

## **Reply to Reviewer #2's comments**

*I disagree with the authors' responses regarding their choice not to use data from the SGP Raman lidar (RL)... This statement is misleading for the following reasons...*

**Answer: We appreciate the reviewer's valuable feedback and insightful suggestions regarding the use of ARM Raman lidar aerosol backscatter and water vapor profiles for PBLHT estimates. We have carefully revised the manuscript to address these comments.**

*My main point in this discussion is that: 1) the RL aerosol and water vapor data provide strong indicators of boundary layer height (recall Ferrare et al. 2012 and Chu et al. 2022 references) and, 2) the authors should indicate that the RL aerosol and water vapor data could be used to do so rather than neglecting this in the paper. Considering that the RL was designed to be first and foremost a lidar to measure water vapor and aerosol profiles, and that such profiles were used to derive PBL heights and published previously (e.g. Chu et al. 2022) this is a serious omission.*

*My recommendation is that the authors include some statements as to the applicability of the RL data for determining BL height and preferably also some reason(s) why such data were not used. Looking at the image of scattering ratio derived from combining the low and high sensitivity channels shown in the second image below, I may suggest a good reason for not using the Raman lidar aerosol scattering ratio data is the presence of many artifacts in the data; the image shows what appear to be temporal oscillations in the data (i.e. vertical stripes) as well as horizontal bands at various altitudes. It is easy to see how these could cause considerable difficulty in automated algorithms to derive BL height. Also, there are apparently no RL water vapor profiles available from the ARM archive for this date so the periodic lack of water vapor profiles could be a reason for not using the RL water vapor data to determine BL height.*

**Answer: We highly appreciate the reviewer's constructive suggestions. We added several sentences in lines between 269 and 275 as suggested.**

**"These measurements enable retrievals of aerosol backscatter coefficient, water vapor mixing ratio, and temperature profiles (Newsom et al., 2013; Thorsen and Fu 2015, Lv et al., 2017, 2018). Studies have previously demonstrated that RL-derived aerosol backscatter coefficient and water vapor profiles can be used to estimate PBLHT (Ferrare et al., 2012; Chu et al., 2022). However, due to known limitations in RL retrievals —such as artifacts in aerosol backscatter coefficients resulting from weak Raman scattering and periodic gaps in water vapor profiles—the authors chose not to incorporate RL aerosol backscatter coefficient and water vapor mixing ratio profiles for estimating PBLHTs in this study. These issues could pose substantial challenges for automated PBLHT detection algorithms."**