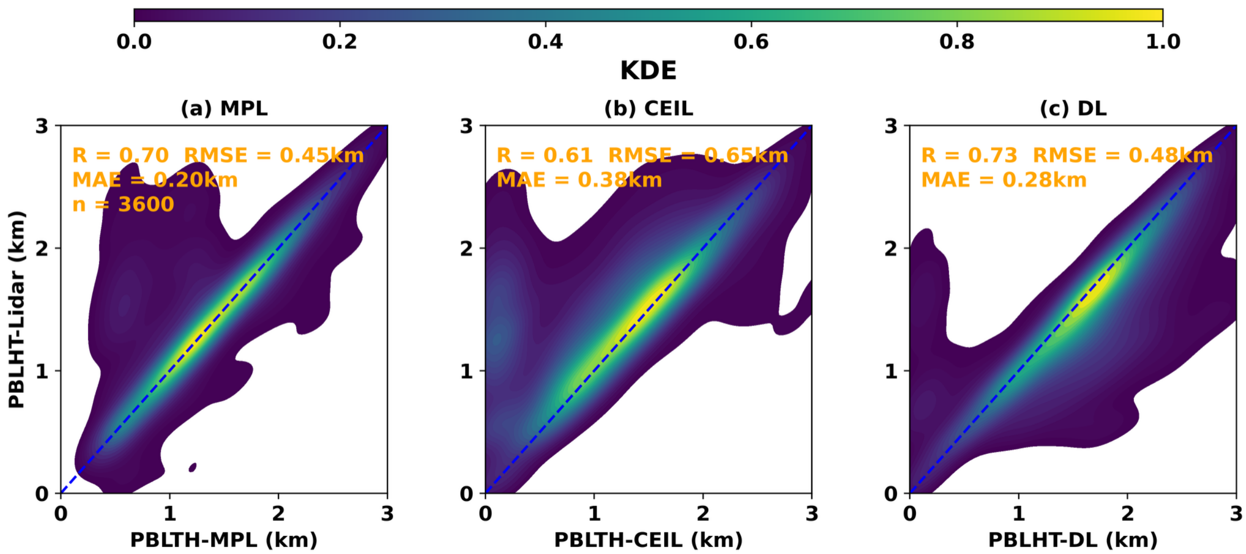

Figure S7. Similar as Figure S1, but for comparisons of (a) PBLHT-MPL; (b) PBLHT-CEIL; and (c) PBLHT-DL against PBLHT-Lidar under afternoon convective PBL conditions between 14:00 and 18:00 local time during summer and fall at the ARM SGP site. PBLHT-Lidar is derived as the median value among PBLHT-MPL, PBLHT-CEIL, and PBLHT-DL.