Supplement of Atmos. Chem. Phys., 18, 7781–7798, 2018
https://doi.org/10.5194/acp-18-7781-2018-supplement

Atmospheric Chemistry and Physics
Open Access
EGU

Supplement of

Secondary aerosol formation promotes water uptake by organic-rich wildfire haze particles in equatorial Asia

Jing Chen et al.

Correspondence to: Jing Chen (chen.jing@ntu.edu.sg) and Mikinori Kuwata (kuwata@ntu.edu.sg)

S1. Back trajectories and carbon emission from wildfires

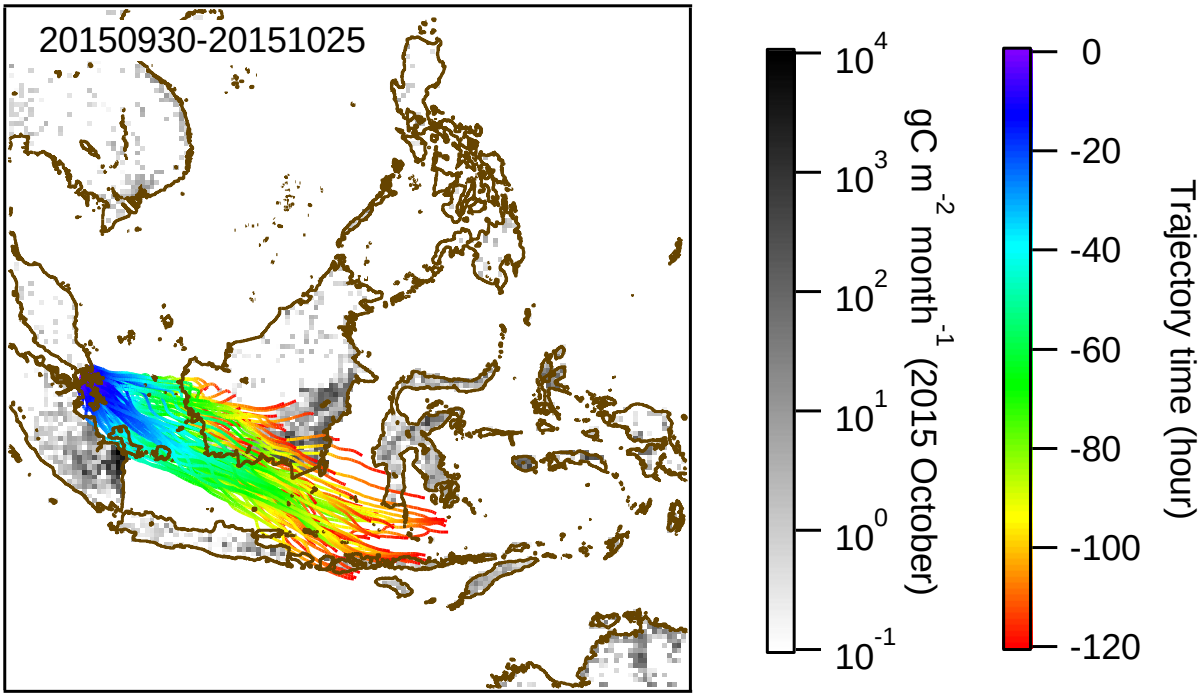

Fig. S1 Back trajectories of air masses arriving at Singapore and monthly carbon emission from wildfires during the observation period of HTDMA measurements. The transport time of wildfire plumes is approximately 1−2 days from South Sumatra, and 3−4 days from Central Kalimantan arriving at Singapore.

The back trajectory was calculated using the NOAA HYSPLIT model at 500 m (Kalnay et al., 1996). The altitude of the trajectories was constrained as iso-sigma. Carbon emission data was from the Global Fire Emissions Database (GFEDv4, https://daac.ornl.gov/VEGETATION/guides/fire_emissions_v4.html).

S2. HTDMA calibration results with 150 nm ammonium sulfate particles

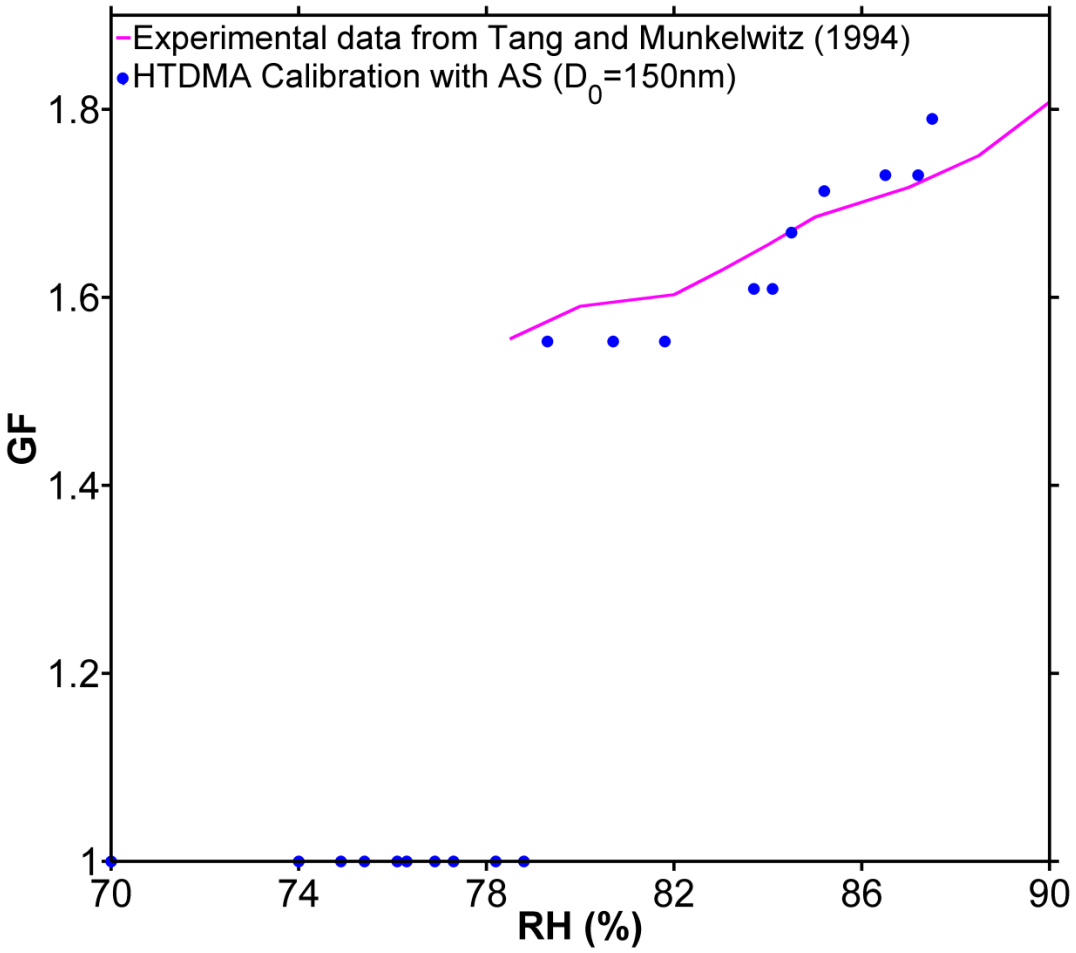

Fig. S2 Comparison of particle diameter growth factor (GF) results derived from the HTDMA calibration data for 150 nm dry ammonium sulfate (AS) particles, and experimental data (without parameterization) obtained by Tang and Munkelwitz (1994).

S3. An example of normalized particle number size distributions of 100 nm particles after humidification at 85 % RH measured using the HTDMA system

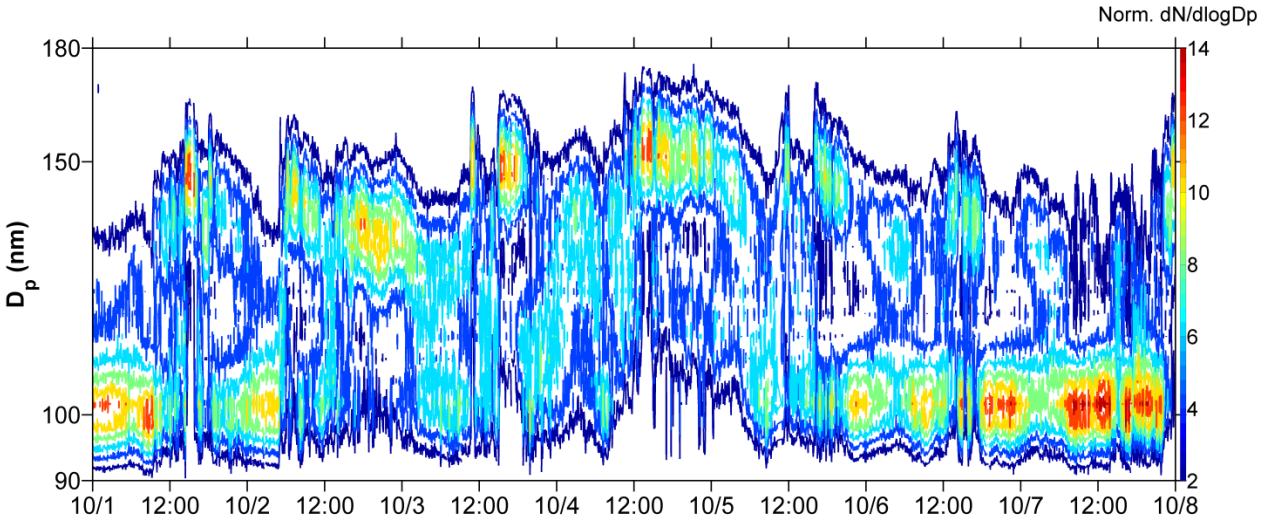

Fig. S3 An example (1−7 Oct 2015) of the HTDMA data at RH = 85% for D_0 = 100 nm particles. Temporal variation of normalized particle number size distributions (i.e., Norm. dN/dlogD_p) is shown, with every 12 hours interval.

S4. Mean particle number and volume size distributions

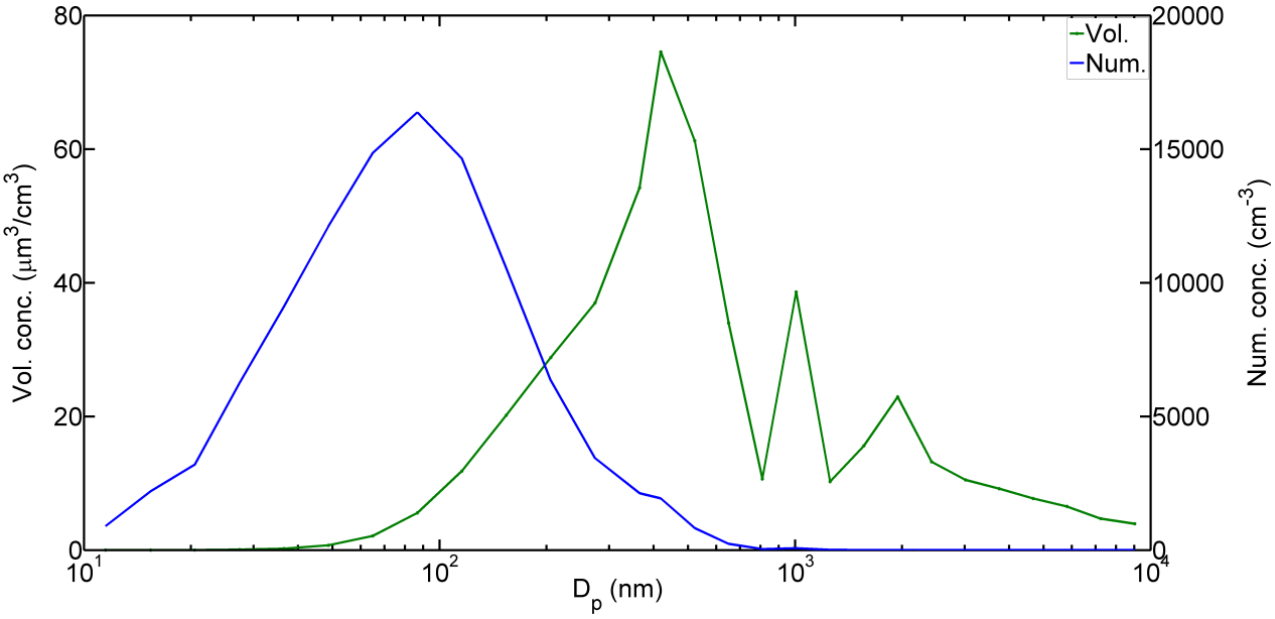

Fig. S4 Mean particle number (Num.) and volume (Vol.) size distributions over the entire wildfire haze observation period. Submicron particles with 200 nm < D_p < 1 μm dominate the particle volume concentration, while 30−200 nm particles are the major contributor to the particle number concentration.

S5. Time series of total particle volume concentrations for PM_1 and PM_{10} measured during the wildfire haze periods

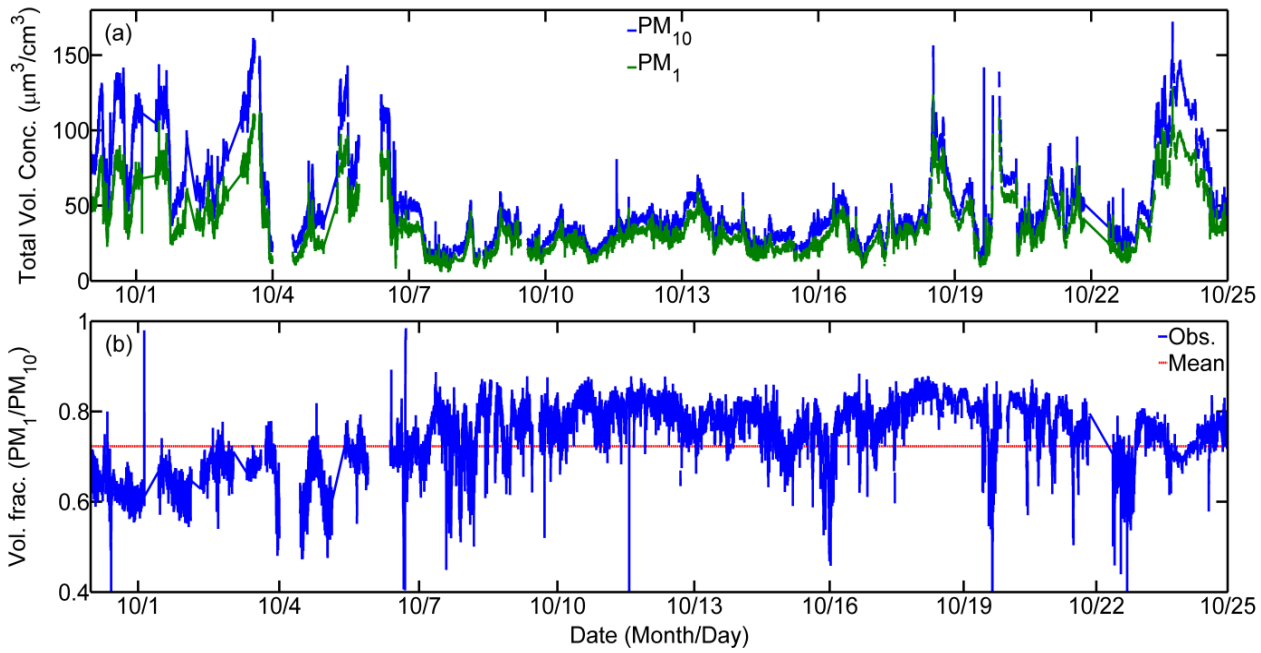

Fig. S5 (a) Time series of total particle volume concentrations (Vol. Conc.) for PM_1 and PM_{10}. (b) The corresponding volume fraction (Vol. frac.) of PM_1 to PM_{10} calculated from the combined particle size distribution. The data from the NanoScan SMPS and OPS were used for the analysis. The red line represents the mean level (approximately 72.3 %) averaged over the entire observation period. This result suggests the predominant role of submicron particles in total particle mass.

S6. Correlations between the mass concentration of organics and that of sulfate

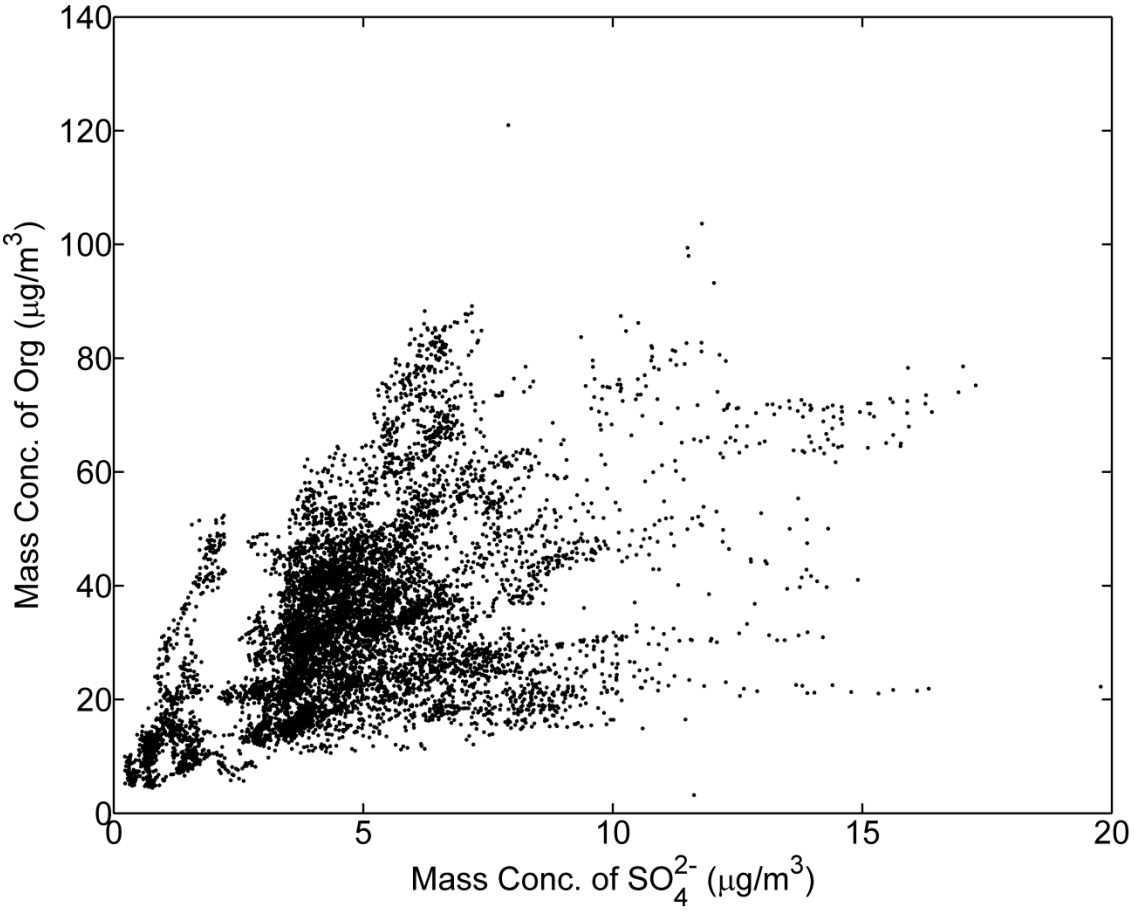

Fig. S6 Correlation between mass concentration of organics and that of sulfate (R = 0.49), without the data measured during the extremely pollution episode in the evening of 19 October 2015 till the noon time of 20 October 2015.

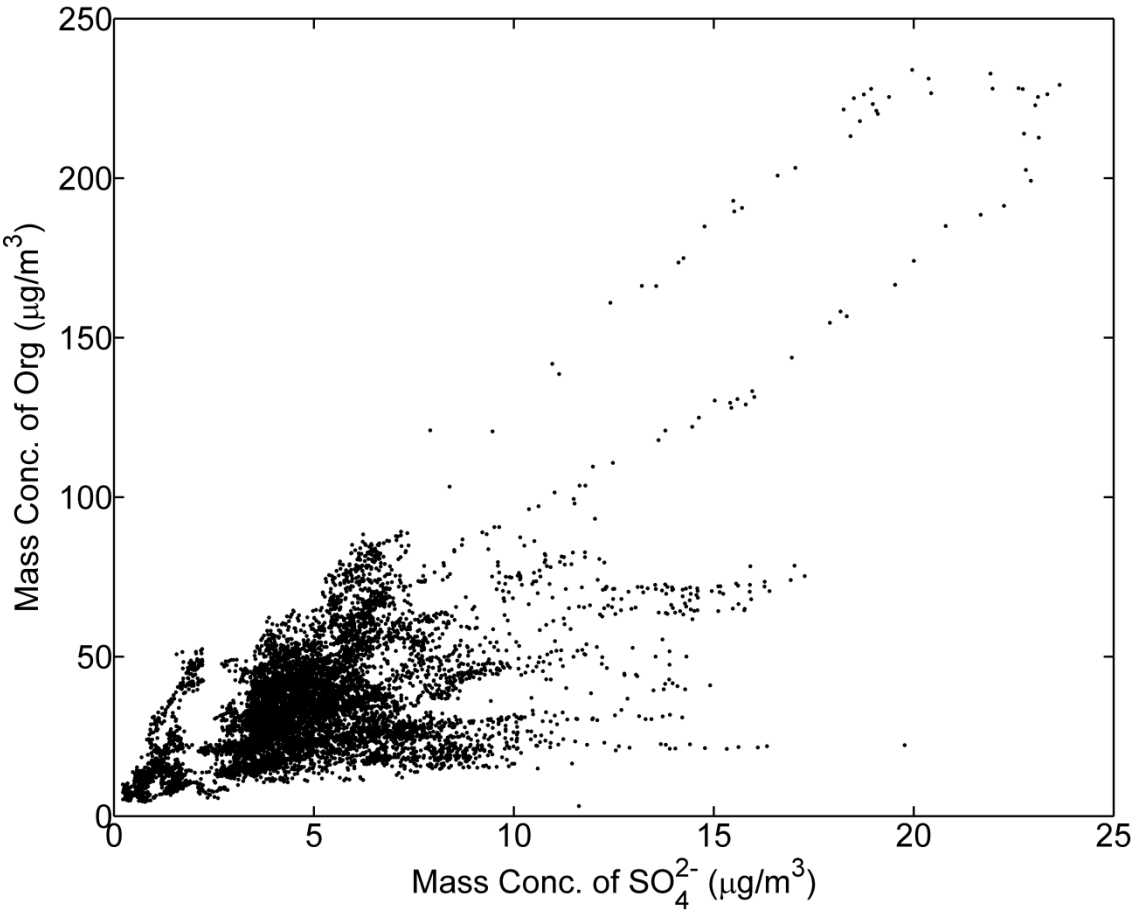

Fig. S7 Correlation between mass concentration of organics and that of sulfate (R = 0.62) during the entire wildfire haze observation period.

References:

Kalnay et al. (1996). The NCEP/NCAR 40-year reanalysis project, Bull. Amer. Meteor. Soc., 77, 437-470.

Tang, I. N. and H. R. Munkelwitz (1994). Water activities, densities, and refractive indices of aqueous sulfates and sodium nitrate droplets of atmospheric importance. J. Geophys. Res. Atmos., 99(D9): 18801-18808.