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Interactive comment on "Information content of OCO-2 oxygen A-band channels for retrieving marine liquid cloud properties" *by* Mark Richardson and Graeme L. Stephens

Anonymous Referee #3

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Review comments on manuscript "Information content of OCO-2 oxygen A-band channels for retrieving marine liquid cloud properties"

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General comments:

This paper presents a theoretical study on retrieving marine boundary layer cloud optical thickness, pressure thickness, and top pressure, using the OCO-2 oxygen A-band

measurements. The method is well defined and the results are of interests to the community. The topic is suitable for publication in AMT, but I do have some concerns for the authors to consider.

1) Marine boundary layer clouds are targets that we have pretty good a priori knowledge; hence it's not surprising to have good retrieval accuracy, but since the goal of the research is to apply the method to OCO-2 retrievals, one question would be how to decide when to retrieve? I would suggest adding at least some discussions on how to identify the clouds that are suitable for applying this method.

2) The literature review should have been more complete. There have been studies on retrieving cloud pressure thickness plus cloud top pressure in the past, especially for thick clouds over dark surfaces (e.g., Ferlay et al. 2010, Yang et al. 2013, Merlin et al., 2016, reference given below).

3) I found the structure of the paper makes understanding the contents difficult. I would suggest some re-arrangements. For example, Section 2 is titled "The OCO-2 satellite and its instruments", I couldn't see how the two subsections fit there: " 2.1 OCO-2 radiative transfer calculations" and "2.2 Optimal estimation and information content". My suggestion would be to use one section to describe forward modeling issues and another section for retrieval related issues.

4) I would suggest converting the information content shown in the article to how many pieces of information can be retrieved. For example, it's not clear to me what information content = 16 means (the red line in Figure 4(a)) physically.

References:

Ferlay, N., and F. Thieuleux, C. Cornet, and A. B. Davis, 2010: Toward New Inferences about Cloud Structures from Multidirectional Measurements in the Oxygen A Band: Middle-of-Cloud Pressure and Cloud Geometrical Thickness from POLDER-3/PARASOL. J. Appl. Meteor. Climatol., 49, 2492–2507. doi:

http://dx.doi.org/10.1175/2010JAMC2550.1.

Merlin, G., Riedi, J., Labonnote, L. C., Cornet, C., Davis, A. B., Dubuisson, P., .Parol, F., 2016: Cloud information content analysis of multi-angular measurements in the oxygen A-band: Application to 3MI and MSPI. Atmospheric Measurement Techniques, 9(10), 4977-4995. doi:http://dx.doi.org/10.5194/amt-9-4977-2016.

Yang, Y., A. Marshak, J. Mao, A. Lyapustin, J. Herman, 2013: A Method of Retrieving Cloud Top Height and Cloud Geometrical Thickness with Oxygen A and B bands for the Deep Space Climate Observatory (DSCOVR) Mission: Radiative Transfer Simulations. J. Quant. Spectrosc. Radiat. Trans. 122, 141-149, http://dx.doi.org/10.1016/j.jqsrt.2012.09.017.

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