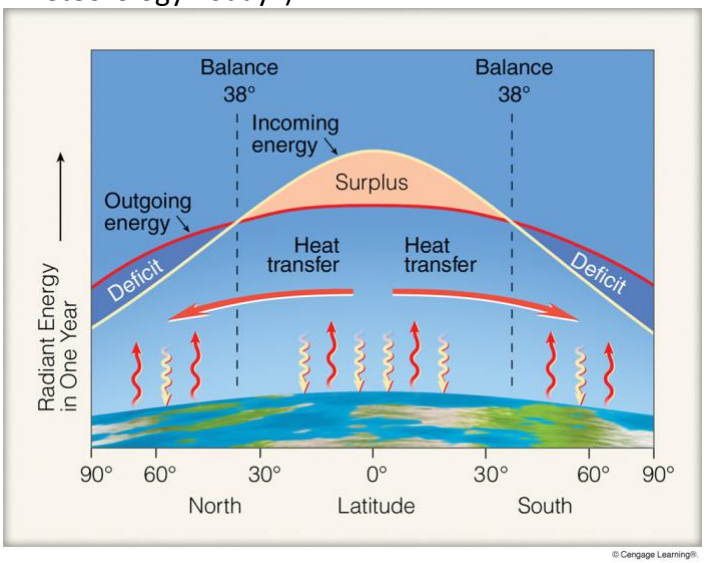
1. Use of an acronym “ATR-42” in the first sentence of the abstract is not helpful for those who do not know what ATR-42 is. Perhaps “manned research flights” ? Use of the ATR-42 is jargon. I did not know which aircraft it is. Perhaps describe the aircraft in the paper and call it ART-42 thereafter.

2. Line 6: I understand the desire to write a catchy first sentence, but “radiator fins” on traditional “radiators” don’t accomplish their purpose through radiation. They actually transfer thermal energy from one substance (a circulating fluid or highly conductive metal) to the air around them through conduction at the interface of the fin and the air that is it immersed within and not so much radiative losses. (Note: most traditional radiator fins are made of shiny metal that have less than ideal emissivity making them poor radiators anyway.) Then, after the air around the fin is warmed, it is transported away either through forced movement or natural convection. The exception are radiator panels on spacecraft that function as the authors are suggesting clouds do, but they are a rare form of embodiment of radiators and actually look like large flat panels and not fins that you find on common devices. So, I understand the author’s ambition to convey the importance of clouds in the upper atmosphere, but the current way it is written is not a good analogy and worse could lead an uninformed reader to the wrong idea about how most radiator fins work.

3. The very first sentence of the paper is also interesting because my elementary textbook understanding of the global energy budget is that the low latitudes cannot cool enough via radiation and that surplus energy is transported poleward through large scale circulations. In contrast, the high latitudes experience a deficit in the radiation budget because loss of radiation prevails over incoming radiation. (See Fig. 17 in Ahrens “Meteorology Today”)



So, what is it about the *subtropics* (roughly 10 – 30 degrees latitudes) that makes them special in terms of their ability to radiate energy? Again, this is in regard to the very first sentence of the paper.

4. Line 7: Try to avoid referring to heat as a noun. What is heat? It is ambiguous. Some people regard radiation as heat. Some regard anything having temperature as heat. Yet these are very different forms of energy. More precise language helps avoid confusion. (Read Bohren & Albrecht, Atmospheric Thermodynamics, 1998, pages 24 – 28.)

5. Line 9: "contribute to cool the Earth further" is awkward wording. Perhaps "contribute to further cooling of the Earth…"

6. Line 1 on page 2: "lidars have the potential to detect them much better" is a broad-brush statement that may not in fact always be true. The first part of that sentence was about passive sensors and but lidars are active sensors. I think one should not belittle passive sensors because lidars also have limitations where radiometers excel. Just carefully point out what lidars can do that passive sensors cannot. That is fair. But don't be dismissive of all passive sensors in half a sentence.

7. Page 3, Line 25, "shooting"? Like with a gun? Perhaps "projection" is more appropriate for a laser or lidar?

8. Page 3, line 24-25: how does one know whether the atmosphere is homogeneous? What constitutes sufficient homogeneity?

9. Lines 32 and 33: use of the word "the" too many times.

10. Line 1 on page 4: comma not needed before the word and

11. Line 8 on page 4: Acronym LSCE was not defined in the body of the paper.

12. Line 11 on page 4: wavelength is not the only issue that makes it eye-safe. The pulse energy, rep rate, and beam diameter also contribute. I suggest stating that eye-safety is a result of all of these parameters. It would be helpful to cite a document that explains in detail the eye-safety calculation.

13. Line 12 on page 4: Is the use of PXI architecture really worth mentioning? Is it related to the performance of the lidar? Why mention it here? For me, what is much more important (and not clear) is the next point:

14. Page 4 or 5: The paper does not mention the specific detector used. Table 1 lists analogue detection but also indicates a photomultipler (PMT) is used. Aren't PMT digital detection as in photon counting? I suggest being more specific on what detector (please state make and model) and what sampling electronics (make and model) are used. These are critical to understanding the nature of the backscatter data.

15. Line 5 on page 5: How about: “ALiAS was installed in the aft of the ATR-5 42 aircraft in an orientation that enabled a direct *near*-horizontal line-of-sight.” (Use of the word *direct* indicates that no scanner was required to achieve this. Near is the truth. It is not always perfectly horizontal.) You may include a sentence that there was no effort to steer the beam to maintain horizontal pointing and compensate for aircraft attitude.

16. Line 19. Could “right” be replaced with something more specific like “starboard”?

17. Line 23 page 6: what does *prototypical* mean here? Was it the actual flight or the flight plan? The first of two per day? Maybe *prototypical* is not the right word choice.

18. Line 23 on page 6 to line 3 on page 7. This is one huge sentence that does not read well. I recommend breaking it up.

19. Line 25 on page 6: what is a “lidar-related science needs” ? This is a vague phrase and leaves the reader wondering. I think the word “needs” should be singular (need) and not plural.

20. Line 7 on page 7: I suggest “Such an aircraft sounding was aimed at…”

21. Line 8 on page 7: Please clarify whether “retrieving aerosol extinction coefficient and volume depolarization ratio profiles” was done using in situ sensors or the lidar. I think this requires a much more explanation and references.

22. Line 10 and 11 on page 7: If it is worth noting then why not tell the poor reader the dates and times? Why tease them? Maybe a footnote or a reference to where they can find these cases?

23. Line 25 on page 7: “Lower troposphere” is pretty general and not helpful. Can you be more specific? In or out of the boundary layer? At the top of the convective boundary layer? Were you flying through the entrainment zone (EZ)? Above the EZ? Perhaps in the capping inversion?

24. By the way, flying in the entrainment zone is typically pretty bumpy ride and the atmosphere is not very horizontally homogeneous (a horizontal lidar beam penetrates inversion air and BL air in plumes). This is challenges two requirements for this project: (1) minimal rolling to maintain horizontal probing and (2) horizontal homogeneity. So, if the flights were indeed near the top of the BL (just above cloud base) near the EZ, can you please comment on whether these issues challenged the measurement goal?

25. Lines 8 – 9 on page 8: breaking the sentence across two points like this is not good style. Complete a sentence and start a new sentence.

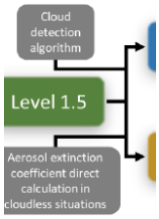
26. Line 13 page 8: use of *prototypical* again. (See point 17 above.) I understand a prototype is a first version of something but in this case the question is whether the first version was actually flown or was the long description just an ideal plan that was never actually done.

27. Line 7 page 9: Use of the word "onwards" not needed because there is no level above 3.

28. Line 7 – 8 page 9: I really don't know what this means: "For level 3 onwards that they are considered globally by flight segment to establish statistics." What does "considered globally by flight segment" mean?

29. Line 1 on page 10: The sentence "This section presents the physics of the measurement." should be removed. "…the physics of the measurement" is a huge and complex topic that would require several books to fully explain. Surely the manuscript is not covering all of it in this section. Maybe "This section presents the steps taken to derive data products."

30. Figure 4. This figure looks nice but I find it not very helpful because it is vague. For example, the following part of the figure is confusing. Are some arrow heads missing? It is not clear what is informing what. Where does "aerosol extinction coefficient direct calculation in cloudless situations" come from? Lidar data? What level?



31. Line 12 page 10: Volts should not be capitalized.

32. Line 12 page 10: Who cares whether they are in volts or digitizer counts? Isn't the voltage of backscatter data arbitrary? Really, why is data in volts important to note? Why is it in volts especially considering it uses a PMT? Shouldn't they be in counts?

33. Line 13 page 10. Resolution implies the ability to resolve. Given that the pulse length is 8 ns, I doubt you could distinguish two independent aerosol features that are 0.75 m apart. Perhaps the word "resolution" is a bit misleading. It is really more like *spatial sampling* along the beam. Whether those are truly independent samples or not is another question. It depends on the response time of the detector and amplifier. One could have 500 MHz sampling, but it doesn't provide value if the pulse length is long and the electronics are slow.

34. Bottom of page 10. Just wondering: How many bits of dynamic range is in the detection subsystem on this analogue lidar? (Again, I am confused because Table 1 indicates it uses a PMT which tells me it is photon counting but it also lists analogue detection mode. What am I missing?) If it is analog detection, then the number of bits is important to understand how well resolved the dynamic range is.

35. Line 18 on page 11. I suggest replacing the word “verified” with “true”.

36. Figure 5. Congratulations on achieving a flat background. However, many people who use this data will wonder why a description of this exercise is in the paper especially if it is not a problem. As having practiced lidar development I appreciate it and think it is worth keeping. But others will wonder. So, I think it would be helpful if the manuscript stated why this was investigated and why you bother to show it. Perhaps cite some examples where it was a problem? Without a good explanation, some may think it is just filler to fatten up the paper with technical stuff.

37. Isn’t a plot of a single waveform for level 1 data more important than a scatter plot showing the flat baseline? (Just wondering why there is not a figure to show a typical return from 1 pulse of level 1 data.)

38. How much averaging (temporal or spatial) is ever done to the data. I don’t recall reading anything above smoothing and it might be worth pointing this out,

39. Same question as above for level 1.5 data. Why not make a plot that shows how data processing transforms a given waveform from level 1 to level 1.5? Then people can see a plot of the actual data. This is helpful so that when they read the data they can check to make sure they see the same thing. They can attempt to recreate the plot on their own and be sure they are looking at things correctly.

40. In fact, I am thinking of a plot that shows the progression of going from level 1 to level 1.5 etc all the wave up to the final product: cloud boundaries. That would be nice.

41. Figure 6 panel b shows the “apparent backscatter coefficient” close to the aircraft (< 1 km range) tend to be more orange than the data out at 2 or 3 km which tends to be yellow. Is this the result of attenuation that is not corrected? I think it is worth explaining this in the manuscript.

42. Please state (it may require a new paragraph) the distribution of roll angles during a typical flight leg and the implications of aircraft roll on the altitude of the lidar beam as a function of range. For example, what happens to the altitude of the beam at 8 km range if the aircraft rolls off of perfectly a horizontal plane by 1 degree? Perhaps the flight data could be used to mark each range gate in a lidar return with an estimated altitude. Also, can the authors please comment on the implications of variability in aircraft roll on what this means for the cloud location data? Is it possible that at one

moment the lidar beam intercepts a small cloud but the next moment it misses the cloud because the aircraft rolled a little bit? Could this rolling (due to the turbulence) make the cloud results look less coherent and more noisy?

43. Line 8 and 9 of page 28: what means “altitude parameters”? This is vague. Is it altitude of the aircraft for each pulse? Is it altitude of the beam for each range gate?

44. Section 5.2.2: Many non-lidar scientists will not understand what overlap factor is. Perhaps one or two sentences to describe what this is and why it must be addressed?

45. Is the aircraft attitude (pitch, roll, yaw, etc.) data included any of the level 1, 1.5, etc data?

46. Can the manuscript please state the size of the data files? For example, megabytes per file?