

## ***Interactive comment on “Liquid marine cloud geometric thickness retrieved from OCO-2’s oxygen A-band spectrometer” by Mark Richardson et al.***

### **Anonymous Referee #3**

Received and published: 25 November 2018

A single-layered cloud optical thickness, pressure thickness and cloud- top pressure retrieval based on oxygen A-band radiance measurements is certainly a worthwhile endeavor and has been a long time coming.

Recommendation: Accept for publication after minor corrections.

Comments:

1) The discussion on Lines 20-32 of Page 3 is important and needs to be crystal clear.

When stating that clouds are homogeneous, make sure to always make clear when you mean vertically homogeneous versus horizontally homogeneous. On Line 26 you write

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"homogeneous plane-parallel clouds" and I originally took this to mean "horizontally homogeneous plane-parallel clouds" but then I came to think that you meant "vertically homogeneous clouds that are also horizontally homogeneous, plane-parallel clouds".

Is the effective radius  $r_e$  on Line 20 of Page 3 the same as the effective radius  $r_{ad,top}$  on Line 29 of Page 3? And is the effective radius  $r_{eff}$  on Line 9 of Page 4 for MODIS really a vertically homogeneous cloud effective radius so perhaps the same as  $r_{e,h}$  on Line 29 of Page 3? Anything that is done to tighten up the meaning of symbols would be helpful in this part of the manuscript.

2) Your horizontal spatial variability parameter (Sect. 5.3.2) will capture some variability but perhaps not some of the important variability as you state. Would it be worthwhile to manually identify scenes where gaps of various sizes exist within a single-layered cloud deck and determine whether or not the retrieval is influenced by ever longer paths through the gaps in such single-layered cloud decks?

3) Lines 14-21 on Page 4 are satellite centric and ignore all of the ground-based measurements that are relevant to this problem. Wouldn't ARM MAGIC measurements be of value here?

4) The words "Direct measurement" in the Section 2.2 heading and "more direct" on Line 23 thereafter seem off target. You are retrieving cloud thickness not measuring it and the retrieval is anything but direct, as all of the words in the pages to come indicate.

5) You need references at the end of Line 3 on Page 5: so "developed (References?)." I would recommend expanding the references to ground-based research too and Qilong Min is one person who pursued oxygen A-band retrievals using ARM data about 10 years back now.

6) Lines 16-19 on Page 5: Qilong Min also investigated the spectral width necessary for oxygen A-band retrievals of cloud structure.

Minor Details:

1) Perhaps the title should start as "Marine liquid-cloud ..." instead of "Liquid marine cloud..."?

2) The measurements are the radiances, correct? Everything else is retrieved, correct? If so, be sure to use the words "measurements" and "retrievals" to reflect this fact. Line 16 of the abstract: "Measurements are of ..." should be "Retrievals are of ...", correct? This occurs a lot throughout the paper.

3) There are minor nonsense phrases throughout the paper because of typos and omissions. An example is Line 4 on Page 15:

"which we Section 5.3.3 linked to ..."

which is much more understandable when the parentheses are added:

"which we (Section 5.3.3) linked to ..."

Other examples are

Line 6, Page 2: "measured by other satellite products" Line 15, Page 12: "This product averages along"

Products do not measure nor average so what do these phrases really mean? Fixing these types of errors throughout the manuscript would further improve its readability.

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