We thank the anonymous reviewer for going over our responses and edits to the manuscript. We affirm that we tried our best to respond to the anonymous reviewer's concerns. The most recent points of Anonymous Referee # 2 (AR2) are below (in black), and we have indicated our responses in blue. We refer to sections of the previous Author's Response document (EGUSPHERE on 13 July 2023) to help us address some of the concerns in this current response document. Many references are made to our last set of responses, which we feel may have been overlooked or misinterpreted.

The submitted manuscript explored aerosol climatology over Manila, Philippines. I find several hypotheses considered by authors and justifications provided in the first draft were not updated in revision. Many of the claims in the revision were not in line with evidence provided by contemporary researchers. I am pointing out few of the major arguments of the authors which are actually not true, primarily vague. Based on the author's response and submitted revision, I recommend the article to be rejected.

We responded to all of the comments of AR2 (pages 16 to 32 of the Author's Response on 13 Jul 2023) and indicated how we edited the manuscript. That 16-page response to AR2 was both complete and accurate. In cases where we felt our discussion (Sections 3.1 and 3.2) was important in the flow of our study, we explained to AR2 our reasoning in the response to Specific Comment # 9 (page 24) and Specific Comment # 12 (SC # 12, page 26).

AR2 in this latest set of reviews states that "claims in the revision were not in line with evidence provided by contemporary researchers" with no specifics on which claims are in question. AR2 also doesn't cite any references to the evidence that they are not "in line with". This makes it difficult for us to address this comment. So that we can address this comment, we would be grateful for clarification with regard to the claims and references which we are not "in line with".

1. Major concern is the scientific novelty and lack of scientific questions that are addressed by the authors. The manuscript is mere of a report of observations made by authors during a certain period. Entire section 3.2 is mere reporting of observation without much scientific context.

   Although it may be that the reviewer does not agree, the manuscript reports on both novel observations and analysis. We go beyond reporting of mere observations and do a detailed analysis and interpretation of the AERONET data with supporting data. Our work also presents interpretation of these data at local (Metro Manila) and regional (30 degree lat/lon centered on Metro Manila) scales, including sources, meteorology, and aerosol characteristics (AOD, EAE, FMF, SSA, AF, and RI). Unfortunately, the reviewer did not provide specifics for us to address. For example, which other publications report all of our findings? We think we did a thorough review based on the 157 references provided in the manuscript, but if we missed something, we would like to know. We note that the depth and order of our discussion in 3.2 builds up our analysis of aerosol

characteristics enabling a fuller understanding of aerosol monthly behavior (beyond AOD) from 2009 to 2018. This analysis is novel as AERONET is the first long-term ground-based aerosol columnar measurement system that was set up in the Metro Manila in 2009. We also performed cluster analysis on the volume size distribution from 2009 to 2018 supported by data from MERRA-2. We have already noted in Specific Comment # 2 (page 19) why our study is important. Our science questions are at the end of the Introduction as noted also in Specific Comment # 2 (page 19).

2. Determination of aerosol type lacks science. SSA was included as a matrix to identify aerosol subtypes but was not actually used properly to distinguish aerosol types. Some of the aerosol types were based on FMF, some on AE, AOD value >0.1 only to indicate polluted AOD. There are several ambiguities in selecting aerosol properties in identifying aerosol types.

   Our response to Specific Comment # 13 (pages 28 to 29) addresses the comment above. We also note that we are not determining "aerosol type", as AR2 suggests, but rather clusters with similar airmass aerosol characteristics. SSA and the other aerosol parameters were used as criteria for air mass assignments for identified clusters as noted in our response in SC # 13. Our approach in using SSA, EAE, FMF, and AOD for airmass aerosol classification is dependent on available thresholds from previous studies and has been used in many other parts of the world for airmass aerosol classification, with example citations already provided in our manuscript: "Dubovik et al., 2002; Pace et al., 2006; Kaskaoutis et al., 2007; Kaskaoutis et al., 2009; Sorooshian et al., 2013; Kumar et al., 2014; Sharma et al., 2014; Che et al., 2015; Kumar et al., 2015; Deep et al., 2021".

3. Figure 1 and 4 does not conclude anything. Why compare MISR against MERRA 2? What does it prove?

   The analysis of the AERONET aerosol parameters depended on the data that was in Figure 1. We referenced it 13 times in 3.1 and 7 times in 3.2. We could not have as complete an analysis as we did without considering the meteorology and water vapor over Metro Manila that we had based on MERRA-2, PERSIANN, and AERONET. We can move Figure 1 to the Supplementary section, although we feel this is a detriment to the paper (e.g., 20 references made to the figure in the paper) and the other reviewer supported its inclusion.

   We had a thorough response to AR2 about using MISR and MERRA-2 in our Author's Response document (Specific Comment # 4, pages 20-23): "Regional AOD values from MISR (remote sensing) and MERRA-2 (reanalysis) were used as independent sources of support for the long-range aerosol particles seen over Metro Manila AOD from AERONET." Both MISR and MERRA-2 average monthly AOD (2009 – 2018 for the 30° x 30° region) peak in March, which proves that there is a regional peak in AOD in Southeast Asia in March that is not as evident in the AERONET AOD over Metro Manila. MISR has additional information on the size, shape, and absorptivity of particles

that can give clues about the source of the regional AOD peak in March (fine, spherical, and absorbing particles).

4. Significant part of case studies is based on NAAPS model outcome which does not provide much detail on actual aerosol climatology. Again, the authors explain "We use NAAPS to provide support for the AERONET data". These maps help associate possible regional emission sources to extreme aerosol loading events in Manila Observatory". In fact, use of NAAPS model forecast over Philippines is questionable as number of AOT assimilations available in and around the Philippines is limited because of the pervasive cloud cover.

   NAAPS was used qualitatively in the analysis of case studies that were associated with the identified airmass aerosol clusters from AERONET data. Reanalysis products such as MERRA-2 and NAAPS help in conditions in which clouds affect remote sensing of aerosol particles such as in Southeast Asia. NAAPS has been used in the way we did for a large number of other published studies (a few of which we cited in the edited manuscript as noted below) aiming to have a supplementary source of support for air pollutant sources. The very purpose of reanalysis data is to fill in the 4-D space of meteorological and pollution conditions in the best way possible, while still recognizing its limitations – which we did in our manuscript.

   Additional text after the last sentence of 2.1.5: “Previous studies have used NAAPS data for an overview of aerosol sources in specific regions of interest (Ross et al., 2018; Foth et al., 2019; Markowicz et al., 2021; Harenda et al., 2022; Mims III, 2022). More recent studies show the need to improve aerosol representation in NAAPS (Edwards et al., 2022), so we will use NAAPS qualitatively, together with MERRA-2 compositional AOD data and back-trajectories, for an overview of aerosol sources that may contribute to extreme events with high AOD from AERONET.”

5. What was the purpose of comparing monthly MISR 0.5x0.5 data against AERONET and MERRA- AOD ? This proves nothing.

   We note the following edits in the manuscript that we made in Specific Comment # 4 (page 22, 2.1.2) and added the actual total region (30° x 30°) over which the data was averaged in to the manuscript (2.1.2): “The total MERRA-2 AOD (mean over 30° x 30° region) for the region was used along with MISR AOD data (mean over 30° x 30° region) to assess the influence of long-range sources to the aerosol column over Manila Observatory.” The AOD peak in March (MISR and MERRA-2) proves that there is a regional peak in AOD in Southeast Asia in March that is not observed over Metro Manila (where there is no distinct AOD peak in March). The speciated MISR AOD data helps reinforce the regional influence on the aerosol particles over Metro Manila especially during high AOD times from July to September (fine, spherical, and absorptive particles) that are consistent with AERONET data.

6. How MISR 0.5x0.5 AOD data was considered as regional (Southeast Asia) baseline remote sensing data to support the Manila Observatory AERONET data.

   Average monthly AOD values from the 30° × 30° region (0.25°N – 30.25°N and 104.75°E – 134.75°E) from 2009 to 2018 are used from MISR. The bounding coordinates are included in the text in 2.1.4 for clarification.

   "Monthly 500 nm AOD data (Level 3 Global Aerosol: 0.5° × 0.5° spatial resolution in the region 0.25°N – 30.25°N and 104.75°E – 134.75°E) from 2009 to 2018 are used from the Multi-angle Imaging SpectroRadiometer (MISR), (Diner et al., 2007; 222 Garay et al., 2018) as regional (Southeast Asia) baseline remote sensing data to support the Manila Observatory AERONET data."

7. "The high EAE over Manila Observatory from July to September is probably regional in nature based on the MISR data" This is no scientific evidence against this claim.

   The text has been edited in 3.2.2 to communicate what is meant by the authors.

   "The high EAE over Manila Observatory from July to September is consistent with the regional (30° latitude x 30°longitude) MISR data that shows increased AOD from fine, spherical, and absorptive particles (Fig. S1) in Southeast Asia during the same months. This suggests that the high EAE observed at the Manila Observatory during these months is not necessarily from local sources."

Additional References:

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