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Atmospheric Measurement Techniques Discussions

Interactive comment on "A development of cloud top height retrieval using thermal infrared spectra observed with GOSAT and comparison with CALIPSO data" *by* Y. Someya et al.

Anonymous Referee #1

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This manuscript uses CO2 slicing method on thermal infrared spectra to retrieve cloud amount and cloud height and compared with data from other satellites. The study reports a reasonable practice though the idea is not novel. But as their results show, the manuscript does show an improvement to the CO2 slicing method with spectral data. This paper is well prepared and demonstrates an useful approach to an important, though old, research topic. The data and method applied are convincing. The presentation is clear and concise. This reviewer recommends this manuscript be published after minor revisions as suggested as follows

1. When talking about CO2 slicing method, the authors should carefully introduce not only its benefit, but also its limitations in applications. E.g., can it be accurate when

cloud is very thin, such as optical depth smaller than $\sim$0.3? Does background surface temperature and atmospheric temperature profile and water vapor profile result in any uncertainty to the cloud retrieval? How significantly?

2. For Eq (1), in remote sensing practice, how can clear-sky R be obtained? This may be the most significant drawback of this method. The authors should justify the treatment.

3. In Section 4.1.2. "CTH was underestimated by slicing because of very thin cirrus near ..." why?

4. CALIPSO has significant errors for detecting optically thin stuff, especially during daytime, this should be discussed in the paper.

5. When discussing about historical background information about very thin cloud detection in Introduction, the data are not complete and updated. For references, please also cite the following 2 papers for latest developments in this important field.

(1) Wenbo Sun, Rosemary R. Baize, Gorden Videen, Yongxiang Hu, and Qiang Fu, "A method to retrieve super-thin cloud optical depth over ocean background with polarized sunlight", Atmos. Chem. Phys., 15, 11909-11918, doi: 10.5194/acp-15-11909-2015 (2015).

(2) Wenbo Sun, Gorden Videen, and Michael I. Mishchenko, "Detecting super-thin clouds with polarized sunlight," Geophy. Res. Lett. 41, 688-693, doi: 10.1002/2013GL058840 (2014).

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