

## **Author responses to comments of Anonymous Referee #2.**

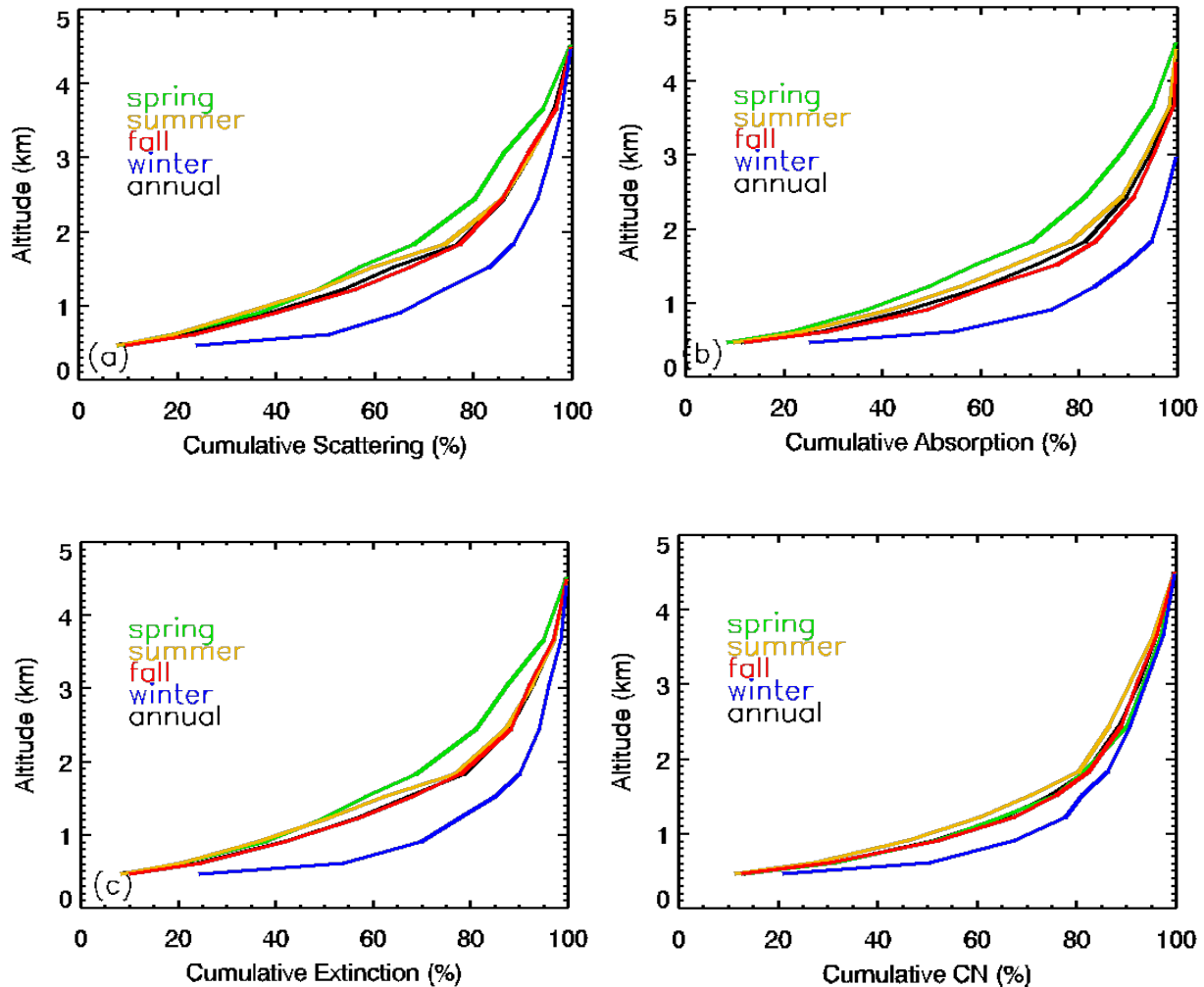
The authors would like to thank Anonymous Referee #2 for his/her review of the manuscript. Here we will attempt to respond to all concerns and answer all questions adequately.

### General Comments:

1) You present the statistics of the vertical profiles as box-whiskers plots which is good. I am just missing and suggesting something that might be of interest to other readers, too: a cumulative statistics of the extensive properties as a function of altitude. What I suggest is that on x-axis you would have for instance  $100\% * \sum(\text{scattering}(i) * \text{layer length}(i))$  where summing goes from surface to altitude  $i$ , divided by the total sum. That would tell, how large a fraction of scattering/absorption/extinction (aod) takes place in the layer below altitude  $i$ . After calculating these, you could easily make seasonal statistical figures and/or a table. This could be then referenced by others.

While cumulative statistics of this type (surface up to the layer height) was not a focus of this study, we agree with this Reviewer that this may be interesting to some readers. We have made cumulative seasonal plots (see figure below) of median scattering, absorption, and extinction (all at 550 nm), and [CN] as the Referee has suggested. The green line representing spring medians lies above the other seasonal lines for scattering, absorption and extinction, and is due to the fact that high altitude (3 km altitude and above) aerosol layers were present more frequently during the springtime. These higher median values can be seen clearly in the seasonal profile plots in Figure 9.

If the Editor agrees, we would be willing to include a higher resolution version of this figure in the revised manuscript.



*2) In page 17206 – 17207 you write: “...The extensive parameters (Fig. 8a–d) show a wavelike pattern, with relatively larger values of these parameters extending to higher altitudes in the summertime. This may be because of the increased height of the top of the mixed layer during the warmer months..” I don’t think it would it be a hard work to acquire data on the boundary layer height for instance from soundings or NOAA/ARL meteorological data. Then you could do like in my previous suggestion: using the PBL height information integrate (=sum) your scattering/absorption/extinction\*height data and so get a quantitative estimate of how large a fraction of total scattering/absorption/extinction takes place in the PBL.*

We agree that Referee #2’s comment about finding the cumulative fraction of extinction that occurs at or below a given altitude is a useful exercise, and we have done those calculations as discussed in our response to Comment #1. With the Editor’s permission we intend to included a new figure showing the cumulative fraction of total column (i.e., up to 4.6 km altitude) extinction below each flight level in the revised manuscript. We do not agree, however, that it is necessary (or easy) to state what fraction of

this extinction takes place in the boundary layer. A robust determination of the boundary layer height is not a simple exercise, and the closest soundings to BND are at Lincoln, IL which is ~90 km away, and the soundings occur at times other than when our aircraft flew. We believe that the reader can look at the statistics presented in Figures 7, 9, 10 and 11 and get an idea of where the statistical top of the mixed layer was. The goals of this study were to compare in situ aerosol measurements made above the surface with co-located surface and satellite measurements, and determination of the boundary layer height was not a priority.

3) The captions of figures 7, 10, and 11: please write the meanings of the boxes and whiskers in the captions.

The meaning of the boxes and whiskers was stated in the text (Pg. 17203, Lines 13-16).

“In these plots the median of each distribution is shown as a vertical line through the box, the ends of the boxes represent the 25th and 75th percentiles of the distributions, and the ends of the whiskers show the 5th and 95th percentiles.”

Is it really necessary to add this to the figure captions, which are already a bit long? Presumably readers are reading through the paper and looking at the figures as they are discussed in the text. We are completely willing to do this if this is considered necessary or preferable by the reviewer and/or editor, but if it is just a suggestion then we would prefer not to do this.