This document includes the reviewer comments (red) and author responses (black). Author responses to anonymous referee #1 are followed by author responses to anonymous referee #3.

Author responses to Anonymous Referee #1:

The authors response adequately addresses my comments on the previous version of the document. However, I have a few minor comments on the revised manuscript.

1. Although the authors addressed my main concern in their response about the use of the CAS data from the 2016 campaign, I would have liked to see them briefly summarize this in the revision. Perhaps around line 217.

A brief summary was added as an appendix at the end of the paper. The following sentence was added at the end of section 6.3: "CAS data were used to represent measurements of droplets with $D < 50$ μm collected during ORACLES 2016 in the absence of CDP data. The sensitivity of S_o to the use of CAS data was examined in Appendix D." The following text was added at the end of the manuscript (along with the addition of Fig. D1 and Table D1):

"Appendix D – Sensitivity of S_o to the use of CAS data from ORACLES 2016

Given the differences between the CAS and PDI N_c and LWC for droplets with $D < 50$ μm during ORACLES 2016 (see supplement), sensitivity tests were performed by first excluding ORACLES 2016 data and second by using PDI data to represent ORACLES 2016 size distributions for $D < 50$ μm in the S_o calculations. These sensitivity tests resulted in minor changes in the trends of S_o versus H (Fig. D1) along with average changes in the magnitude of S_o up to 0.05 (Table D1). The noted changes suggest that the discussion of trends in S_o described in this study is robust as it relates to the inclusion of ORACLES 2016 data and the use of CAS data for the deployment. Since the 2016 deployment contributed about a third of the ORACLES measurements, data from the 2016 deployment were included in the study so as not to reduce the size of the dataset.

The slight decrease in S_o for thick clouds ($H > 256$ m) upon removal of ORACLES 2016 data is associated with a decrease in the number of thick clouds (Table D1). The use of PDI data resulted in minor changes because S_o primarily depends on N_c and R_p. The CAS and PDI datasets had small differences in the average N_c (95 % confidence intervals of 9 to 12 cm^{-3}) and R_p was calculated using droplets with $D > 50$ μm which do not include contributions from either the CAS or the PDI. The documentation of differences between the ORACLES cloud probes (see supplement) highlights the measurement uncertainties associated with the cloud probe datasets."

2. Line 36: Suggest changing "the existing relationships between Rp and Nc in model parameterizations must be adjusted to account..." to something like "adjustments to existing relationships between Rp and Nc in model parameterizations should be considered to account..."

The sentence was updated to "These results suggest the changes in cloud microphysical properties were driven by ACIs rather than meteorological effects, and adjustments to existing

relationships between R_p and N_c in model parameterizations should be considered to account for the role of ACIs."

3. Line 515: Should this be Fig 7 instead of Fig 8?

This was changed.

4. Line 592: I think, but am not entirely convinced, that I understand what the authors are trying to convey here with reference to the new Fig 9. Suggest they expand the description in the text and figure caption a little. So that it is clear how the figure shows "the impact of deltaNc or deltaRp on S0 depends on the original...."

The following text was added at the end of the paragraph: "Figure 9 shows the impact of ΔN_c and ΔR_p on S_o depends on the original values for N_c and R_p as the same ΔN_c or ΔR_p can have an opposing effect on S_o. For example, a decrease in N_c at point 1 would decrease the slope and the S_o value while the same decrease in N_c at point 2 would increase the slope and the S_o value."

Author responses to Anonymous Referee #3:

The authors have done a good job to address reviewer concerns. I had some minor suggestions:

Line ~95-96: when you write "unique meteorological conditions", what is meant be this? be specific rather than citing other papers.

The papers were cited to point the reader to information on field campaigns mentioned at the start of the sentence. The paragraph text was rearranged, and the unique conditions are introduced in the next two sentences:

"Recent field campaigns focused on studying ACIs over the southeast Atlantic Ocean because unique meteorological conditions are present in the region (Zuidema et al., 2016; Redemann et al., 2021). Biomass-burning aerosols from southern Africa are lofted into the free troposphere (Gui et al., 2021) and transported over the southeast Atlantic by mid-tropospheric winds where the aerosols overlay an extensive MSC deck that exists off the coast of Namibia and Angola (Adebiyi and Zuidema, 2016; Devasthale and Thomas, 2011). The above-cloud aerosol plume is associated with elevated water vapor content (Pistone at al., 2021) which influences cloud-top humidity and dynamics following the mechanisms discussed by Ackerman et al. (2004)."

The title seems to address only a fraction of the paper. Another title would be more helpful that fully captures everything that is presented.

The title of the paper was changed to: "Factors Affecting Precipitation Formation and Precipitation Susceptibility of Marine Stratocumulus with Variable Above and Below-Cloud Aerosol Concentrations over the Southeast Atlantic**"**

It seems there are sometimes negative precip susceptibility values. This is interesting and can be discussed briefly in light of others who have shown this too and attributed it to possible influence of giant particles: https://doi.org/10.1002/2016JD026019

The following text was added in Section 6.4:

"An airborne investigation of marine stratocumulus off the Californian coast attributed negative values of S_o to the influence of giant cloud condensation nuclei (Dadashazar et al., 2017). The authors hypothesized the low statistical significance of the negative estimate of S_o could be associated with precipitation suppression by aerosol particles."

Regarding these statements: "The ORACLES dataset addresses the "lack of long-term data sets needed to provide statistical significance for a sufficiently large range of aerosol variability influencing specific cloud regimes over a range of macrophysical conditions" (Sorooshian et al., 2010)."...My suggest is to tone this down a bit since this one dataset doesn't fully address this issue. It is a step in the right direction, but still there is room for improvement with more flights and to gather more statistics.

This sentence was moved to the end of the paragraph and changed to:

"The ORACLES dataset can be combined with future investigations of marine stratocumulus to address the "lack of long-term data sets needed to provide statistical significance for a sufficiently large range of aerosol variability influencing specific cloud regimes over a range of macrophysical conditions" (Sorooshian et al., 2010)."

OTHER CHANGES:

1. The first affiliation was updated to reflect a name change for the organization.
2. Table formatting was changed to remove colors following journal recommendation.
3. Line 198: O'Brien et al. (2021, in prep) changed to O'Brien et al. (2022, in prep)
4. The following reference was added:
   "Dadashazar, H., Wang, Z., Crosbie, E., Brunke, M., Zeng, X., Jonsson, H., Woods, R. K., Flagan, R. C., Seinfeld, J. H., and Sorooshian, A.: Relationships between giant sea salt particles and clouds inferred from aircraft physicochemical data, J. Geophys. Res.-Atmos., 122, 3421–3434, https://doi.org/10.1002/2016JD026019, 2017."