

## ***Interactive comment on “Seasonal differences in the vertical profiles of aerosol optical properties over rural Oklahoma” by E. Andrews et al.***

**Anonymous Referee #2**

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General Comments:

In “Seasonal differences in the vertical profiles of aerosol optical properties over rural Oklahoma” Andrews et al. present an analysis of over 5 years’ worth of aerosol optical property vertical profiles over the SGP site in Oklahoma from the IAP aircraft. The primary objective of the manuscript is to answer the following three scientific questions:

1. Are there seasonal differences in vertical profiles of aerosol properties?
2. Are the seasonal trends consistent with other aerosol measurements?
3. Do these differences correspond with source region/transport?

The authors do a reasonable job at answering the first two questions, but the third

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question only receives a cursory analysis in my opinion and needs to be expanded prior to publication.

The manuscript is well written and the scientific methods used are outlined clearly and valid. The presentation is well structured and the objectives are clearly stated. The data presented will aid in the validation of both chemical transport models and satellite retrievals. However, the analyses presented are rather limited. As a result, there is not a sufficient amount of new material presented to merit publication yet. A more thorough analysis of the source region/transport (3rd question above) should provide an adequate amount of novel information for publication.

Specific Comments:

Table 1: Indicate the number of flights in each season and month in each year to show the distribution of flights over the indicated time. This is to help determine whether there were any temporal biases based on flight distribution.

Figure 1: Why are there no error bars on the fall and spring profiles as well as the asymmetry parameter? These would be helpful to determine the amount of variability in the data.

Figure 2 and the discussion related to the data presented therein: Is there a reason why the optical properties were adjusted to 673 nm and not 500 nm for comparison with AERONET? Regarding specifically the single scattering albedo comparison, are there 3-wavelength PSAP data or multi-wavelength aethalometer data available at the SGP site for the time period of the study? It is difficult to believe that the inverse wavelength correction for the absorption data is constant over the year.

Figure 3 and the discussion related to the data presented therein: I assume the trajectories shown in the figure are the cluster means. This should be stated. Better yet, trajectory density plots would provide better representations of each cluster. It is difficult to believe that clusters with 5, 3, or 2 trajectories are statistically significant. Why

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was a maximum of 6 clusters allowed? This seems arbitrary. How were the number of clusters chosen? Why are the spring and fall clusters not shown? To better answer the third scientific question as stated in the Introduction, I feel like a statistical analysis of the aerosol properties for each of the seasonal clusters (as referred to on page 11949, lines 13,14) should be presented. This would help to better answer question 3 as well as provide important information to the modeling and satellite communities regarding aerosol properties of different transport regimes.

It would be nice to show seasonal profiles of T and RH so that boundary layer heights could be approximated in each season. This would put the aerosol property variability with height in greater context.

Technical Corrections:

Page 11941, line 19: "measured" should be changed to "measure"

Page 11943, line 11: Please define PSAP

Page 11949, line 24: Add "the" between "have" and "opportunity"

Figure 2: Change WIN to DJF to be consistent with the other seasons

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Interactive comment on Atmos. Chem. Phys. Discuss., 11, 11939, 2011.