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Supplement of

A comparison of long-term trends in observations and emission inventories of NO_x

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S1 Data and Methods

Table S1. Reference list of all R packages that were used.

Package	Author(s)	Year
devtools	H. Wickham, J. Hester, W. Chang	2020
dplyr	H. Wickham, R. Francois, L. Henry, K. Müller	2020
egg	B. Auguie	2019
forcats	H. Wickham	2020
geosphere	R. J. Hijmans	2019
ggnewscale	E. Campitelli	2020
ggplot2	H. Wickham	2016
ggpubr	A. Kassambara	2020
ggrepel	K. Slowikowski	2020
gridExtra	B. Auguie	2017
lubridate	G. Grolemund, H. Wickham	2011
maptools	R. Bivand, N. Lewin-Koh	2019
matrixStats	H. Bengtsson	2020
openair	D. C. Carslaw, K. Ropkins	2012
rgdal	R. Bivand, T. Keitt, B. Rowlingson	2019
rgeos	R. Bivand, C. Rundell	2019
rlang	L. Henry, H. Wickham	2020
segmented	V. M. R. Muggeo	2008
stringr	H. Wickham	2019
tibble	K. Müller, H. Wickham	2020
tidyr	H. Wickham, L. Henry	2020
viridis	S. Garnier	2018

Table S2. Data sources of the city shapefiles that were used for retrieving the corresponding gridcells from the EMEP grid. All shapefiles were downloaded in January 2020.

City	URL
Amsterdam	https://maps.amsterdam.nl/open_geodata/?k=202
Augsburg	https://www.arcgis.com/home/item.html?id=ae25571c60d94ce5b7fcbf74e27c00e0
Berlin	https://esri-de-content.maps.arcgis.com/home/item.html?id=9ae4f23075d340adb6580a6d9603f9fa
Geneva	https://opendata.swiss/de/dataset/swissboundaries3d-bezirksgrenzen
Linz	https://www.data.gv.at/katalog/dataset/bezirksstadtabgrenzung/resource/1aa22b8d-ef5f-4c66-be62-9bb5045bf1de
London	https://data.london.gov.uk/dataset/inner-and-outer-london-boundaries-london-plan-consultation-2009
Prague	https://data.gov.cz/datov%C3%A1-sada?iri=https%3A%2F%2Fdata.gov.cz%2Fzdroj%2Fdatov%C3%A9-sady%2Fhttp---atom.cuzk.cz-api-3-action-package_show-id-cz-00025712-cuzk_ruian-obce-shp_554782
Vienna	https://www.data.gv.at/katalog/dataset/stadt-wien_bezirksgrenzenwien
Zurich	https://data.stadt-zuerich.ch/dataset?q=grenzen

Table S3. Sources and availability of data sets on wind directions and wind speed for seven cities. DWD – Deutscher Wetterdienst (German Weather Service); CHMU – Český hydrometeorologický ústav (Czech Hydrometeorological Institute); ZAMG – Zentralanstalt für Meteorologie und Geodynamik (Central Institution for Meteorology and Geodynamics).

City	Source	Station	Temp. Res.	Timeframe
Augsburg (DE)	DWD: Climate Data Center	Augsburg 00232	hourly	1998 – 2017
Berlin (DE)	DWD: Climate Data Center	Berlin-Tempelhof 00433	hourly	1997 – 2017
Geneva (CH)	MeteoSchweiz: IDAWEB	Geneva Cointrin GVE	hourly	1991 – 2017
London (GB)	Met Office (e-mail)	London Heathrow	hourly	2008 – 2017
Prague (CZ)	CHMU (e-mail)	Praha-Klementinum	7am, 2+9pm	2012 – 2017
Vienna (AT)	ZAMG: Jahrbuch	Wien Hohe Warte	7am, 2+7pm	1992 – 2017
Zurich (CH)	MeteoSchweiz: IDAWEB	Zurich Affoltern REH	hourly	1992 – 2017

S2 Absolute Emissions and Increments

Figure S1. Urban increments (UIs) and total emissions of NO_x for seven European cities. The UIs are derived from rural and urban background monitoring stations; emissions are averaged for the urban areas based on the EMEP emissions grid. Shaded areas represent one standard deviation. Note the different scales for emissions and UIs.

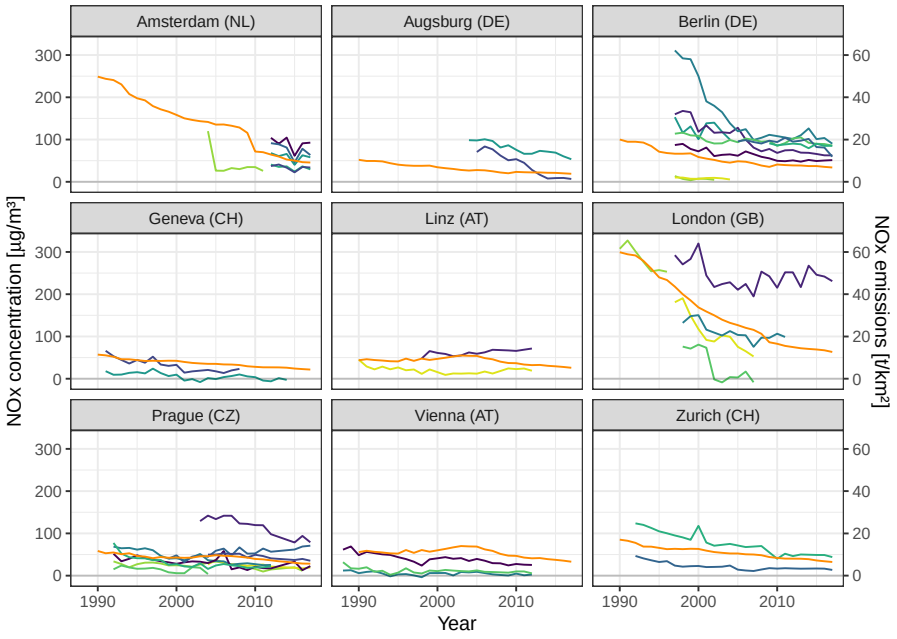

Figure S2. Roadside increments (RIs) and traffic emissions of NO_x for nine European cities. The orange lines represent traffic emissions and these are averaged for the urban areas based on the EMEP emissions grid. All other lines depict individual RIs which are each specific to a certain urban traffic monitoring station. Note the different scales for emissions and RIs.