

Comment on essd-2022-59

Anonymous Referee #1

Referee comment on "Attenuated atmospheric backscatter profiles measured by the CO₂ Sounder lidar in the 2017 ASCENDS/ABoVE airborne campaign" by Xiaoli Sun et al., Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2022-59-RC1>, 2022

General Comments:

This manuscript presents the data of profile measurements derived from the airborne-based CO₂ Sounder lidar operating at 1572 nm. Complement to the XCO₂ column measurement, this new data set provides the opportunity, to identify clouds, estimate the height of aerosol layers above the ground, and detect smoke plumes from wildfires using a space-based or airborne-based lidar. The method and dataset would benefit retrieval algorithms development for current and future space-based greenhouse gas lidar missions. The presented methods and data are presented clearly and the paper is generally well written and can be accepted after minor revisions.

Specific Comments:

- The flight path includes footprint over water, could you please give statement about the detectability of XCO₂ and atmospheric profile over water?
- What does "the detector gain was changed by a factor of 2 in each step." In line 254 stands for ? Please also briefly describe how the gain of the lidar detector was adjusted during the flight.
- CO₂ absorption lines are difference in pressure and temperature, It is better to also illustrate how the offset locking frequency sample the variable CO₂ absorption line in the atmosphere in Figure 2.

