Stubborn aerosol: Why particulate mass concentrations do not drop during the wet season in Metro Manila, Philippines

Miguel Ricardo A. Hilario[a], Paola Angela Bañaga[b,c], Grace Betito[b,c], Rachel A. Braun[d,†], Maria Obiminda Cambaliza[b,c], Melliza Templonuevo Cruz[b], Genevieve Rose Lorenzo[a], Alexander B. MacDonald[d,+], Preciosa Corazon Pabroa[e], James Bernard Simpas[b,c], Connor Stahl[d], John Robin Yee[e], Armin Sorooshian[a,d,*]

[a] Department of Hydrology and Atmospheric Sciences, University of Arizona, Tucson, AZ 85721, USA

[b] Manila Observatory, Quezon City 1108, Philippines

[c] Department of Physics, School of Science and Engineering, Ateneo de Manila University, Quezon City 1108, Philippines

[d] Department of Chemical and Environmental Engineering, University of Arizona, Tucson, AZ 85721, USA

[e] Philippine Nuclear Research Institute - Department of Science and Technology, Commonwealth Avenue, Diliman, Quezon City 1101, Philippines

[†] Now at: Healthy Urban Environments Initiative, Global Institute of Sustainability and Innovation, Arizona State University, Tempe, AZ, USA

[+]Now at: Department of Environmental Sciences, University of California, Riverside, CA, 92521, USA

[*]Corresponding author: Armin Sorooshian (armin@email.arizona.edu)

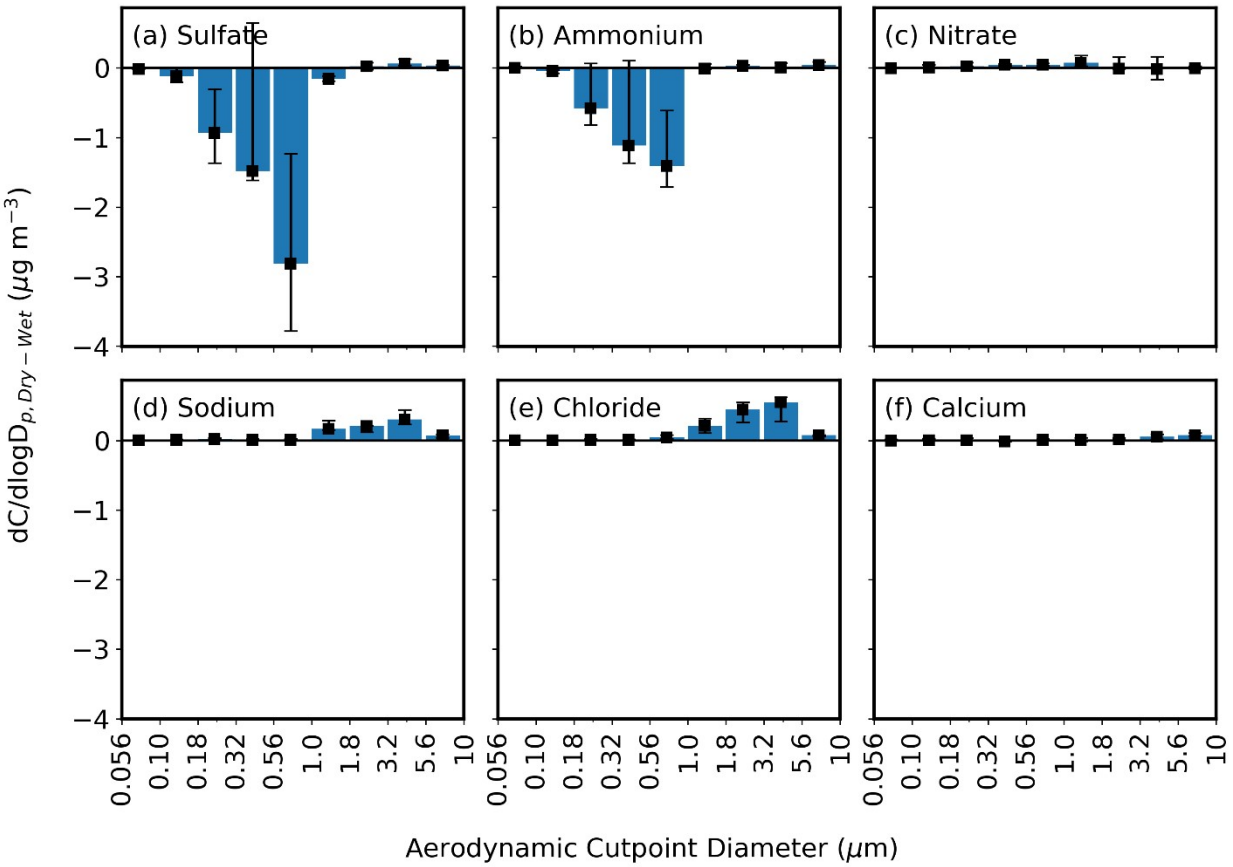

Figure S1. Size-resolved differences in seasonal median concentrations (dry minus wet) of (a) sulfate, (b) ammonium, (c) nitrate, (d) sodium, (e) chloride, and (f) calcium. A positive (negative) value indicates higher dry (wet) season average concentrations. Lower (upper) ends of error bars represent the differences in 25th (75th) percentile concentrations between seasons.

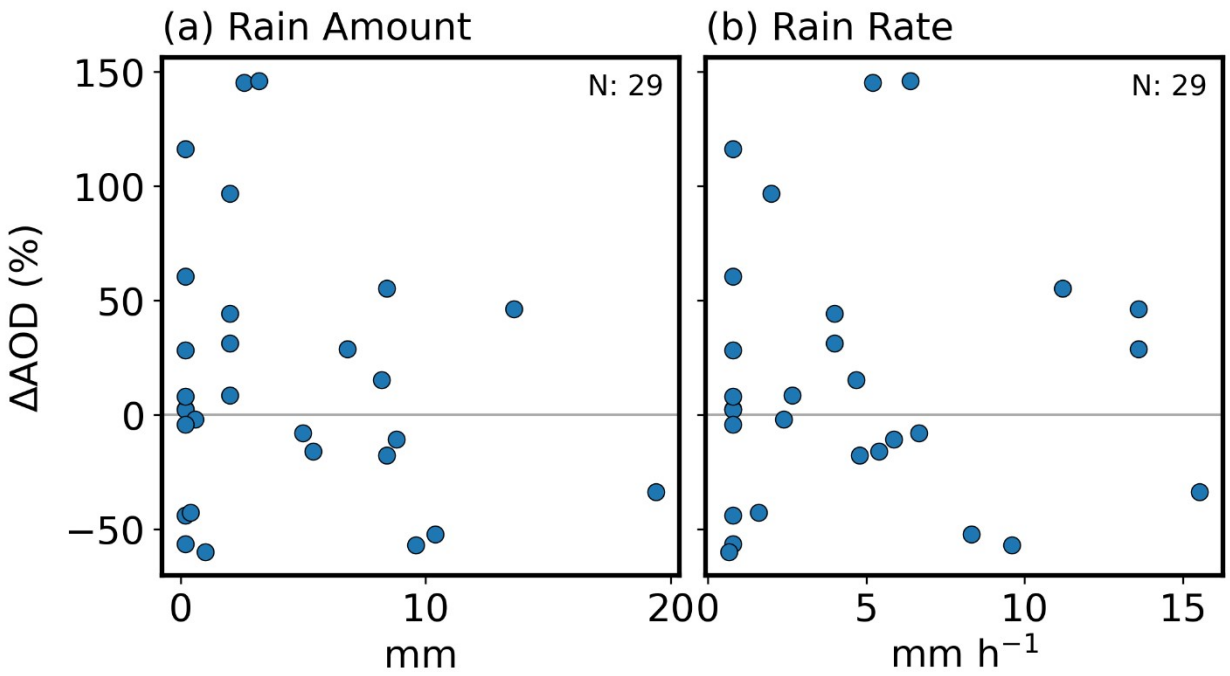

Figure S2. Scatterplots of the percent difference in AOD before and after rain events (ΔAOD; 2012-2019) as a function of (a) rain amount (mm) and (b) rain rate (mm h^{-1}). Only data from the wet season were plotted (May – Oct). AOD averaging window was 3 hours.

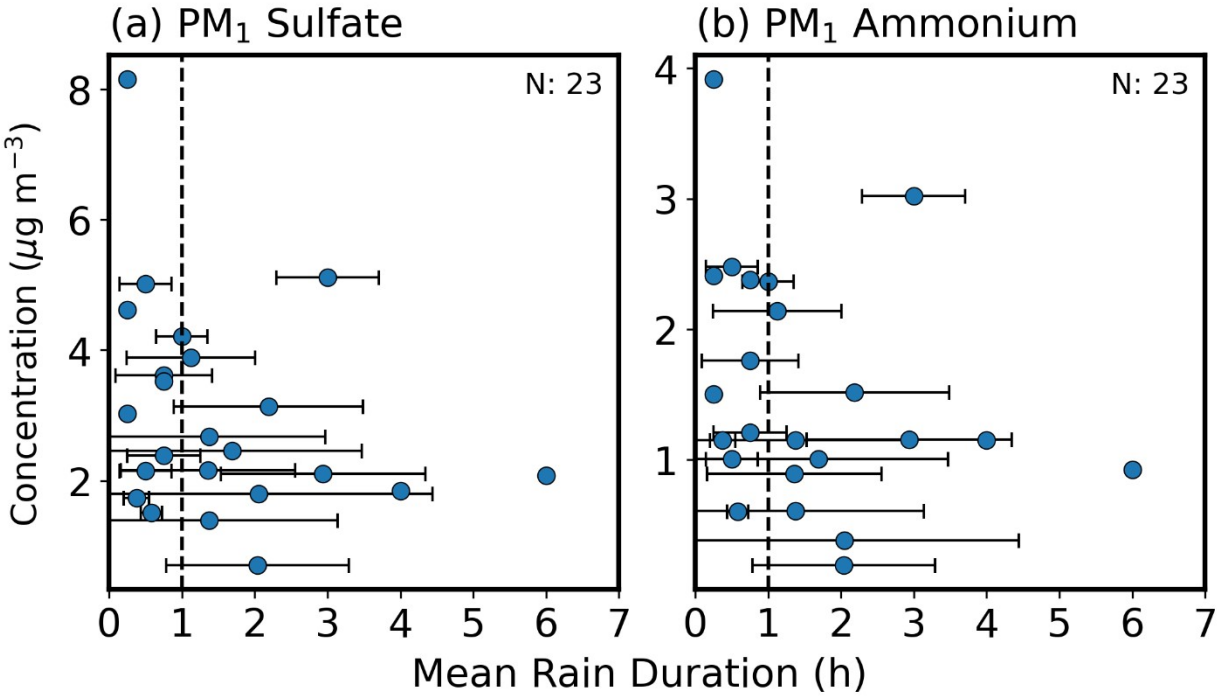

Figure S3. Scatterplots of PM_1 (a) sulfate and (b) ammonium as a function of mean rain duration during each MOUDI set with error bars along the x-axis representing one standard deviation. Note that points without error bars consist of single rain events. Only data from the wet season were plotted (May – Oct). Note that y-axes limits are not the same across panels. The black dashed vertical lines mark the median rain duration based on Fig. 3c.

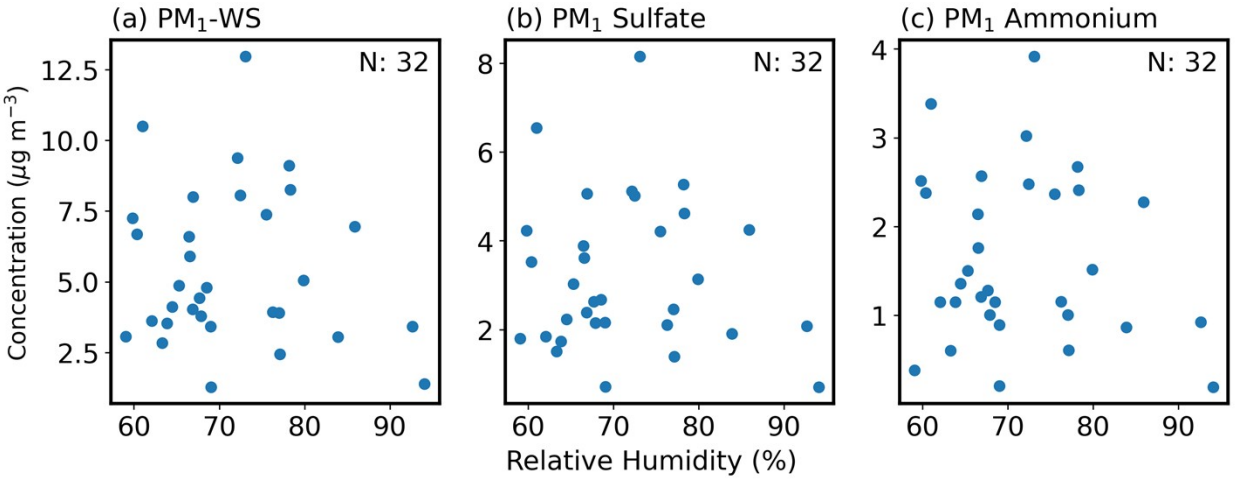

Figure S4. Scatterplots of RH (%) and submicrometer (a) total water-soluble species (PM_1-WS), (b) sulfate, and (c) ammonium. Only data from the wet season were plotted (May – Oct). Note that y-axes limits are not the same across panels. Concentrations are generally enhanced when RH is 70 – 80%, likely due to aqueous chemistry.

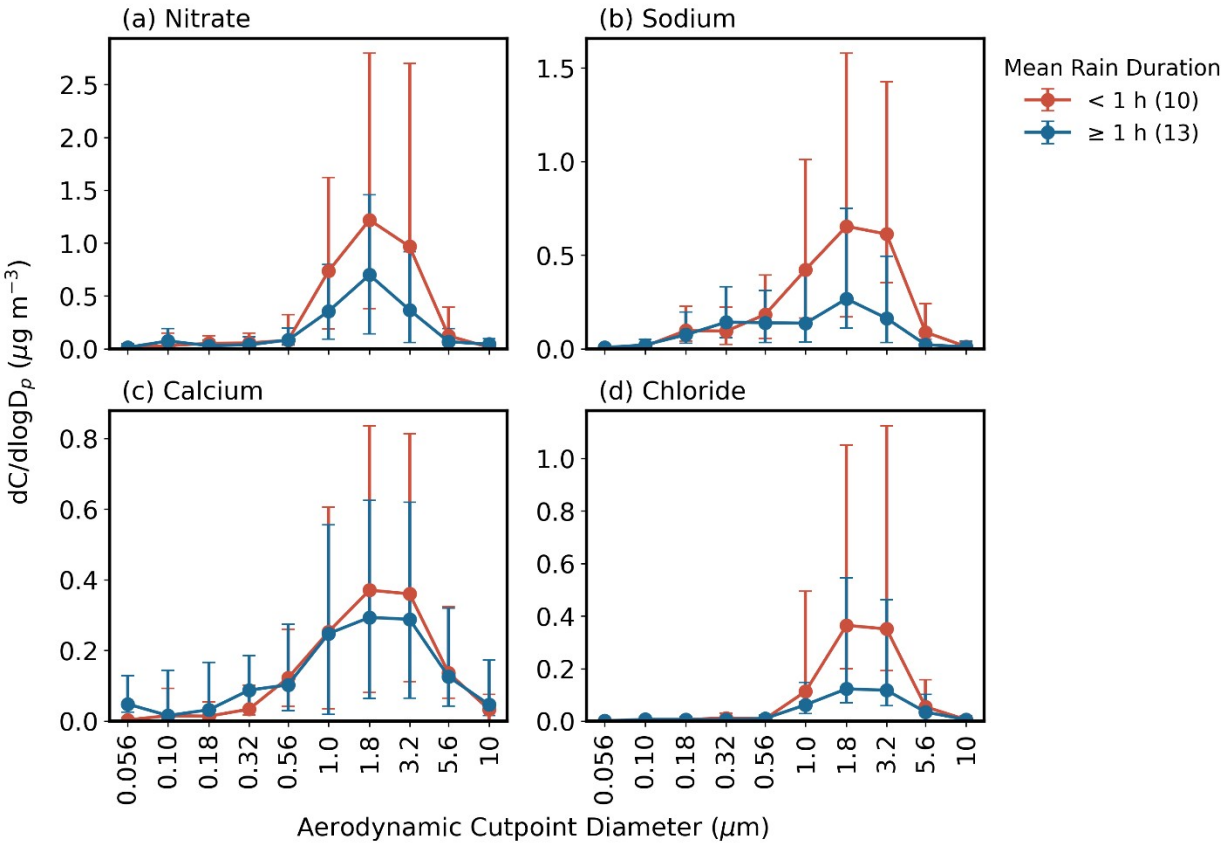

Figure S5. Size distributions of median (a) nitrate, (b) sodium, (c) calcium, and (d) chloride for different mean rain durations. Only data from the wet season were plotted (May – Oct). Note that y-axes limits are not the same across panels. The number of MOUDI sets per grouping is provided in parentheses in the legend. Lower and upper ends of error bars represent the 25th and 75th percentile concentrations, respectively.