

## ***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.***

**Anonymous Referee #3**

Received and published: 4 June 2019

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 modelling for limb scattering retrievals of aerosol extinction.

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

C1

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 675 nm were also studied (SCIAMACHY and OSIRIS use 750 nm for example).

Minor comments:

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

Abstract line 11: what does “stable” mean?

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)

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

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.

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

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

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

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

C2

Equation 1: Typesetting with units is strange

Line 159: "similarity in appearance" needs quantification; otherwise this is not a helpful statement

Line 163: No brackets on equation numbers

Table 2: Is this information necessary?

Figure 1: Green text on figures is hard to read

Line 218: something wrong with the wording here

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"

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Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2019-119, 2019.