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Interactive comment on “Characterization of atmospheric aerosol in the US Southeast from ground- and space-based measurements over the past decade” by E. J. Alston et al.

Anonymous Referee #1

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This study investigates the decadal trends in aerosols over the SE US using a combination of surface PM_{2.5} and satellite observations. The manuscript is generally clear and the methodology sound. The only major deficiency is an inadequate justification of the contrast they draw between their results and Goldstein et al., 2009. I detail this a bit below, and suggest that the authors either need to soften their conclusions or provide more analysis to justify their interpretation. Minor comments also follow.

Major Comments:

1. The authors see substantially different patterns and trends to G09. Further justifi-

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cation and investigation is required. The authors suggest that the difference they see in spatial patterns of AOD compared to G09 is due to the use of Level 2 vs. Level 3 data, as well as different years – this could easily be verified by the authors. The discussion in the Conclusions section is unconvincing. The authors indicate that the temperature record in the region is flat, but need to provide details on whether the cited study was for the exact same region and time period. It is also unclear how what they have shown disputes the G09 results as the authors have shown here that there is a significant trend only at the surface and the total column AOD trend is non-existent or muted. Thus, it appears that aerosol aloft could behave different from at the surface (in agreement with G09), and in particular they cannot discount the possibility of a layer of organic aerosol aloft. And thus that surface PM2.5 is responding to decreasing anthropogenic emissions, but that total column aerosol trends include additional factors.

2. Page 7576, line 22: Given that only 1 of 3 satellite records show a decreasing trend, it is false to say that this analysis presents evidence of solar brightening.

Minor comments

1. Page 7560, line 19: unclear what alpha=0.05 refers to here, suggest remove “for alpha=0.05” or provide details of t-test.
2. Section 2.1: do the PM2.5 measurements include water? Please give this information in the text.
3. Page 7565, line 24: what are “fill values”? are these interpolated or duplicated?
4. Section 2.2: did you cloud filter the data at all? This relates to the larger issue of how cloud cover can impact your long-term trends and seasonality. It would be helpful to tell the reader how the amount of data in each season is impacted by cloud cover. You should also verify whether there is any trend in cloud cover that may impact the satellite data coverage and hence the AOD trend.
5. Section 2.2: in Section 2.3 you give information from the literature on comparisons

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of MISR and AERONET, to be consistent similar information should be provided for MODIS vs. AERONET.

6. Page 7567, lines 10-18: I am a little unclear here on your matching process. Can you confirm that you in fact did not use only co-located data? This may be fine for presenting independent maps and trends, but for scatter plots you should include EXACT comparisons (Figure 4). Thus, you should grid the MODIS and MISR data to the same grid and only include grid boxes where both were observed to create averages.

7. Figure 3: you should discuss at least briefly why 2007 was high when you first discuss this figure on page 7568 and not leave it to page 7571.

8. Figure 4: I don't understand what data is shown on this figure, so perhaps the caption could be expanded a bit? I understand that the data is seasonal means, but there are more than 10 points, so it is not the average value on the 5x5 grid for each year. Does each symbol represent a value over each PM2.5 site? Co-located grid-boxes in the region?

9. Page 7569, line 21: grammar: "AOD values near clouds can double due to . . ."

10. Figure 6: why is winter on a different color bar than summer? It makes the figure confusing to compare.

11. Page 7571, line 18: grammar "product produces smoother . . ."

12. Page 7573, lines 1-5: You should be clear that the correlation trends here are driven by the seasonality in aerosols in the SE (not the long-term trend). This correspondence in seasonality was previously shown in Figures 1 and 2 so it seems it would be more informative to look at the correlation in the de-seasonalized trends.

13. Page 7573, lines 6-7: It is incorrect to say that trends are "readily apparent" in all datasets, when there is no apparent trend in the satellite datasets.

14. Page 7573, line 8-11: Could you tell us more about the 2007 fire? Where was it

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located?

15. Page 7574, line 10: typo, I believe you should refer to Figure 9 not 8 here
16. Page 7573/7574: I'm confused about how the distinction between metro Atlanta and outside this region discussed in the text matches with Figure 9. This figure appears to show very similar trends for both in the TEOM data.
17. Page 7574, line 17: You need to be specific about what is correlated. Temporal correlation of the regional means?
18. Page 7576, line 3-4: there is no negative trend in AOD, do you mean PM2.5?

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