This study introduced a design of lidar to retrieve Martian column CO_2 and pressure profiles. Compared with previous study, the main innovation is compact lidar configuration with small telescope dimensions and low laser pulse energies using the 1.96 µm CO_2 absorption band. Online and offline bands around 1.96 µm are selected to formulate a differential absorption optical depth algorithm. Finally, the authors conducted an OSSE experiment to estimate retrieval uncertainties. When the design is implemented, retrieved data should be useful for Martian research. The manuscript is well written.

We appreciate the time and effort you have dedicated to reviewing our manuscript. Your insights, along with those of the other reviewer, have been valuable. We have thoroughly revised the manuscript, and our responses to your comments are provided below in blue.

Specific comments:

In Fig. 2, temperature data is not well fitted. Is the fitted temperature curve used for calculation in Fig.3? If so, how it affects CO_2 absorption optical depth in Fig. 3?

There are few percent errors in the fitted temperature curve. These errors exhibit some random nature, and the overall error for the entire profile is not significant. They do not substantially impact the CO_2 number density, as demonstrated in the newly added Fig. 3c, which directly influences the CO_2 absorption optical depth (AOD). Therefore, the impact of the temperature fitting error on CO_2 AOD is not significant. We note that the curve is used for simulation purposes only, and both pressure and temperature data should be updated in the future in the data processing.

Technical correction:

Lines 305 and 321: 2 should be subscript in CO2.

Corrected.