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Atmospheric Measurement Techniques Discussions

Interactive comment on "A high-level cloud detection method utilizing the GOSAT TANSO–FTS water vapor saturated band" *by* Nawo Eguchi and Yukio Yoshida

Anonymous Referee #2

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Manuscript number: amt-2018-122 Full title: A high-level cloud detection method utilizing the GOSAT TANSO–FTS water vapor saturated band Author(s): Eguchi and Yoshida

The paper describes an improved method to detect high-level clouds using GOSAT TANSO–FTS spectral measurements. The cloud detection method is evaluated with collocated CALIOP measurements. The matching ratio of clouds (i.e., the ratio of cloud detected by both GOSAT and CALIPSO to clouds detected by GOSAT) is 85% for pixels with the collocated distance between GOSAT and CALIPSO less than 25 km. The cloud flag based on the proposed method is useful to investigate spatial distribution of

cirrus clouds. The topic in the presented paper is suitable to the journal, Atmospheric Measurement Techniques. However, the presented paper contains many grammatical mistakes and ambiguity throughout the paper. Although the authors mention the issue in thin cirrus cloud detection in the introduction, the evaluation of the cloud detection is based on all condition including low water clouds, and it is hard to know if the proposed method improves the cloud detection for thin cirrus clouds compared to the existing method. Overall, major revisions with more quantitative analysis are necessary to make the paper being worth publishing to the journal. In particular, quantitative and more detailed analysis against the following question may be needed: How much does the proposed method improve an accuracy of cloud detection compared to the existing water vapor saturation method?

Specific comments:

Page 1, line14 "optically thin (optical thickness less than 1.0) and higher-level (above 8-15 km) clouds are in general difficult to detect with conventional passive sensors that measure reflected sunlight" This statement is incorrect. Conventional passive satellite measurements can detect cloud with optical thickness of greater than 0.1–0.3 (e.g., Holz et al., 2016, Fig. 1).

Page 2, lines 11–16: There are two not show figures, which are seems to be important in terms of the motivation of this study written in lines 19–20 "Therefore the above 20 results suggest that a more precise cloud detection method to remove the higher-level clouds is required". These figures should be shown in the manuscript to enhance clarity.

Page 4, line 19: "Figure 2(a) shows the simulated spectra for cloud-free cases with different precipitable water vapor amounts." Which forward model do you use? The authors should describe at least a brief explanation about the model to reduce the ambiguity.

Page 4, line 32 to page 5, line 2, and Figure 3: What is the criterion to collect these scenes? Are these scenes from all pixels? If so, it is hard to relate these groups with particular atmospheric conditions. For example, thin cirrus clouds and low-level marine stratocumulus clouds have similar brightness temperature (BT). Even a clear-sky with relatively low sea surface temperature and sub-visual cirrus clouds may be similar BTs. In addition, I suggest the authors to specify the mean and standard deviation of BT for each group.

Page 5, line 14: How much does the quality filter screen out low-quality data?

Page 6, lines 7-8: "The criteria for match-up between TANSO–FTS and CALIOP data were within 400 km for the distance between each footprint center location and within five minutes for the observation time difference." 400 km is too far and inappropriate for collocated-pixel comparisons. The authors use just four months of data for the comparison. Since GOSAT and CALIPSO has long measurement duration, I suggest the authors to extend the data period and to use more strict and appropriate criterion for the distance in between both satellite pixels.

Figure 7: Please specify the definition of the matching ratio for each row. In addition, if you use the CALIPSO cloud detection as a benchmark, the matching ratio M1 and M2 are odd. To show the performance of the proposed cloud detection method with TANSO-FTS, it should be M1 = A/(A+C) and M2 = D/(B+D) shouldn't be? Otherwise, we don't evaluate how much TANSO–FTS misses thin cirrus clouds that CALIPSO detect.

Page 7, lines 7–20: Does the proposed method improve cirrus cloud detection compared to the current method? What is the minimum optical thickness that the proposed method can detect clouds with an acceptable accuracy? Why do you include pixel with low stratocumulus clouds detected by CALIPSO into the analysis?

Page 8, lines 26–28: I'm not convinced with the statement. In order to state this, I suggest the authors to demonstrate at least the mating ratios (A+D)/ALL or B/(B+D) as function of cloud optical thickness.

Reference: Holz, R. E. et al. (2016), Resolving ice cloud optical thickness biases between CALIOP and MODIS using infrared retrievals, Atmos. Chem. Phys., 16(8), 5075–5090.

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