

Atmos. Chem. Phys. Discuss., referee comment RC1  
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## **Comment on acp-2022-481**

Anonymous Referee #1

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Referee comment on "Measurement Report: Observed Increase in Southern Hemisphere Reflected Energy from Clouds During December 2020 and 2021" by Jay Herman et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-481-RC1>, 2022

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The authors analyze EPIC ultraviolet reflectance data, focusing on peaks in December 2020 and November 2021, and (I think) attempt to answer the question of whether these peaks are physical (due to clouds) or retrieval artifacts due to changing viewing angles. Based on differences between the Northern and Southern Hemisphere peaks and a comparison with an independent instrument, they conclude the December 2020 and November 2021 peaks are due to increased Southern Hemisphere cloudiness.

As detailed below, I am confused about the motivation for the paper and about whether the authors applied corrections to the EPIC data to account for the changing viewing angles. The paper is also poorly written and edited at present. I cannot recommend publication barring major revisions to the manuscript.

### **General comments:**

A. Overall motivation: From the paper I remain unconvinced that December 2020 and 2021 had interesting anomalies that really need explaining. It would be helpful to show that the differences seen in those months are large compared to interannual variability in general (e.g., as measured by the interannual standard deviation of previous years).

The introduction and concluding paragraph frame the study as primarily motivated by the question of whether angular dependencies are substantially affecting EPIC measurements. I did not pick up on this motivation from the abstract or title of the paper.

The authors also claim they correct the EPIC data for changes in orbit in 2020 and 2021, although they do not describe how this is done. If they are able to correct for the orbit

changes, then what added benefit is the analysis shown? Or is the analysis supposed to be a confirmation that the corrections indeed work and the differences seen after correction are due to cloud changes?

B. General sloppiness: Overall I found the paper incredibly hard to follow. I believe a large portion of this could be fixed by better organization and explanation on the part of the authors. The use of equations is particularly galling, with 9 equations stacked in a row with minimal explanation at one point and a tenth equation placed within a figure caption. There are also a large number of typos and grammar mistakes.

### **Specific comments:**

Lines 21-22: Isn't there an effect of eccentricity here too, as the Earth is closer to the Sun in December?

Lines 88-89: I don't believe the fact that increased reflection was observed in 2020 and 2021 has been introduced. It might be good to show that here and give a sense of how large the anomalies are relative to other years.

Lines 115-116: What is the correction? As mentioned above, this seems fundamental to the paper's motivation.

Equations 1-9: The equations could definitely be explained better. Maybe interspersing them within the text instead of just listing them all at once would be an improvement?

Eq. 5:  $L_{ER}$  is not defined. Should B be  $B_i$ ?

Line 127: "and" should be "an"?

Figure 1: Why is data from 2019 excluded? Could you please explain the data gap.

Line 153: Isn't this Figure 4?

Line 176: Could you explain how Figure 3 supports this?

Figures 4-8, 10-11: What is the y-axis showing? Are you reporting the amount of sunlight reflected in a given latitude band divided by the entire amount of sunlight received by the Earth? So the sum of everything should be  $\sim 30\%$ ?

Figure 5 bottom right panel: What does a negative value for percent of sunlight reflected mean?

Figure 5 legend: The red line should be labeled 2016-2017, not 2017-2017. The blue line should be labeled 2018-2019, not 2018-2919.

Line 176: There is no justification for this being an Appendix with only one sentence and one figure. Why not just bring it into the main text?

Figure 6: Maybe put error bars of 1 standard deviation around the 2015-2018 values to show if the December 2020 values are really that extreme?

Figure 6/Eq. 10: Are you defining an equation inside of a figure caption? Please define the equation within the main text.

Line 202: How does Figure 2 support this?