Supplement of

Ozone (O_3) observations in Saxony, Germany for 1997 - 2020: Trends, modelling and implications for O_3 control

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Table S1. Data availability and proportion of missing data of hourly concentrations of ozone in the Saxony air quality measurement network used in the project.

Station	Station type	Begin time	End time	Years	Missing values / %
DD-Nord	Traffic	01.01.1997 00:00	31.12.2020 23:00	24	3.2
Annaberg	Urban	02.01.1997 00:00	31.12.2020 23:00	24	2.3
Bautzen	Urban	01.01.2005 00:00	31.12.2020 23:00	16	0.9
DD-Winkelmannstr.	Urban	19.06.2008 23:00	31.12.2020 23:00	12.5	1.1
L-Thekla	Urban	02.04.2004 00:00	29.04.2020 18:00	16.1	1.6
L-West	Urban	01.01.2000 00:00	31.12.2020 23:00	21	1.8
Plauen-DWD	Urban	20.11.2003 13:00	14.07.2020 08:00	16.7	2.5
Zittau-Ost	Urban	10.01.1997 12:00	31.12.2020 23:00	24	2.3
Collmberg	Rural	30.09.1998 11:00	31.12.2020 23:00	22.3	2.1
Niesky	Rural	05.05.2003 15:00	31.12.2020 23:00	17.7	1.4
Radebeul-Wahnsd.	Rural	01.01.1974 00:00	31.12.2020 23:00	47	3.3
Schkeuditz	Rural	06.06.2003 13:00	31.12.2020 23:00	17.6	1
Carlsfeld	Mountain	01.01.1997 00:00	31.12.2020 23:00	24	2.3
Fichtelberg	Mountain	01.01.1997 00:00	31.12.2020 23:00	24	4.7
Schwartenberg	Mountain	11.02.1998 14:00	31.12.2020 23:00	22.9	2.1
Zinnwald	Mountain	02.01.1997 09:00	31.12.2020 23:00	24	2

Table S2: Availability of further measurement parameters (O_3, NO, NO_2, NO_x, temperature (T), global radiation (GR), relative humidity (RH), wind direction (WD), wind speed (WS), and air pressure) per station.

Station	Station type	O_3	NO	NO_2	NO_x	T	GR	RH	WD	WS	Air pressure
DD-Nord	Traffic	x	x	x	x	x	x	x	x	x	x
Annaberg	Urban	x	x	x	x	x	x	x	x	x	x
Bautzen	Urban	x	x	x	x	x	x	x	x	x	x
DD-Winkelmannstr.	Urban	x	x	x	x	x	x	x	x	x	x
L-Thekla	Urban	x				x	x	x	x	x	x
L-West	Urban	x	x	x	x	x	x	x	x	x	x
Plauen-DWD	Urban	x				x	x	x	x	x	x
Zittau-Ost	Urban	x	x	x	x	x	x	x	x	x	x
Collmberg	Rural	x	x	x	x	x	x	x	x	x	x
Niesky	Rural	x	x	x	x	x	x	x	x	x	x
Radebeul-Wahnsd.	Rural	x	x	x	x	x	x	x	x	x	x
Schkeuditz	Rural	x	x	x	x	x	x	x	x	x	x
Carlsfeld	Mountain	x				x	x	x	x	x	x
Fichtelberg	Mountain	x				x	x	x	x	x	x
Schwartenberg	Mountain	x	x	x	x	x	x	x	x	x	x
Zinnwald	Mountain	x	x	x	x	x	x	x	x	x	x

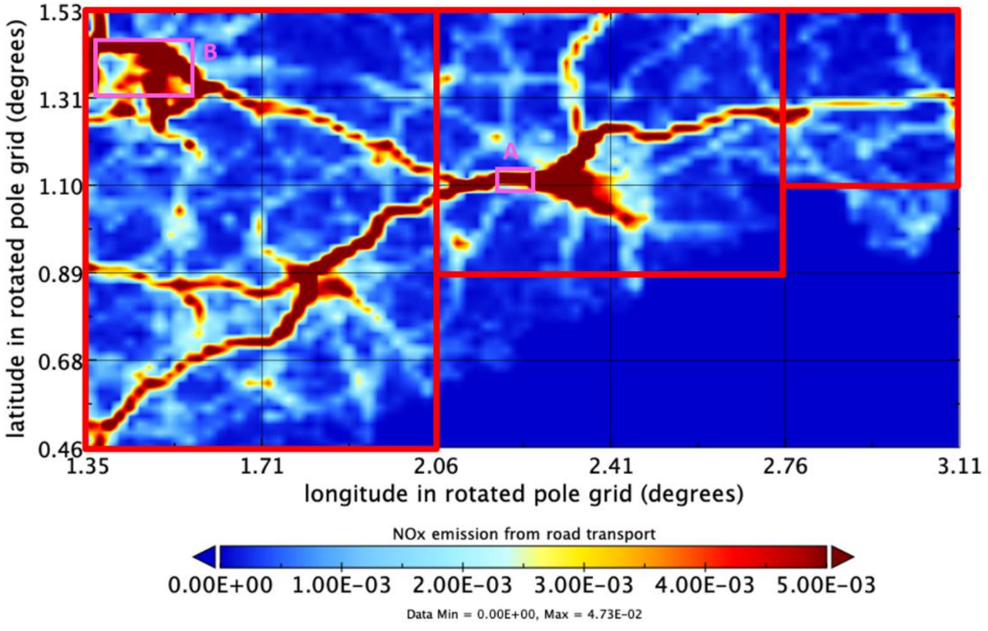

Figure S1: The whole saxony as the emission area for modelling. The entire region was divided into three red rectangular areas and the emission data (here coloured by NO_x emission value (in kg m^{-2}) from road transport in 2019) were averaged according to the ratio of area. The areas marked with A and B in pink, respectively, are suggestive of traffic and Leipzig urban area for averaging the emission data.

Table S3. Modelling configuration and settings for summer and winter scenarios.

Model setting	Unit	Summer	Winter	Reference
Initial time		00:00 CET, 14 July, 2019	00:00CET, 14 January, 2019	
Meteorological conditions				
Temperature	°C	15	4	Measured
Pressure	hPa	1000	1000	Measured
Relative humidity	%	70	70	Measured
Ratio of Solar radiation*		0.7	0.4	Measured
Deposition rate				
NO_2	cm s^{-1}	0.3	3	Rondón et al. (1993)
N_2O_5	cm s^{-1}	100	2	Hoffmann et al. (2019)
O_3	cm s^{-1}	0.8	0.08	Clifton et al. (2020)
NO	cm s^{-1}	0.05	0.05	Zhu et al. (2020)
HNO_3	cm s^{-1}	3.5	3.5	Zhu et al. (2020)
H_2O_2	cm s^{-1}	1	1	Zhu et al. (2020)
CO	cm s^{-1}	0.1	0.1	Zhu et al. (2020)
HCl	cm s^{-1}	1	1	Zhu et al. (2020)
NH_3	cm s^{-1}	1	1	Zhu et al. (2020)
SO_2	cm s^{-1}	1	1	Zhu et al. (2020)
HSO_4	cm s^{-1}	2	2	Zhu et al. (2020)
HCHO	cm s^{-1}	1	1	Zhu et al. (2020)
CH_3OH	cm s^{-1}	1	1	Zhu et al. (2020)
CH_3CH_2OH	cm s^{-1}	0.5	0.5	Zhu et al. (2020)
PANs	cm s^{-1}	0.7	0.7	Wu et al. (2012)
CHClO	cm s^{-1}	0.2	0.2	Hoffmann et al. (2019)
CHBrO	cm s^{-1}	0.2	0.2	Hoffmann et al. (2019)
Boundary layer height (BLH)				
Daytime BLHs	m	500	2000	
Nighttime BLHs	m	250	1000	
Measured Chemical data				
O_3	μg m^{-3}	63	43	Measured

NO_2	µg m^{-3}	6.5	13.3	Measured
SO_2	µg m^{-3}	54	3	UBA website
CO	µg m^{-3}	178.1	178.1	Zellweger et al. (2009)
CH_4	µg m^{-3}	1155.8	1155.8	Schaefer (2019)
HONO	ppb	0.5	0.5	Stieger et al. (2018)
PAN	ppb	0.5	0.5	Pandey Deolal et al. (2014)

* Ratio of solar radiation was derived from the measured solar radiation, it is equal to the mean value divided by the maximum.

Table S4. Dominant initial gas-phase concentrations applied in the final 24-hour simulations for summer and winter scenarios. The identity of each species is given as a compound string based on the CAPRAM and MCM models (*https://capram.tropos.de/index.html* and *https://mcm.york.ac.uk/*).

Summer		**Winter**	
Compound string	**Unit**	**Compound string**	**Unit**
Summer	**molec cm^{-3}**	**Winter**	**molec cm^{-3}**
C	4.34E+13	C	4.34E+13
H2	1.28E+13	H2	1.28E+13
CO	3.83E+12	CO	3.83E+12
O3	7.91E+11	O3	5.35E+11
CO2	9.10E+15	CO2	9.10E+15
[H2O]	5.10E+17	[H2O]	5.10E+17
[O2]	5.10E+18	[O2]	5.10E+18
[N2]	1.96E+19	[N2]	1.96E+19
SO2	2.82E+10	SO2	4.70E+10
H2O2	8.53E+09	H2O2	6.45E+09
NO2	8.56E+10	NO2	1.74E+11
HONO	1.23E+10	HONO	1.23E+10
OC	3.44E+07	OC	9.31E+06
C=O	9.46E+10	C=O	1.28E+11
CCO	4.87E+10	CCO	1.94E+10
CC=O	4.90E+10	CC=O	2.94E+11
CCCO	9.43E+06	CCCO	7.20E+07
CCC=O	3.25E+09	CCC=O	4.71E+10
CC(O)C	1.34E+09	CC(O)C	1.86E+10
CC(=O)C	9.85E+09	CC(=O)C	4.11E+10
CCCCO	2.40E+07	CCCCO	3.32E+08
CCCC=O	1.13E+09	CCCC=O	1.14E+10
CCC(O)C	1.27E+07	CCC(O)C	1.02E+08
CCC(=O)C	1.42E+11	CCC(=O)C	7.44E+10
CC(C)CO	2.04E+05	CC(C)CO	2.42E+04

CC(C)C=O	6.99E+07	CC(C)C=O	5.34E+08
CC(O)(C)C	2.48E+04	CC(O)(C)C	8.71E+02
CCC(O)CC	2.16E+04	CCC(O)CC	5.79E+04
CCC(=O)CC	3.56E+08	CCC(=O)CC	5.71E+08
CCC(C)CO	4.98E+04	CCC(C)CO	1.36E+05
CCC(C)C=O	4.79E+06	CCC(C)C=O	5.20E+07
CCC(O)(C)C	6.99E+03	CCC(O)(C)C	8.75E+03
CC(O)C(C)C	3.27E+04	CC(O)C(C)C	8.87E+04
CC(=O)C(C)C	5.30E+08	CC(=O)C(C)C	9.20E+08
C1CCC(O)CC1	2.95E+06	C1CCC(O)CC1	7.18E+07
C1CCC(=O)CC1	5.09E+08	C1CCC(=O)CC1	2.52E+09
CC(=O)CC(O)(C)C	6.00E+02	CC(=O)CC(O)(C)C	2.83E+02
OCCO	1.05E+07	OCCO	1.25E+07
OCC=O	9.45E+09	OCC=O	1.96E+10
CC(O)CO	2.28E+08	CC(O)CO	4.98E+09
CC(=O)CO	6.19E+09	CC(=O)CO	4.91E+09
CC(O)C=O	7.78E+07	CC(O)C=O	8.09E+08
CC(O)(C)C=O	4.50E+06	CC(O)(C)C=O	1.15E+06
C=C	2.00E+09	C=C	4.33E+10
CCCCC=O	2.25E+08	CCCCC=O	6.78E+09
O=CC=C	1.41E+09	O=CC=C	1.23E+10
O=CC=O	6.84E+09	O=CC=O	2.64E+10
CC(C=O)=C	9.58E+08	CC(C=O)=C	7.20E+08
CC(=O)C=O	3.03E+09	CC(=O)C=O	6.20E+09
CC=CC=O	9.91E+07	CC=CC=O	5.40E+08
C	4.62E+13	C	5.09E+13
CC	1.65E+10	CC	8.75E+10
CCC	1.91E+10	CCC	8.32E+09
CCCC	1.78E+11	CCCC	1.02E+11
CC(C)C	5.06E+09	CC(C)C	2.76E+09
CCCCC	1.03E+09	CCCCC	1.17E+10
CCC(C)C	1.89E+09	CCC(C)C	2.06E+10
CCCCCC	7.61E+08	CCCCCC	1.10E+10
CCCC(C)C	1.13E+09	CCCC(C)C	1.51E+10
CCC(C)CC	2.21E+08	CCC(C)CC	3.19E+09
CC(C)C(C)C	1.28E+08	CC(C)C(C)C	1.93E+09
CCCCCCC	3.60E+09	CCCCCCC	5.85E+10
CCCC(C)CC	6.53E+08	CCCC(C)CC	1.08E+10
CCCCCCCC	6.38E+08	CCCCCCCC	1.18E+10
CCCCCCCCC	2.33E+08	CCCCCCCCC	4.68E+09

CCCCCCCCCC	1.54E+08	CCCCCCCCCC	3.26E+09
CCCCCCCCCCC	3.64E+08	CCCCCCCCCCC	8.19E+09
C1CCCCC1	5.58E+08	C1CCCCC1	9.16E+09
CC=C	8.70E+08	CC=C	2.12E+10
CCC=C	1.62E+08	CCC=C	4.03E+09
cCC=CC	6.24E+07	cCC=CC	1.75E+09
CC=CC	5.19E+07	CC=CC	1.38E+09
CC(C)=C	1.11E+06	CC(C)=C	5.73E+07
CCCC=C	1.04E+08	CCCC=C	2.32E+09
CCC(C)=C	3.35E+05	CCC(C)=C	1.46E+07
CC(C)C=C	1.75E+07	CC(C)C=C	3.90E+08
CC=C(C)C	2.52E+07	CC=C(C)C	8.88E+08
CCCCC=C	2.06E+08	CCCCC=C	5.01E+09
C	4.62E+13	C	5.09E+13
O=CO	3.28E+09	O=CO	1.73E+09
c1ccccc1	2.04E+09	c1ccccc1	1.12E+10
O=CC1OC1C=CC=O	9.75E+05	O=CC1OC1C=CC=O	3.73E+06
c1ccc(O)cc1	1.29E+07	c1ccc(O)cc1	6.18E+07
c1ccccc1C	4.34E+09	c1ccccc1C	6.65E+10
c1cccc(O)c1C	1.81E+08	c1cccc(O)c1C	5.84E+09
CC(=O)C=CC1OC1C=O	7.49E+06	CC(=O)C=CC1OC1C=O	9.24E+07
Cc1ccccc1C	1.60E+08	Cc1ccccc1C	2.56E+09
CC1(C=O)OC1(C)C=CC=O	2.37E+06	CC1(C=O)OC1(C)C=CC=O	3.30E+07
Cc1cccc(O)c1C	9.67E+05	Cc1cccc(O)c1C	8.07E+06
c1c(C)cccc1C	3.84E+07	c1c(C)cccc1C	6.77E+08
CC(=O)C=CC1OC1(C)C=O	1.22E+06	CC(=O)C=CC1OC1(C)C=O	2.33E+07
c1c(C)c(O)ccc1C	3.09E+05	c1c(C)c(O)ccc1C	3.06E+06
c1cc(C)ccc1C	2.06E+08	c1cc(C)ccc1C	3.35E+09
CC(=O)C=CC1(C)OC1C=O	1.20E+06	CC(=O)C=CC1(C)OC1C=O	1.69E+07
c1cc(C)c(O)cc1C	9.40E+05	c1cc(C)c(O)cc1C	7.90E+06
c1ccccc1CC	3.97E+07	c1ccccc1CC	6.98E+08
c1cccc(O)c1CC	2.69E+05	c1cccc(O)c1CC	2.83E+06
CCC(=O)C=CC1OC1C=O	1.59E+05	CCC(=O)C=CC1OC1C=O	2.34E+06
c1ccccc1CCC	1.38E+07	c1ccccc1CCC	2.14E+08
c1cccc(O)c1CCC	7.75E+04	c1cccc(O)c1CCC	7.17E+05
CCCC(=O)C=CC1OC1C=O	4.54E+04	CCCC(=O)C=CC1OC1C=O	5.83E+05
c1ccccc1C(C)C	3.50E+06	c1ccccc1C(C)C	5.75E+07
c1cccc(O)c1C(C)C	2.14E+04	c1cccc(O)c1C(C)C	2.10E+05
CC(C)C(=O)C=CC1OC1C=O	1.25E+04	CC(C)C(=O)C=CC1OC1C=O	1.72E+05
Cc1cccc(C)c1C	1.99E+07	Cc1cccc(C)c1C	3.44E+08

Cc1ccc(O)c(C)c1C	4.53E+04	Cc1ccc(O)c(C)c1C	4.88E+05
CC(=O)C=CC1OC1(C)C(=O)C	1.16E+06	CC(=O)C=CC1OC1(C)C(=O)C	2.94E+07
Cc1ccc(C)cc1C	7.07E+07	Cc1ccc(C)cc1C	1.22E+09
Cc1c(O)c(C)ccc1C	1.60E+05	Cc1c(O)c(C)ccc1C	1.72E+06
CC(=O)C=CC1(C)OC1(C)C=O	2.79E+06	CC(=O)C=CC1(C)OC1(C)C=O	5.79E+07
c1c(C)cc(C)cc1C	4.95E+07	c1c(C)cc(C)cc1C	6.87E+08
c1c(C)c(O)c(C)cc1C	3.19E+05	c1c(C)c(O)c(C)cc1C	5.17E+06
CC(=O)C=C(C)C1OC1(C)C=O	6.17E+05	CC(=O)C=C(C)C1OC1(C)C=O	1.06E+07
Cc1ccccc1CC	2.72E+07	Cc1ccccc1CC	4.14E+08
CCC1(C=O)OC1(C)C=CC=O	3.54E+05	CCC1(C=O)OC1(C)C=CC=O	4.61E+06
Cc1cccc(O)c1CC	1.44E+05	Cc1cccc(O)c1CC	1.14E+06
c1c(C)cccc1CC	1.20E+07	c1c(C)cccc1CC	2.08E+08
CCC(=O)C=CC1OC1(C)C=O	3.08E+05	CCC(=O)C=CC1OC1(C)C=O	5.42E+06
c1ccc(C)c(O)c1CC	8.47E+04	c1ccc(C)c(O)c1CC	7.69E+05
c1ccccc1C=C	5.83E+06	c1ccccc1C=C	3.57E+08
c1ccccc1C=O	1.47E+09	c1ccccc1C=O	9.50E+09
CLC(CL)=C(CL)CL	1.99E+09	CLC(CL)=C(CL)CL	5.10E+08
CLC(CL)=CCL	3.19E+08	CLC(CL)=CCL	1.72E+08
CLCCCL	1.96E+08	CLCCCL	5.18E+07
CLC=C	5.84E+07	CLC=C	1.16E+09
O=CCL	1.01E+08	O=CCL	4.16E+08
C=CC=C	4.75E+07	C=CC=C	2.04E+09
C=CC(C)=C	8.42E+08	C=CC(C)=C	5.52E+07
CC(=O)C=C	1.80E+09	CC(=O)C=C	9.14E+07
CC(=C)CC=O	1.33E+07	CC(=C)CC=O	9.36E+05
CC(=O)CC=C	9.11E+07	CC(=O)CC=C	4.90E+06
COC=O	2.21E+10	COC=O	5.16E+09
CC(=O)OC	2.26E+09	CC(=O)OC	6.33E+08
CCOC(=O)C	2.78E+09	CCOC(=O)C	1.35E+09
CCCOC(=O)C	1.76E+08	CCCOC(=O)C	1.85E+09
CC(=O)OC(C)C	7.26E+09	CC(=O)OC(C)C	5.86E+09
CCCCOC(=O)C	4.54E+08	CCCCOC(=O)C	6.24E+09
COC	9.59E+09	COC	6.22E+09
CCOCC	2.45E+07	CCOCC	5.73E+08
COCCO	3.85E+08	COCCO	8.60E+09
COCC=O	4.98E+07	COCC=O	1.04E+09
CCOCCO	1.61E+03	CCOCCO	1.70E+04
CCOCC=O	3.76E+04	CCOCC=O	3.01E+05
CCCC(=O)C	1.37E+08	CCCC(=O)C	3.85E+08
CCCCC(=O)C	1.01E+08	CCCCC(=O)C	4.55E+08

CCCC(=O)CC	1.15E+08	CCCC(=O)CC	4.25E+08
CC(=O)CC(C)C	2.70E+07	CC(=O)CC(C)C	1.38E+08
C12CC(C1(C)C)CC=C2C	3.12E+08	C12CC(C1(C)C)CC=C2C	2.49E+08
CC1(C)C(CC12)CCC2=C	3.10E+08	CC1(C)C(CC12)CCC2=C	4.28E+08
CC1(C)C(C2)C(=O)CCC12	5.15E+09	CC1(C)C(C2)C(=O)CCC12	2.43E+09
C1CC(C)=CCC1C(C)=C	7.84E+07	C1CC(C)=CCC1C(C)=C	1.83E+09
CC(=O)O	3.59E+10	CC(=O)O	9.59E+10
CCC(=O)O	1.09E+09	CCC(=O)O	4.81E+09
C1OC1	8.56E+08	C1OC1	2.14E+08
OCCOO	1.54E+08	OCCOO	2.16E+08
OCCON(=O)=O	2.59E+08	OCCON(=O)=O	1.15E+08
OCCCOO	5.36E+07	OCCCOO	1.08E+07
OCCCON(=O)=O	1.29E+08	OCCCON(=O)=O	4.31E+07
OCCC=O	1.16E+09	OCCC=O	1.46E+09
OCCCO	1.34E+06	OCCCO	1.64E+05
CC(OO)CO	1.54E+07	CC(OO)CO	3.10E+08
CC(ON(=O)=O)CO	2.97E+08	CC(ON(=O)=O)CO	1.03E+09
CC(O)COO	5.02E+06	CC(O)COO	5.83E+07
CC(O)CON(=O)=O	1.89E+07	CC(O)CON(=O)=O	6.49E+07
CCC(OO)CO	2.99E+06	CCC(OO)CO	7.39E+07
CCC(ON(=O)=O)CO	9.07E+07	CCC(ON(=O)=O)CO	4.19E+08
CCC(=O)CO	5.00E+07	CCC(=O)CO	9.92E+07
CCC(O)CO	6.19E+05	CCC(O)CO	2.66E+06
CC(OO)CCO	3.92E+05	CC(OO)CCO	7.14E+05
CC(ON(=O)=O)CCO	5.04E+06	CC(ON(=O)=O)CCO	8.84E+06
CC(O)CCO	1.45E+05	CC(O)CCO	3.22E+04
CC(=O)CCO	1.34E+08	CC(=O)CCO	4.09E+08
CC(O)C(OO)C	7.58E+06	CC(O)C(OO)C	1.54E+08
CC(O)C(ON(=O)=O)C	1.63E+08	CC(O)C(ON(=O)=O)C	1.47E+09
CC(O)C(=O)C	8.22E+07	CC(O)C(=O)C	3.57E+08
CC(O)C(O)C	3.04E+05	CC(O)C(O)C	4.13E+06
CC(OO)(C)CO	1.69E+05	CC(OO)(C)CO	3.34E+06
CC(ON(=O)=O)(C)CO	7.33E+05	CC(ON(=O)=O)(C)CO	3.30E+06
CC(O)(C)CO	2.81E+04	CC(O)(C)CO	1.30E+04
CC(CO)COO	6.61E+04	CC(CO)COO	1.38E+04
CC(CO)CON(=O)=O	3.15E+05	CC(CO)CON(=O)=O	2.01E+05
CC(CO)C=O	1.84E+06	CC(CO)C=O	6.98E+06
CC(CO)CO	1.84E+03	CC(CO)CO	2.19E+02
CC(O)(C)COO	1.62E+06	CC(O)(C)COO	5.08E+05
CC(O)(C)CON(=O)=O	5.63E+06	CC(O)(C)CON(=O)=O	1.26E+06

CCC(O)CCOO	1.00E+06	CCC(O)CCOO	2.57E+05
CCC(O)CCON(=O)=O	2.78E+06	CCC(O)CCON(=O)=O	3.04E+06
CCC(O)CCO	3.64E+04	CCC(O)CCO	4.96E+03
CCC(O)CC=O	7.42E+06	CCC(O)CC=O	5.79E+06
CCC(O)C(OO)C	3.71E+06	CCC(O)C(OO)C	6.21E+07
CCC(O)C(ON(=O)=O)C	6.68E+07	CCC(O)C(ON(=O)=O)C	8.92E+08
CCC(O)C(O)C	2.44E+05	CCC(O)C(O)C	2.81E+06
CCC(O)C(=O)C	2.87E+07	CCC(O)C(=O)C	2.14E+08
CC(OO)C(C)CO	6.23E+04	CC(OO)C(C)CO	6.10E+04
CC(ON(=O)=O)C(C)CO	1.07E+06	CC(ON(=O)=O)C(C)CO	2.08E+06
CC(O)C(C)CO	6.15E+03	CC(O)C(C)CO	2.84E+03
CC(=O)C(C)CO	4.30E+06	CC(=O)C(C)CO	1.27E+07
CCC(OO)(C)CO	5.55E+04	CCC(OO)(C)CO	1.03E+06
CCC(ON(=O)=O)(C)CO	2.75E+05	CCC(ON(=O)=O)(C)CO	1.56E+06
CCC(O)(C)CO	2.57E+05	CCC(O)(C)CO	1.04E+04
CC(O)(C)CCO	2.39E+05	CC(O)(C)CCO	3.97E+04
CC(C)C(OO)CO	3.45E+05	CC(C)C(OO)CO	8.32E+06
CC(C)C(ON(=O)=O)CO	1.27E+07	CC(C)C(ON(=O)=O)CO	6.94E+07
CC(C)C(O)CO	2.14E+04	CC(C)C(O)CO	2.65E+05
CC(C)C(=O)CO	4.85E+06	CC(C)C(=O)CO	1.36E+07
CC(O)(C)CCOO	3.39E+06	CC(O)(C)CCOO	1.75E+06
CC(O)(C)CCON(=O)=O	3.96E+07	CC(O)(C)CCON(=O)=O	2.00E+07
CC(O)(C)CC=O	1.80E+07	CC(O)(C)CC=O	6.01E+07
CC(OO)C(O)(C)C	1.78E+06	CC(OO)C(O)(C)C	3.28E+07
CC(ON(=O)=O)C(O)(C)C	6.93E+07	CC(ON(=O)=O)C(O)(C)C	4.62E+08
CC(O)C(O)(C)C	6.44E+04	CC(O)C(O)(C)C	1.13E+06
CC(=O)C(O)(C)C	4.71E+08	CC(=O)C(O)(C)C	5.53E+09
CCC(O)(C)COO	2.30E+06	CCC(O)(C)COO	1.87E+05
CCC(O)(C)CON(=O)=O	7.91E+06	CCC(O)(C)CON(=O)=O	6.48E+05
CCC(O)(C)C=O	5.65E+06	CCC(O)(C)C=O	5.98E+05
CC(O)C(C)COO	1.11E+05	CC(O)C(C)COO	7.70E+04
CC(O)C(C)CON(=O)=O	2.43E+05	CC(O)C(C)CON(=O)=O	6.44E+05
CC(O)C(C)C=O	7.81E+05	CC(O)C(C)C=O	5.13E+06
CC(O)C(OO)(C)C	5.48E+06	CC(O)C(OO)(C)C	8.95E+07
CC(O)C(ON(=O)=O)(C)C	7.07E+07	CC(O)C(ON(=O)=O)(C)C	2.48E+08
C1CC(O)C(OO)CC1	3.05E+04	C1CC(O)C(OO)CC1	5.16E+05
C1CC(O)C(ON(=O)=O)CC1	3.26E+05	C1CC(O)C(ON(=O)=O)CC1	2.84E+06
C1CC(O)C(O)CC1	9.40E+02	C1CC(O)C(O)CC1	1.07E+04
C1CC(O)C(=O)CC1	1.67E+05	C1CC(O)C(=O)CC1	8.82E+05
CC(=O)C(OO)C(O)(C)C	2.31E+00	CC(=O)CC(O)(C)CO	7.43E+03

CC(=O)CC(O)(C)COO	1.08E+00	CC(=O)CC(O)(C)C=O	8.51E+02
CC(=O)CC(O)(C)CON(=O)=O	4.82E+00	CC(O)(C)CC(=O)COO	7.98E+05
CC(=O)CC(O)(C)CO	9.24E+03	CC(O)(C)CC(=O)CO	3.28E+04

Table S5. Changing the emission multiplier for NO_x and TNMVOC in the simulations. Total simulations numbers are 1600 (40 x 40).

Number	Emission Factor
1	0.001
2	0.005
3	0.01
4	0.05
5	0.1
6	0.5
7	1
8	1.5
9	2
10	2.5
11	3
12	3.5
13	4
14	4.5
15	5
16	5.5
17	6
18	6.5
19	7
20	7.5
21	8
22	8.5
23	9
24	9.5
25	10
26	10.5
27	11
28	11.5
29	12
30	15
31	20
32	25

33	30
34	35
35	40
36	45
37	50
38	60
39	70
40	80

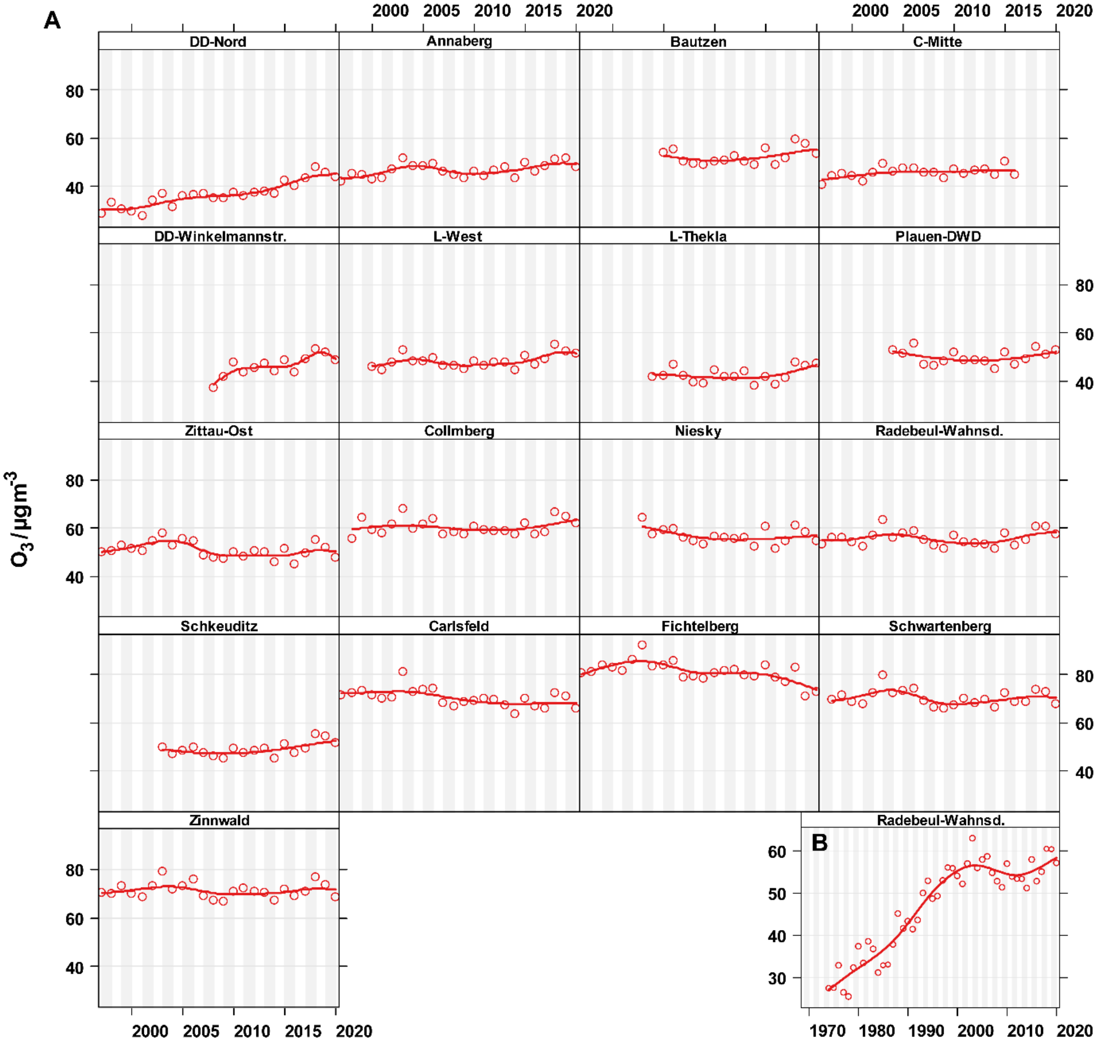

Figure S2: Smooth trends in annual means of O_3 for A) all stations from 1997 (or later) to 2020 and B) Radebeul-Wahnsdorf from 1974 - 2020.

Table S6. Trends of the mean ozone concentration at the stations of the Saxony air quality monitoring network for three different time periods. Statistically non-significant values with $p > 0.05$ are put in brackets. * means the years begin from 2008.

Station	Station type	All available years		15 years		10 years	
		1997 (or later) until 2020		2006 to 2020		2011 to 2020	
		abs. Trend	rel. Trend	abs. Trend	rel. Trend	abs. Trend	rel. Trend
		µg m^{-3} year^{-1}	% year^{-1}	µg m^{-3} year^{-1}	% year^{-1}	µg m^{-3} year^{-1}	% year^{-1}
DD-Nord	Traffic	0.65	2.30	0.75	2.27	1.19	3.50
Annaberg	Urban	0.17	0.38	0.28	0.63	0.51	1.14
Bautzen	Urban	0.24	0.47	0.35	0.72	0.59	1.19
DD-Winkelmannstr.	Urban	0.65	1.57	0.65*	1.57*	0.74	1.75
L-West	Urban	0.19	0.42	0.38	0.83	0.64	1.42
L-Thekla	Urban	(0.15)	(0.37)	(0.13)	(0.32)	0.51	1.28
Plauen-DWD	Urban	(-0.09)	(-0.17)	(0.09)	(0.20)	(0.41)	(0.85)
Zittau-Ost	Urban	-0.14	-0.27	(0.03)	(0.06)	(0.24)	(0.51)
Collmberg	Rural	(-0.03)	(-0.05)	0.26	0.45	0.53	0.92
Niesky	Rural	(-0.13)	(-0.23)	(0.05)	(0.10)	(0.15)	(0.28)
Radebeul-Wahnsd.	Rural	(0.05)	(0.09)	0.27	0.52	0.71	1.38
Schkeuditz	Rural	0.25	0.53	0.43	0.93	0.68	1.49
Carlsfeld	Mountain	-0.26	-0.35	(-0.12)	(-0.17)	(0.00)	(-0.01)
Fichtelberg	Mountain	-0.31	-0.37	-0.37	-0.45	-0.79	-0.95
Schwartenberg	Mountain	(-0.05)	(-0.06)	(0.15)	(0.22)	(0.26)	(0.37)
Zinnwald	Mountain	(-0.02)	(-0.03)	(0.15)	(0.22)	(0.14)	(0.20)

Table S7. Trends for all available years since 1997, 15 years from 2006 to 2020 and 10 years from 2011 to 2020 of NO_x (A), NO (B), NO_2 (C), and O_x (D). Statistically non-significant values with $p > 0.05$ are put in brackets. * means the years begin from 2008.

(A)

NO_x		All available years		15 years		10 years	
		1997 or later - 2020		2006 - 2020		2011 - 2020	
Station	Station type	abs. Trend	rel. Trend	abs. Trend	rel. Trend	abs. Trend	rel. Trend
		µg m^{-3} year^{-1}	% year^{-1}	µg m^{-3} year^{-1}	% year^{-1}	µg m^{-3} year^{-1}	% year^{-1}
DD-Nord	Traffic	-2.96	-2.57	-3.32	-3.54	-3.83	-4.77
Annaberg	Urban	-1.66	-2.46	-1.6	-2.98	-1.56	-3.42
Bautzen	Urban	-1.13	-3.09	-1.13	-3.19	-1.32	-4.27
DD-Winkelmannstr.	Urban	-0.9	-2.75	-0.90*	-2.75*	-0.9	-3.03

L-West	Urban	-0.57	-1.88	-0.58	-2.17	-0.75	-3.06
L-Thekla	Urban						
Plauen-DWD	Urban						
Zittau-Ost	Urban	-0.3	-1.35	-0.22	-1.18	-0.5	-2.59
Collmberg	Rural	-0.31	-1.89	-0.36	-2.55	-0.37	-2.99
Niesky	Rural	-0.24	-2.04	-0.24	-2.04	-0.15	-1.41
Radebeul-Wahnsd.	Rural	-0.44	-1.77	-0.48	-2.26	-0.56	-2.97
Schkeuditz	Rural						
Carlsfeld	Mountain						
Fichtelberg	Mountain						
Schwartenberg	Mountain	-0.36	-2.13	-0.4	-2.91	-0.3	-2.71
Zinnwald	Mountain	-0.4	-2.22	-0.46	-3.27	-0.32	-2.92

(B)

NO		**All available years**		**15 years**		**10 years**	
		1997 or later - 2020		**2006 - 2020**		**2011 - 2020**	
Station	**Station type**	**abs. Trend**	**rel. Trend**	**abs. Trend**	**rel. Trend**	**abs. Trend**	**rel. Trend**
		μg m^{-3} year^{-1}	**% year^{-1}**	**μg m^{-3} year^{-1}**	**% year^{-1}**	**μg m^{-3} year^{-1}**	**% year^{-1}**
DD-Nord	Traffic	-1.22	-2.93	-1.27	-4.02	-1.49	-5.53
Annaberg	Urban	-0.65	-2.78	-0.6	-3.33	-0.7	-4.61
Bautzen	Urban	-0.29	-3.46	-0.29	-3.62	-0.31	-4.59
DD-Winkelmannstr.	Urban	-0.11	-2.09	-0.11*	-2.09*	-0.15	-2.96
L-West	Urban	-0.07	-1.62	-0.05	-1.34	-0.1	-2.74
L-Thekla	Urban						
Plauen-DWD	Urban						
Zittau-Ost	Urban	-0.02	-0.78	-0.01	-0.6	-0.1	-2.98
Collmberg	Rural	-0.01	-0.44	0	-0.18	-0.01	-0.48
Niesky	Rural	-0.01	-0.85	-0.01	-0.85	-0.02	-1.26
Radebeul-Wahnsd.	Rural	-0.03	-1.07	-0.02	-0.9	-0.05	-2.04
Schkeuditz	Rural						
Carlsfeld	Mountain						

Fichtelberg	Mountain						
Schwartenberg	Mountain	-0.01	-0.69	-0.01	-1.01	-0.02	-1.53
Zinnwald	Mountain	-0.02	-1.24	-0.01	-0.99	(-0.01)	(-0.43)

(C)

NO_2		All available years		15 years		10 years	
		1997 or later - 2020		2006 - 2020		2011 - 2020	
Station	Station type	abs. Trend	rel. Trend	abs. Trend	rel. Trend	abs. Trend	rel. Trend
		µg m^{-3} year^{-1}	% year^{-1}	µg m^{-3} year^{-1}	% year^{-1}	µg m^{-3} year^{-1}	% year^{-1}
DD-Nord	Traffic	-1.06	-2.06	-1.4	-3.1	-1.56	-3.99
Annaberg	Urban	-0.65	-2.02	-0.69	-2.61	-0.57	-2.54
Bautzen	Urban	-0.68	-2.82	-0.68	-2.95	-0.78	-3.84
DD-Winkelmannstr.	Urban	-0.63	-2.65	-0.63*	-2.65*	-0.58	-2.71
L-West	Urban	-0.45	-1.91	-0.51	-2.39	-0.57	-3.04
L-Thekla	Urban						
Plauen-DWD	Urban						
Zittau-Ost	Urban	-0.26	-1.5	-0.25	-1.64	-0.32	-2.24
Collmberg	Rural	-0.29	-2.04	-0.35	-2.83	-0.34	-3.33
Niesky	Rural	-0.21	-2.25	-0.21	-2.25	(-0.10)	(-1.20)
Radebeul-Wahnsd.	Rural	-0.39	-1.86	-0.44	-2.48	-0.51	-3.25
Schkeuditz	Rural						
Carlsfeld	Mountain						
Fichtelberg	Mountain						
Schwartenberg	Mountain	-0.33	-2.34	-0.38	-3.28	-0.29	-3.23
Zinnwald	Mountain	-0.36	-2.39	-0.43	-3.77	-0.35	-3.89

(D)

O_x	All available years	15 years	10 years
	1997 or later - 2020	2006 - 2020	2011 - 2020

Station	**Station type**	**abs. Trend**	**rel. Trend**	**abs. Trend**	**rel. Trend**	**abs. Trend**	**rel. Trend**
		µg m^{-3} year^{-1}	**% year^{-1}**	**µg m^{-3} year^{-1}**	**% year^{-1}**	**µg m^{-3} year^{-1}**	**% year^{-1}**
DD-Nord	Traffic	-0.21	-0.52	-0.33	-0.82	-0.26	-0.68
Annaberg	Urban	-0.24	-0.62	-0.23	-0.63	(-0.09)	(-0.25)
Bautzen	Urban	-0.25	-0.67	-0.21	-0.56	(-0.20)	(-0.55)
DD-Winkelmannstr.	Urban	(-0.07)	(-0.22)	(-0.07) *	(-0.22) *	(-0.03)	(-0.07)
L-West	Urban	-0.14	-0.4	(-0.10)	(-0.28)	(-0.07)	(-0.21)
L-Thekla	Urban						
Plauen-DWD	Urban						
Zittau-Ost	Urban	-0.22	-0.63	-0.14	-0.43	(-0.13)	(-0.41)
Collmberg	Rural	-0.16	-0.43	(-0.08)	(-0.24)	-0.02	-0.05
Niesky	Rural	(-0.13)	(-0.40)	(-0.13)	(-0.40)	(-0.04)	(-0.12)
Radebeul-Wahnsd.	Rural	-0.17	-0.45	-0.1	-0.29	-0.03	-0.1
Schkeuditz	Rural						
Carlsfeld	Mountain						
Fichtelberg	Mountain						
Schwartenberg	Mountain	-0.2	-0.46	-0.17	-0.41	(-0.08)	(-0.21)
Zinnwald	Mountain	-0.18	-0.42	-0.17	-0.43	(-0.16)	(-0.41)

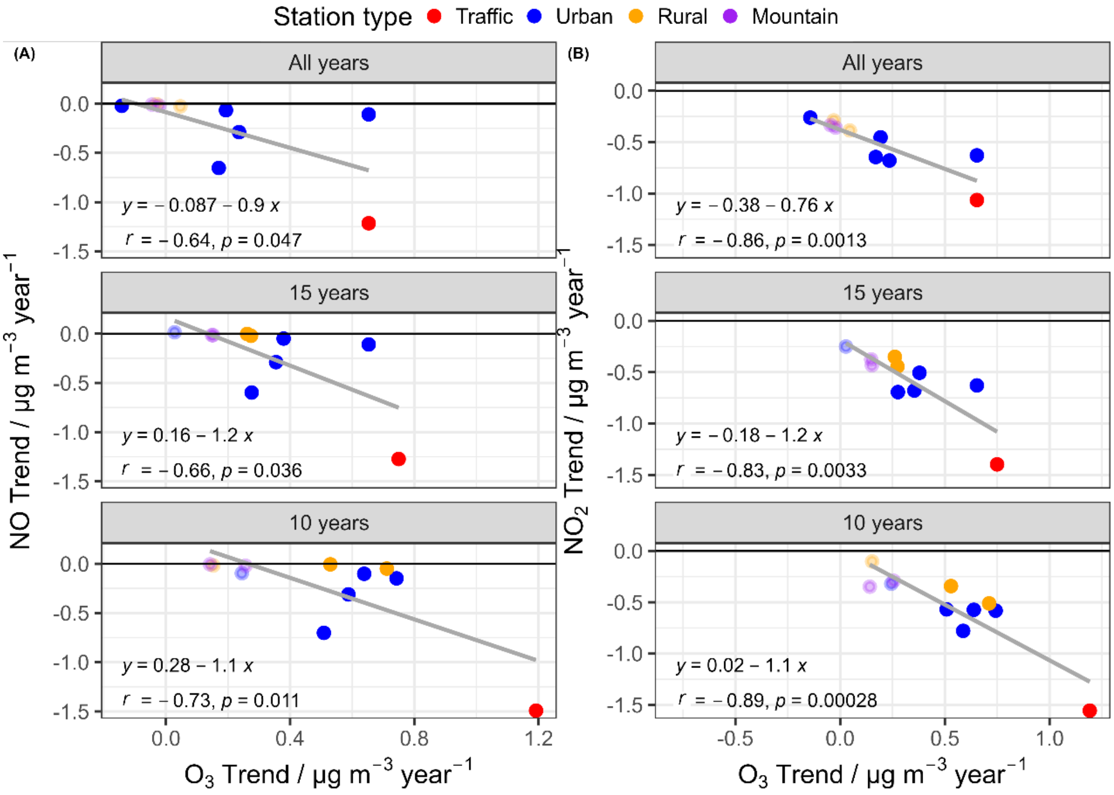

Figure S3: Relationships between O_3 trends and NO, NO_2 trends across all stations for three different time periods. Transparent dots indicate statistically non-significant O_3 trends.

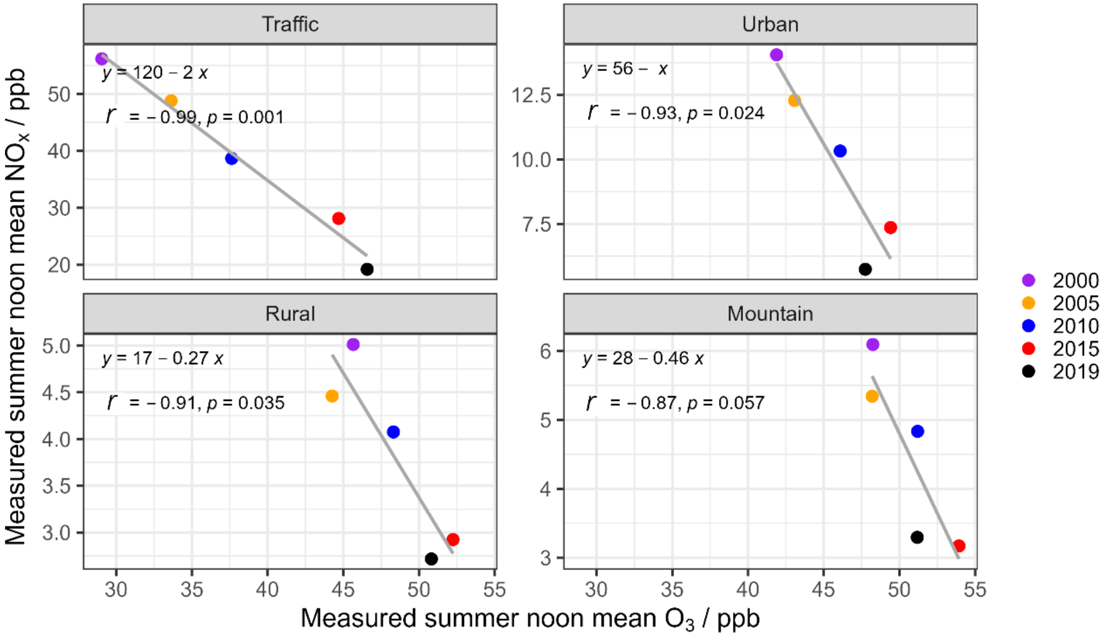

Figure S4: Correlations between measured averaged noon (12:00 - 13:00) NO$_x$ in ppb (~0.82 times and 0.53 times for NO and NO$_2$, respectively, concentrations in μg m^{-3}) and O$_3$ in ppb (~0.51 times O$_3$ concentration in μg m^{-3}) of four station types in summer over 5 years (2000, 2005, 2010, 2015 and 2019).

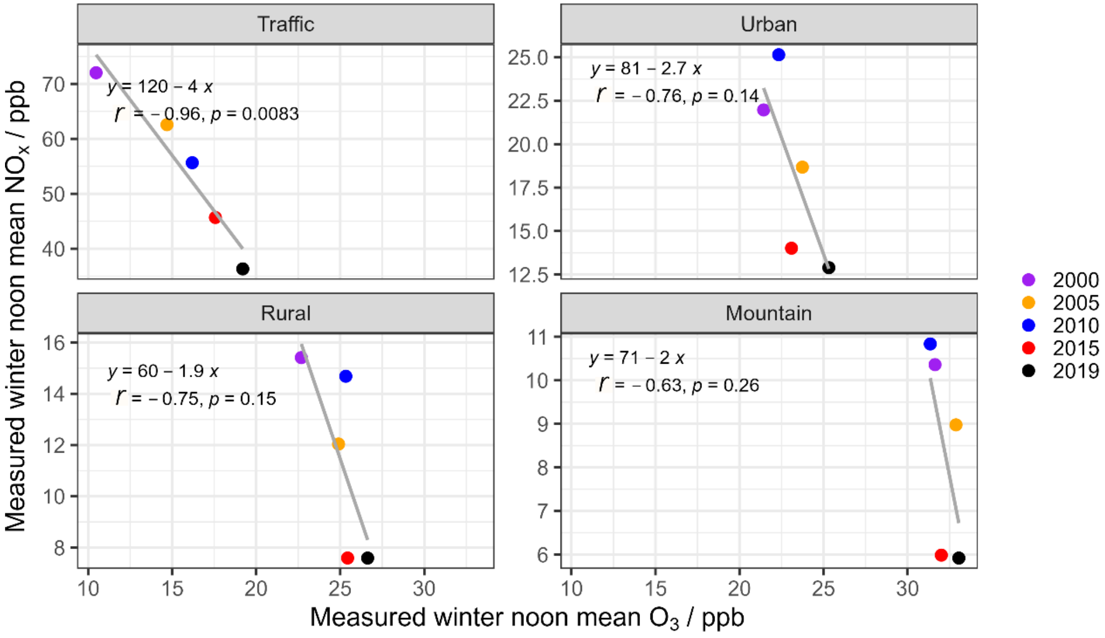

Figure S5: Correlations between measured averaged noon (12:00 - 13:00) NO_x (~0.82 times and 0.53 times for NO and NO_2, respectively, concentrations in µg m^{-3}) and O_3 in ppb (~0.51 times O_3 concentration in µg m^{-3}) of four station types in winter over 5 years (2000, 2005, 2010, 2015 and 2019).

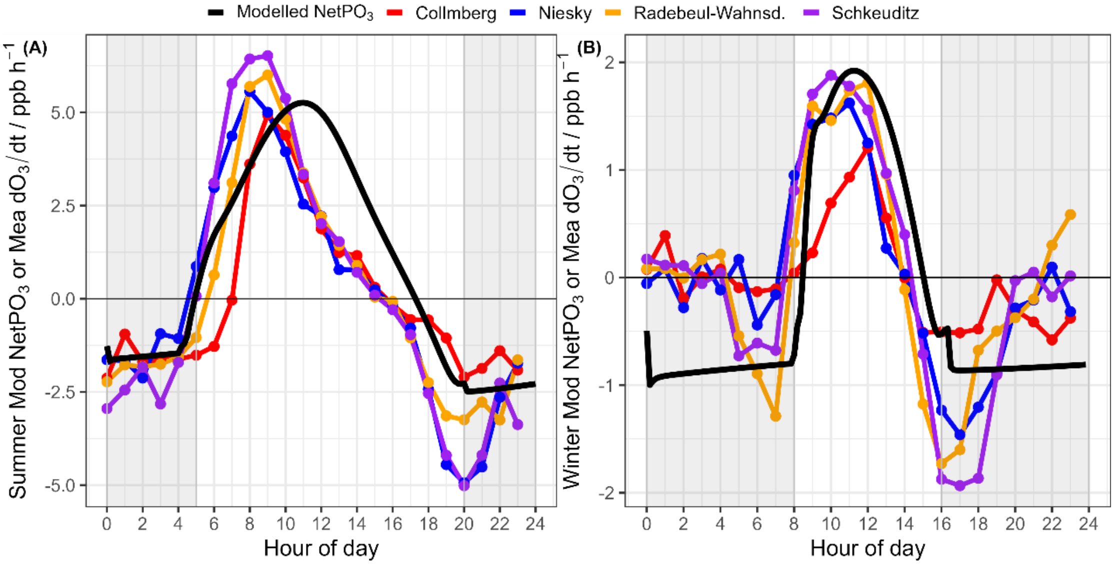

Figure S6: Diurnal profiles of the modelled net O_3 production rate ($NetPO_3$ in ppb h^{-1}) and measured O_3 change rate (dO_3/dt, ppb h^{-1}) for summer (A) and winter (B), respectively. Linear correlation coefficient (r) between modelled and measured rates is larger than 0.8 in both seasons.

Table S8. TNMVOC concentrations for the summer scenario used to include station type data into the isopleth diagram (Fig. 10 A). These are derived from comparing measured and modelled NO_x, as well as measured dO_3/dt and modelled $NetPO_3$ values.

				Measured		Modelled		
Year	**Period**	**Hour**	**Station type**	**NO_x**	**dO_3/dt**	**NO_x**	**$NetPO_3$**	**TNMVOC**
				ppb	ppb h^{-1}	ppb	ppb h^{-1}	ppb
2000	Summer	6 - 12	Traffic	65.22	2.74	65.27	2.74	91.87
2000	Summer	6 - 12	Urban	19.07	4.13	19.02	4.13	54.06
2000	Summer	6 - 12	Rural	8.49	2.89			
2000	Summer	6 - 12	Mountain	7.15	1.2			
2005	Summer	6 - 12	Traffic	59.17	3.69	59.16	3.69	90.7
2005	Summer	6 - 12	Urban	18.27	4.27	18.22	4.27	53.8
2005	Summer	6 - 12	Rural	7.06	3.45			
2005	Summer	6 - 12	Mountain	6.22	1.16			
2010	Summer	6 - 12	Traffic	45.62	3.87	45.65	3.87	78.79
2010	Summer	6 - 12	Urban	15.08	4.63	15.12	4.63	52.05

2010	Summer	6 - 12	Rural	5.94	3.42			
2010	Summer	6 - 12	Mountain	5.53	1.18			
2015	Summer	6 - 12	Traffic	34.27	4.32	34.23	4.32	69.81
2015	Summer	6 - 12	Urban	11.48	4.75	11.51	4.75	48.6
2015	Summer	6 - 12	Rural	4.96	3.73			
2015	Summer	6 - 12	Mountain	3.94	1.3			
2019	Summer	6 - 12	Traffic	23.87	4.55	23.82	4.55	60.64
2019	Summer	6 - 12	Urban	9.59	4.88	9.61	4.87	46.91
2019	Summer	6 - 12	Rural	4.54	3.89			
2019	Summer	6 - 12	Mountain	3.67	1.64			

Table S9. TNMVOC concentrations for the winter scenario used to include station type data into the isopleth diagram (Fig. 10 B). These are derived from comparing measured and modelled NO_x, as well as measured dO_3/dt and modelled $NetPO_3$ values.

				Measured		**Modelled**		
Year	**Period**	**Hour**	**Station type**	**NO_x**	**dO_3/dt**	**NO_x**	**$NetPO_3$**	**TNMVOC**
				ppb	ppb h^{-1}	ppb	ppb h^{-1}	ppb
2000	Winter	8 - 12	Traffic	80.56	0.78	80.58	0.78	178.88
2000	Winter	8 - 12	Urban	31.48	1.45	31.43	1.46	108.46
2000	Winter	8 - 12	Rural	16.38	0.97			
2000	Winter	8 - 12	Mountain	10.46	0.69			
2005	Winter	8 - 12	Traffic	68.96	0.85	68.97	0.85	164.34
2005	Winter	8 - 12	Urban	23.16	1.22	23.12	1.22	92.69
2005	Winter	8 - 12	Rural	12.87	0.99			
2005	Winter	8 - 12	Mountain	8.42	0.44			
2010	Winter	8 - 12	Traffic	63.24	0.98	63.26	0.98	157.86
2010	Winter	8 - 12	Urban	29.75	1.32	29.73	1.32	104.25
2010	Winter	8 - 12	Rural	15.34	1.30			
2010	Winter	8 - 12	Mountain	10.08	0.68			
2015	Winter	8 - 12	Traffic	55.01	1.42	55.06	1.42	150.5
2015	Winter	8 - 12	Urban	20.24	1.61	20.22	1.61	93.22
2015	Winter	8 - 12	Rural	9.11	1.17			
2015	Winter	8 - 12	Mountain	5.97	0.48			
2019	Winter	8 - 12	Traffic	43.47	1.59	43.44	1.59	131.06
2019	Winter	8 - 12	Urban	18.16	1.65	18.12	1.65	90.94
2019	Winter	8 - 12	Rural	8.85	1.17			
2019	Winter	8 - 12	Mountain	5.67	0.35			

Table S10. The species list of NMVOCs measured by online thermodesorption gas chromatography with flame ionization dectection in Borna, south of Leipzig, Germany.

Number	Compounds
1	1-Butene
2	1-Hexene
3	1-Pentene
4	1,2,3-Trimethylbenzene
5	1,2,4-Trimethylbenzene
6	1,3-Butadiene
7	1,3,5-Trimethylbenzene
8	2-Methylheptane
9	2-Methylhexane
10	2-Methylpentane
11	2,2-Dimethylbutane
12	2,2,4-Trimethylpentane
13	2,3-Dimethylbutane
14	2,3-Dimethylpentane
15	2,3,4-Trimethylpentane
16	2,4-Dimethylpentane
17	3-Methylheptane
18	3-Methylhexane
19	3-Methylpentane
20	a-Pinene
21	Acetylene
22	b-Pinene
23	Benzene
24	cis-2-Butene
25	cis-2-Pentene
26	Cyclohexane
27	Cyclopentane
28	Ethane
29	Ethene
30	Ethylbenzene
31	i-Butane
32	i-Butene
33	i-Pentane
34	i-Propylbenzene
35	Isoprene
36	Limonene
37	m-Diethylbenzene

38	m-Ethyltoluene
39	m,p-Xylene
40	Methylcyclohexane
41	Methylcyclopentane
42	n-Butane
43	n-Decane
44	n-Dodecane
45	n-Heptane
46	n-Hexane
47	n-Nonane
48	n-Octane
49	n-Pentane
50	n-Propylbenzene
51	n-Undecane
52	o-Ethyltoluene
53	o-Xylene
54	p-Diethylbenzene
55	p-Ethyltoluene
56	Propane
57	Propene
58	Styrene
59	Toluene
60	trans-2-Butene
61	trans-2-Pentene
62	1-Hexene
63	2,2-Dimethylbutane
64	3-Methylpentane
65	Butadiene
66	n-Hexane

Table S11. Statistical summary of total measured NMVOCs (unit in ppb) throughout the year 2022 in Borna.

NMVOCs	Mean	Max
Summer	3.55	29.72
Winter	6.04	204.55

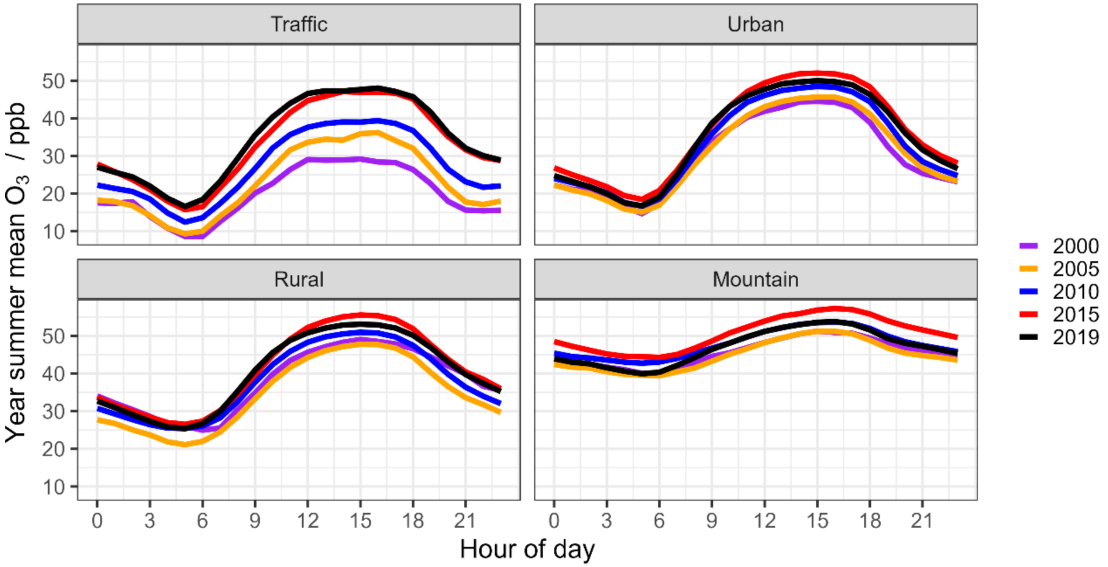

Figure S7: Diurnal summer profiles of hourly averaged measured O_3 over five years (2000, 2005, 2010, 2015, and 2019) across four station types.

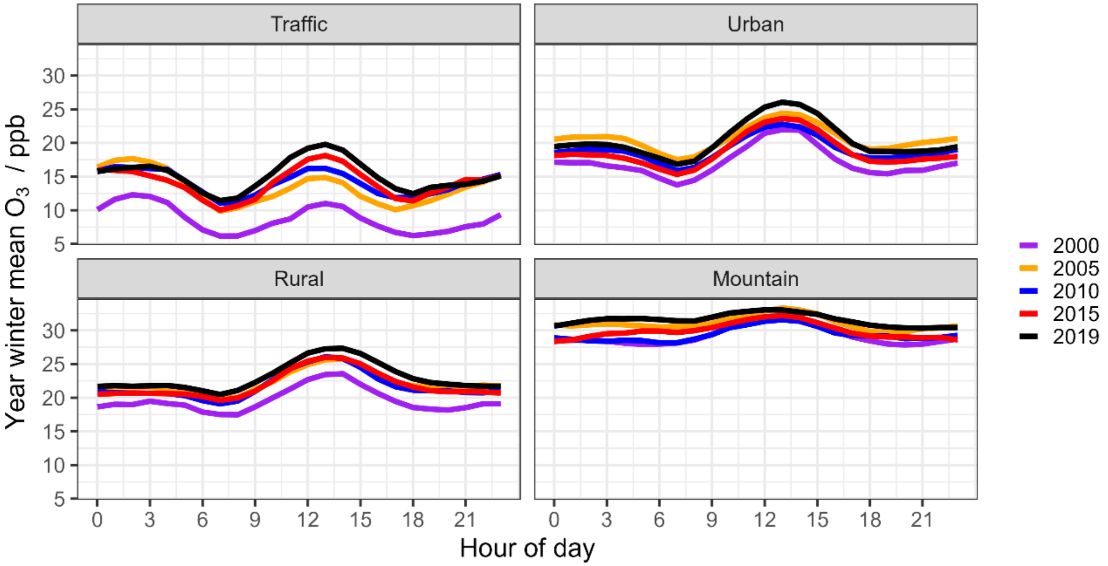

Figure S8: Diurnal winter profiles of hourly averaged measured O_3 over five years (2000, 2005, 2010, 2015, and 2019) across four station types.

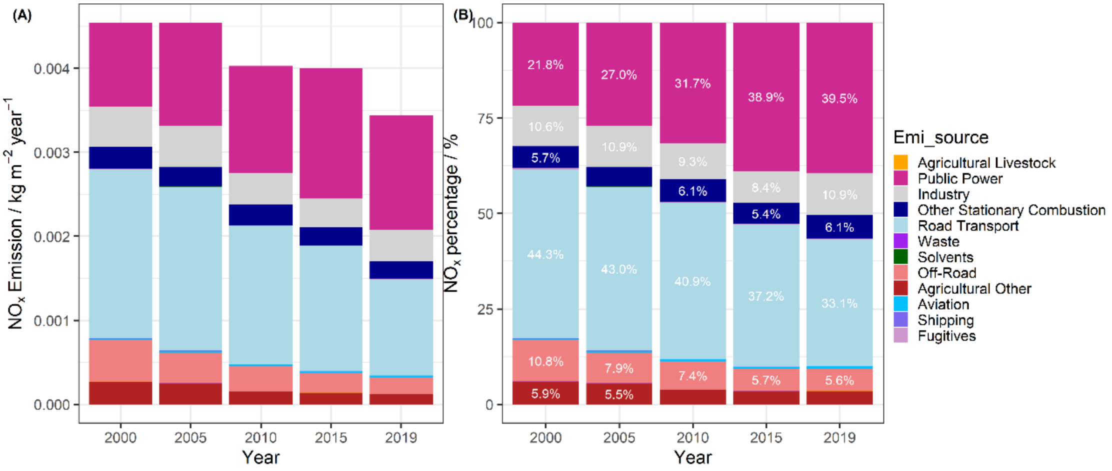

Figure S9: Saxony anthropogenic emissions of NO_x. Emission data were averaged over the selected Saxony regions (Fig. S1).

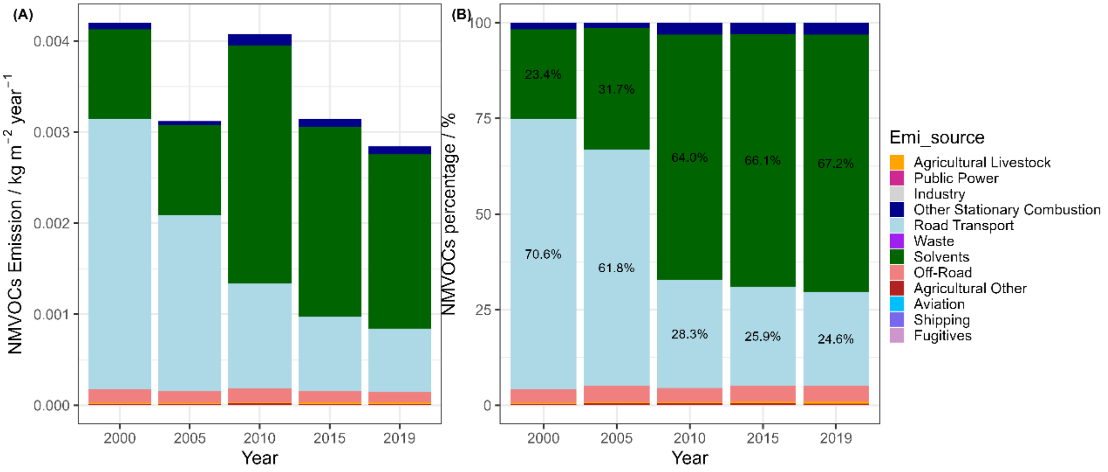

Figure S10: Traffic anthropogenic emissions of NMVOCs. Emission data were averaged over the selected traffic area (Fig. S1).

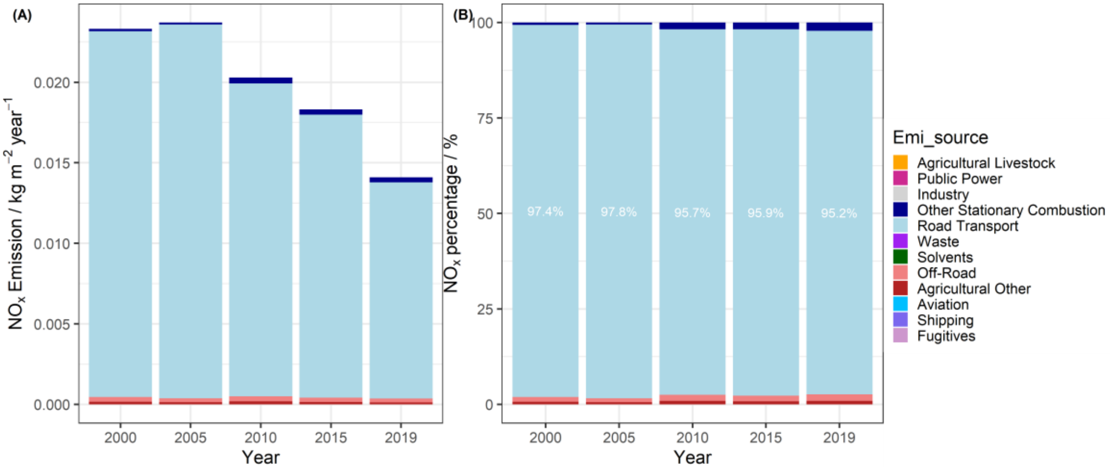

Figure S11: Traffic anthropogenic emission of NO_x. Emission data were averaged over the selected traffic area (Fig. S1).

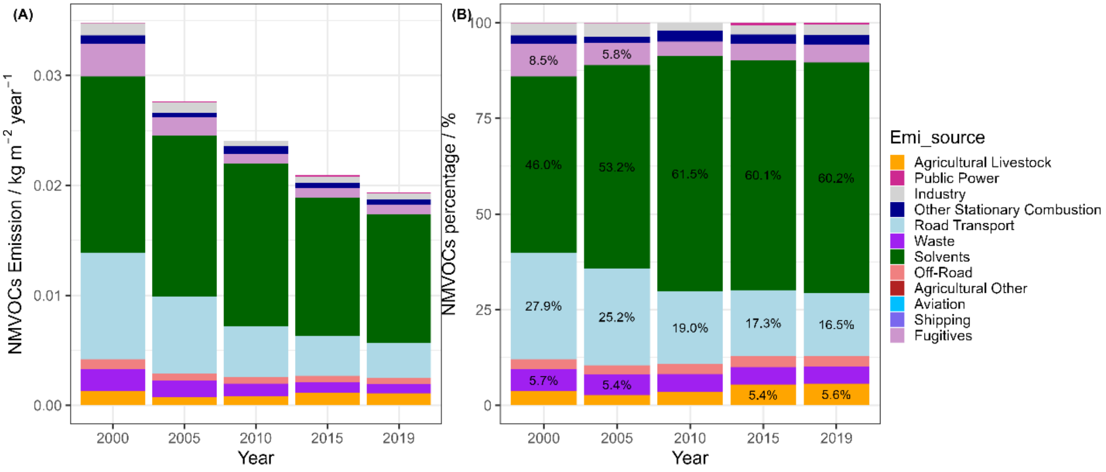

Figure S12: Leipzig urban anthropogenic emission NMVOCs. Emission data were averaged over the selected urban area (Fig. S1).

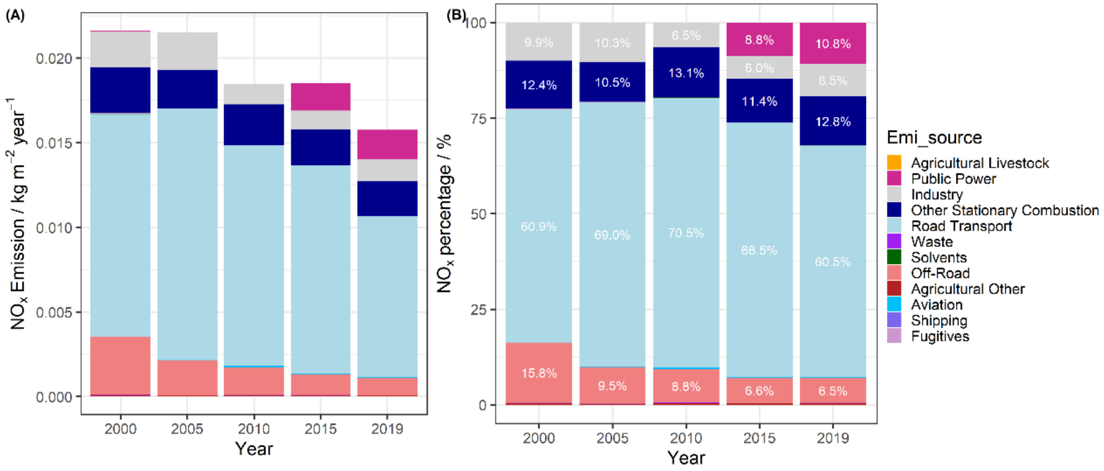

Figure S13: Leipzig urban anthropogenic emission NO$_x$. Emission data were averaged over the selected urban area (Fig. S1).

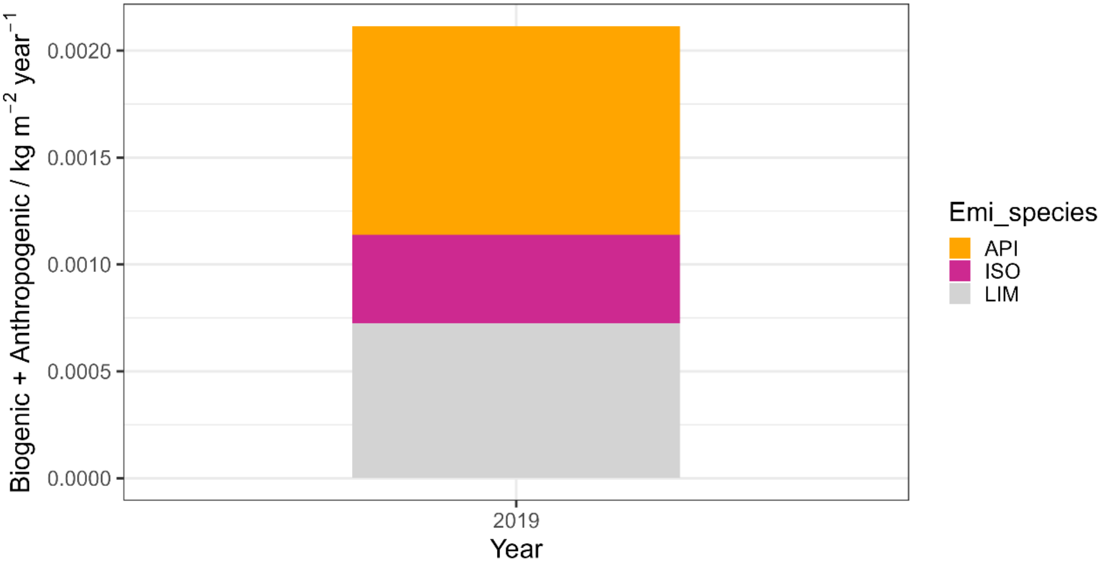

Figure S14: Biogenic emissions of isoprene (ISO) and alpha-pinene (API) in Saxony for the year 2019, along with anthropogenic and biogenic emission data for limonene (LIM) in the same year, were averaged over the selected regions in Saxony (as shown in Fig. S1). Emission inventories in 2019 from the German Environment Agency (UBA) for Germany and Thürkow et al. (2024).

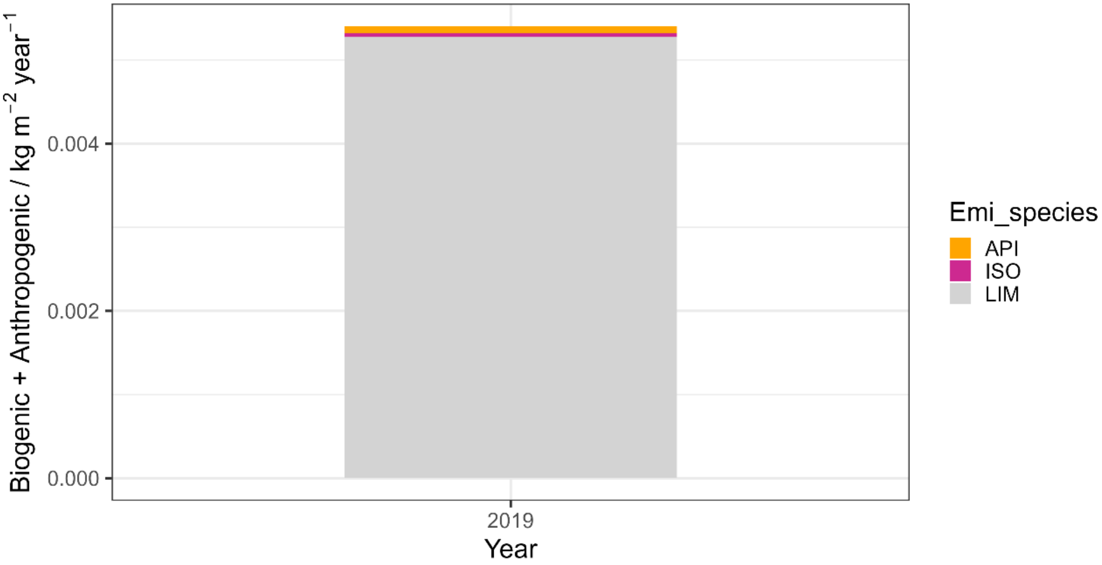

Figure S15: Biogenic emissions of isoprene (ISO) and alpha-pinene (API) in selected Leipzig urban area (Fig. S1) for the year 2019, along with anthropogenic and biogenic emission data for limonene (LIM) in the same year. Emission inventories in 2019 from the German Environment Agency (UBA) for Germany and Thürkow et al. (2024).

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