Supplementary material

Table S1: Parameters used for the size resolved anthropogenic primary particle emissions. Since the particle number size distribution properties and chemical properties were found in different studies, the exact size resolved chemical composition used in this study will not be identical with the references.

	Mode 1	Mode 2	Mode 3	Mode 4	Mode 5
Dp road (nm)	3.0[a]	20.0[a]	77.0[a]	-	-
σ road	1.25 [a]	1.9 [a]	1.75 [a]	-	-
$N_{mode\ i}/N_{tot}$ road	0.02 [a]	0.90 [a]	0.08[a]	-	-
EC fraction road	0[b]	0.2[b]	0.64[b]	-	-
POA fraction road	1[b]	0.8[b]	0.27[b]	-	-
Mineral fraction road	0	0	0.09	-	-
Dp ship (nm)	14.0[c]	90.0[c]	-	-	-
σ ship	1.45[c]	1.52[c]	-	-	-
$N_{mode\ i}/N_{tot}$ ship	0.438[c]	0.562[c]	-	-	-
EC fraction ship	0[d]	0.52[d]	-	-	-
POA fraction ship	1[d]	0.08[d]	-	-	-
Mineral fraction ship	0	0.4	-	-	-
Dp wood (nm)	7.7[e]	23.8[e]	64.2[e]	150.0[e]	530.0[e]
σ wood	1.26[e]	1.49[e]	1.50[e]	1.60[e]	1.30[e]
$N_{mode\ i}/N_{tot}$ wood	0.032[e]	0.241[e]	0.497[e]	0.227[e]	0.003[e]
EC fraction wood	0	0	0.025[f]	0.025[f]	0.025[f]
POA fraction wood	1	1	0.96 [f]	0.96 [f]	0.96 [f]
Mineral fraction wood	0	0	0.015	0.015	0.015

[a]Value from Kristensson et al. (2004) for LDV at 70 km/h, [b]Values estimated from data in Pohjola et al. (2007), [c]Values from Petzold et al. (2008), [d]Values estimated from data in Moldanová et al. (2009), [e]Values from Kristensson (2005), [f]Values from Schauer et al. (2001).

Table S2. Parameters used to calculate temperature dependent aerosol yields for oxidation products of different organic compounds.

Org. comp.	**Ox. Agent**	α_1	α_2	$K_{om,1}$ $(m^3/\mu g)$	$K_{om,2}$ $(m^3/\mu g)$	ΔH_1 *(kJ/mol)*	ΔH_2 *(kJ/mol)*	$T_{ref,1}$ *(K)*	$T_{ref,2}$ *(K)*
α-pinene	OH	0.5[a]	-	0.02[a]	-	40[a]	-	320[a]	-
	O_3	0.08[a]	0.42[a]	0.5[a]	0.005[a]	100[a]	38[a]	310[a]	310[a]
	NO_3	0.1[a]	-	0.02[a]	-	40[a]	-	310[a]	-
β-pinene	OH	1.0[a]	-	0.02[a]	-	60[a]	-	310[a]	-
	O_3	0.03[a]	0.38[a]	0.5[a]	0.005[a]	100[a]	40[a]	310[a]	300[a]
	NO_3	1.0[b]	-	0.0163[b]	-	60[b]	-	~310[b]	-
Δ3-carene	OH	0.054[b]	0.517[b]	0.043[b]	0.0042[b]	100[c]	40[c]	~310[b]	~310[b]
	O_3	0.128[b]	0.068[b]	0.337[b]	0.0036[b]	100[c]	40[c]	~310[b]	~310[b]
	NO_3	0.743[b]	0.257[b]	0.0088[b]	0.0091[b]	80[c]	40[c]	~310[b]	~310[b]
D-limonene	OH	0.239[b]	0.363[b]	0.055[b]	0.0053[b]	100[c]	40[c]	~310[b]	~310[b]
	O_3	0.03[c]	0.38[c]	0.055[c]	0.0053[c]	40[c]	100[c]	~310[b]	~310[b]
	NO_3	1.0[c]	-	0.055[c]		80[c]	80[c]	~310[b]	~310[b]
Isoprene	OH	0.232[d]	0.0288[d]	0.00862[d]	1.62[d]	-	-	-	-
	O_3	0.232[d]	0.0288[d]	0.00862[d]	1.62[d]	-	-	-	-
	NO_3	0.232[d]	0.0288[d]	0.00862[d]	1.62[d]	-	-	-	-
Benzene	OH+NO	0.072[e]	0.888[e]	3.315[e]	0.0090[e]	40[c]	40[c]	300[c]	300[c]
	$OH+HO_2$	0.37[e]	-	-	-	-	-	-	-
Toluene	OH+ NO	0.095[a]	0.20[a]	0.5[a]	0.005[a]	40[a]	40[a]	300[a]	300[a]
	$OH+HO_2$	0.36[e]	-	-	-	-	-		
Xylene	OH+NO	0.044[a]	0.15[a]	0.5[a]	0.005[a]	60[a]	60[a]	300[a]	300[a]
	$OH+HO_2$	0.30[e]	-	-	-	-	-	-	-

[a]Values from Svendby et al., 2008, [b]Values from Griffin et al., 1999, [c]Estimated values for this work, [d]Values from Henze and Seinfeld, 2006, [e]Values from Ng et al., 2007

Table S3. Emission fractions of existing non-volatile POA emissions if treating the POA as semi-volatile and including IVOC emissions.

C* at 298 K (μg/m^3)	10^{-2}	10^{-1}	1	10^1	10^2	10^3	10^4	10^5	10^6
Emission fractions[a] SVPOA	0.03	0.06	0.09	0.14	0.18	0.30	0.20	0.50	0.80
Emission fractions[a] IVOCs	0	0	0	0	0	0	0.20	0.50	0.80

[a]Mass ratio to existing EMEP POA emissions, values adopted from Robinson et al. (2007), Shrivastava et al. (2008) and Tsimpidi et al. (2010).

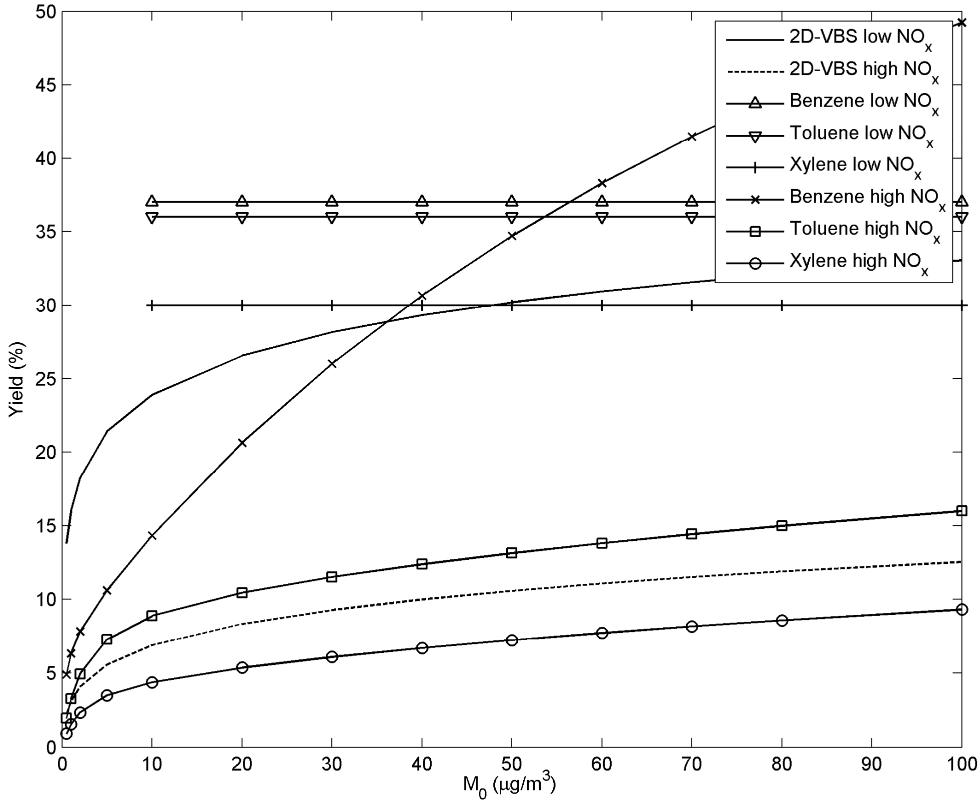

Figure S1. SOA Yield for benzene, toluene and xylene (BTX), at 300 K, at high NO_x and low NO_x conditions (Ng et al., 2007) and BTX SOA yield at 300 K from 2D-VBS model used in ADCHEM.

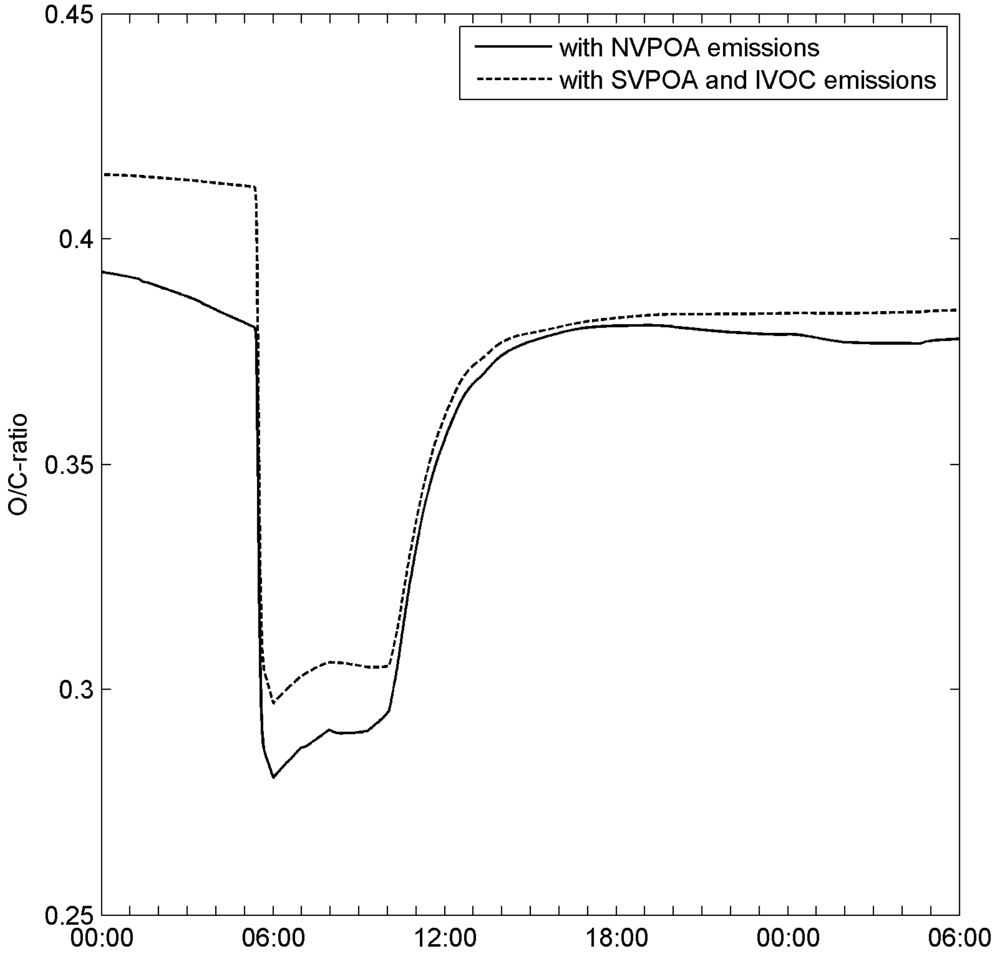

Figure S2. Modeled O/C-ratio in the center of the urban plume with non-volatile POA (NVPOA) emissions (base case) or with semi-volatile (SVPOA) and intermediate VOC (IVOC) emissions from anthropogenic sources.

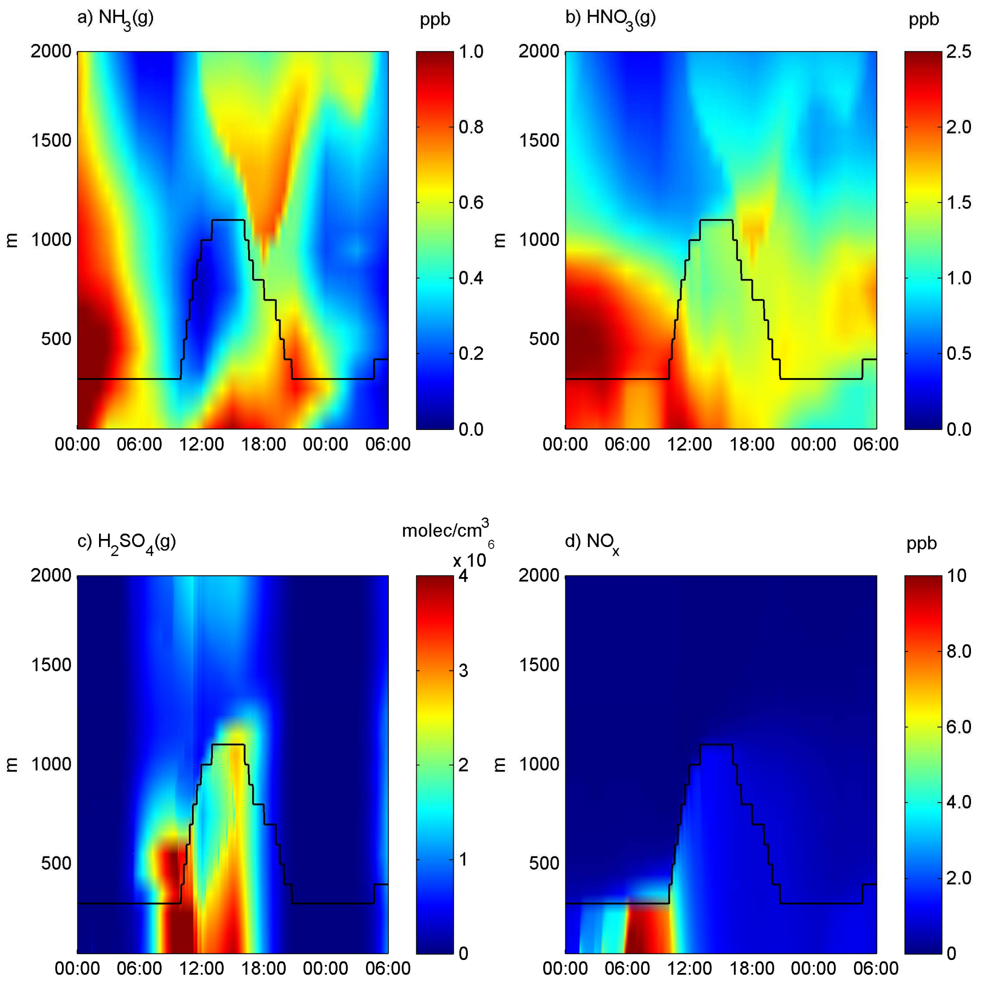

Figure S3. Modeled ammonia (a), nitric acid (b), sulfuric acid (c) and NO_x (d), from 6 hours before Malmö (00:00) until 24 hours downwind Malmö, in vertical direction (0-2000 m a.g.l.), in the center of the urban plume. The mixing height along the trajectory is also displayed.

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