Response to Referee #2:

We would like to express our sincere gratitude to the anonymous referee for his/her helpful comments that will help to improve the quality of the manuscript. A point by point response is included below. Comments are in blue and italics, and our responses are in black.

Titos and coauthors for publication in Atmospheric Chemistry Physics.

The authors have used data collected by the aerosol observing system during the Two Column Aerosol Project to characterize the aerosol characteristics at Cape Cod, MA. The authors have reported the observed aerosol light-absorption and light-scattering coefficients together with the single scattering albedo and Angstrom exponent. The scattering enhancement factor is also calculated by using the observations from the dry and wet nephelometers. The authors have proposed an exponential equation that estimates aerosol hygroscopic growth as a function of single scattering albedo. I think the article is well-written and will be of use to scientist studying aerosol radiative properties together with the wider meteorological community. But I see that the article falls short in some ways and hence recommend it to be published after major revisions. Please find below my specific comments.

Major Comments:

1) During the TCAP field campaign there were two aerosol observing systems part of the AMF-1, the aerosol observing system (AOS) and Marine aerosol observing system (MAOS). The article should use the data from the condensation particle counter (CPC) and the Hygroscopic Tandem Differential Mobility Analyzed (HTDMA), part of the MAOS and AOS to characterize the aerosol size distribution and size increase due to increase in RH.

This is a really good suggestion. However, as far as we know, the MAOS data is not yet available for distribution. The current data in the ARM archive are raw data with no flow, dilution and inversion corrections to the data. In addition, the two sets of measurements overlapped for only one month. For these reasons, we are unable to compare the two data sets.

2) The authors have done a good job in summarizing the aerosol radiative properties as measured by the AOS. But the article falls short in describing the general meteorology during the presence of the aerosols. Mainly, a plume of aerosols might be coming from an urban area, but if precipitation is accompanied by that plume, then due to aerosol scavenging, the number concentration will be less and so will be the aerosol impact on atmospheric radiation. So, I highly encourage the authors to include some description of the meteorological conditions during the presence of different aerosol composition.

Following the referee suggestion, we will include a paragraph summarizing the mean meteorological features during the campaign in the Overview section of the revised manuscript and in the wind sector analysis section to emphasize the different meteorological features during the presence of different aerosol types. Concerning the effect of precipitation, we agree with the referee in the importance of precipitation in the measured aerosol properties. Precipitation will have an effect not only on the total scattering but on the aerosol size distribution and composition. To reduce the influence of instrument noise on the γ calculation, low scattering events (which are normally associated with precipitation) were excluded from the data analysis (only values of σ_{sp}(550 nm) > 5 Mm^{-1} were considered). Trying to correlate the aerosol hygroscopic growth to precipitation would be difficult as most of those data were excluded from the analysis. For a comprehensive analysis we would need to include precipitation events not only at the immediate site, but also several hours downwind of the site. This type of work is beyond the scope of this paper, which focuses mainly on the development of a new empirical method for estimating aerosol hygroscopic growth.

3) From the AOS and MAOS data, in addition to the quantities calculated by the authors, it is also possible to calculate the backscatter fraction and submicron scattering fraction. Calculation of these quantities might (probably) provide some insights on the aerosol composition. Fan et al. (2010 JGR) and Manoharan et al. (2014 ACP) might be of some help.

We agree with the reviewer in that interesting information can be derived from the backscatter fraction and the submicron scattering fraction. Thus, we will include these variables in the revised manuscript.

4) The authors have described the figures in the text, but many a times have not drawn any scientific conclusions from them or at least speculated the scientific importance of the data. For example, I am not sure what scientific insights are gained from Fig 3. I suggest the authors go through the manuscript and figures again and draw some science conclusion from the presented data. Thanks.

We have changed the wording on page 3370 - line 14 to better clarify the intent of Figure 3. The graph shows that for situations dominated by aerosol sea salt (SAE<1) the scattering in the PM_1 fraction experienced a higher enhancement than in the PM_{10} fraction. This indicates that small sea salt particles have a larger scattering enhancement compared to coarse sea salt particles. This behavior can be explained by a shift in the size distribution to a scattering regime with a higher scattering efficiency when the SAE is greater than 1. This information will be included in the revised manuscript.

We have strengthened the discussion of Figure 4 in order to clarify the main scientific features of it. Furthermore, as recommended by Prof. Horvarth in his review, we have

omitted Figure 5, since the better information is given in Figure 6 and this figure is also easier to visualize than Figure 5. Figures have been renumbered accordingly.

5) The Cimel sun-photometer and Multi-Filter Rotating Shadowband Radiometer (MFRSR) are also part of the AMF-1 and measure the aerosol optical depth (AOD). It will be great if the authors also characterize the AOD measurements.

We agree with the referee that including the results derived from CIMEL measurements might be interesting. However, we believe that it does not add to the content of this paper and to the analysis of the scattering enhancement due to water uptake that is the main objective of the work. Comparison of the data with AOD is beyond the scope of this paper as it requires information on the meteorological variables and aerosol particles properties with vertical resolution.

Minor Comments:

1) Line 3-4 page 3362: I am not sure TCAP is some kind of framework, it was a ARM funded field campaign. Please revise the sentence to reflect that.

We have corrected it throughout the text.

2) Line 10 page 3366: PTFE stands for Polytetrafluouroethylene … it will be great if you mention the full-form of PTFE together with PTFE.

Done.

3) Section 2.1: While describing AMF-1 instrumentation, usually the article Mather and Voyles (2013, BAMS) and Miller and Slingo (2007, BAMS) are mentioned.

The aforementioned references will be included.

4) Page 3368, Line 7: Not sure what the "de" is after 550 nm.

We apologize for the mistake; this was a typo that will be corrected in the revised version of the manuscript.

5) The measured quantities are absorption and scattering coefficients. You have provided equations for SAE and f(RH,λ), but have not done so for SSA. It will be great if you do that too.

We will explicitly include the equation for calculating SSA in the revised manuscript. Due to the inclusion of the backscatter and the submicron scattering fractions in the revised manuscript, the equations needed for their calculation will be also included in the Methodology section.