

## ***Interactive comment on “Orbiting Carbon Observatory-2 (OCO-2) cloud screening algorithms; validation against collocated MODIS and CALIOP data” by T. E. Taylor et al.***

### **Anonymous Referee #1**

Received and published: 28 December 2015

Review of the paper “Orbiting Carbon Observatory-2 (OCO-2) cloud screening algorithms; validation against collocated MODIS and CALIOP data” by Taylor et al.

The cloud screening algorithms used in the operational processing of OCO-2 spectra are described, and OCO-2 cloud screening is validated by comparison to MODIS and CALIOP data. The paper points out the strengths and weaknesses of the algorithms (separately and in tandem). This paper both supplies useful information in regard to OCO-2, and in a general sense, to future CO<sub>2</sub> measuring experiments which will encounter similar computational constraints and the need to screen for clouds.

The paper should be published after minor revision.

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**Major comments** The paper does a convincing job to demonstrate that the algorithms can be used to yield a 30% processing of the OCO-2 profiles, while maintaining overall agreement of 80-90% with the MODIS cloud mask.

**Minor comments** Most of my comments are suggested to improve the reader's comprehension of the text. My specific comments refer to places in the text at which my reading cadence stopped, indicating something about the sentence that was not easy to grasp. Abstract, page 1, line 21. After reading the full paper, I think I understand what was implied by the cryptic sentence. Suggest change to: "With tuning of algorithmic threshold parameters that allows for processing of  $\tau_{A_2}$  30% of all measurements,..." Page 2, lines 45-51. Mention that each footprint is associated with spectra for all three OCO2 bands, and reference the March 2015 ATBD, plus citing appropriate Figure(s). Page 2, line 54. Explain (perhaps in a separate sentence on line 56) that optical thickness refers to gas+cloud+aerosol, and that "cloudy" refers to cloud plus aerosol in the paper. Page 3, line 81. What paper does "this validation study" refer to? Page 3, line 82. Change to "reported in Taylor et al., (2012)" Page 4, line 106. Change to "Since OCO-2 collects almost" Page 4, line 126. Define subscript s and a. Page 5, line 147. Change to "light to the OCO-2 radiance. Secondly, the 1.6  $\mu\text{m}$  and 2.0  $\mu\text{m}$  band strengths" Page 6, line 191. Why are two thresholds displayed (instead of just one threshold)? Page 7, line 206. Change to "quicker fall of in the ILS wings" Page 7, lines 212-215. This sentence is difficult to read. Rephrase (and then have someone else also read the sentence to make sure it is clear). Page 7, line 220. The phrase "significant albedo contrast" is not clear. Is "when there is significant differences in the surface albedos of the two CO2 bands" the intended meaning? Page 7, line 226. Use the information from Page 8, line 238, to define what is meant by low and high clouds. Page 7, line 226. In a separate paragraph, identify in words and meaning, the various screening variables. Page 7, line 232. If you know which type of features trigger the two algorithms, provide this information. Page 8, line 233. Have you numerically determined this fact? If so, provide a little more information. Page 8, line 235, and Figures 3 and 7. The "hump" near forward model and/or CALIOP optical depths of 3

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is very odd. If you have a good explanation for this, please provide it when Figure 3 is first discussed. Page 9, line 279. Renumber Figure 1 to Figure 3 (and renumber 2 and 3 to 1 and 2). It does not make sense to encounter Figure 1 in the text after first discussing Figures 2 and 3. Page 12, line 384. The pc may be missing an – overscore mark. Page 12, line 392. The usage of “cloudy” to include cloud plus aerosol becomes problematic, since my mindset in reading the previous pages reverted to thinning of clouds as water and/or ice cloud particles, not micron sized aerosol particles. The use of the Angstrom coefficient implies that you are referring to the aerosol index (i.e. AOD x Angstrom coefficient). Lines 391–392 brought my reading cadence to a standstill, since too much is said in too little space. Suggest some expansion of the sentence to clarify the sentence. Page 13, line 412. Is Throughput missing a divisor (e.g.  $N_{total}$ )? Page 14, line 435. Change to “as once soundings have been ..” Page 14, line 442. May make more sense to discuss the three metrics in terms of the post-launch settings (instead of the pre-launch settings). Page 15, line 487. Suggest change to “It is critical to avoid latitudinal gradient biases in the ...” and/or other phrases. The phrase “spatial sampling biases” is too ambiguous. Clarify. Page 16, line 516. Does the MODIS cloud mask utilize the Deep-Blue AODs? If not, this can be mentioned. Page 17, lines 574 – 579. I was not convinced by the reason presented in the text, that sub 5 km inhomogeneity in the cirrus cloud field accounts for the discrepancy stated on line 574. Upper tropospheric cirrus have horizontal length scales usually larger than 5 km. Page 18, line 601. Has the adeptness of ABP to detect very thin scattering layers high in the atmosphere been confirmed by recent calculations (after OCO-2 was positioned to more closely be in the CALIOP orbit)? If this is incorrect, revise and/or delete the claim. Page 18, lines 600 and 604. These two sentences are inconsistent (“unable” in line 600, “identifies most” in line 604). It may make more sense to move the sentence at the end of line 603 to the Conclusions. Figure 1. There is a black shading along the orbit track over clear ground in the middle of Panel (b). The blue part of the track makes sense, and the black part of the clouds makes sense, but north of the clouds near 25.3 N, the black shading is not expected. Figure 5. The green shading is of little

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help. Would black and white panels (remove the color) make more sense? Figures 3 and 7. The “hump” near forward model and/or CALIOP optical depths of 3 is very odd. If you have a good explanation for this, please provide it when Figure 3 is first discussed.

Please also note the supplement to this comment:

<http://www.atmos-meas-tech-discuss.net/8/C4525/2015/amtd-8-C4525-2015-supplement.pdf>

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