



### Supplement of

# Substantial secondary organic aerosol formation in a coniferous forest: observations of both day and night time chemistry

A. K. Y. Lee et al.

Correspondence to: A. K. Y. Lee (klee@chem.utoronto.ca)

The copyright of individual parts of the supplement might differ from the CC-BY 3.0 licence.



Figure S1: The location of sampling site (Raven's Nest, red marker). The sampling site located with a coniferous forest mountain area at an elevation of 1320 m-asl.

m/z	VOCs	Sensitivity (normalized count per ppbv)	Limit of detection (LOD, pptv)
33.034	Methanol	10.4	200
47.014	Formic acid	17.9	110
59.049	Acetone	30.9	18
69.070	Isoprene	9.9	9
71.053	Methyl vinyl ketone (MVK) + methacrolein (MACR)	12.6	9
81.070	$\Sigma$ monoterpene fragment		
87.070	Methyl-3-buten-2-ol (MBO)		
137.133	$\Sigma$ Monoterpenes	5.6	9

### **Biogenic period**

## Period with mixed biogenic and anthropogenic influence



Figure S2: Left panel: biogenic episode, right panel: period with a mix of biogenic and anthropogenic influence. Time series (PST) profiles of (a) Temperature and relative humidity, (b) monoterpene and isoprene measured by PTR-ToF-MS, c) Organic, nitrate, sulfate, ammonium, and chloride measured by HR-ToF-AMS, (d) background OA, BSOA-1, and BSOA-2 determined by PMF analysis, (e) particle number size distribution measured SMPS.



Figure S3: Correlation of BVOC mixing ratios (solid purple circle: monoterpenes, open brown circle: isoprene) and ambient temperature.



Figure S4: (a) Correlation of organic mass and acetone. The color scale represents the mixing ratio of methanol. (b) Correlation of organic mass and methanol. The color scale represents the mixing ratio of acetone. (c) Correlation of organic mass and formic acid. The color scale represents the mixing ratio of methanol.



Figure S5: Histograms of O:C and H:C ratios of organic aerosol.



Figure S6: Time series (PST) profiles of total organic mass, BSOA-1/BSOA-2 ratio, and  $C_2H_3O^+$ / $CO_2^+$  ratio during the biogenic period.



Figure S7: Diurnal patterns of the AMS signals of  $NO^+$ ,  $NO_2^+$  and  $NO^+/NO_2^+$  during the period with a mix of biogenic and anthropogenic influence.



Figure S8: Time series (PST) profiles of nitrate and sulfate during the whole sampling period.

### **Calculation of organic nitrate mass**

The mass concentration of the nitrate functional groups (- $ONO_2$ ) in organic compounds is estimated using the AMS mass concentrations of  $NO^+$  and  $NO_2^+$  followed by the calculation suggested by Xu et al. (2015).

 $[-ONO_2] = [NO^+] + [NO_2^+]$ 

where 30, 46, and 62 are the molecular weights of NO<sup>+</sup>, NO<sub>2</sub><sup>+</sup>, and -ONO<sub>2</sub>, respectively.

The mass concentration of nitrate functional groups in organic compounds is used to estimate the mass concentration of organic nitrates (ON) by the following equation.

 $[ON] = ([-ONO_2]/62) \times MW_{ON}$ 

where  $MW_{ON}$  is the average molecular weight of organic nitrates, which is assumed to range from 200 to 300 g/mol.

### **Reference:**

Xu, L., Guo, H., Boyd, C. M., Klein, M., Bougiatioti, A., Cerully, K. M., Hite, J. R., Isaacman-VanWertz, G., Kreisberg, N. M., Knote, C., Olson, K., Koss, A., Goldstein, A. H., Hering, S. V., de Gouw, J., Baumann, K., Lee, S., Nenes, A., Weber, R. J. and Ng, N. L.: Effects of anthropogenic emissions on aerosol formation from isoprene and monoterpenes in the southeastern United States, Proc. Natl. Acad. Sci. U. S. A., 112, 37-42, 2015.