

Atmos. Chem. Phys. Discuss., referee comment RC2  
<https://doi.org/10.5194/acp-2021-926-RC2>, 2022  
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## Comment on acp-2021-926

Anonymous Referee #2

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Referee comment on "Exploring Relations between Cloud Morphology, Cloud Phase, and Cloud Radiative Properties in Southern Ocean Stratocumulus Clouds" by Jessica Danker et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-926-RC2>, 2022

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Overall, this paper provides a clear and comprehensive description of its methodology, findings and implications. The study evaluates the evolution of clouds over the Southern Ocean, which is directly related to processes and feedbacks over the region that are in desperate need of improved understanding to improve weather and climate models. Results focus on long scale trends such as seasonality as well as trends on the timescales of days/weeks by separately evaluating open and closed cellular cloud regimes. Specifically, the authors evaluate whether cloud phase is correlated with the transition of closed to open cell regimes, which is certainly a pertinent question. The study is well cited and contains ample discussion of previous studies in relation to the study's findings. I recommend the manuscript be accepted with minor revisions.

Comments:

The phase product is performed as a vertical integration. As I understand it, any combination of liquid/ice/mixed pixels will result in the classification of the column as mixed-phase (as long as there is at least one pixel containing liquid and/or ice). Can you comment on this in relation to potentially restricting  $liq < (liq + ice)$  from being classified as mixed phase assuming both liq and ice are greater than 0? (e.g., for in situ observations, often mixed-phase is classified as  $0.9 > LWC/TWC > 0.1$ , such as described in Korolev et al. (2017) mixed phase review paper).

You refer to albedo as reflectivity numerous times in the paper which can be confusing

(especially since it's a remote sensing paper). It might be best to just say albedo.

Line 19: "These differences in cloud albedo"\*

Line 55-57: This sentence is confusing

Figure 2: Change y-axis label to just "Probability"

Figure 2 caption: Can you specify what category you are referring to? Are they normalized by cloud regime type and respective row variable? Then I don't think you need to add the category comment.

Line 166: Where did you get 55% from? Did you calculate it by using all the COT values (including different seasons and cloud regime types) in table 1? If so, please specify.

Line 230: Introduce SLCs here (and not at line 238). Also, it's slightly confusing to introduce this since you introduce SLC (the same acronym except clouds isn't plural) at line 10.

Line 258-259: Why isn't the peak at -5C observed for closed cell MCC?

Line 342-343: What part of your results suggest mixing is relevant to CTH? You just mentioned data limitations prevent you from evaluating turbulence/circulations and no significant trends were found between SST and sfc wind speed.