

Response to Referee Comments (RC1) for acp-2019-131

“Quantifying aerosol size distributions and their temporal variability in the Southern Great Plains, USA”

Referee Comments received on 7 July 2019

We would like to thank the reviewer for their time and comments. We have responded to their comments below.

1) I am not sure whether replacing the season names with MAM, JJA etc. increases clarity. At least for me, it caused more confusion than just using the season names with a definition.

The authors prefer to use the MAM, JJA, SON, and DJF terminology since it reminds the readers what data went into these statistics. However, we did add the following statement on P4, L15 to make a stronger connection between these acronyms and the seasons.

“Throughout this manuscript, the terms MAM, JJA, SON, and DJF can be used interchangeably with spring, summer, autumn and winter, respectively.”

2) page 4, line 25: “...concentrations around 3 m was a data artifact.” Do the authors have a explanation for the cause of the artefact? Is this related to the factors given at page 5, line 3 (“ It is important to note...”)?

The cause of the data artifact was likely related to the size of the bin widths around 3 microns in the APS data processing. We have added the following “... data artifact, which is believed to have been caused by inaccurate size bin boundaries determined from the initial instrument calibration.” at the end of the current sentence to provide this information in the manuscript.

3) Figure 4 and corresponding text: did I understand correctly that a bolded box means that the 5-95% range is significantly different than in the ALL case? how is this determined? Not being a statistician, I do not fully understand how this is determined, and maybe an explanation could be useful for many readers too.

The reviewer did correctly understand that the bolded boxes in Figure 4 represented instances where the seasonal 5-95% range is significantly different than the ALL data. This determination of statistical significance was determined in the same manner as for all the statistics shown in Figure 4. We had provided an example of how the statistical difference works for the DJF mean on page 5, Lines 20-29. We have also added the following statement after the example, “The same process was completed for the median, IQR, and R595 statistics for each season.” to make it clearer that the process was the same for all the statistics.

4) Figures 6, 8 and 10: the local time could be indicated as well as the UTC time. Alternatively, the solar noon and midnight could be shown in the plot.

We agree that adding local time would be helpful here. As such, we have recreated Figures 6, 8, 10, and 11 to include two axes for both UTC time and Central Daylight Time (UTC-5). We have also made this change to the corresponding figures in the Supplement.

5) page 11, line 13: “The similarities between the timing of the peak concentrations of the 12-hour cycles for NT and N7-30nm further demonstrate the regulating relationship that N7-30nm has on NT .” - What is meant with regulating relationship? The smaller particle range seems to be dominating the size distribution, and therefore the total number follows the N7-30nm , but I don't consider this as regulating. This could maybe be clarified.

We can see why the reviewer doesn't like the term regulating, as it can be interpreted in several ways in this context. We have replaced this sentence to read “The similarities between the timing of the peak concentrations of the 12-hour cycles for NT and N7-30nm further demonstrate that the variability in N7-30nm is the driving mechanism for the variability in NT. “ to make our point clearer.

6) Page 13, line 16: “Because size-resolved measurements for a longer time period were unavailable, cycles in aerosol number concentrations for periods of days to weeks were tested only for NT” I did not fully understand, I thought that the whole dataset was a size-resolved dataset?

5 years (2009 through 2013) of data had size-resolved aerosol distributions. However, 5 years of data did not provide large enough seasonal samples for testing cycles with longer time periods (several-day to several-week cycles, Section 4.3). This comment in the conclusion referred to this part of the analysis. We have added some clarifying statements in the conclusion section to make this clearer.