

# ***Interactive comment on “A comparison of lognormal and gamma size distributions for characterizing the stratospheric aerosol phase function from OPC measurements” by Ernest Nyaku et al.***

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This paper presents an analysis of the suitability of log-normal and gamma distributions to the particle size measurements from in situ OPC balloon flights. The authors motivate this work based on the implications that the fitted distribution has on the derived aerosol scattering phase function that is required in the radiative transfer forward modeling for limb scattering retrievals of aerosol extinction.

The results have merit and the study is well conducted; however, I completely agree

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with the major issue raised by Referee 2. The study needs to include a quantitative assessment of the impact these results have on the aerosol retrievals. Reporting the difference in phase functions, as the study currently stands, is of limited use, but with some additional work to show the impact on the retrievals, it becomes potentially quite important. One aspect to consider for example is that the forward scattering peak that the authors sometimes choose to cut off the phase function figures can be quite important with multiple scattering and high albedo. In line with this comment, I think the authors should put this study more deeply in the context of the Chen et al., 2018. There are similarities and those should be discussed in detail in light of the new results. Finally, the work would be more broadly useful if wavelengths other than 675nm were also studied (SCIAMACHY and OSIRIS use 750nm for example)

**Response:** Chen et al. 2018, have conducted a parallel study where they compared the retrieved aerosol extinction profiles from the OMPS/LP using the V1.0 (bimodal lognormal distribution) and V1.5 (gamma distribution) retrieval algorithms to the extinction profiles derived from SAGE III (on the International Space Station). The results obtained, indicated an improvement in the V1.5 extinction profiles to within 10% at altitudes 19-29 km. The authors of the paper are including this information and referencing the above paper.

In our next study, we plan to include other wavelengths greater than 675nm.

### Minor Comments:

1- Mixed use of APF and  $P_a$  in the text for the aerosol phase function. Choose one.

**Response:** There is no difference between  $P_a(\Theta)$  and APF. Only  $P_a(\Theta)$  will be used to represent the Stratospheric Aerosol Phase function.

2- Abstract line 11: what does “stable” mean?

**Response:** The sentence contain the word "stable" has been removed.

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**3-** Abstract last sentence: The exclusion of certain bins is too specific for the nature of the rest of the abstract (cannot be understood without a lot more detail from the paper)

**Response:** Noted. The last part of the Abstract has been rephrased.

**4-** Introductory paragraph should probably contain some motivating statement about the impact of several moderate volcanic eruptions over the last decade.

**Response:** This has been noted and we have added a statement about the impact of moderate volcanic eruptions.

**5-** Line 32: what does “homogeneous” mean? i.e. there is still a size distribution of particle sizes; also, the refractive index should be for hydrated sulfuric acid, and should be stated and referenced

**Response:** The word "homogeneous" is used in this line to mean "the particles have the same properties throughout". The refractive index has been stated for hydrated sulfuric acid and referenced.

**6-** Lines 65-68: Quantify “sufficient” and “high precision”; this statement needs more detail

**Response:** More details have been included to elaborate on the statements made by Toubanc (1996).

**7-** Line 69: Bourassa et al., ACP, 2012 is the reference for OSIRIS version 5.0

**Response:** Noted

**8-** Line 72: Size distribution parameters for OMPS v1.0 and v1.5 should be stated, possibly included in Table 1 somehow

**Response:** The size distribution parameters of OMPS v1.0 and v1.5 have been included in Table 1.

**9-** Line 73: Use of Angstrom exponent should be motivated; this statement is out of place at the moment

**Response:** A motivational statement has been included.

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**10-** Equation 1: Typesetting with units is strange

**Response:** The units have been removed from the equation.

**11-** Line 159: “similarity in appearance” needs quantification; otherwise this is not a helpful statement

**Response:** The statement “similarity in appearance” has been deleted from the text.

**12-** Line 163: No brackets on equation numbers

**Response:** Noted and corrected.

**13-** Table 2: Is this information necessary?

**Response:** This information is necessary to show the reader the months in which measurement were made each year and also the frequency of measurements throughout the period considered (2008 - 2017).

**14-** Figure 1: Green text on figures is hard to read

**Response:** A darker shade of green has been used on this figure.

**15-** Line 218: something wrong with the wording here

**Response:** The word “taking” has been replaced with “taken”.

**16-** Line 223: It doesn’t follow that the phase functions agree for scattering angles greater than 20 degrees “because the fits of the two distributions overlap”

**Response:** The statement “because the fits of the two distributions overlap” has been removed.

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