

Interactive comment on “Comparing Airborne and Satellite Retrievals of Optical and Microphysical Properties of Cirrus and Deep Convective Clouds using a Radiance Ratio Technique” by Trismono C. Krisna et al.

Anonymous Referee #2

Received and published: 13 November 2017

The authors utilize an airborne radiometer to evaluate MODIS ice cloud retrievals and determine the impact of photons vertical penetration in remotely-sensed cloud effective radius. In addition, in-situ aircraft observations appear to partially validate their hypothesis on the value of different wavelengths for assessing the cloud microphysical vertical structure. The manuscript is interesting and the idea that different near-infrared wavelengths provide information about the cloud vertical structure is interesting. However, the sampling is very small and the in-situ observations matched with MODIS and the radiometer SMART are limited to a few points, so any solid statistical inference or

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validation of the authors' algorithm (and assumptions) are difficult. Moreover, I do not think it is well-justified the pre-processing of MODIS reflectances as the derivation of a new MODIS 1640 nm using only the 2130 nm reflectance is unphysical. The authors cite a number of papers for justifying the MODIS corrections, but this is a misinterpretation of the literature results. I am struggling with my recommendations because even though the authors show some interesting results, the analysis is not rigorous, and the comparison between MODIS science team retrievals and their own MODIS cloud retrievals is flawed.

Specific comments:

- The derivation of MODIS band 6 using band 7 is unphysical and the justification based on the results in Wang et al (2006) is misleading as Wang et al. shows that the correction is useful for estimating NDVI, which is a completely different problem. The 2130 nm and 1640 nm have distinctive photon vertical penetration (e.g. your figure 11) so the conversion is unphysical. I do not think the paper can be accepted until they authors use the standard MODIS channels without any correction. I agree that the 1640 nm MODIS channel has issues, so I would suggest the direct use of the 2130 nm channel instead.
- The authors correct the MODIS 1240 nm channels using as a justification Lyapustin et al (2014) but, again, the use of this reference is misleading. This paper only corrects MODIS in order to remove a spurious trend. Moreover, the new collection 6 radiances should have incorporated the modifications described in Lyapustin et al. Overall, the use of SMART for correcting MODIS is unjustified. It is much more rigorous to list the differences between SMART and MODIS and then compare the retrievals, keeping in mind the instruments differences.
- A central assumption is the liquid optical depth and effective radius of the layer below the cirrus clouds. The authors choose constant values for each case but these uncertain values can substantially bias the retrievals, and moreover there is no way to know

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if the constant values are correct or not. So, any comparison with MODIS standard retrievals will have the huge uncertainty due to the liquid optical depth utilized for creating the lookup tables (the use of climatological values is suspicious). This is very problematic because it is unclear whether the new retrievals are better than MODIS. Overall, to prove the point that accurate ice retrievals depend on the ability of accounting for the cloud layer below the cirrus clouds, you only need synthetic observations, which is why I do not see the point of comparing satellite and airborne remote sensing retrievals.

- I find it surprising that the authors did not retrieve effective radius using MODIS 3.78 μm channel. If you want to demonstrate that the liquid cloud layer can bias the retrievals, then you have to calculate the effective radius for all the available MODIS channels.

- In my opinion, the main conclusion of the paper is that accounting for liquid clouds is far more important than accounting for the vertical inhomogeneity.

- I believe collection 6 utilizes a new habit for the lookup table calculations. This new habit appears to produce different results compared to the ice crystal habit of collection 5.

- I do not see the value of section 5.4. If you deem it necessary, please include the section as a part of the appendix.

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2017-758>, 2017.