Reply to Reviewer 1
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The valuable comments by Reviewer 1 are greatly appreciated. Our replies to the Reviewer 1 comments are given below.

1. General Considerations: *This article discusses the retrieval of stratospheric aerosol extinction profiles using the OMPS-LP measurements. The authors use a gamma particle size distribution derived from the CARMA model instead of the standard lognormal assumption, and it is found that this helps to improve the spectral response of the modelled signal at 20.5 km. The approach is a novel one and valuable to the limb scattering aerosol retrieval community. The writing is concise, and the material is generally well explained; after the following minor edits I recommend publication.*
Reply: We thank Reviewer 1 for the positive comments.

2. Specific Comments: *Some additional information on how and why the CARMA ASD was chosen would be beneficial. It is not clear what sampling is used to derive the parameters in Table 2. What years are the June-July-August data from, what altitudes are used, etc. Is a single GD chosen due to retrieval requirements, or other reasons? Why is sampling near Laramie important if the balloon data is not compared against?*
Reply: We add 'at 20km' in Table 2. A single GD for 20km is chosen due to retrieval requirements. We add explanatory text: 'In the retrieval algorithm, we assume that the size distribution is height independent, so that one GD at 20 km is used to represent the aerosol size distribution at all heights.'

As indicated, we are leveraging some CARMA simulations that were performed as part of a Pinatubo-focused study, so all simulations are for the period 1990 – 1993. The June-July-August data used is the average of that season over those 4 years. In this paper we are using only CARMA Wyoming data because we did validate offline that the ASD there was well reflected in the balloon data (from non-volcanic periods), (Kovilakam and Deshler, 2015).

Figure 1*: Usually the majority of the increase in extinction is attributed to Ruang/ Reventador in late 2002 (from the figure it appears the increase starts before 2003) and Manam in 2005 (eg. Vernier et al, 2011). Is there a reason the increase is attributed to Anatahan here?*
Reply: Thank you for pointing this. We updated the caption, and changed the text to 'Ruang/Reventador in late 2002 and Manam in 2005'.

Figure 2*: Why is only the 20km altitude shown in panel B? Also, why are only select CARMA radii used as comparison points (red dots) in panel B and not all of them?*
Reply: Because ASD at 20 km is used in the retrieval (see Reply to Specific Comments above). We add text: 'The cumulative CARMA data (circles) are chosen in consisting with the OPC in situ measurements which has a gap ranging from 0.01 µm to 0.1 µm (Kovilakam and Deshler, 2015)'

Page 5, Line 15-16: *It is not clear that a Gamma distribution is better from this plot, Particularly for the 25 km distribution, which appears bimodal. May be a fitted lognormal distribution in panel B as a reference would make this clearer?*

Reply: We agree with you that lognormal distribution would fit very well to the observations. In our case, however, a Gamma size distribution (GD) represents a significantly better fit to the CARMA data than a unimodal normal distribution (UD) or a bimodal lognormal size distribution (BD), and our comparison results between the calculated and the observed ASIs suggest that Gamma-CARMA ASD is suitable for OMPS/LP measurements. The following two figures show the fitting results.

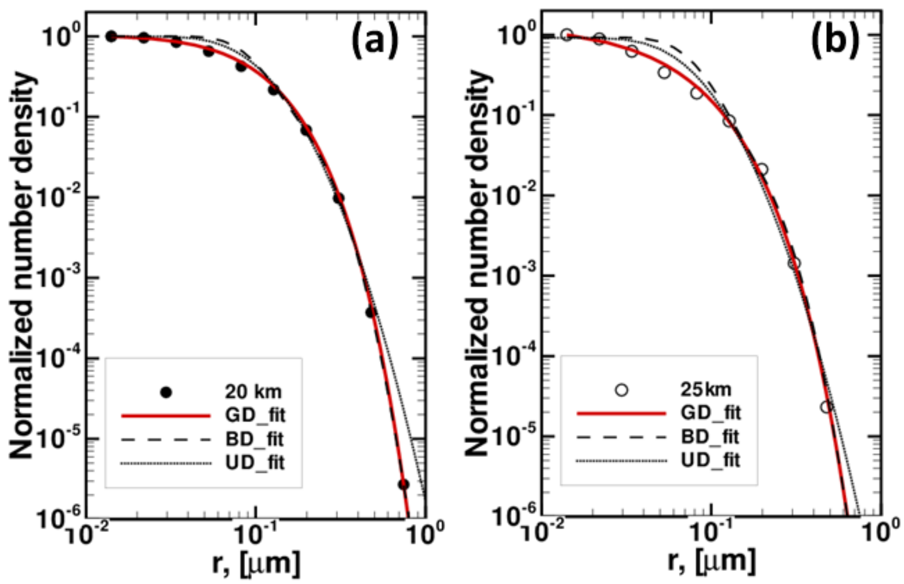

Figure R1. Gamma size distribution (GD), unimodal normal distribution (UD) and bimodal lognormal size distribution (BD) fits to the cumulative number density (N>r) for 20 km (a) and 25km (b). For the purpose of comparison, the cumulative CARMA data between 0.02 - 0.1 µm are also shown.

To make this clearer, we add a GD fit in Figure 2b for 25 km as you suggested. You can find that the GD with just 2 parameters fits CARMA data at 25km also well.

Figure 7: *More information on this plot is needed. Is this a simulation at each scattering angle shown, or an average over many orbits? Is this using real data or simulated? You mention the scene reflectivity (and presumably zenith angle) is an important factor in the sensitivity, but that value is not mentioned here.*

Reply: Figure 7a shows the simulated phase function changes at each scattering angle and Figure 7b shows the effect of the phase function changes on the retrieved extinction using OMPS/LP measurements for a single orbit on September 12, 2016. We have added the information on this Figure. The effect of reflectivity is also mentioned hear.

Figures 6-7: *These figures nicely relate the gamma parameters to more physical quantities and the impact of a particular change (α,β±10%) on the retrieval. However, I think the piece of information that is needed to interpret the results is how much the fitted*

gamma parameters vary in the CARMA model, and how much the phase function varies over this range.
Reply: We have added text 'It is apparent that the phase function is quite sensitive to β. A ±10% change in β can produce a ±10% change in the calculated aerosol phase function, whereas for a 10% change in α the percentage change of aerosol phase function is within ±3%.'

Page 11, Line 5-8*: If the difference in phase function ratio and retrieved extinction ratios is due to multiple scattering, wouldn't the smearing effect be more pronounced at 20.5 km, rather than 25.5 km? Lower altitudes generally have a larger multi-scatter component to the signal.*
Reply: That is correct. We have added text 'Since lower altitudes generally have a larger multi-scatter component to the signal, the smearing effect is more pronounced at 20.5 km, rather than at 25.5 km'.

Figure 11*: I think it is important to show the wavelength relationship for other altitudes. Particularly if only the CARMA data at 20.5 km was used to generate the ASD used in the retrieval.*
Reply: We have added a second panel in Figure 12 to show the wavelength relationship for another altitude at 25.5km.

Page 14, Line 7*: It should maybe be mentioned that the retrieval is performed at 675 nm, so the residual must (presumably) be zero at this wavelength for both methods?*
Reply: That is true. We have added text 'Note that our aerosol retrieval is performed at 675 nm, so the ASI residual at this wavelength are very close to zero for both methods'.

Page 15, Line 13-14*: From Figures 11/12, the spectral dependence seems to be affected for the entire Northern hemisphere. From Figure 5, this could range from about 60-120°, please define "small Θ".*
Reply: That is correct. We have changed 'except at small Θ' to 'for the southern hemisphere'.

3 Technical Comments
Page 3, Line 20*: Seems odd to start a paragraph with an equation, should it come after line 12?*
Reply: Fixed.

Page 4, Line 21*: At 20 and 25 km altitudes?*
Reply: The '20 km altitude' has been changed to '20 and 25 km altitudes'.

Page 6, Line 20*: CARAM to CARMA*
Reply: Fixed.

Page 6, Line 21*: GD distribution = Gamma Distribution distribution?*
Reply: The 'GD distribution' has been changed to 'Gamma distribution'.

Page 11, Line 5*: duo to due*
Reply: Done.