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Discussions

Interactive comment on "Airborne Measurements of CO$_2$ Column Concentrations made with a Pulsed IPDA Lidar using a Multiple-Wavelength-Locked Laser and HgCdTe APD Detector" *by* James B. Abshire et al.

Anonymous Referee #1

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This is a descriptive overview manuscript on the topic of the NASA Goddard CO2 Sounder lidar, the retrieval algorithm, and associated data product examples from two airborne campaigns. These campaigns each consisted of multiple flights and took place in the years 2014 and 2016. The accompanying figures (photos, graphics) are informative. In general it's a well-organized paper that should be of interest to a large segment of the readers. Here are a few comments and questions relating to spots where clarification would be helpful.

(1) Section 3, line 40: Here reference is made to the optical bandpass filters and ac-

C1

companying Figure 5. It isn't clear why the 2014 filter was not used in the 2016 flights. The 2016 filter appears to be worse in terms of variability of transmission vs. wavelength.

(2) Section 4: Figure 8 is an informative diagram of the retrieval algorithm. It is stated on the figure and on page 5, line 38, that the initial computation assumes a vertically uniform mixing ratio. Later, page 6, line 13, in the paragraph devoted to "clumped fitting", it is stated that clumped fitting "solves for terms like the XCO2 vertical gradient.." Please expand on how this is accomplished.

(3) Section 4: The clumped fitting appears to be an important step, mitigating several potential sources of bias. It would be helpful to expand on this. Also, can you cite one or more references relevant to the multi-pixel approach used by OCO-2 or AIRS?

(4) Section 6 and Figure 11: Figure 11, cited on page 5, line 46, is difficult to interpret. First, it would help to enlarge it. Also, it's not clear from the legend and the plots which is the lidar range and which is the ground elevation. What is the source of the ground elevation numbers? Is it ground elevation or scattering surface elevation from the altimetry? Since SF1 is over the redwoods, this is a case where the potential capability of the lidar to distinguish the optical scattering surface elevation from the ground elevation should become apparent, provided that accurate measurements can be made over short distance scales.

(5) Table 3: This table lists a few numbers from "mean slant range" and "ground elevation" These appear to be averages over each of the fixed altitude segments. As such, they are averages over several km. Correct? What do we learn from these numbers?

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