Ubiquitous Influence of Wildfire Emissions and Secondary Organic Aerosol on Summertime Atmospheric Aerosol in the Forested Great Lakes Region

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1 Supporting Measurements

Meteorological data (Figure S1), including wind direction, wind speed, relative humidity, and temperature, were collected by a Vaisala WXT510 weather sensor located at the top of the PROPHET tower. Variations in meteorological conditions throughout the study, and average meteorological conditions during each period of influence, are discussed in the main text. In order to determine the origin of the influential air masses (Figure S2), backward air mass trajectories were calculated using the NOAA Hybrid Single Particle Lagrangian Integrated Trajectory (HYSPLIT) Model (Stein et al., 2015). A final altitude of 500 m AGL was used for the field site, with each trajectory modeling the proceeding 72 h. During each of the three influence air mass locations, median, was well as 25^{th} and 75^{th} percentile aerosol number, mass, and size distributions were calculated based on SMPS measurements (Figures S3 and S4). Predicted NH_4^+ (Figure S4) was calculated using the methods described by Sueper (2010). Though these calculations indicate the aerosol is likely acidic, there are caveats associated with these calculations, as outlined by Hennigan et al. (2015). Therefore, the pH cannot be reliably calculated beyond a qualitative indication of whether or not the aerosol is acidic.

References

Hennigan, C.J., Izumi, J., Sullivan, A.P., Weber, R.J., Nenes, A., 2015. A critical evaluation of proxy methods used to estimate the acidity of atmospheric particles. Atmos. Chem. Phys. 15, 2775-2790.

Stein, A., Draxler, R., Rolph, G., Stunder, B., Cohen, M., Ngan, F., 2015. NOAA's HYSPLIT atmospheric transport and dispersion modeling system. B. Am. Meteorol. Soc. 96, 2059-2077.

Sueper, D., 2010. ToF-AMS analysis software. Available at: http://cires1.colorado.edu/jimenez-group/ToFAMSResources/ToFSoftware/index.html.

VanReken, T., Mwaniki, G., Wallace, H., Pressley, S., Erickson, M., Jobson, B., and Lamb, B.: Influence of air mass origin on aerosol properties at a remote Michigan forest site, Atmos. Environ., 107, 35-43, 2015.

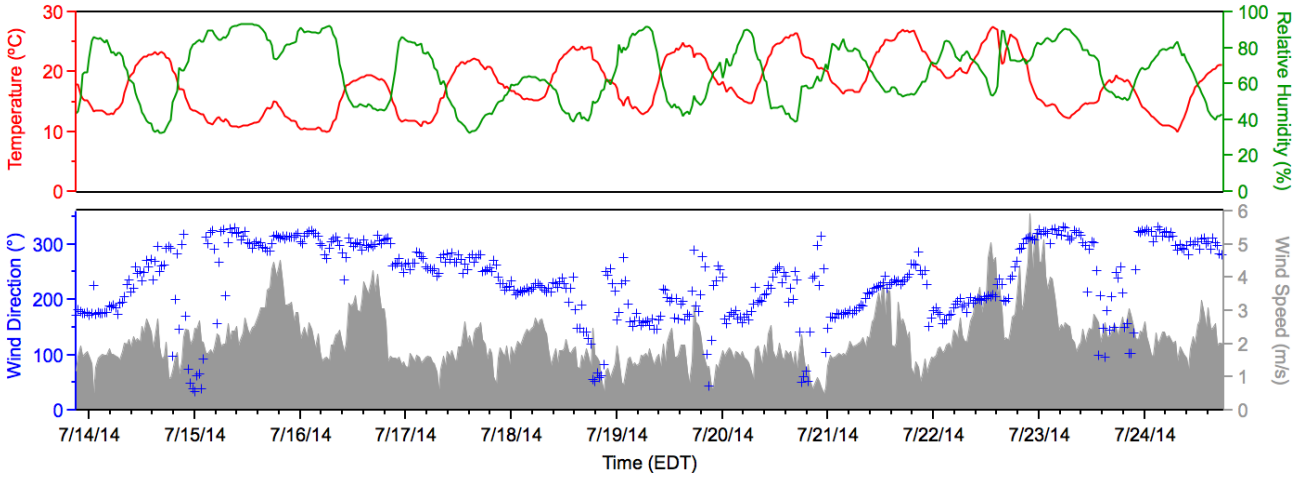

Figure S1. Meteorological conditions measured from a height of ~30 m at the UMBS PROPHET Tower.

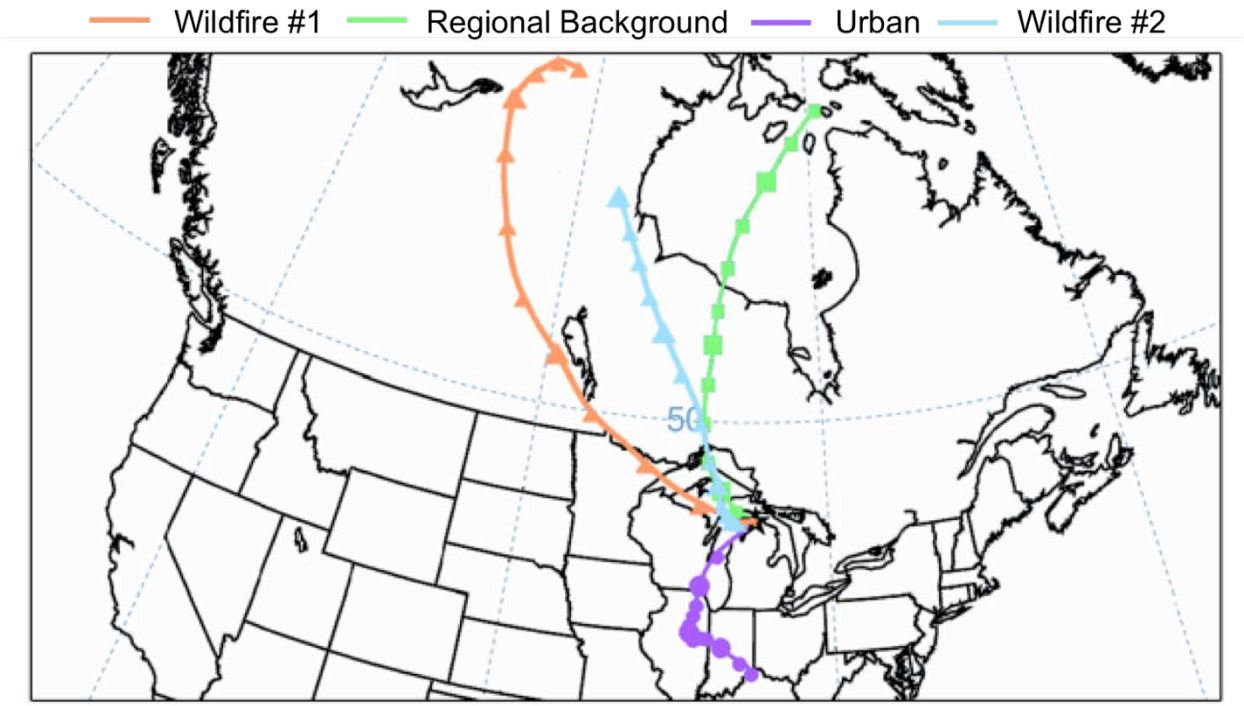

Figure S2. Representative 72 h HYSPLIT back trajectories with a final altitude of 500 m for the four air mass influences, with markers indicating 6 h intervals. Trajectory start times were: Wildfire #1: 7/14/2014 07:00 EDT, Regional Background: 7/17/2014 07:00 EDT, Urban: 7/21/2014 07:00 EDT, Wildfire #2: 7/24/14 07:00 EDT. Colors correspond to the air mass of influence indicated in Figure 3.

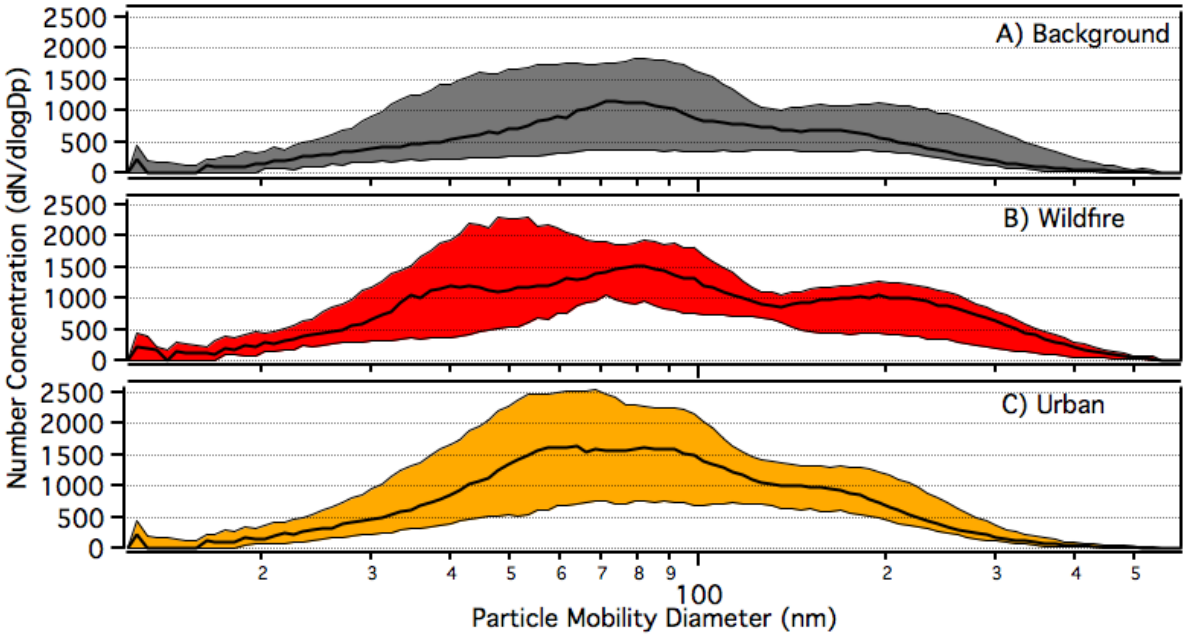

Figure S3. Median and 25th/75th percentiles of size-resolved particle number concentration distributions, as measured by SMPS, during the three air mass periods of interest: (A) Background, (B) Wildfire, and (C) Urban. For comparison, particle size distributions by air mass origin at UMBS in summer 2009 were previously discussed in detail by VanReken et al. (2015).

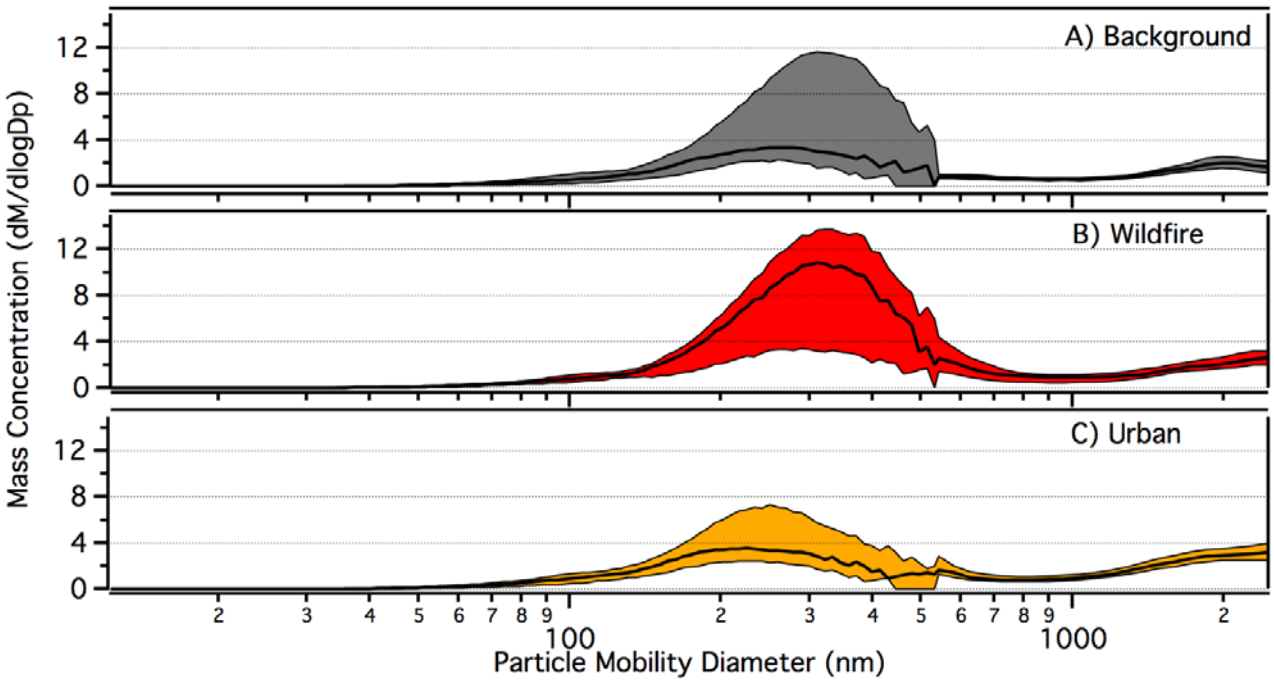

Figure S4. Median and 25th/75th percentiles of size-resolved particle mass distributions, as measured by SMPS and APS (assuming a density of 1.5 g cm^{-3}), during the three air mass periods of interest: (A) Background, (B) Wildfire, and (C) Urban.

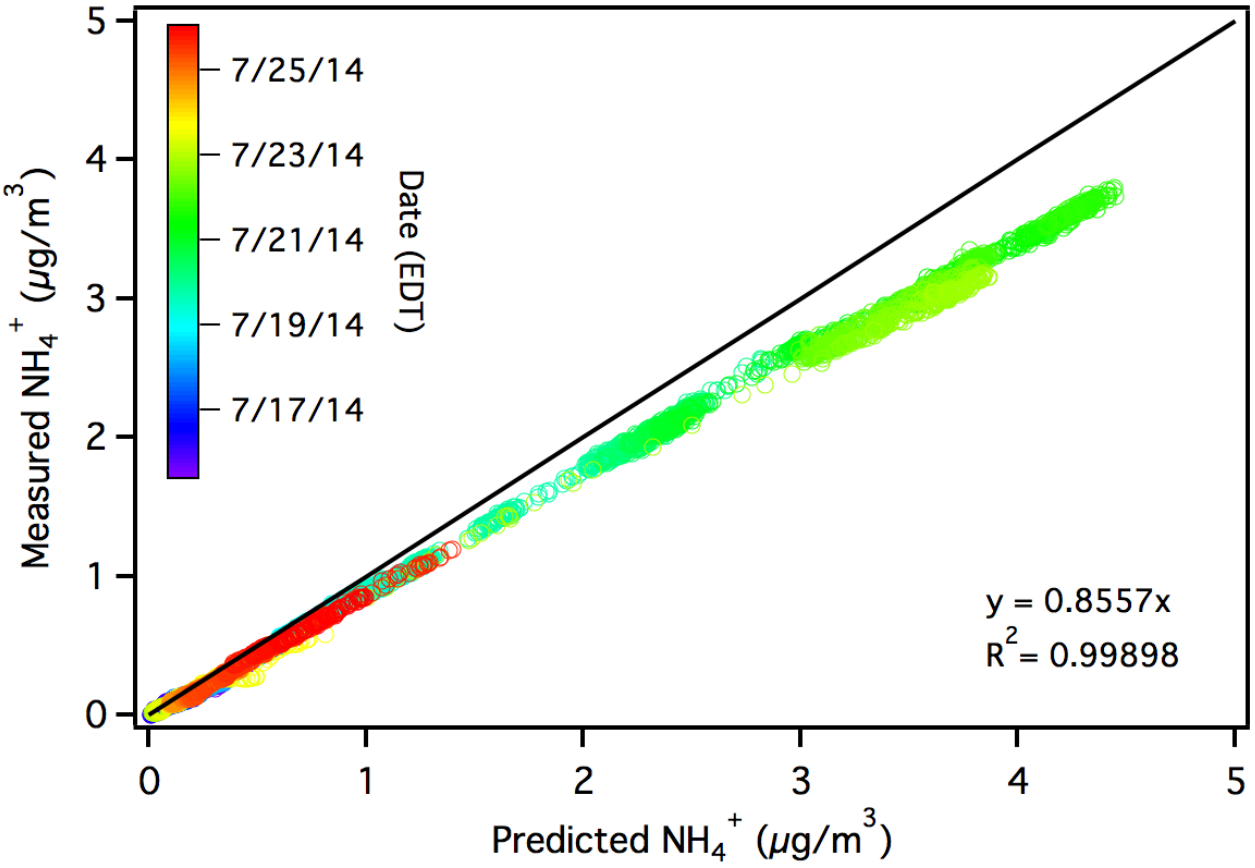

Figure S5. Ammonium balance calculated from predicted ammonium versus measured ammonium from the HR-AMS, following the method of Sueper (2010). A 1:1 line is showed in black for reference.