

The authors would like to thank the reviewer for the careful evaluation of our manuscript and constructive comments. Our responses to specific comments are below.

1) While it is great to reinforce key differences between MODIS and EPIC, there are a lot of text repetitions in the manuscript. For example, the part about fixed cloud effective radius on Page 2, 4 and 6. It is also mentioned many times about why it is necessary to use dual thresholds for cloud phase determination, etc. I would recommend reading through the whole paper again, then the authors will realise that many same references are mentioned over and over again, indicating that some reorganisation could be made.

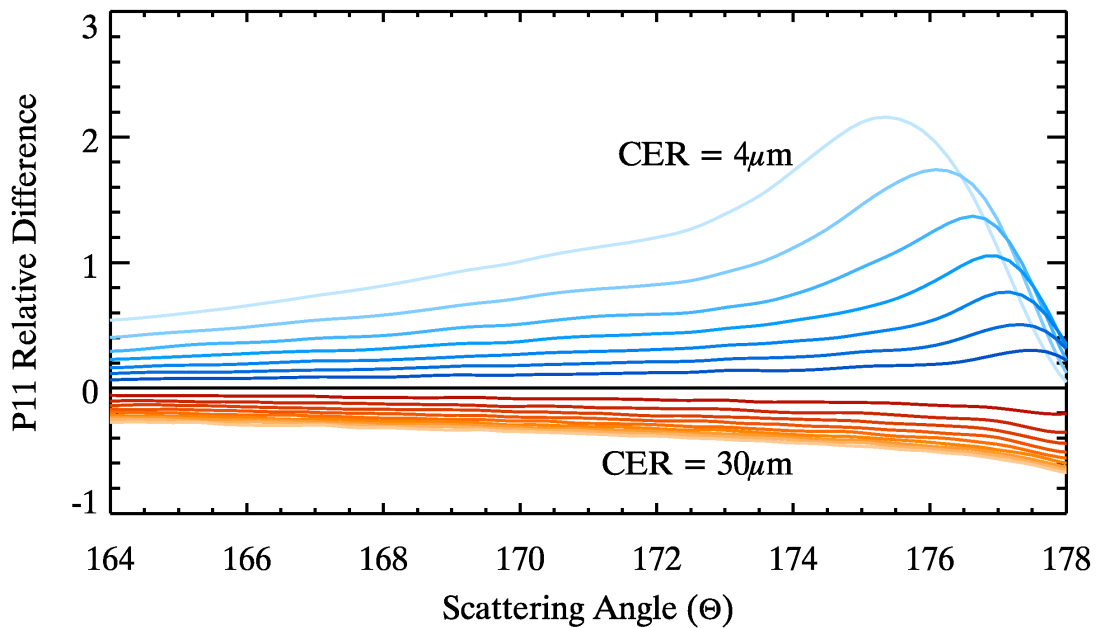
While we understand the reviewer's concern regarding repetition, we believe much of the repetition is necessary as a means to reinforce many of the salient assumptions and concepts of the current investigation. That said, we did move one sentence from the introduction (Section 1) to the algorithm description (Section 2) (see p. 4, lines 22-24).

In addition, Page 7, Line 33-35, I find the sentence is interesting but not necessary, because why one would like to select an inappropriate cloud temperature threshold?

We appreciate the reviewer's question. The notion underlying this statement is not that one would deliberately select inappropriate cloud temperature thresholds (indeed, why would one like to!), but that the thresholds may not be appropriate for all cases. This is particularly relevant given the expected difficulty of applying thresholds based on the O₂ A-band cloud temperatures that are weighted more towards the middle of the cloud rather than towards cloud top. We in fact allude to this in the succeeding sentence (p. 8, lines 5-8).

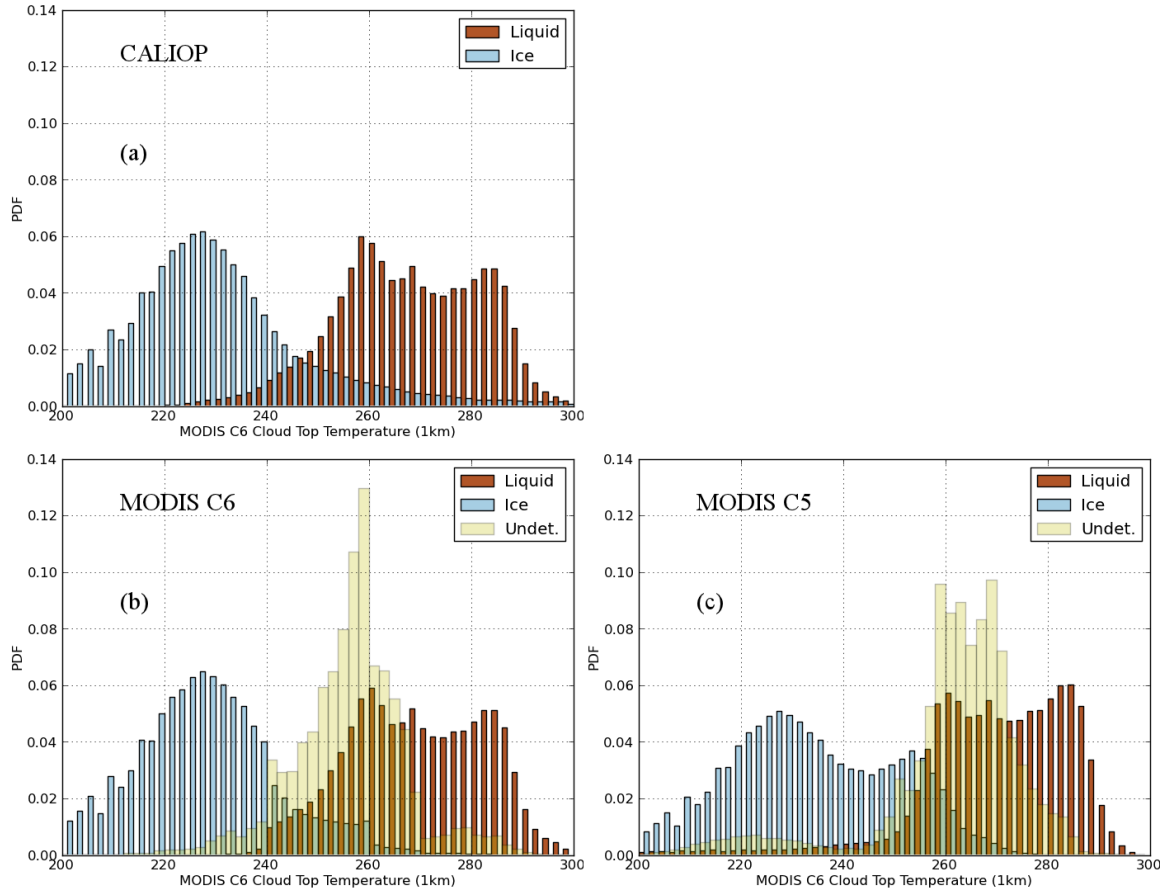
2) Page 9, Line 7–11: Could the authors please explain why large retrieval errors occur at certain scattering angles?

This is an excellent question. The large liquid COT retrieval errors at certain scattering angles (e.g., $174^\circ < \Theta < 178^\circ$) are almost certainly a result of the sensitivity of the scattering phase function at those angles to effective size. Note that these differences are largest at small COT (< 2), where the single scattering component is expected to dominate the total reflectance. The figure below shows relative phase function differences, with respect to (and normalized by) the phase function of the assumed liquid CER = 12 μm , at the 0.66 μm wavelength for different liquid CER – blue and red shaded lines denote CER smaller and larger than 12 μm , respectively. The largest phase function differences correspond to the $174^\circ < \Theta < 178^\circ$ scattering angle range, consistent with Figs. 9-10. We have added a statement to the manuscript that summarizes this phase function sensitivity (p. 9, lines 17-19).



3) Page 7: it would have been better if the authors tried to implement zonally-dependent cloud temperature thresholds. Or at least, the author could analyse MODIS cloud products to support the temperature range used in Figure 5.

This is an excellent comment, and we note that the results shown in Fig. 5 have indeed persuaded us to pursue a zonally-dependent cloud temperature threshold for the operational EPIC product. We also note that the temperature thresholds assumed here were in fact derived from a global analysis of one month (November 2012) of the MODIS cloud products and the active lidar products of CALIOP; see the figure below (Figure 11 from Marchant et al., 2016). That said, it is important to re-emphasize that the thresholds used here are appropriate for the IR-derived cloud temperature retrievals that are more sensitive to the top of the cloud compared to the O₂ A-band retrievals that are more sensitive to the middle of the cloud. Thus defining the appropriate zonal thresholds for use with the EPIC O₂ A-band cloud height product is left for future efforts, in particular after a sufficient amount of data has been produced such that a thorough analysis with co-located lidar observations can be pursued. We have added text clarifying the provenance of the CTT thresholds used here (p. 5, lines 33-35).



(Figure 11, Marchant et al., 2016). Probability density functions (PDFs) of CALIOP (a) and MODIS C6 (b) and C5 (c) cloud phase against the MODIS 1km cloud top temperature for November 2012.

4) Regarding Figure 5 and Page 5, it is not immediately clear if both thresholds increase 1K, or the authors change one at a time. Please make it clear in the text and the figure caption.

This is a good comment. We do shift both the liquid and ice thresholds simultaneously in the same direction, such that both either increase by the stated amount, or decrease by the stated amount. We have clarified this in the text (p. 6, line 5).

5) Page 4: It is mentioned that different data sets are used for atmospheric profiles. Could the author please explain why, and elaborate on the potential impact on retrievals?

This is another good comment. We first note that all retrievals shown in the manuscript use the NCEP GDAS ancillary profiles. For production of the official NASA EPIC dataset that will be available to the public, however, the NASA GEOS-5 ancillary profiles will be used per project requirements. We have opted for the NCEP GDAS profiles here simply because they are currently used for the operational NASA MODIS products (MOD06), and the required algorithm code is already in place; we note that the MOD06 algorithm team is currently testing the GEOS-5 profiles as a replacement for GDAS, though this functionality is not yet available to the current investigation. Nevertheless, for COT retrievals, the impact of the atmospheric profile is relatively minor since the spectral channel used for these

retrievals, the 680 nm channel that is the reference for the 687 nm O₂ B-band, is largely free of atmospheric absorption. The largest impact of the atmospheric profile assumption is expected to be on the O₂ A-band height retrievals, though we again emphasize that investigating the uncertainties of these retrievals is beyond the scope of this manuscript.

6) Page 5: It is not immediately clear if retrieval is performed at MODIS pixels or at EPIC pixels for "EPIC proxy version", although one can figure it out later when reading the result section. It would be good to make things a bit clear here.

This is a good suggestion. We have added text clarifying the retrieval resolution (p. 6, lines 5-7).