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Atmospheric Chemistry and Physics Discussions

Supplement of

Atmospheric submicron aerosol composition and particulate organic nitrate formation in a boreal forestland–urban mixed region

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Supplementary Materials

Atmospheric Submicron Aerosol Composition and Particulate Organic Nitrate Formation in a Boreal Forestland-Urban Mixed Region

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S1. Experimental

S1.1 Trajectory analysis

To investigate the aerosol regional source on the measurement site, 48 h back trajectories at 500m arrival height above ground level were computed every 2h using Hybrid Single Particle Lagragian Integrated Trajectory model (HYSPLIT-4) (Draxler, R.R. and Rolph, G.D., 2013).

S2. Results and discussion

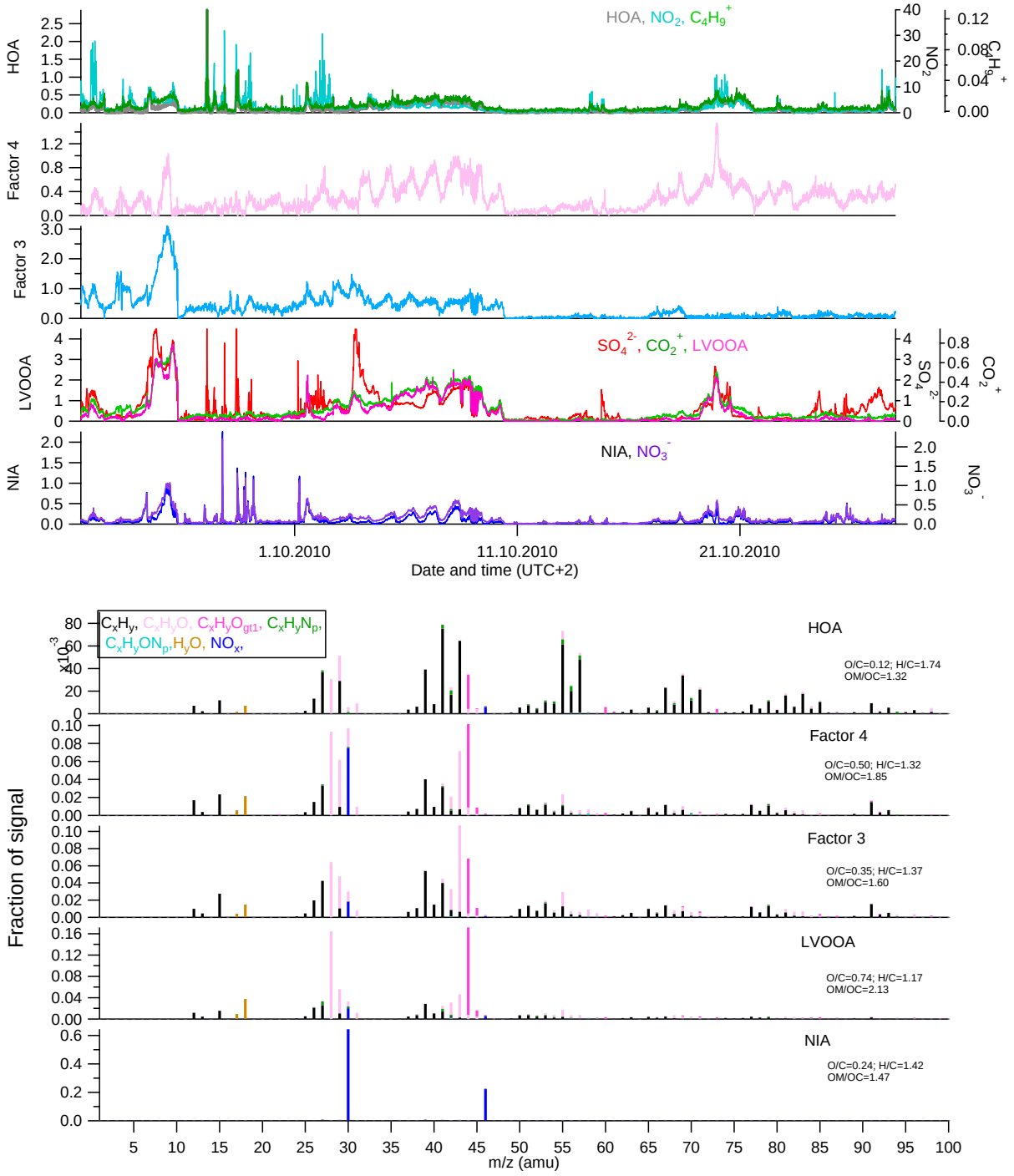


Figure S1. Time series and mass profiles by PMF analysis at 5-factor solution. Factor 3 and 4 were merged to generate a new factor by a mass-weighted combination, which results are reported in the paper. HOA, hydrocarbon-like organic aerosol; LVOOA, low-volatile oxygenated OA; NIA, nitrate inorganic aerosol

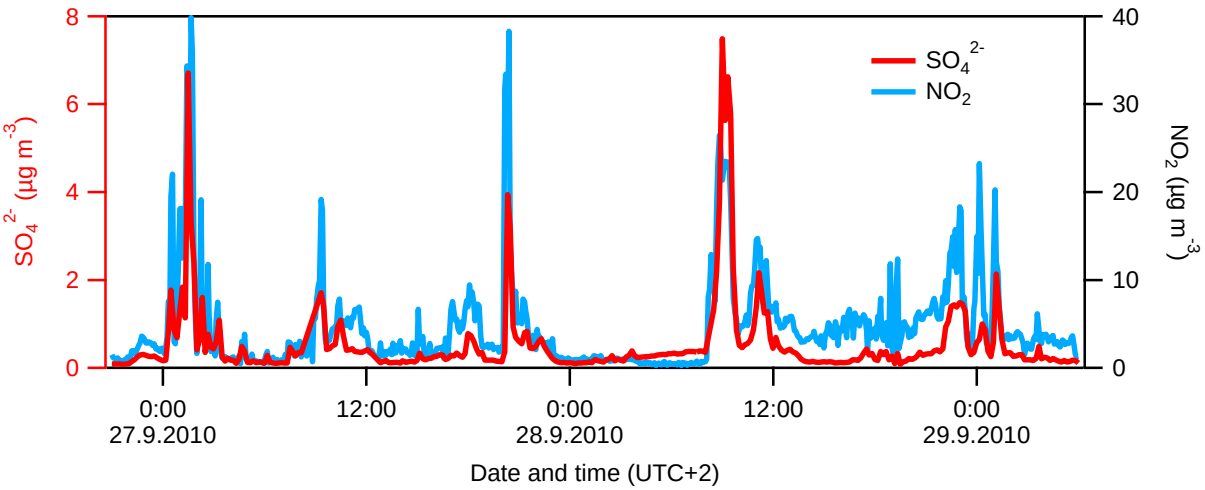


Figure S2. Comparisons of time series of SO_4^{2-} and NO_2 during the primary aerosol emitting days, which is shown in the gray bar in Figure 1. Good correlation of SO_4^{2-} with NO_2 suggests that the SO_4^{2-} is primary in nature during this period.

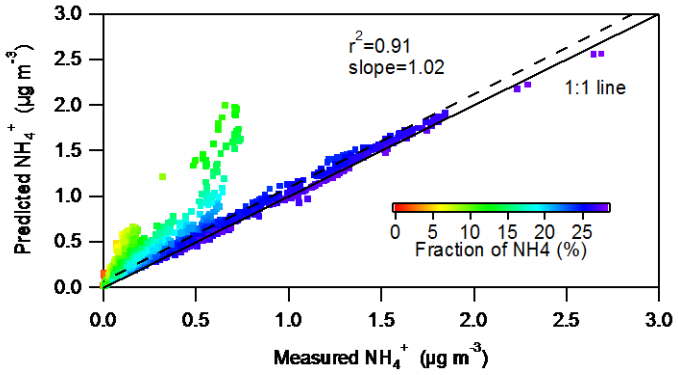
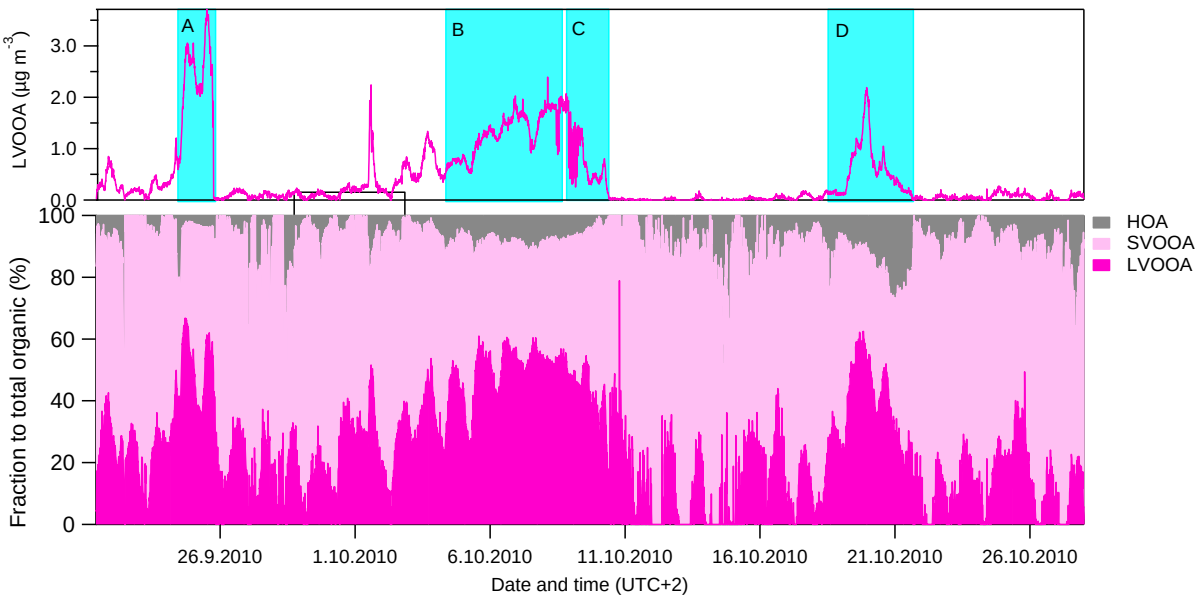
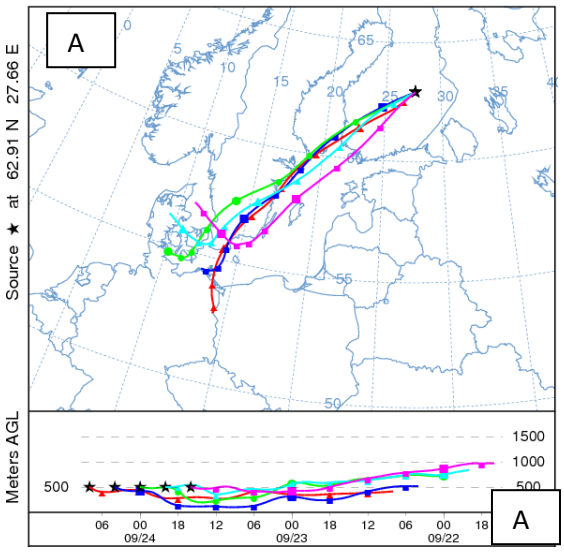
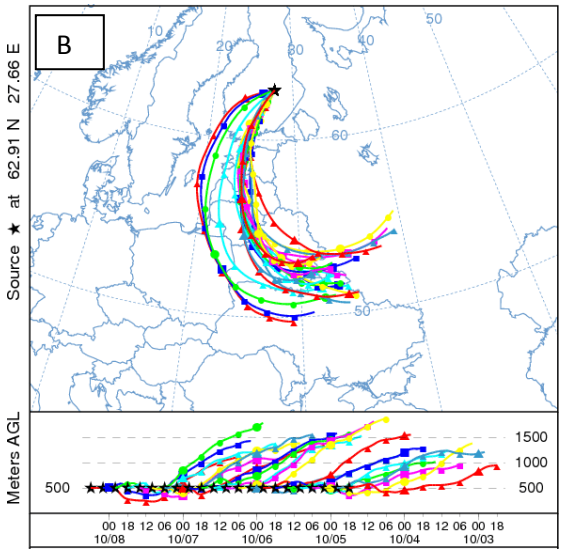
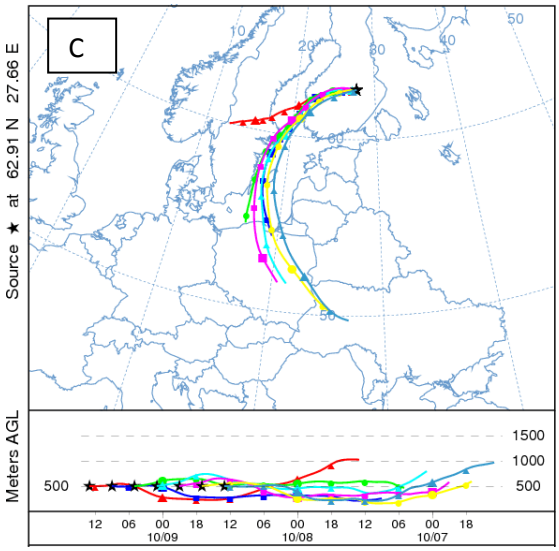


Figure S3. Predicted NH_4^+ (assuming fully neutralized aerosol) vs measured NH_4^+, colored by the mass fraction of measured NH_4^+ to the sum of SO_4^{2}+ NO_3+Cl^-. The predicted NH_4^+ was determined by $NH_4^+{}_{,pre} = 18\times(2\times SO_4^{2-}/96 + NO_3^-/62 + Cl^-/35.5)$, where NH_4^+, SO_4^{2-}, NO_3^- and Cl^- represent the mass concentrations (in µg m^{-3}) of the species and the denominators correspond to their molecular weights. The factor 18 is the molecular weight of NH_4^+ (Zhang et al., 2007).


A
B
C
D
LVOOA (µg m-3)
3.0
2.0
1.0
0.0
100
80
60
40
20
0
Fraction to total organic (%)
HOA
SVOOA
LVOOA
26.9.2010
1.10.2010
6.10.2010
11.10.2010
16.10.2010
21.10.2010
26.10.2010
Date and time (UTC+2)


A
Source ★ at 62.91 N 27.66 E
Meters AGL
1500
1000
500
500
06 00 18 12 06 00 18 12 06 00 18
09/24 09/23 09/22
A


B
Source ★ at 62.91 N 27.66 E
Meters AGL
1500
1000
500
500
00 18 12 06 00 18 12 06 00 18 12 06 00 18 12 06 00 18 12 06 00 18
10/08 10/07 10/06 10/05 10/04 10/03


C
Source ★ at 62.91 N 27.66 E
Meters AGL
1500
1000
500
500
12 06 00 18 12 06 00 18 12 06 00 18
10/09 10/08 10/07

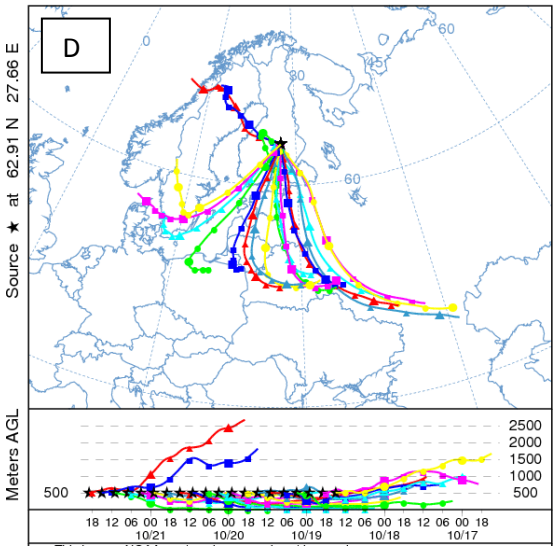

D
Source ★ at 62.91 N 27.66 E
Meters AGL
2500
2000
1500
1000
500
500
18 12 06 00 18 12 06 00 18 12 06 00 18 12 06 00 18 12 06 00 18
10/21 10/20 10/19 10/18 10/17

Figure S4. Top panel: time series of LVOOA and mass fractions of LVOOA to total organic. Four periods on the LVOOA plumes were selected for the back trajectory studies marked by blue bars. Bottom panel: Back trajectory analysis on the sources of LVOOA. The trajectories were conducted on the four plumes of LVOOA time series, showing LVOOA were from South Finland, south Sweden, central Europe.

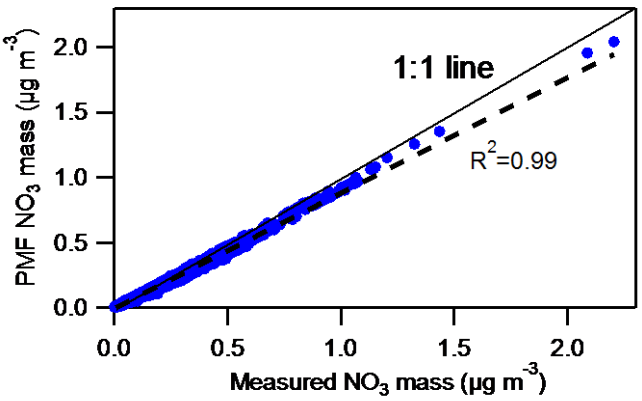


Figure S5. Comparisons of mass concentrations of nitrate aerosols between the fitted by PMF and the measured by AMS.

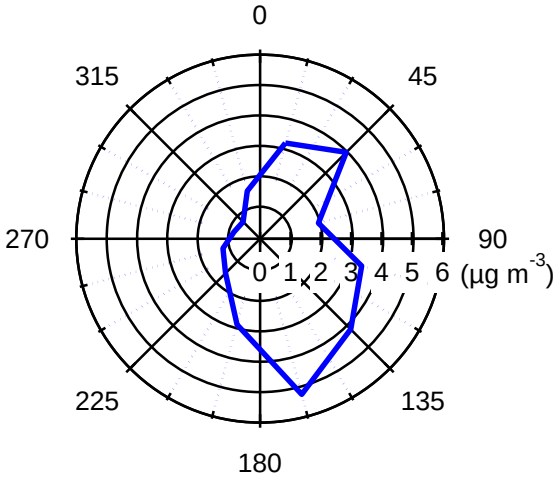


Figure S6. Wind rose for NO_2.

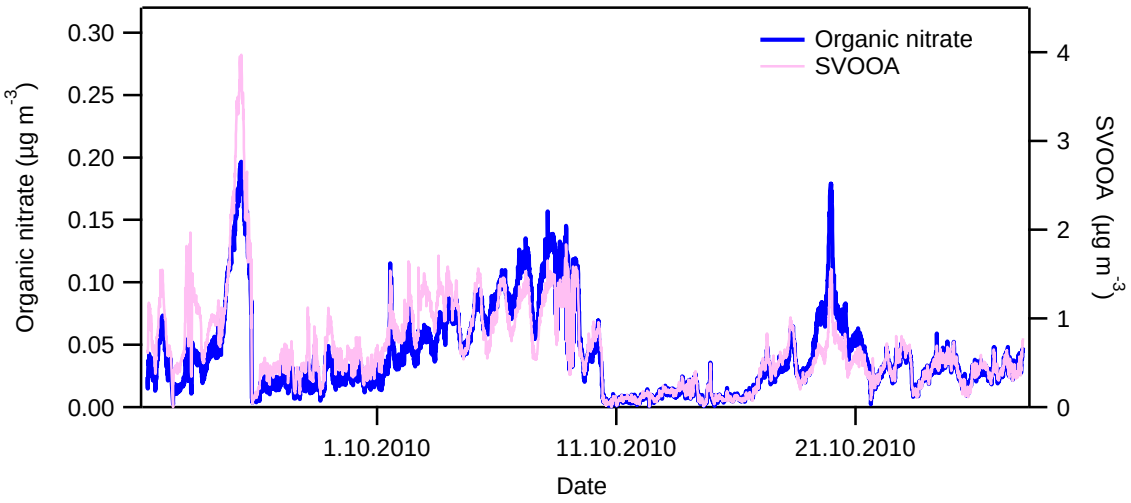


Figure S7**.** Comparison of SVOOA and particulate organic nitrate.

References

Draxler, R.R., and Rolph, G.D.: HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) Model access via NOAA ARL READY Website (http://ready.arl.noaa.gov/HYSPLIT.php). NOAA Air Resources Laboratory, Silver Spring, MD, 2003.

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