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Interactive comment on "How should we aggregate data? Methods accounting for the numerical distributions, with an assessment of aerosol optical depth" *by* Andrew M. Sayer and Kirk D. Knobelspiesse

Anonymous Referee #3

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This paper looks at an important yet widely neglected issue in selecting the appropriate summary statistics to create daily or monthly climatology from instantaneous measurements. AOD is used as an example, but the study is applicable to any geophysical variables. The study is well thought out, carefully executed, and clearly presented. I have a few comments below. 1. It would be appealing to give plausible explanations, from the standpoint of physical mechanisms, to the fact that certain geophysical variables, like AOD, follow lognormal distribution (raindrop size is often described by Gamma distribution, which has a similar skewed shape to lognormal), while some are

Gaussian. I find the authors' attempt at P6L5 unconvincing. Statistically, lognormal distribution arises from multiplicative processes while normal distribution is from summation of independent/identically distributed (Gaussian or non-Gaussian) processes (central limit theorem). But I feel that it is hard to relate this statistical interpretation to the physical processes happening in reality. The reason for the skewed distribution of many geophysical variables may be due to the simple fact that they are positively defined. This is also supported by the authors' analysis that in clean conditions (AOD approaching positively zero), geometric and arithmetic means are not all that different. 2. Negative or zero AODs are set to a very small positive value. This has to be done in order to calculate geometric mean. I wonder in such special cases (even if they are rare), does it incur any arbitrary bias that renders use of geometric mean less meaningful compared to arithmetic mean? How would the operational L2-to-L3 algorithm deal with the negative or zero retrievals? 3. A possible development for aerosol product is to collate products from different sensors for the overlapping domain (such as the MODIS twins from Terra and Aqua). In that case, which mean is more appropriate, geometric or arithmetic? 4. The study discussed the impact of geometric vs arithmetic means on trend analysis. How about the aerosol climatic impact? Are L3 products used in climate model evaluation or assimilation that the choice of aggregation method may have important effects?

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