



Supplement of

Distinct aerosol populations and their vertical gradients in central Amazonia revealed by optical properties and cluster analysis

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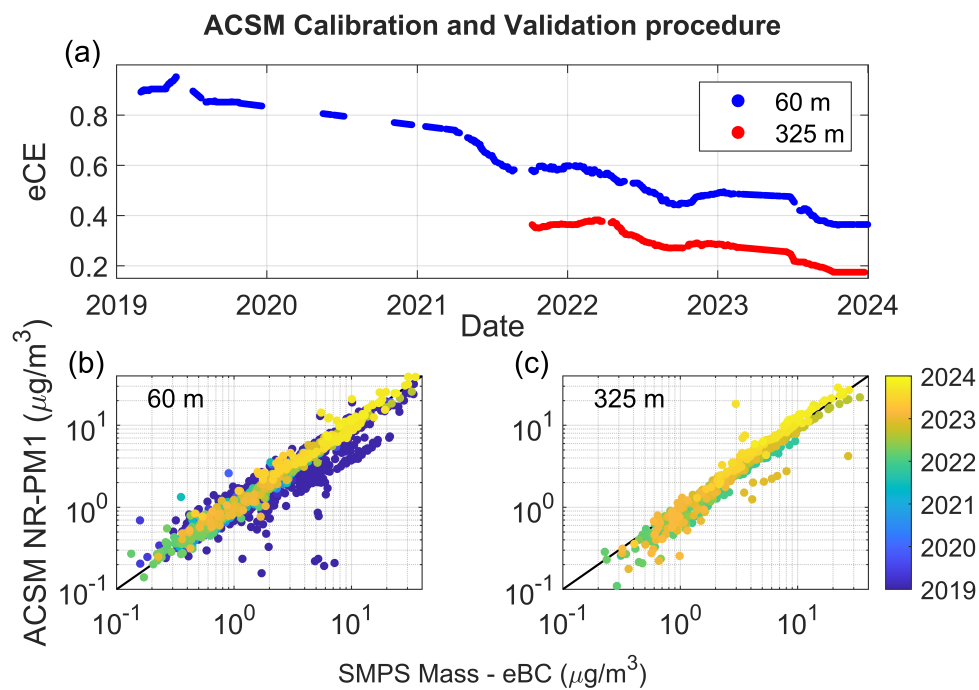


Figure S1. Calibration and validation procedure for the ACSM aerosol concentrations. Panel (a) shows the eCE at 60 m (blue) and 325 m (red). Below, the panels show scatter plots between the NR-PM1 and the difference between the SMPS-derived mass and the eBC at 60 m (b) and 325 m (c) heights. The black lines are 1:1 for reference.

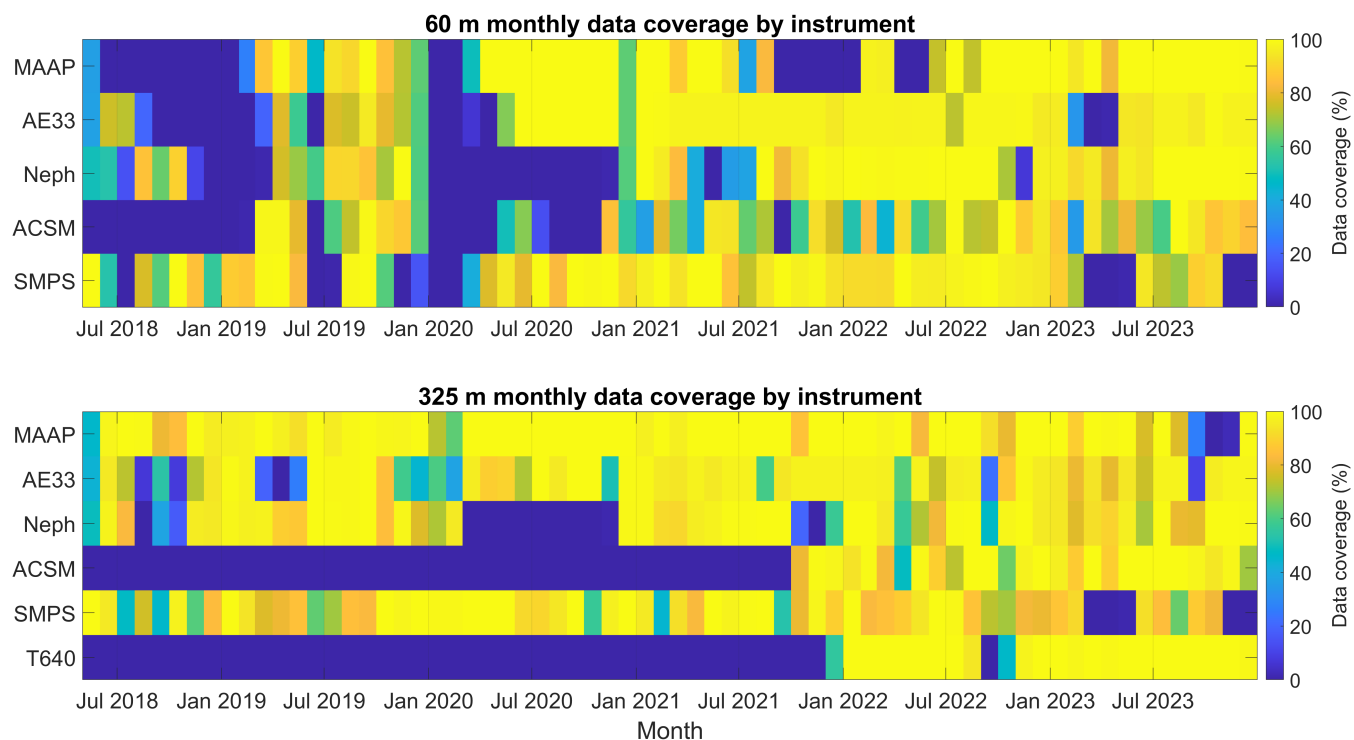


Figure S2. Monthly data coverage time series for the utilized instruments as heat maps. The 325 m ACSM was installed in October 2021 and the Teledyne T640 began operations in December 2021.

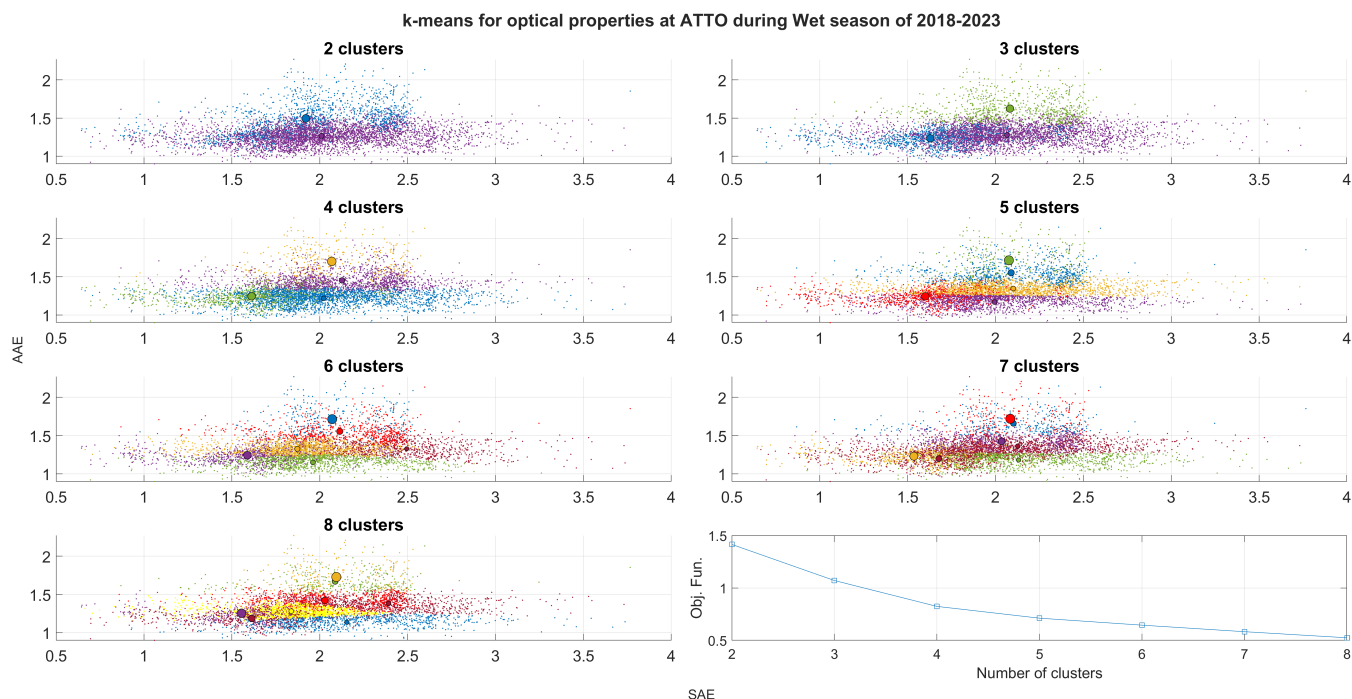


Figure S4. Example run of the k-means algorithm with varying number of clusters from 2 to 8. On the bottom right, the average value of the objective function is shown for each attempt. The clusters are shown with different colors sorted randomly for each plot, and the larger dots mark the centroids of each cluster, with their size indicating the average eBC concentration.

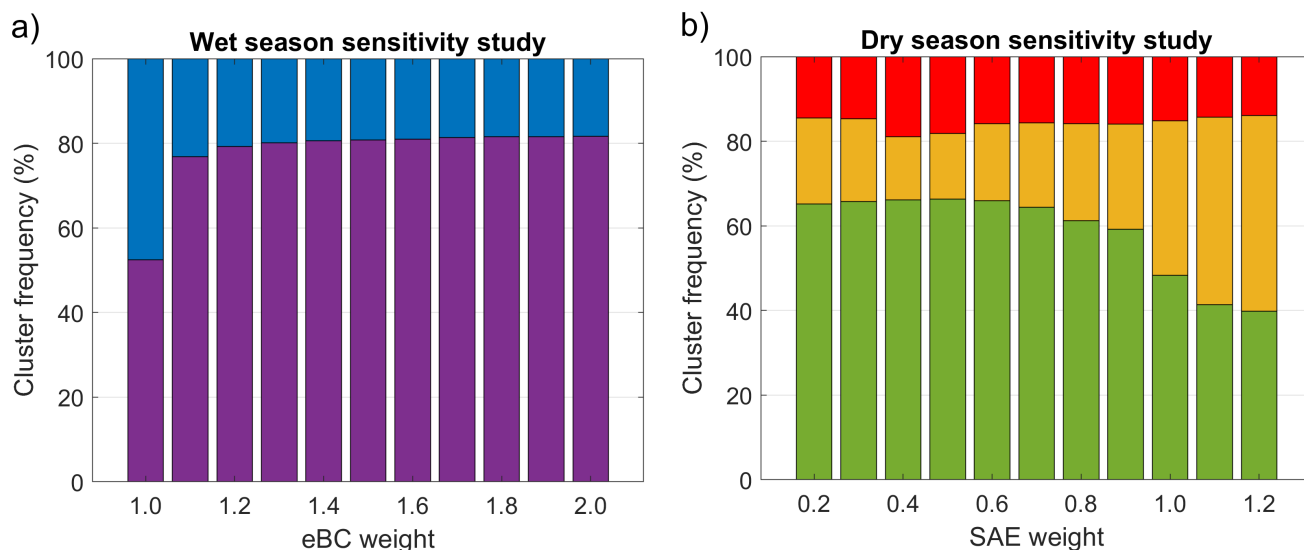


Figure S5. Sensitivity study of the k-means algorithm used in this study as a function of the weights attributed to (a) the eBC in the wet season and (b) the SAE in the dry season.

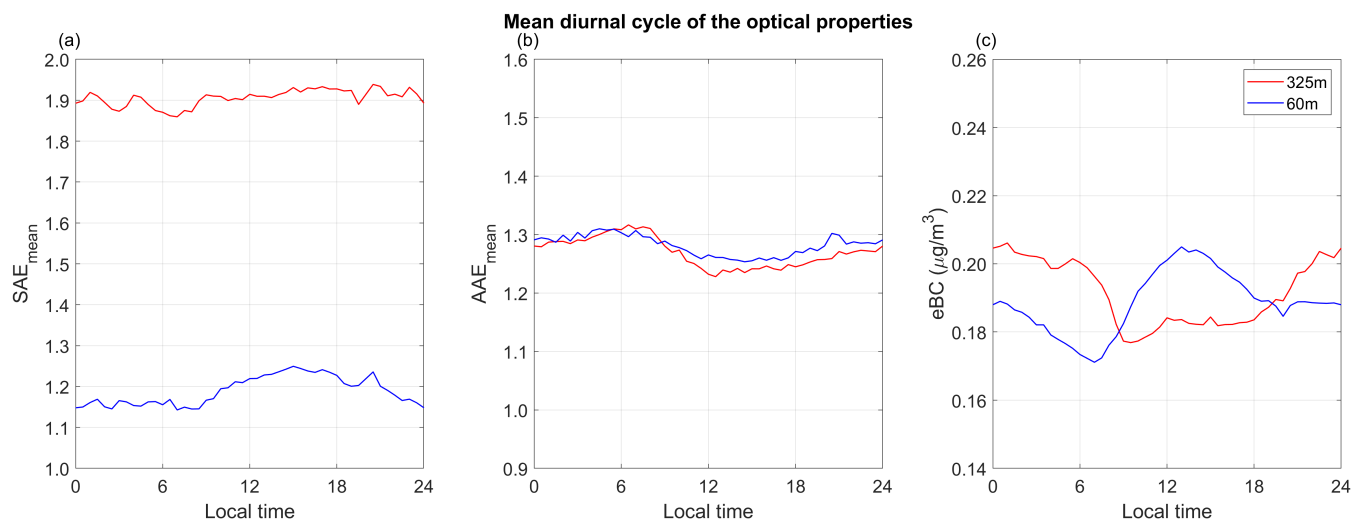


Figure S6. Diurnal cycle of the optical properties (SAE, AAE, and eBC concentration) included in the clustering determination. The blue and red lines indicate 60 and 325 m measurement heights, respectively.

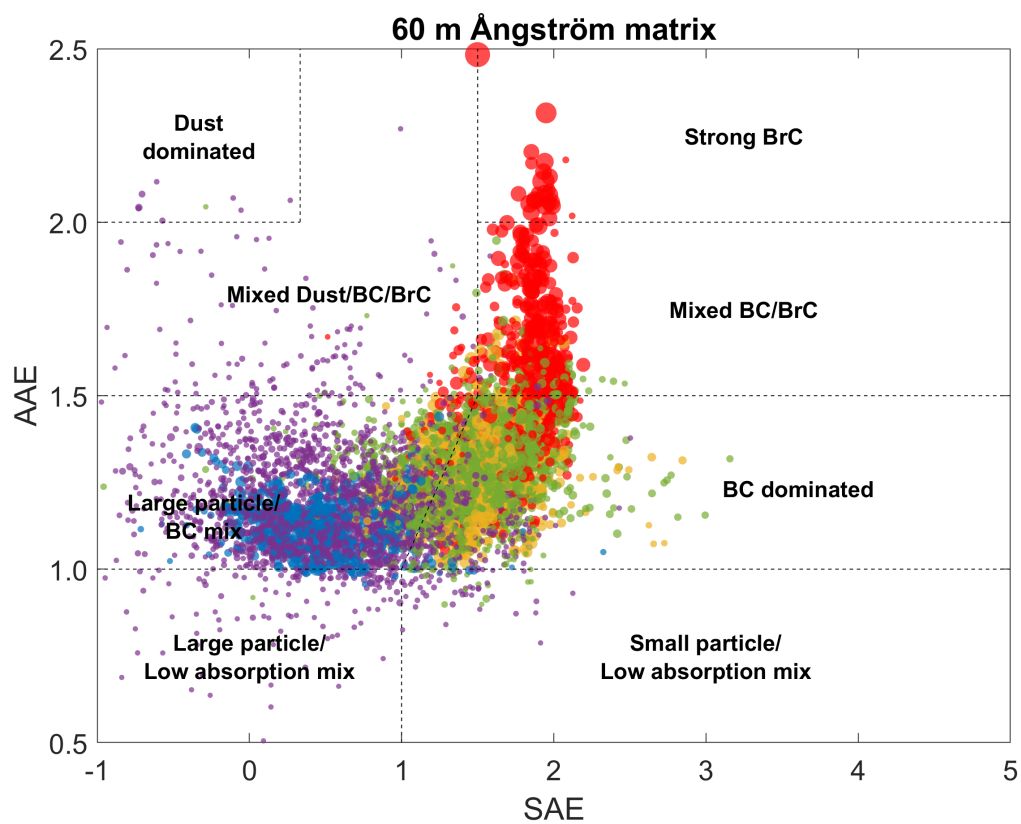


Figure S7. Ångström matrix for the 60 m optical measurements, with the point size indicating the equivalent black carbon concentration and the colors representing the identification of clusters. The highlighted regions relate to possible particle composition as introduced by Cappa et al. (2016).

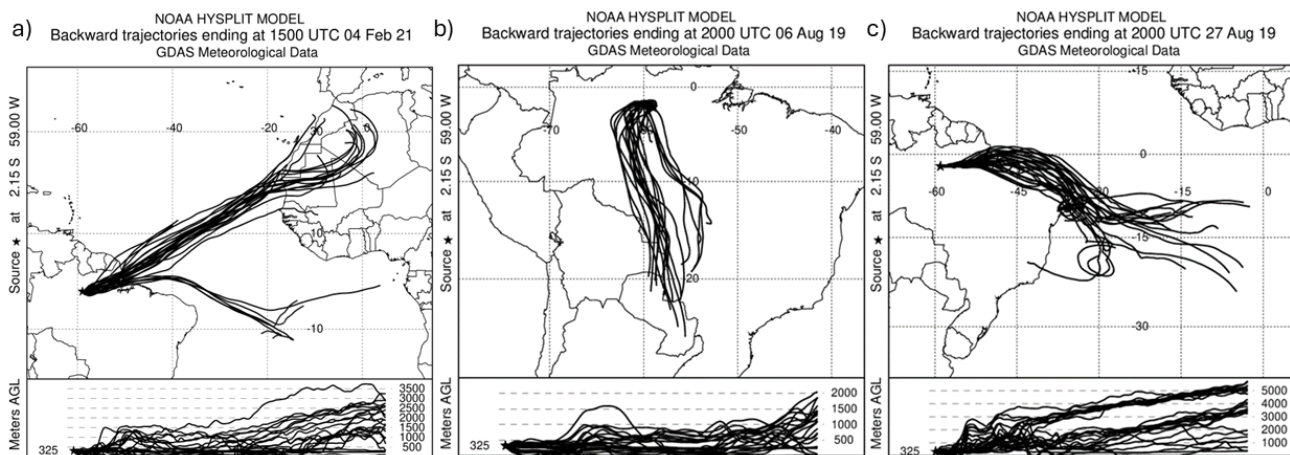


Figure S8. Back trajectories calculated using the NOAA HYSPLIT model for typical days of different clusters. On panel (a), a 10-day simulation showing the movement of air masses from North Africa to Amazonia during Feb 2021. On panel (b), a 72-hour simulation of trajectories arriving at ATTO on 06 Aug 2019, showing the influence of South American air masses, and on panel (c), a 240-hour simulation of air masses coming from Equatorial Africa arriving at ATTO on 27 Aug 2019.

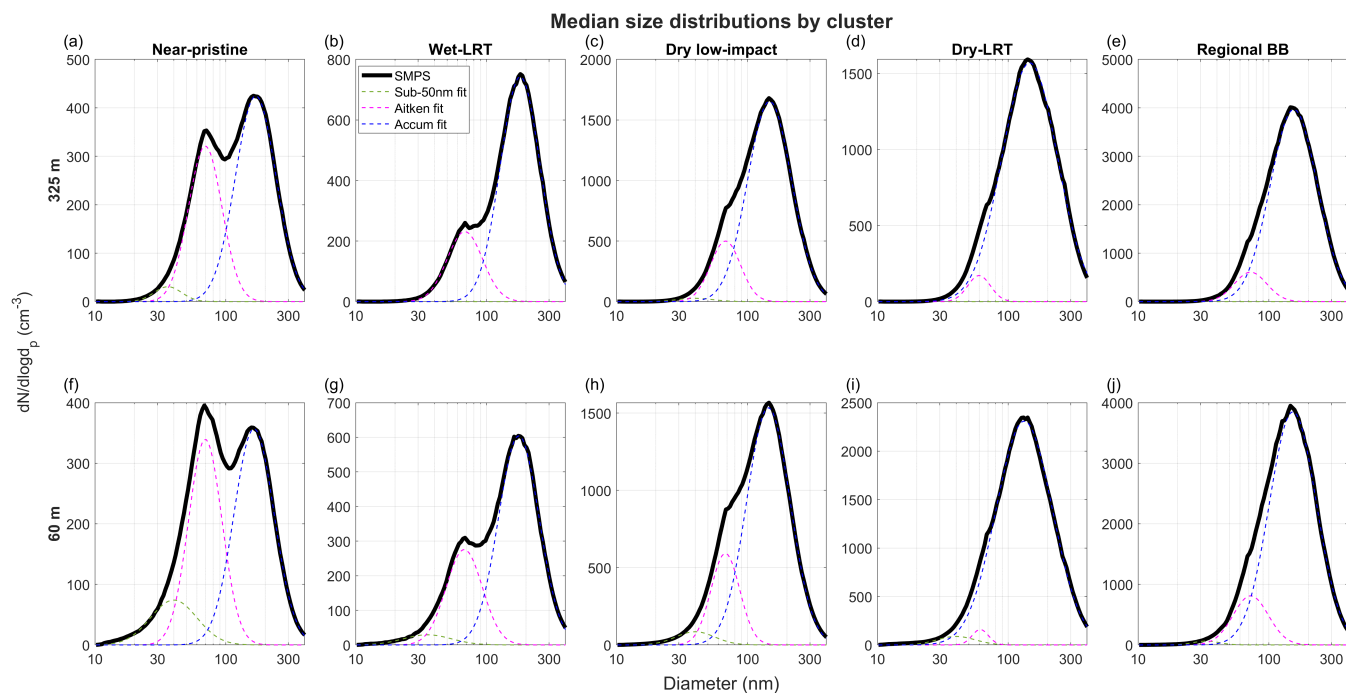


Figure S9. Median size distributions of the aerosol particles at (a-e) 325 m and (f-j) 60 m during the periods outlined by each cluster, with their respective multi-modal log-normal fits.

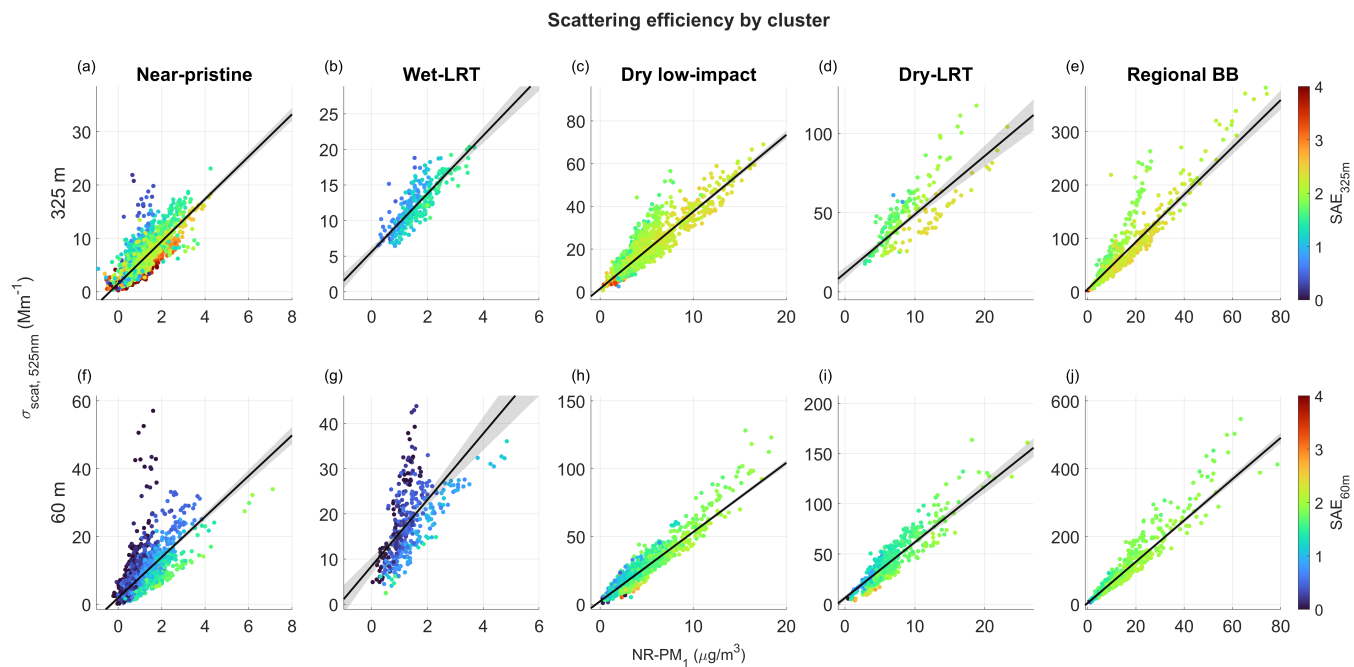


Figure S10. Scatter plots of non-refractive PM₁ mass and scattering coefficient at 525 nm measured at 325 m (a-e) and 60 m (f-j) for each cluster, with linear fit. The shaded areas indicate the 95% confidence interval. The colors indicate the average SAE for each dot.