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.
technical corrections

- Line 44: “...records the laser signal backscattered from the atmosphere and the surface.” should be “backscattered from the atmosphere and reflected by the surface.”

- Line 58: Typo, CO2 should be subscript 2.

- Line 95-97: The sentence is too long to follow, and “append” should be “appends”, “close and save” should be “closes and saves”.

- Line 103: “nine groups” could be “9 groups”, in order to consist with above text (for example line 87).

- Line 210: add a comma after “The optical signal power collected by the lidar can be written as”. 
Lin 262: “equals” should be “equal”.