

“The diurnal cycle of cloud profiles over land and ocean between 51S and 51N, seen by the CATS spaceborne lidar from the International Space Station” by Vincent Noel et al.

This paper documents the diurnal cycle of the cloud vertical profiles over a large part of the globe, using CATS lidar, operating on the International Space Station. Cloud fractions from different locations, seasons, instruments have been compared, by taking the advantage of this unique dataset. The study is interesting and useful. But it would be better to relate the role of dynamic and thermodynamic processes to the differences of CF found from different conditions, which is not clearly presented. I recommend some modifications to improve the paper before publication.

Major issues:

1. The second paragraph of Introduction needs more support references to help the readers to better understand the background. For example, ‘well documented by passive satellite imagery’, it would be better to add in relative works. The same suggestion for ‘b) cloud detections from ground-based active instruments’ part. There are a lot of works have been done with ground-based instruments on cloud property analysis, I would appreciate if you can give a few references here.
2. The authors chose ARM SGP site for the comparison, is there any particular reason to compare two mid-latitude continental sites with CATS? Comparing with oceanic type of clouds would be interesting, if there are any possibilities. Since you actually didn’t really process the SGP dataset, I would suggest that you could keep this part as an additional material.
3. You talked about the pronounced mid-level clouds over continent many times which has been well documented, could you give a more detailed explanation for that, and the role of dynamic and thermodynamic processes.

Minor issues:

1. On Figure 1, is there any way to show the number of samples on the plots as well? In the text, the latitude range is 51S-51N, but on most of the plots, it’s 55S-55N. It is better to keep it consistent.
2. The color bar need to be adjusted and extended to greater than 20%, add in unit, and keep the x axis and y axis consistent for the same figure group, specially figure 4.
3. Figure 5, better to label A, B, C... on the subplot for each location.
4. Line 515: Using passive instruments to retrieve the cloud properties is different from active instruments, they don’t have the same sensitivity for the thin clouds. It isn’t a fair comparison here.
5. Another thing to note is that, besides cloud detection, retrieving a cloud top height from especially for thin clouds and in multi-layered situations.