Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2016-281-AC3, 2016

Atmospheric Measurement Techniques Discussions

Interactive comment on "The On-Orbit Performance of the Orbiting Carbon Observatory-2 (OCO-2) Instrument and its Radiometrically Calibrated Products" *by* David Crisp et al.

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Received and published: 6 November 2016

We greatly appreciate the detailed review by anonymous referee #4. We have attempted to address all of the issues that they have raised. These changes are documented here and in the text. We hope these changes adequately address these concerns.

<Specific Comments>

(1) Page 2, Lines 29-30, "The optical bench and focal planes : : :.. operating temperatures (near -152.4 C and -6.4 _C, respectively" Is it near and -6.4 _C and -152.4 C, respectively?

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Corrected. It now reads: “. . . cooled to their operating temperatures (near -6.4 °C and -152.4 ïĆřC, respectively)“

(2) Page 11, Lines 17-18, “the relative radiometric performance (zero level offset, gain, and gain linearity) of spectral samples within a given channel must be known to within 0.1%” What is the definition of zero level offset, gain, and gain linearity of 0.1%?

Here, we changed the term ”zero level offset“ to “ dark offset“ to make this more consistent with the discussion of bad pixels. The gain and gain linearity are now explicitly defined in terms of the continuum radiance level: “ For example, the relative radiometric performance (defined in terms of the dark offset, gain, and gain linearity; see Rosenberg et al. 2016) of spectral samples within a given channel must be known to within 0.1% of the continuum brightness across the spectral range of each channel to fully exploit the spectrally-dependent information in each sounding.“

(3) Page 19, Line 18, “a thick layer of ice would significantly alter the ABO2 instrument line shape (ILS) function,” Is the reason why thick layer affects ILS the mechanism described in page 10, lines 13 – 20?

No. The dispersion (not ILS) changes discussed on pg 10, lines 13-20 are not produced by a thick layer of ice on the FPAs. Those changes in dispersion (not ILS) are caused with physical distortions in the optical bench and FPA mounts associated with thermal stresses imposed by ice accumulation on the thermal straps that connect the cryocooler and FPAs. Thick layers of ice on the FPAs would produce ice lenses, that would distort the light incident on the FPAs. There is no evidence of that effect on OCO-2.

(4) Page 30, Figure 5. (a) Definition of “maximum measurable signal” will be helpful for readers. Is it dynamic range of the AD converter? Do the data used in Figure 5 (a) include cloud contaminated scene? How do authors calculate SNR from observed data?

We now explicitly define “maximum measurable signal” in the text with the parenthetic note: “(i.e. the maximum signal for which the instrument meets its radiometric calibration standards, see Table 1 and Rosenberg et al., 2016).“ The data shown in the maps in Figure 5b have been screened for optically-thick clouds. The SNR calculation is described in detail in the L1B ATBD (Eldering et al. 2016a) and in greater detail in Rosenberg et al. (2016). Repeating that description once again here would add substantially to the length of this paper. We did add a statement near the top of section 5.1 stating “(see Eldering et al.; 2015 and Rosenberg et al. 2016 for a description of the methods used to derive the SNR).

(5) Page 35, Figure 10. Which period of data is used? For 18 months?

This figure was generated using data collected between November 2014 and January 2015, as now noted in the figure caption.

(8) Page 43, Figure 18 “with a backup lamp (Lamp 2)” Why back up lamp data is used in calibration? How to use and compare primary and back up (monthly) lamps on orbit? How about the third one?

To clarify this point, we have added the following sentence to the description of the calibration channel in Section 3: “. Lamp 1 is used for routine calibration (every orbit not used for downlink), while lamps 2 and 3 are used less frequently (monthly) to track degradation in lamp 1.” Also, in section 6.5.2, we note “Comparisons of results obtained using the primary calibration lamp, which is used on all nominal polar calibration orbits (Lamp 1) to that of the other two lamps, which are used less frequently (Lamps 2 and 3) indicate that the output of this calibration lamp has also decreased somewhat in the ABO2 channel.”

We use lamp 2 in this figure to reduce uncertainties due to the $\sim$1% lamp 1 degradation.

<Technical Corrections>

(1) Page 13 Table 3 What does “BPM” stand for? Is it “bad pixel map”?

Yes, we made that change in Table 3.

(2) Page 15, Line 10, The 7 > The V7?

Yes. We made that change.

(3) Figures 10, 12 and 14, Captions O2A, O2, CO2, O2A: “2”s are subscript.

Done.

(4) Page 42, Figure 17, Caption, Green points Are they “green triangles?”

Yes, we made that change in the caption.

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