

## ***Interactive comment on “Improved Retrievals of Carbon Dioxide from the Orbiting Carbon Observatory-2 with the version 8 ACOS algorithm” by Christopher W. O’Dell et al.***

### **Anonymous Referee #1**

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This paper, about the application of ACOS XCO<sub>2</sub> retrieval algorithm to OCO-2 V8 L1b data, is a clearly written and well-conceived effort of value to the community. I suggest the publication of the paper. There are a few choices that were made in the study (described below) that I think need to be either addressed in more detail, or at least more fully justified. No extra data or processing are needed, so I think it will not be time-consuming. From a general aspect, I would suggest to short the paper a bit, for example the algorithm evolution review part distributed in several small sections and the bias correction part. Overall, this is a nice paper.

1 Page 2 Data prescreening: In this section, the fraction of soundings that passed the

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prescreening is shown for December 2015 and June 2016. What is the overall fraction for each of these two months? Further, the variation of this fraction from month to month is also interesting since it can give us a general impression how many valid data we can have for level-2 processing.

2 Page 6 Table 2: The prior value used for CO<sub>2</sub> profile is not clear. It is only mentioned here that “same as TCCON”. In page 19, line 27 it is also mentioned that “prior CO<sub>2</sub> profile . . . that used by TCCON”. It is still not clear to me what is used as prior value. More explanations are needed since later the retrieval products are also validated with TCCON.

3 Page 19, line 20: Although it is mentioned in Appendix that the BRDF parameters is fixed, it is better to mention it here as well.

4 page 31 line 9: “31% of water soundings and 55% of land soundings pass the XCO<sub>2</sub> quality flag”, why water soundings have much lower chance to pass through the quality filtering? What is the overall data yields for ocean-glint and land respectively?

4 One major conclusion of the paper is that “Updates to the radiance calibration and retrieval forward model in version 8 have improved many aspects of the retrieved data products.” This conclusion is made from the validation of bias-corrected V7 and V8 results with both TCCON (Figure. 18) and models (Figure. 19). Can we see similar improvement from uncorrected L2 data? If the improvements come from L1b radiance calibration and forward model itself, we should be able to see the effects from uncorrected L2 results. Also, I think looking at the uncorrected data will make things more clearly since the bias correction processing can confuse the source of improvements.

Some reference are lost, for example: Page 2, line 26: missed reference Page 5, line 10: missed reference Page 21, line 12: missed reference . . .

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