We thank Reviewer 1 for their time, comments, and helping to make this a better manuscript. Please see our reply to each comment below. For exact wording changes and additions made to the manuscript, please refer to the marked up manuscript.

Reviewer Comment: L195-200: How is “low level cloud” defined?

Response: Text has been added in the second paragraph of section 4.1 to address this and with reference given for the LIDAR retrieval.

Reviewer Comment: L230-235: Presumably, Figure 5b shows the global impact of reduced SEP Sc bias. For example, it shows an increased low cloud amount along the ITCZ. Although it is not within the scope of this paper to discuss the global impact of reduced Sc bias, it would be helpful to provide information on whether the differences we see on Figure 5 are significant. This can help guide future work.

Response: This is an excellent suggestion! We have added stippled areas to this plot to show where differences are statistically significant. In addition, text was modified/added in section 4.1 to discuss these results.

Reviewer Comment: L290: In general, I would like to see more discussion on the mechanisms behind the improvement in SEP-RRM-FIVE. What processes lead to improved Sc with FIVE and with RRM respectively? Here the authors touched on turbulence and cloud top feedback. More detailed discussion would be appreciated.

Response: Thank you for this suggestion. Yes, we agree more description and context was needed. At the end of section 4.1 we added a couple paragraphs to address this.

Reviewer Comment: L315-320: The presence of positive and negative bias along the coast in DJF, MMA, and SON in FIVE simulations suggests that the location of the Sc deck is shifted north of the observed Sc. Is this the case? If so, does it suggest that the bias is related to large-scale circulation instead of BL processes?

Response: This is a very interesting point and thus far our analysis has not shown strong evidence that the errors in the large-scale circulation are the leading cause of this placement bias. We hypothesize that parameterization deficiencies are the first order cause of the remaining bias, as already noted in the text.

Reviewer Comment: L330: “further refinement of the vertical grid in VEP could lead to additional improvements”, are there studies to support this claim?

Response: It was found in the original E3SM-FIVE prototype paper (Lee et al. 2021) that running with increased vertical resolution (16x relative to E3SM in the boundary layer) beyond that used in this paper (8x) has modest improvements to the Sc biases. Thus, It is possible that 16x vertical resolution in FIVE coupled with high horizontal resolution could further reduce the biases presented in this paper. The appropriate reference has been added near original line L330 (at the end of section 4.2) to support our speculation.

We thank Reviewer 2 for their time, comments, and helping to make this a better manuscript. Please see our reply to each comment below. For exact wording changes and additions made to the manuscript, please refer to the marked up manuscript.

Reviewer Comment: I find the article interesting and well written. The lack of improvement in representing stratocumulus and other boundary-layer clouds remains challenging. Therefore, the focus of the paper is of particular interest. Given the rise of global high-resolution modeling, it is important to provide insight into the effectiveness of improving low clouds with refined resolutions. However, I don't really understand how this happens. Using FIVE, some parameterized processes should be better represented, but it is not explained which of them mostly explains this difference, and how the changes act on the cloud coverage. Is it related to the way some processes are represented at the sub-grid scale and are sensitive to resolution (e.g. scale awareness)? Is it cloud-top entrainment, convective transport, turbulence closure, cloud radiation? This would help clarify why resolutions are so important, and how other climate modeling groups might use this framework.

So I thus suggest that the article be accepted after the minor comments I highlight. I would like to see the authors describe in more detail the reasons why vertical resolution is so important, and which processes are most sensitive to this refinement.

Response: Thank you for this excellent suggestion. Yes, we agree more description and context was needed. At the end of section 4.1 we added a couple paragraphs to address this.

Specific comments:

Reviewer Comment: Line 59: "panacea": Unclear and not necessary.

Response: The wording has been changed here.

Reviewer Comment: Line 100: "elements": Unclear. Do you mean grid boxes/columns?

Response: The wording here has been made more clear and with appropriate references given.

Reviewer Comment: Lines 283-285 + Figure 6b: How do you explain that the RMSE is as high in the HR simulations as in LR? Does this suggest that HR simulations are not realistic in reproducing spatial pattern of low clouds?

Response: Spatial patterns of low clouds are realistic in the HR simulations, as demonstrated by the geographical bias patterns in figure 4. Though, the bias is reduced locally in the stratocumulus regions, those regions are geographically quite small and thus does not have a dramatic effect on the global skill scores. In addition, it appears that the HR simulations have slightly more bias and error in the storm tracks, which is likely compensating the improved error scores in the stratocumulus regions.

Reviewer Comment: The variability of the COSP low-cloud amount may differ from the model cloud variability by changes in the high-cloud amount. How much does this influence the biases in the seasonal variability (Figure 12)? Overall, do the authors find the same result (improvement by FIVE, and HR) if using the model low-cloud amount?

Response: Using the model low-cloud amount (specifically the variable "CLDLOW") produces nearly scientifically indistinguishable results when compared to using the LIDAR simulated low-cloud ("CLDLOW_CAL"). See attached figure (which uses CLDLOW) and compare that to figure 12.

Reviewer Comment: Line 370-371: What is the relative coverage of the SEP-RRM region? This would be a relevant comparison to the 0.05% the authors put forward.

Response: The SEP-RRM covers approximately 4.3% percent of the globe. This has been added to the text.