Supplementary Materials

Boundary-Layer Height Outweighs Wind Speed in Explaining Daily Urban Air Pollution: Unique-Variance Attribution and a City Typology for 10 French Cities

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This file contains Figures S1 to S3 and Tables S1 to S11, numbered in the order of their first citation in the article. Section numbers refer to the article. sr^2, semi-partial R^2. BLH, boundary-layer height. HAC, heteroskedasticity and autocorrelation consistent. Pooled, all daily values of each city. Rung 3, deseasonalized monthly anomalies. Rung 4, the same with the calendar-year means removed (Section 2.2.4). Lille covers 2018–2021 (urban-background station Lille Fives). The tables are also given in numerical form in an Excel workbook, provided as a separate supplementary file. The workbook alone gives the per-city part of Table S10. The daily dataset is deposited on Zenodo (Data Availability Statement).

Provenance of the hourly record (Section 2.3 and Figure S1)

The hourly series of Marseille and Lyon are the validated hourly data of urban-background stations. At Marseille they come from the same stations as the daily series. At Lyon they come from one of its two stations, FR20062, and their daily means agree closely with the daily series (r = 0.97 to 1.00, Table S1). The hourly file predates the re-extraction of the ERA5 surface fields used in the harmonised daily dataset. Its wind therefore comes from the original interpolated source, and it correlates with the harmonised daily wind at r = 0.97 at Marseille and 0.96 at Lyon, with a mean offset of +3.0 and +1.0 km h^{-1} respectively. Recomputing every whole-day window from 1 to 30 days with the harmonised daily wind (open circles in Figure S1) leaves the conclusions of Section 2.3 unchanged. It changes the sign of three near-zero correlations, all below 0.07 in absolute value: ozone at Marseille at 5 and 7 days, and NO_2 at Lyon at 20 days. The ozone sign change at Marseille thus moves from between 4 and 5 days to between 7 and 10 days. The largest difference is 0.20, for ozone at Marseille at the 30-day window, and 0.13 for the primary species. Δ^* values are accordingly quoted to about ±0.3 day. One caution for later work. The boundary-layer height carried by the Marseille hourly file is not the corrected land-point series of the daily dataset, since the two agree only at r = 0.43 with a mean offset of +40 m. Boundary-layer height is not used in the two diagnostics of Section 2.3, but the hourly file must not be used for a boundary-layer analysis before that field is re-extracted.

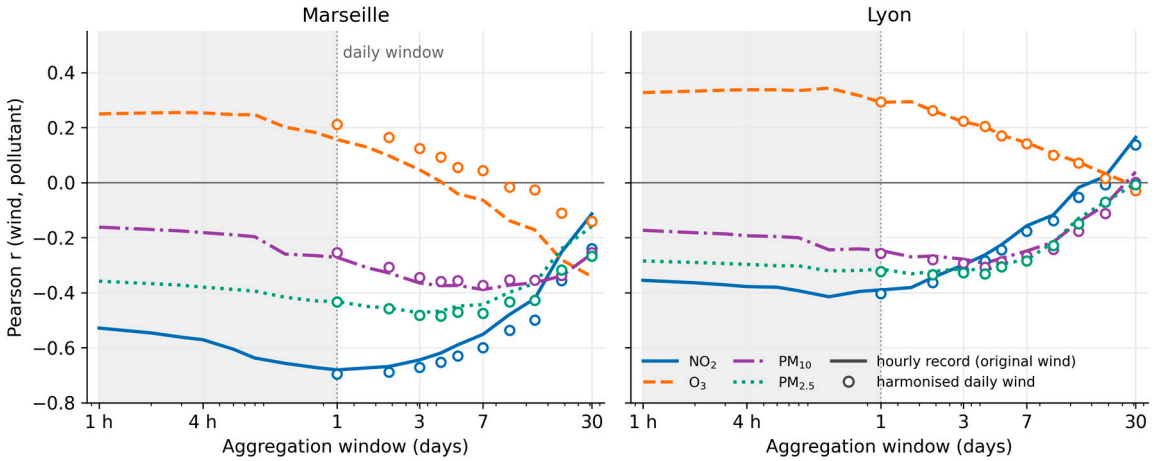


Figure S1. Wind–pollution correlation as a function of the temporal aggregation window for the two hourly reference cities, Marseille (left) and Lyon (right), for the four pollutants (raw series, 2018–2025, non-overlapping windows from 1 h to 720 h, or 30 days). Lines, hourly record with its original wind. Open circles, windows of 1 to 30 days recomputed with the harmonised daily wind of the main dataset. The daily window is marked by the dotted line and the sub-daily range is shaded. At Marseille the three primary species stay negative at every window. Ozone is positive at short windows and becomes negative beyond 4 days with the original wind and beyond 7 days with the harmonised wind. At Lyon the NO_2 and O_3 correlations change sign by 30 days, O_3 only slightly, while the two particulate species lose their coupling.

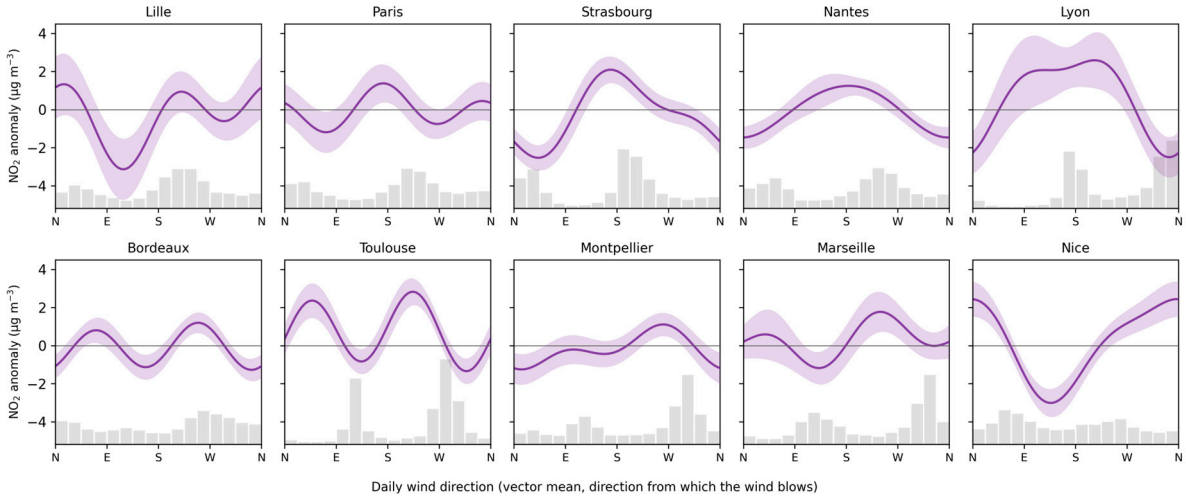


Figure S2. Response of the deseasonalized NO_2 anomalies (third rung) to the daily wind direction, by city. Purple line: effect of the four Fourier terms in the model with the seven predictors, centred on its mean over the period, with its 95% HAC confidence band. Grey bars: share of days in each 22.5° sector of the daily vector-mean direction, over the days of the fit (common scale, 0 to 60%). Direction from which the wind blows.

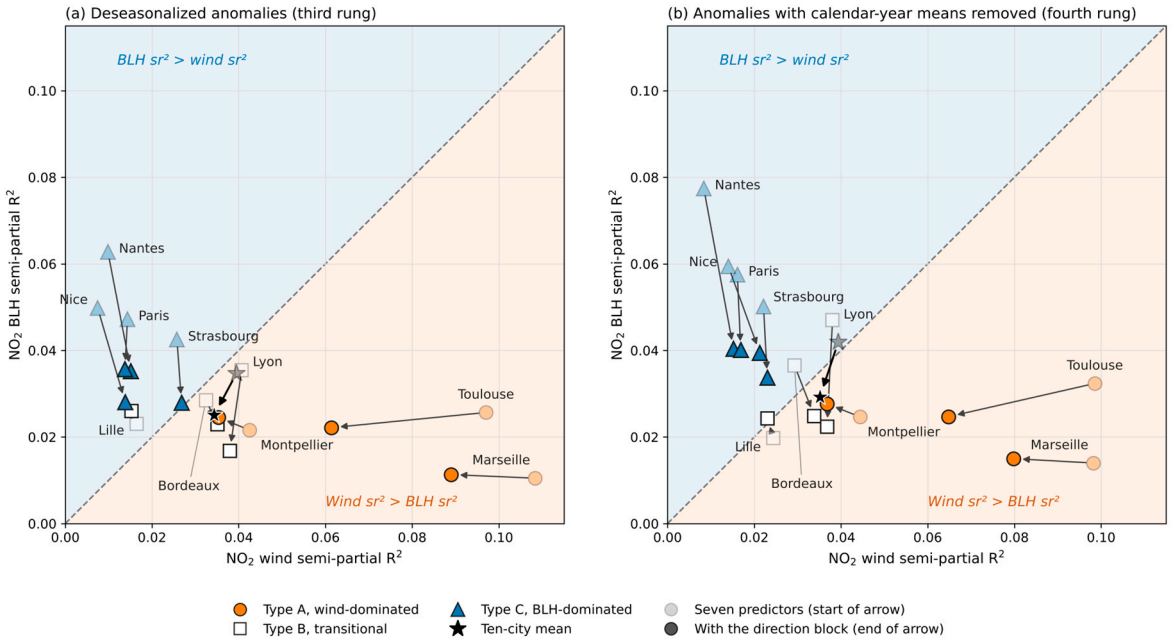


Figure S3. Effect of the wind-direction block on the NO_2 wind/BLH balance, by city: (a) deseasonalized anomalies (third rung), (b) anomalies with the calendar-year means removed (fourth rung). Each arrow starts at the estimate of the seven-predictor model (faded marker, the positions of Figure 10 in panel b) and ends at the estimate of the model augmented with the four Fourier terms of the daily wind direction (Section 2.2.5). Star: ten-city mean. Below the dashed 1:1 line, wind carries the larger unique share. Values in Table S8, part (h).

Table S1. Stations and day-by-day check of the pollution series. Each series is compared with the daily means (UTC days with at least 18 valid hours, mean of the available stations) of the validated hourly data that France reports to the European Environment Agency (EEA, E1a data). Station type and area are from the EEA metadata. Station names are those of the national database. Codes are listed in numerical order and paired with names only where stated.

(a) Stations, EEA codes and types, and agreement with the validated hourly data. MAD, mean absolute deviation (μg m⁻³). The national daily values are rounded to 1 or 0.1 μg m⁻³. Paris PM_{10} deviates more in 2019 (mean 1.0 μg m⁻³), for which the exact set of stations could not be identified (part d). Two other days exceed 0.5 μg m⁻³ Paris O_3 on 6 December 2022 (0.59) and Paris PM_{10} on 19 February 2025 (0.52). The corrected Lille series was built from these data, hence its MAD of 0.03.

City	Stations (names)	EEA station codes	EEA type and area	MAD NO_2	MAD O_3	MAD PM_{10}	MAD $PM_{2.5}$	Smallest share of days within 0.5 μg m⁻³
Marseille	5 Avenues (FR03043, also O_3), St Louis (FR03014)	FR03014, FR03043	background, urban	0.16	0.25	0.17	0.10	1.00
Toulouse	Berthelot	FR12030	background, urban	0.15	0.25	0.25	0.09	1.00
Montpellier	Près d'Arènes	FR08016	background, urban	0.18	0.25	0.25	0.09	1.00
Bordeaux	Talence	FR31002	background, urban	0.15	0.25	0.25	0.09	1.00
Lyon	Gerland, Lyon Centre	FR20017, FR20062	background, urban	0.15	0.19	0.17	0.10	1.00
Strasbourg	Nord (FR16029, also O_3), Neudorf, Est	FR16029, FR16038, FR42010	background, urban	0.15	0.25	0.19	0.12	1.00
Nice	Nice Arson	FR24036	background, urban	0.25	0.24	0.25	0.12	1.00
Nantes	CIM Bouteillerie	FR23188	background, urban	0.12	0.25	0.25	0.09	1.00
Lille	Lille Fives (2018–2021)	FR11025	background, urban	0.03	0.03	0.03	0.03	1.00
Paris	Les Halles, 7e, 12e, 13e, 18e, Centre, Stade Lenglen	FR04004, FR04014, FR04037, FR04055, FR04060, FR04143, FR04179	background, urban	0.09	0.14	0.26	0.11	0.92

(b) Former composite Lille series of the submitted dataset, identified against the EEA data. Each period is reproduced to rounding by the stations listed. The series is replaced in the corrected dataset by Lille Fives (FR11025), 2018–2021.

Pollutant	Period	Station(s)	EEA type
NO_2	2018–2021	Mean of FR11007 and FR11025	traffic + urban background
NO_2	2022–2023	FR11007	traffic
NO_2	2024–2025	FR11114	suburban background
PM_{10}, $PM_{2.5}$	2018–2022	FR11034	traffic
PM_{10}, $PM_{2.5}$	2023–2025	Mean of FR11034, FR11038 and FR11114	traffic + urban + suburban background
O_3	2018–2022	FR11114	suburban background
O_3	2023–2025	Mean of FR11038 and FR11114	urban + suburban background

(c) Years of valid data per station and pollutant, 2018–2025: days with at least 18 valid hours in the validated EEA data, UTC days. On each day a city series is the mean of the stations available that day. FR16038 (Strasbourg) has no valid O_3 or PM_{10} data over the period. The Lille days include three days of January 2022, outside the series.

City	Pollutant	EEA code	Station name	First valid day	Last valid day	Valid days	2018	2019	2020	2021	2022	2023	2024	2025
Marseille	NO_2	FR03014	St Louis	2018-01-01	2025-12-31	2865	364	360	363	359	364	330	361	364
Marseille	NO_2	FR03043	5 Avenues	2018-01-01	2025-12-31	2830	358	346	358	347	350	359	358	354

City	Pollutant	EEA code	Station name	First valid day	Last valid day	Valid days	2018	2019	2020	2021	2022	2023	2024	2025
Marseille	O_3	FR03043	5 Avenues	2018-01-01	2025-12-31	2816	351	346	354	335	360	356	360	354
Marseille	PM_{10}	FR03014	St Louis	2018-01-01	2025-12-31	2724	290	313	364	359	348	328	361	361
Marseille	PM_{10}	FR03043	5 Avenues	2018-01-01	2025-12-31	2811	343	353	358	353	361	350	347	346
Marseille	$PM_{2.5}$	FR03014	St Louis	2020-01-08	2025-12-31	2114	0	0	357	359	348	328	361	361
Marseille	$PM_{2.5}$	FR03043	5 Avenues	2018-01-01	2025-12-31	2817	349	353	358	353	361	350	347	346
Toulouse	NO_2	FR12030	Berthelot	2018-01-01	2025-12-31	2866	356	355	361	357	363	351	366	357
Toulouse	O_3	FR12030	Berthelot	2018-01-01	2025-12-31	2903	361	358	366	364	365	363	364	362
Toulouse	PM_{10}	FR12030	Berthelot	2018-01-01	2025-12-31	2850	356	352	349	353	355	359	364	362
Toulouse	$PM_{2.5}$	FR12030	Berthelot	2018-01-01	2025-12-31	2839	360	332	349	354	355	363	364	362
Montpellier	NO_2	FR08016	Près d'Arènes	2018-01-01	2025-12-31	2817	355	357	355	342	352	358	347	351
Montpellier	O_3	FR08016	Près d'Arènes	2018-01-01	2025-12-31	2870	353	361	358	360	354	363	365	356
Montpellier	PM_{10}	FR08016	Près d'Arènes	2018-01-01	2025-12-31	2814	334	358	355	350	352	355	360	350
Montpellier	$PM_{2.5}$	FR08016	Près d'Arènes	2018-01-01	2025-12-31	2754	308	355	347	327	352	355	360	350
Bordeaux	NO_2	FR31002	Talence	2018-01-01	2025-12-31	2690	362	342	364	357	210	351	351	353
Bordeaux	O_3	FR31002	Talence	2018-01-01	2025-12-31	2705	363	365	365	351	189	356	352	364
Bordeaux	PM_{10}	FR31002	Talence	2018-01-01	2025-12-31	2516	363	344	352	356	54	359	339	349
Bordeaux	$PM_{2.5}$	FR31002	Talence	2018-01-01	2025-12-31	2510	357	344	352	356	54	359	339	349
Lyon	NO_2	FR20017		2018-01-01	2025-12-31	2638	351	343	354	361	300	198	366	365
Lyon	NO_2	FR20062		2018-01-01	2025-12-31	2821	354	341	365	340	355	359	363	344
Lyon	O_3	FR20017		2018-01-01	2024-03-18	2089	324	357	340	339	339	313	77	0
Lyon	O_3	FR20062		2018-01-01	2025-12-31	2870	363	353	365	348	360	356	364	361
Lyon	PM_{10}	FR20017		2018-01-01	2025-12-31	2807	347	355	351	357	348	328	362	359
Lyon	PM_{10}	FR20062		2018-01-01	2025-12-31	2816	335	352	364	338	358	360	362	347
Lyon	$PM_{2.5}$	FR20017		2020-05-13	2025-12-31	1974	0	0	220	357	348	328	362	359
Lyon	$PM_{2.5}$	FR20062		2018-01-01	2025-12-31	2837	352	356	364	338	358	360	362	347
Strasbourg	NO_2	FR16029	Nord	2018-01-01	2025-12-31	2812	311	363	364	361	361	356	365	331
Strasbourg	NO_2	FR16038		2018-01-01	2020-06-03	879	364	360	155	0	0	0	0	0
Strasbourg	NO_2	FR42010		2019-11-21	2025-12-31	2152	0	41	360	359	355	359	317	361
Strasbourg	O_3	FR16029	Nord	2018-01-01	2025-12-31	2886	364	361	366	357	361	362	358	357
Strasbourg	PM_{10}	FR16029	Nord	2018-01-01	2025-12-31	2804	356	347	342	343	354	336	361	365
Strasbourg	PM_{10}	FR42010		2019-11-16	2025-12-31	2222	0	42	359	363	365	362	366	365
Strasbourg	$PM_{2.5}$	FR16029	Nord	2025-01-01	2025-12-31	365	0	0	0	0	0	0	0	365
Strasbourg	$PM_{2.5}$	FR16038		2018-01-01	2020-06-02	852	358	351	143	0	0	0	0	0
Strasbourg	$PM_{2.5}$	FR42010		2019-11-16	2025-12-31	2228	0	44	363	363	365	362	366	365
Nice	NO_2	FR24036	Nice Arson	2018-01-01	2025-12-31	2879	351	362	362	364	354	359	365	362
Nice	O_3	FR24036	Nice Arson	2018-01-01	2025-12-31	2885	355	358	363	362	365	357	364	361
Nice	PM_{10}	FR24036	Nice Arson	2018-01-01	2025-12-31	2865	355	355	358	361	361	355	357	363

City	Pollutant	EEA code	Station name	First valid day	Last valid day	Valid days	2018	2019	2020	2021	2022	2023	2024	2025
Nice	$PM_{2.5}$	FR24036	Nice Arson	2018-01-01	2025-12-31	2865	355	355	358	361	361	355	357	363
Nantes	NO_2	FR23188	CIM Bouteillerie	2018-01-01	2025-12-31	2889	365	360	358	356	364	365	360	361
Nantes	O_3	FR23188	CIM Bouteillerie	2018-01-01	2025-12-31	2894	363	365	357	365	361	365	357	361
Nantes	PM_{10}	FR23188	CIM Bouteillerie	2018-01-01	2025-12-31	2886	361	356	361	363	362	365	362	356
Nantes	$PM_{2.5}$	FR23188	CIM Bouteillerie	2018-01-01	2025-12-31	2822	349	349	316	363	362	365	362	356
Lille	NO_2	FR11025	Lille Fives	2018-01-01	2022-01-03	1340	329	364	341	303	3	0	0	0
Lille	O_3	FR11025	Lille Fives	2018-01-01	2022-01-03	1350	326	352	314	355	3	0	0	0
Lille	PM_{10}	FR11025	Lille Fives	2018-01-01	2022-01-03	1330	326	352	304	345	3	0	0	0
Lille	$PM_{2.5}$	FR11025	Lille Fives	2018-01-01	2022-01-03	1242	310	334	314	281	3	0	0	0
Paris	NO_2	FR04004		2018-01-01	2025-12-31	2832	336	354	363	365	348	344	359	363
Paris	NO_2	FR04014		2018-01-01	2025-12-31	2821	342	363	361	352	331	343	366	363
Paris	NO_2	FR04037		2018-01-01	2025-12-31	2776	355	358	355	362	338	333	312	363
Paris	NO_2	FR04055		2019-10-04	2025-12-31	2079	0	66	334	288	359	363	309	360
Paris	NO_2	FR04060		2018-01-03	2025-12-31	2852	359	340	345	359	357	364	365	363
Paris	NO_2	FR04143		2018-01-01	2019-09-22	624	361	263	0	0	0	0	0	0
Paris	NO_2	FR04179		2018-01-01	2025-12-31	2556	337	354	346	315	352	353	147	352
Paris	O_3	FR04004		2018-01-01	2025-12-31	2851	343	355	364	362	356	344	362	365
Paris	O_3	FR04037		2018-01-01	2025-12-31	2892	348	364	363	365	361	365	361	365
Paris	O_3	FR04055		2019-09-28	2025-12-31	2218	0	67	344	363	362	361	361	360
Paris	O_3	FR04143		2018-01-01	2019-09-22	624	365	259	0	0	0	0	0	0
Paris	PM_{10}	FR04004		2018-01-01	2025-12-31	2780	339	358	350	344	350	321	359	359
Paris	PM_{10}	FR04055		2019-10-05	2025-12-31	1573	0	66	282	308	231	258	266	162
Paris	PM_{10}	FR04143		2018-01-01	2019-09-22	594	345	249	0	0	0	0	0	0
Paris	PM_{10}	FR04179		2018-01-01	2025-12-31	2570	337	353	326	346	355	355	138	360
Paris	$PM_{2.5}$	FR04004		2022-01-01	2025-12-31	1344	0	0	0	0	335	300	356	353
Paris	$PM_{2.5}$	FR04055		2019-10-01	2025-12-31	2120	0	37	301	355	361	363	362	341
Paris	$PM_{2.5}$	FR04143		2018-01-01	2019-09-22	575	338	237	0	0	0	0	0	0

(d) Paris PM_{10} in 2019: effect of the deviation on the unique contributions. From April to December 2019 the dataset exceeds the mean of the four EEA stations (FR04004, FR04055, FR04143, FR04179) by 1.3 µg m⁻³ on average (0.05 µg m⁻³ from January to March). The 2019 values were replaced by that mean and the seven-predictor model refitted. The sr^2 change by 0.001 at most.

Frame	Wind sr^2, dataset	BLH sr^2, dataset	Wind sr^2, 2019 rebuilt	BLH sr^2, 2019 rebuilt
Pooled	0.0012	0.0687	0.0014	0.0689
Rung 3	0.0000	0.0517	0.0000	0.0515

Frame	Wind sr², dataset	BLH sr², dataset	Wind sr², 2019 rebuilt	BLH sr², 2019 rebuilt
Rung 4	0.0000	0.0524	0.0000	0.0514

(e) Hourly records of Figure S1 and Section 2.3, compared hour by hour with the validated EEA data after a one-hour shift between the two time stamps. Marseille reproduces the stations of its daily series. Lyon reproduces FR20062 alone, whereas its daily series is the mean of FR20017 and FR20062.

City	Pollutant	Series reproduced	Hours compared	Share of hours within 0.5 µg m⁻³	r
Marseille	NO_2	Mean of FR03014 and FR03043	70110	1.000	1.000
Marseille	O_3	FR03043	68045	1.000	1.000
Marseille	PM_{10}	Mean of FR03014 and FR03043	69957	1.000	1.000
Marseille	$PM_{2.5}$	Mean of FR03014 and FR03043	69410	1.000	1.000
Lyon	NO_2	FR20062	67671	1.000	1.000
Lyon	O_3	FR20062	68641	1.000	1.000
Lyon	PM_{10}	FR20062	68080	1.000	1.000
Lyon	$PM_{2.5}$	FR20062	68491	1.000	1.000

Table S2. Sensitivity of the main statistics to the Lille series. The former composite Lille series of the submitted dataset mixed traffic, urban-background and suburban-background stations (Table S1). The corrected series is that of the urban-background station Lille Fives (FR11025), 2018–2021.

(a) Ten-city and nine-city means, with the conventions of the article. Pooled sr^2, seven-predictor model in the pooled frame. Rung 3, deseasonalized anomalies. Rung 4, the same with the calendar-year means removed.

Statistic	Ten cities, Lille Fives 2018–2021	Nine cities, Lille excluded	Ten cities, former composite Lille series
Mean r(wind, BLH), pooled	0.700	0.689	0.700
Mean r(wind, BLH), deseasonalized	0.806	0.799	0.806
Raw-correlation ratio BLH/wind, NO_2	1.43	1.42	1.40
Same, PM_{10}	1.31	1.33	1.30
Same, $PM_{2.5}$	1.42	1.45	1.42
Pooled sr^2 wind, NO_2	0.0175	0.0192	0.0178
Pooled sr^2 BLH, NO_2	0.0667	0.0697	0.0679
Pooled sr^2 wind, O_3	0.0080	0.0088	0.0079
Pooled sr^2 BLH, O_3	0.0352	0.0382	0.0355
Pooled sr^2 wind, PM_{10}	0.0072	0.0078	0.0070
Pooled sr^2 BLH, PM_{10}	0.0606	0.0586	0.0593
Pooled sr^2 wind, $PM_{2.5}$	0.0047	0.0052	0.0048
Pooled sr^2 BLH, $PM_{2.5}$	0.0461	0.0433	0.0449
NO_2 rung 3, wind	0.0395	0.0420	0.0393
NO_2 rung 3, BLH	0.0347	0.0360	0.0359
NO_2 rung 4, wind	0.0394	0.0410	0.0390
NO_2 rung 4, BLH	0.0419	0.0443	0.0437

(b) Lille, wind and BLH sr^2 of the seven-predictor model with the two series.

Series	Pollutant	Frame	n	Wind sr^2	BLH sr^2
Lille Fives (FR11025), 2018–2021	NO_2	Pooled	1337	0.0015	0.0405
Lille Fives (FR11025), 2018–2021	NO_2	Rung 3	1337	0.0165	0.0230
Lille Fives (FR11025), 2018–2021	NO_2	Rung 4	1337	0.0244	0.0198
Lille Fives (FR11025), 2018–2021	O_3	Pooled	1346	0.0004	0.0079
Lille Fives (FR11025), 2018–2021	O_3	Rung 3	1346	0.0000	0.0098
Lille Fives (FR11025), 2018–2021	O_3	Rung 4	1346	0.0000	0.0092
Lille Fives (FR11025), 2018–2021	PM_{10}	Pooled	1327	0.0017	0.0794
Lille Fives (FR11025), 2018–2021	PM_{10}	Rung 3	1327	0.0006	0.0654
Lille Fives (FR11025), 2018–2021	PM_{10}	Rung 4	1327	0.0005	0.0626
Lille Fives (FR11025), 2018–2021	$PM_{2.5}$	Pooled	1239	0.0001	0.0711
Lille Fives (FR11025), 2018–2021	$PM_{2.5}$	Rung 3	1239	0.0002	0.0665
Lille Fives (FR11025), 2018–2021	$PM_{2.5}$	Rung 4	1239	0.0000	0.0601
Former composite series, 2018–2025	NO_2	Pooled	2512	0.0046	0.0518
Former composite series, 2018–2025	NO_2	Rung 3	2512	0.0145	0.0346
Former composite series, 2018–2025	NO_2	Rung 4	2512	0.0208	0.0383
Former composite series, 2018–2025	O_3	Pooled	2512	0.0002	0.0112
Former composite series, 2018–2025	O_3	Rung 3	2512	0.0001	0.0189
Former composite series, 2018–2025	O_3	Rung 4	2512	0.0001	0.0194
Former composite series, 2018–2025	PM_{10}	Pooled	2455	0.0001	0.0658
Former composite series, 2018–2025	PM_{10}	Rung 3	2455	0.0003	0.0518
Former composite series, 2018–2025	PM_{10}	Rung 4	2455	0.0003	0.0500
Former composite series, 2018–2025	$PM_{2.5}$	Pooled	2431	0.0006	0.0590
Former composite series, 2018–2025	$PM_{2.5}$	Rung 3	2431	0.0007	0.0546
Former composite series, 2018–2025	$PM_{2.5}$	Rung 4	2431	0.0007	0.0539

(c) Lille, NO_2: difference D = wind sr^2 − BLH sr^2 and its bootstrap 95% interval under three series (stationary block bootstrap, mean block 10 days, 2000 resamples). FR11038 is the only urban-background station of the

agglomeration that measures the four pollutants after 2021 (from 2023, 14 km from the centre). The interval includes zero in all six cases.

Series	Frame	n	Wind sr^2	BLH sr^2	D	D 2.5%	D 97.5%
Lille Fives (FR11025), 2018–2021	Rung 3	1337	0.0165	0.0230	−0.007	−0.036	0.023
Former composite series, 2018–2025	Rung 3	2512	0.0145	0.0346	−0.020	−0.043	0.002
FR11025 (2018–2021) spliced with FR11038 (2023–2025)	Rung 3	2363	0.0107	0.0262	−0.016	−0.038	0.005
Lille Fives (FR11025), 2018–2021	Rung 4	1337	0.0244	0.0198	0.005	−0.027	0.033
Former composite series, 2018–2025	Rung 4	2512	0.0208	0.0383	−0.018	−0.037	0.003
FR11025 (2018–2021) spliced with FR11038 (2023–2025)	Rung 4	2363	0.0190	0.0274	−0.008	−0.030	0.014

(d) Lille Fives (FR11025): valid days and annual means. Daily means of the validated hourly EEA data, UTC days with at least 18 valid hours.

Year	Valid days NO_2	Valid days O_3	Valid days PM_{10}	Valid days $PM_{2.5}$	Mean NO_2 (µg m^{-3})	Mean O_3 (µg m^{-3})	Mean PM_{10} (µg m^{-3})	Mean $PM_{2.5}$ (µg m^{-3})
2018	329	325	326	310	28.8	44.9	21.5	16.6
2019	364	352	352	334	22.5	46.4	20.1	13.2
2020	341	314	304	314	17.4	48.8	16.8	11.9
2021	303	355	345	281	19.5	43.4	18.3	12.9

Table S3. Ten-city mean Pearson correlation matrix of the seven meteorological parameters and the four pollutants. Pooled daily levels, 2018–2025, lower triangle. Each coefficient is computed per city on complete daily pairs, then averaged over the ten cities. V, wind speed at 10 m. BLH, boundary-layer height. T, 2 m temperature. RH, 2 m relative humidity. P, surface pressure. TCC, total cloud cover. PR, precipitation. Wind direction, a circular variable, is not included. The pollutant × parameter block is the ten-city mean of Figure 2, and the wind–BLH coefficient (0.70) is the pooled mean of Figure 3b.

	NO_2	**O_3**	**PM_{10}**	**$PM_{2.5}$**	**V**	**BLH**	**T**	**RH**	**P**	**TCC**	**PR**
NO_2	1.00										
O_3	−0.56	1.00									
PM_{10}	0.49	−0.13	1.00								
$PM_{2.5}$	0.55	−0.30	0.88	1.00							
V	−0.40	0.20	−0.28	−0.34	1.00						
BLH	−0.58	0.55	−0.36	−0.48	0.70	1.00					
T	−0.41	0.60	−0.06	−0.26	−0.13	0.25	1.00				
RH	0.19	−0.59	−0.02	0.16	−0.09	−0.45	−0.44	1.00			
P	0.24	−0.16	0.27	0.29	−0.32	−0.30	−0.09	−0.05	1.00		
TCC	−0.09	−0.23	−0.21	−0.12	0.17	−0.03	−0.20	0.56	−0.30	1.00	
PR	−0.14	−0.02	−0.21	−0.18	0.25	0.10	−0.04	0.33	−0.38	0.39	1.00

Table S4. Linear versus generalized additive model comparison for the forty city × pollutant pairs. Pooled frame, seven predictors. R^2 linear and R^2 GAM are the explained variance of each model. EDF (total) is the summed effective degrees of freedom of the seven smooth terms of the generalized additive model (GAM): penalized regression splines with ten basis functions per predictor, the smoothing parameter being selected by generalized cross-validation over ten values from 1 to 10^6. Gain = R^2 GAM − R^2 linear. The GAM outperforms the linear model in all forty pairs, with a median gain of +0.089. Lille = Lille Fives, 2018–2021. Absolute GAM gains and EDF remain conditional on the smoothing specification.

City	Pollutant	n	R^2 linear	R^2 GAM	EDF (total)	Gain
Bordeaux	NO_2	2690	0.559	0.609	32.1	0.050
Lille	NO_2	1337	0.500	0.546	22.0	0.047
Lyon	NO_2	2919	0.400	0.484	34.0	0.084
Marseille	NO_2	2922	0.600	0.655	25.5	0.054
Montpellier	NO_2	2817	0.531	0.597	25.6	0.065
Nantes	NO_2	2889	0.551	0.626	32.3	0.075
Nice	NO_2	2879	0.325	0.388	24.2	0.063
Paris	NO_2	2922	0.486	0.562	33.2	0.076
Strasbourg	NO_2	2918	0.503	0.591	41.1	0.088
Toulouse	NO_2	2866	0.578	0.638	33.7	0.060
Bordeaux	O_3	2705	0.663	0.702	32.2	0.040
Lille	O_3	1346	0.648	0.727	30.0	0.079
Lyon	O_3	2914	0.764	0.799	34.0	0.035
Marseille	O_3	2816	0.568	0.661	25.2	0.092
Montpellier	O_3	2870	0.501	0.615	33.9	0.114
Nantes	O_3	2894	0.592	0.665	40.2	0.073
Nice	O_3	2885	0.523	0.578	39.9	0.056
Paris	O_3	2922	0.686	0.734	33.2	0.048
Strasbourg	O_3	2843	0.763	0.812	32.9	0.050
Toulouse	O_3	2903	0.620	0.688	33.7	0.068
Bordeaux	PM_{10}	2516	0.274	0.475	39.7	0.201
Lille	PM_{10}	1327	0.355	0.462	22.0	0.107
Lyon	PM_{10}	2922	0.265	0.460	42.1	0.195
Marseille	PM_{10}	2913	0.137	0.281	41.5	0.144
Montpellier	PM_{10}	2814	0.245	0.396	41.9	0.150
Nantes	PM_{10}	2886	0.219	0.358	40.2	0.140
Nice	PM_{10}	2865	0.135	0.216	32.1	0.081
Paris	PM_{10}	2916	0.374	0.470	33.3	0.096
Strasbourg	PM_{10}	2895	0.412	0.500	33.0	0.089
Toulouse	PM_{10}	2850	0.255	0.400	33.6	0.145
Bordeaux	$PM_{2.5}$	2510	0.381	0.601	39.6	0.220
Lille	$PM_{2.5}$	1239	0.372	0.450	21.7	0.078
Lyon	$PM_{2.5}$	2900	0.385	0.601	42.0	0.216
Marseille	$PM_{2.5}$	2889	0.279	0.461	33.5	0.182
Montpellier	$PM_{2.5}$	2754	0.294	0.467	41.8	0.173
Nantes	$PM_{2.5}$	2822	0.329	0.466	40.1	0.137
Nice	$PM_{2.5}$	2865	0.204	0.322	24.2	0.119
Paris	$PM_{2.5}$	2727	0.389	0.503	41.1	0.113
Strasbourg	$PM_{2.5}$	2903	0.423	0.535	41.1	0.112
Toulouse	$PM_{2.5}$	2838	0.335	0.527	33.8	0.192

Table S5. Unique contributions of wind and BLH in the generalized additive models. GAM unique contribution = R^2 of the full GAM minus R^2 of the GAM without that smooth. The full GAMs are those of Table S4. The reduced models keep the smoothing parameter λ of the full model. The last two columns of part (a) re-select λ for each reduced model (sensitivity). Four pollutants in the pooled frame and on rung 4, NO_2 on rung 3. Rung 3, deseasonalized anomalies. Rung 4, the same with the calendar-year means removed.

(a) Per city, pollutant and frame, with the linear sr^2 for comparison. The leading term is the same in 85 of the 90 comparisons. Montpellier $PM_{2.5}$ on rung 4 is a near tie in the GAM (0.026 against 0.026). Lille NO_2 on rung 4 is at parity in the linear model and led by BLH in the GAM.

City	Pollutant	Frame	n	R^2 linear	R^2 GAM	EDF (GAM)	λ (GCV)	Linear sr^2 wind	Linear sr^2 BLH	GAM unique wind	GAM unique BLH	Leading term, linear	Leading term, GAM	Same lead	GAM unique wind (λ re-selected)	GAM unique BLH (λ re-selected)
Marseille	NO_2	Pooled	2922	0.600	0.655	25.5	21.54	0.0881	0.0204	0.0860	0.0277	Wind	Wind	Yes	0.0860	0.0277
Toulouse	NO_2	Pooled	2866	0.578	0.638	33.7	4.64	0.0541	0.0464	0.0525	0.0516	Wind	Wind	Yes	0.0525	0.0516
Montpellier	NO_2	Pooled	2817	0.531	0.597	25.6	21.54	0.0182	0.0359	0.0183	0.0314	BLH	BLH	Yes	0.0183	0.0314
Bordeaux	NO_2	Pooled	2690	0.559	0.609	32.1	4.64	0.0008	0.0861	0.0082	0.0742	BLH	BLH	Yes	0.0082	0.0742
Lyon	NO_2	Pooled	2919	0.400	0.484	34.0	4.64	0.0065	0.0889	0.0118	0.1148	BLH	BLH	Yes	0.0118	0.1148
Strasbourg	NO_2	Pooled	2918	0.503	0.591	41.1	1.00	0.0002	0.0935	0.0029	0.1284	BLH	BLH	Yes	0.0029	0.1312
Nice	NO_2	Pooled	2879	0.325	0.388	24.2	21.54	0.0045	0.0630	0.0042	0.0548	BLH	BLH	Yes	0.0042	0.0548
Nantes	NO_2	Pooled	2889	0.551	0.626	32.3	4.64	0.0008	0.0950	0.0003	0.0959	BLH	BLH	Yes	−0.0024	0.0959
Lille	NO_2	Pooled	1337	0.500	0.546	22.0	21.54	0.0015	0.0405	0.0020	0.0589	BLH	BLH	Yes	−0.0045	0.0589
Paris	NO_2	Pooled	2922	0.486	0.562	33.2	4.64	0.0000	0.0978	0.0070	0.1116	BLH	BLH	Yes	0.0070	0.1116
Marseille	O_3	Pooled	2816	0.568	0.661	25.2	21.54	0.0066	0.0343	0.0264	0.0735	BLH	BLH	Yes	0.0264	0.0735
Toulouse	O_3	Pooled	2903	0.620	0.688	33.7	4.64	0.0556	0.0053	0.0453	0.0527	Wind	BLH	No	0.0453	0.0527
Montpellier	O_3	Pooled	2870	0.501	0.615	33.9	4.64	0.0048	0.0609	0.0211	0.1304	BLH	BLH	Yes	0.0182	0.1258
Bordeaux	O_3	Pooled	2705	0.663	0.702	32.2	4.64	0.0011	0.0686	0.0033	0.0815	BLH	BLH	Yes	0.0033	0.0782
Lyon	O_3	Pooled	2914	0.764	0.799	34.0	4.64	0.0012	0.0131	0.0072	0.0369	BLH	BLH	Yes	0.0072	0.0369
Strasbourg	O_3	Pooled	2843	0.763	0.812	32.9	4.64	0.0017	0.0329	0.0051	0.0585	BLH	BLH	Yes	0.0051	0.0585
Nice	O_3	Pooled	2885	0.523	0.578	39.9	1.00	0.0023	0.0473	0.0092	0.0741	BLH	BLH	Yes	0.0092	0.0768
Nantes	O_3	Pooled	2894	0.592	0.665	40.2	1.00	0.0013	0.0424	0.0068	0.0580	BLH	BLH	Yes	0.0068	0.0580
Lille	O_3	Pooled	1346	0.648	0.727	30.0	4.64	0.0004	0.0079	0.0111	0.0441	BLH	BLH	Yes	0.0111	0.0441
Paris	O_3	Pooled	2922	0.686	0.734	33.2	4.64	0.0046	0.0390	0.0147	0.0641	BLH	BLH	Yes	0.0128	0.0617
Marseille	PM_{10}	Pooled	2913	0.137	0.281	41.5	1.00	0.0002	0.0171	0.0158	0.0227	BLH	BLH	Yes	0.0195	0.0227
Toulouse	PM_{10}	Pooled	2850	0.255	0.400	33.6	4.64	0.0036	0.0981	0.0107	0.1105	BLH	BLH	Yes	0.0107	0.1105
Montpellier	PM_{10}	Pooled	2814	0.245	0.396	41.9	1.00	0.0005	0.0139	0.0233	0.0200	BLH	Wind	No	0.0233	0.0200
Bordeaux	PM_{10}	Pooled	2516	0.274	0.475	39.7	1.00	0.0021	0.0557	0.0067	0.1106	BLH	BLH	Yes	0.0067	0.1106
Lyon	PM_{10}	Pooled	2922	0.265	0.460	42.1	1.00	0.0018	0.0817	0.0084	0.1523	BLH	BLH	Yes	0.0084	0.1523
Strasbourg	PM_{10}	Pooled	2895	0.412	0.500	33.0	4.64	0.0020	0.0680	0.0007	0.0979	BLH	BLH	Yes	0.0007	0.0936
Nice	PM_{10}	Pooled	2865	0.135	0.216	32.1	4.64	0.0182	0.0288	0.0291	0.0415	BLH	BLH	Yes	0.0334	0.0415
Nantes	PM_{10}	Pooled	2886	0.219	0.358	40.2	1.00	0.0405	0.0951	0.0322	0.1236	BLH	BLH	Yes	0.0322	0.1285
Lille	PM_{10}	Pooled	1327	0.355	0.462	22.0	21.54	0.0017	0.0794	0.0039	0.1029	BLH	BLH	Yes	−0.0043	0.0927
Paris	PM_{10}	Pooled	2916	0.374	0.470	33.3	4.64	0.0012	0.0687	0.0032	0.1019	BLH	BLH	Yes	−0.0005	0.1019
Marseille	$PM_{2.5}$	Pooled	2889	0.279	0.461	33.5	4.64	0.0107	0.0186	0.0172	0.0183	BLH	BLH	Yes	0.0172	0.0183
Toulouse	$PM_{2.5}$	Pooled	2838	0.335	0.527	33.8	4.64	0.0018	0.0705	0.0009	0.0952	BLH	BLH	Yes	0.0009	0.0952
Montpellier	$PM_{2.5}$	Pooled	2754	0.294	0.467	41.8	1.00	0.0025	0.0113	0.0095	0.0287	BLH	BLH	Yes	0.0095	0.0287
Bordeaux	$PM_{2.5}$	Pooled	2510	0.381	0.601	39.6	1.00	0.0002	0.0428	0.0037	0.1194	BLH	BLH	Yes	0.0037	0.1194

City	Pollutant	Frame	n	R^2 linear	R^2 GAM	EDF (GAM)	λ (GCV)	Linear sr^2 wind	Linear sr^2 BLH	GAM unique wind	GAM unique BLH	Leading term, linear	Leading term, GAM	Same lead	GAM unique wind (λ re-selected)	GAM unique BLH (λ re-selected)
Lyon	$PM_{2.5}$	Pooled	2900	0.385	0.601	42.0	1.00	0.0008	0.0479	0.0019	0.1312	BLH	BLH	Yes	0.0019	0.1312
Strasbourg	$PM_{2.5}$	Pooled	2903	0.423	0.535	41.1	1.00	0.0122	0.0312	0.0043	0.0560	BLH	BLH	Yes	0.0043	0.0560
Nice	$PM_{2.5}$	Pooled	2865	0.204	0.322	24.2	21.54	0.0022	0.0210	0.0095	0.0326	BLH	BLH	Yes	0.0095	0.0274
Nantes	$PM_{2.5}$	Pooled	2822	0.329	0.466	40.1	1.00	0.0165	0.0913	0.0143	0.1127	BLH	BLH	Yes	0.0143	0.1171
Lille	$PM_{2.5}$	Pooled	1239	0.372	0.450	21.7	21.54	0.0001	0.0711	0.0068	0.0728	BLH	BLH	Yes	0.0068	0.0625
Paris	$PM_{2.5}$	Pooled	2727	0.389	0.503	41.1	1.00	0.0001	0.0551	0.0007	0.0820	BLH	BLH	Yes	0.0007	0.0856
Marseille	NO_2	Rung 4	2922	0.632	0.687	23.5	21.54	0.0982	0.0140	0.0893	0.0266	Wind	Wind	Yes	0.0893	0.0266
Toulouse	NO_2	Rung 4	2866	0.524	0.568	24.3	21.54	0.0986	0.0324	0.1055	0.0343	Wind	Wind	Yes	0.1014	0.0343
Montpellier	NO_2	Rung 4	2817	0.472	0.511	24.3	21.54	0.0444	0.0246	0.0524	0.0262	Wind	Wind	Yes	0.0486	0.0262
Bordeaux	NO_2	Rung 4	2690	0.482	0.504	23.1	21.54	0.0293	0.0365	0.0342	0.0397	BLH	BLH	Yes	0.0342	0.0397
Lyon	NO_2	Rung 4	2919	0.410	0.442	24.3	21.54	0.0380	0.0470	0.0385	0.0646	BLH	BLH	Yes	0.0385	0.0666
Strasbourg	NO_2	Rung 4	2918	0.458	0.493	23.9	21.54	0.0221	0.0501	0.0193	0.0712	BLH	BLH	Yes	0.0152	0.0744
Nice	NO_2	Rung 4	2879	0.270	0.306	23.1	21.54	0.0140	0.0594	0.0228	0.0436	BLH	BLH	Yes	0.0228	0.0436
Nantes	NO_2	Rung 4	2889	0.482	0.529	31.6	4.64	0.0084	0.0774	0.0080	0.0850	BLH	BLH	Yes	0.0080	0.0850
Lille	NO_2	Rung 4	1337	0.502	0.552	21.0	21.54	0.0244	0.0198	0.0185	0.0363	Wind	BLH	No	0.0116	0.0363
Paris	NO_2	Rung 4	2922	0.533	0.593	32.1	4.64	0.0161	0.0575	0.0190	0.0713	BLH	BLH	Yes	0.0190	0.0736
Marseille	O_3	Rung 4	2816	0.317	0.356	23.3	21.54	0.0001	0.0228	0.0082	0.0448	BLH	BLH	Yes	0.0082	0.0400
Toulouse	O_3	Rung 4	2903	0.524	0.555	32.5	4.64	0.0816	0.0058	0.0787	0.0161	Wind	Wind	Yes	0.0787	0.0161
Montpellier	O_3	Rung 4	2870	0.302	0.335	32.3	4.64	0.0126	0.0089	0.0232	0.0160	Wind	Wind	Yes	0.0232	0.0160
Bordeaux	O_3	Rung 4	2705	0.528	0.548	23.2	21.54	0.0003	0.0659	0.0009	0.0600	BLH	BLH	Yes	−0.0025	0.0559
Lyon	O_3	Rung 4	2914	0.584	0.595	24.2	21.54	0.0140	0.0091	0.0170	0.0148	Wind	Wind	Yes	0.0192	0.0189
Strasbourg	O_3	Rung 4	2843	0.607	0.630	23.8	21.54	0.0006	0.0340	0.0012	0.0410	BLH	BLH	Yes	−0.0015	0.0410
Nice	O_3	Rung 4	2885	0.224	0.274	30.8	4.64	0.0003	0.0418	0.0159	0.0465	BLH	BLH	Yes	0.0159	0.0514
Nantes	O_3	Rung 4	2894	0.578	0.599	23.6	21.54	0.0030	0.0659	0.0025	0.0637	BLH	BLH	Yes	0.0025	0.0637
Lille	O_3	Rung 4	1346	0.535	0.581	29.0	4.64	0.0000	0.0092	0.0013	0.0290	BLH	BLH	Yes	0.0013	0.0378
Paris	O_3	Rung 4	2922	0.550	0.574	24.0	21.54	0.0026	0.0545	0.0039	0.0543	BLH	BLH	Yes	0.0039	0.0543
Marseille	PM_{10}	Rung 4	2913	0.135	0.225	23.5	21.54	0.0000	0.0186	0.0135	0.0267	BLH	BLH	Yes	0.0135	0.0267
Toulouse	PM_{10}	Rung 4	2850	0.262	0.324	24.3	21.54	0.0003	0.0636	0.0057	0.0530	BLH	BLH	Yes	0.0005	0.0477
Montpellier	PM_{10}	Rung 4	2814	0.269	0.340	32.3	4.64	0.0016	0.0214	0.0254	0.0275	BLH	BLH	Yes	0.0295	0.0321
Bordeaux	PM_{10}	Rung 4	2516	0.226	0.346	30.6	4.64	0.0010	0.0238	0.0131	0.0504	BLH	BLH	Yes	0.0131	0.0504
Lyon	PM_{10}	Rung 4	2922	0.245	0.343	32.4	4.64	0.0000	0.0527	0.0074	0.0612	BLH	BLH	Yes	0.0116	0.0612
Strasbourg	PM_{10}	Rung 4	2895	0.421	0.482	23.9	21.54	0.0045	0.0469	0.0092	0.0488	BLH	BLH	Yes	0.0055	0.0488
Nice	PM_{10}	Rung 4	2865	0.191	0.217	23.1	21.54	0.0026	0.0060	0.0074	0.0113	BLH	BLH	Yes	0.0107	0.0156
Nantes	PM_{10}	Rung 4	2886	0.205	0.305	31.5	4.64	0.0127	0.0622	0.0164	0.0840	BLH	BLH	Yes	0.0164	0.0840
Lille	PM_{10}	Rung 4	1327	0.372	0.492	21.0	21.54	0.0005	0.0626	0.0068	0.0694	BLH	BLH	Yes	0.0068	0.0606
Paris	PM_{10}	Rung 4	2916	0.368	0.452	32.3	4.64	0.0000	0.0524	0.0073	0.0664	BLH	BLH	Yes	0.0027	0.0664
Marseille	$PM_{2.5}$	Rung 4	2889	0.276	0.362	23.5	21.54	0.0068	0.0186	0.0170	0.0263	BLH	BLH	Yes	0.0121	0.0263
Toulouse	$PM_{2.5}$	Rung 4	2838	0.292	0.364	32.5	4.64	0.0012	0.0676	0.0073	0.0538	BLH	BLH	Yes	0.0073	0.0538
Montpellier	$PM_{2.5}$	Rung 4	2754	0.285	0.354	32.2	4.64	0.0007	0.0163	0.0263	0.0257	BLH	Wind	No	0.0302	0.0302
Bordeaux	$PM_{2.5}$	Rung 4	2510	0.279	0.404	30.6	4.64	0.0015	0.0334	0.0153	0.0613	BLH	BLH	Yes	0.0153	0.0613
Lyon	$PM_{2.5}$	Rung 4	2900	0.289	0.386	32.3	4.64	0.0010	0.0453	0.0122	0.0514	BLH	BLH	Yes	0.0122	0.0514

City	Pollutant	Frame	n	R^2 linear	R^2 GAM	EDF (GAM)	λ (GCV)	Linear sr^2 wind	Linear sr^2 BLH	GAM unique wind	GAM unique BLH	Leading term, linear	Leading term, GAM	Same lead	GAM unique wind (λ re-selected)	GAM unique BLH (λ re-selected)
Strasbourg	$PM_{2.5}$	Rung 4	2903	0.397	0.471	32.0	4.64	0.0095	0.0299	0.0178	0.0299	BLH	BLH	Yes	0.0178	0.0299
Nice	$PM_{2.5}$	Rung 4	2865	0.262	0.296	23.1	21.54	0.0008	0.0034	0.0057	0.0082	BLH	BLH	Yes	0.0057	0.0082
Nantes	$PM_{2.5}$	Rung 4	2822	0.252	0.353	31.4	4.64	0.0128	0.0916	0.0159	0.1006	BLH	BLH	Yes	0.0159	0.1006
Lille	$PM_{2.5}$	Rung 4	1239	0.379	0.486	28.6	4.64	0.0000	0.0601	0.0111	0.0603	BLH	BLH	Yes	0.0182	0.0673
Paris	$PM_{2.5}$	Rung 4	2727	0.354	0.441	32.0	4.64	0.0000	0.0555	0.0081	0.0633	BLH	BLH	Yes	0.0031	0.0633
Marseille	NO_2	Rung 3	2922	0.603	0.652	23.6	21.54	0.1083	0.0105	0.1013	0.0189	Wind	Wind	Yes	0.1013	0.0189
Toulouse	NO_2	Rung 3	2866	0.482	0.520	24.3	21.54	0.0970	0.0257	0.1024	0.0259	Wind	Wind	Yes	0.0982	0.0259
Montpellier	NO_2	Rung 3	2817	0.410	0.448	24.5	21.54	0.0425	0.0216	0.0511	0.0222	Wind	Wind	Yes	0.0511	0.0222
Bordeaux	NO_2	Rung 3	2690	0.451	0.465	16.5	100.00	0.0325	0.0285	0.0367	0.0315	Wind	Wind	Yes	0.0367	0.0279
Lyon	NO_2	Rung 3	2919	0.341	0.369	24.5	21.54	0.0407	0.0355	0.0405	0.0499	Wind	BLH	No	0.0405	0.0522
Strasbourg	NO_2	Rung 3	2918	0.436	0.467	24.3	21.54	0.0258	0.0425	0.0233	0.0571	BLH	BLH	Yes	0.0192	0.0603
Nice	NO_2	Rung 3	2879	0.191	0.227	23.2	21.54	0.0075	0.0498	0.0156	0.0388	BLH	BLH	Yes	0.0101	0.0327
Nantes	NO_2	Rung 3	2889	0.433	0.468	23.5	21.54	0.0098	0.0628	0.0109	0.0681	BLH	BLH	Yes	0.0069	0.0681
Lille	NO_2	Rung 3	1337	0.419	0.467	21.3	21.54	0.0165	0.0230	0.0125	0.0369	BLH	BLH	Yes	0.0125	0.0369
Paris	NO_2	Rung 3	2922	0.452	0.493	23.9	21.54	0.0143	0.0472	0.0163	0.0570	BLH	BLH	Yes	0.0123	0.0570

(b) Ten-city means. Ratio = BLH/wind. Spearman = rank correlation across the ten cities of (BLH − wind), linear against GAM.

Frame	Pollutant	Linear wind	Linear BLH	Linear ratio	GAM wind	GAM BLH	GAM ratio	Cities with same lead (of 10)	Spearman of the balance
Pooled	NO_2	0.0175	0.0667	3.8	0.0193	0.0749	3.9	10	0.90
Pooled	O_3	0.0080	0.0352	4.4	0.0150	0.0674	4.5	9	0.94
Pooled	PM_{10}	0.0072	0.0606	8.4	0.0134	0.0884	6.6	9	0.76
Pooled	$PM_{2.5}$	0.0047	0.0461	9.8	0.0069	0.0749	10.9	10	0.67
Rung 3	NO_2	0.0395	0.0347	0.9	0.0411	0.0406	1.0	9	0.92
Rung 4	NO_2	0.0394	0.0419	1.1	0.0408	0.0499	1.2	9	0.90
Rung 4	O_3	0.0115	0.0318	2.8	0.0153	0.0386	2.5	10	0.94
Rung 4	PM_{10}	0.0023	0.0410	17.7	0.0112	0.0499	4.4	10	0.76
Rung 4	$PM_{2.5}$	0.0034	0.0422	12.2	0.0137	0.0481	3.5	9	0.90

Table S6. Significance of the wind and BLH terms, classical F-test and HAC Wald test. Seven-predictor model, standardized predictors. $F = (n - 8)\, sr^2/(1 - R^2)$, equal to the squared OLS t-statistic. W = squared ratio of the coefficient to its Newey–West (Bartlett kernel) standard error, compared with a χ^2 distribution with one degree of freedom. The truncation lag is selected for each model by the automatic procedure of Newey and West (1994), with a preliminary bandwidth of 4(n/100)^(2/9) rounded down (8 days, 6 to 7 at Lille). Variance ratio = HAC variance/OLS variance of the coefficient. Rung 3, deseasonalized anomalies. Rung 4, the same with the calendar-year means removed.

(a) Per city, pollutant, frame and term.

City	Pollutant	Frame	Term	n	sr^2	Lag (days)	F (classical)	p (F)	W (HAC)	p (HAC)	Variance ratio
Marseille	NO_2	Pooled	Wind	2922	0.0881	23	641.8	3.8×10^{-128}	238.5	8.2×10^{-54}	2.69
Marseille	NO_2	Pooled	BLH	2922	0.0204	23	149.0	1.9×10^{-33}	76.9	1.8×10^{-18}	1.94
Toulouse	NO_2	Pooled	Wind	2866	0.0541	17	365.9	7.5×10^{-77}	254.6	2.6×10^{-57}	1.44
Toulouse	NO_2	Pooled	BLH	2866	0.0464	17	314.0	9.4×10^{-67}	216.3	5.9×10^{-49}	1.45
Montpellier	NO_2	Pooled	Wind	2817	0.0182	20	108.9	4.8×10^{-25}	36.2	1.8×10^{-9}	3.01
Montpellier	NO_2	Pooled	BLH	2817	0.0359	20	215.3	5.0×10^{-47}	94.6	2.3×10^{-22}	2.28
Bordeaux	NO_2	Pooled	Wind	2690	0.0008	20	4.9	0.028	2.5	0.112	1.92
Bordeaux	NO_2	Pooled	BLH	2690	0.0861	20	524.0	4.4×10^{-116}	200.3	1.8×10^{-45}	2.62
Lyon	NO_2	Pooled	Wind	2919	0.0065	29	31.8	1.9×10^{-8}	21.1	4.3×10^{-6}	1.50
Lyon	NO_2	Pooled	BLH	2919	0.0889	29	431.5	1.7×10^{-89}	157.9	3.3×10^{-36}	2.73
Strasbourg	NO_2	Pooled	Wind	2918	0.0002	27	0.9	0.346	0.3	0.573	2.80
Strasbourg	NO_2	Pooled	BLH	2918	0.0935	27	547.7	4.0×10^{-111}	138.0	7.5×10^{-32}	3.97
Nice	NO_2	Pooled	Wind	2879	0.0045	23	19.1	1.3×10^{-5}	9.3	0.002	2.04
Nice	NO_2	Pooled	BLH	2879	0.0630	23	267.8	1.3×10^{-57}	142.5	7.7×10^{-33}	1.88
Nantes	NO_2	Pooled	Wind	2889	0.0008	23	5.0	0.025	2.3	0.128	2.18
Nantes	NO_2	Pooled	BLH	2889	0.0950	23	609.6	2.9×10^{-122}	208.1	3.5×10^{-47}	2.93
Lille	NO_2	Pooled	Wind	1337	0.0015	20	4.1	0.044	1.5	0.222	2.73
Lille	NO_2	Pooled	BLH	1337	0.0405	20	107.5	2.9×10^{-24}	35.6	2.4×10^{-9}	3.02
Paris	NO_2	Pooled	Wind	2922	0.0000	29	0.1	0.727	0.0	0.852	3.52
Paris	NO_2	Pooled	BLH	2922	0.0978	29	554.1	2.6×10^{-112}	124.5	6.5×10^{-29}	4.45
Marseille	O_3	Pooled	Wind	2816	0.0066	21	43.0	6.5×10^{-11}	15.5	8.1×10^{-5}	2.77
Marseille	O_3	Pooled	BLH	2816	0.0343	21	223.5	1.1×10^{-48}	93.5	4.2×10^{-22}	2.39
Toulouse	O_3	Pooled	Wind	2903	0.0556	20	423.1	7.4×10^{-88}	206.3	8.9×10^{-47}	2.05
Toulouse	O_3	Pooled	BLH	2903	0.0053	20	40.1	2.7×10^{-10}	15.2	9.7×10^{-5}	2.64
Montpellier	O_3	Pooled	Wind	2870	0.0048	24	27.6	1.6×10^{-7}	11.1	8.7×10^{-4}	2.49
Montpellier	O_3	Pooled	BLH	2870	0.0609	24	349.1	1.4×10^{-76}	142.5	7.4×10^{-33}	2.45
Bordeaux	O_3	Pooled	Wind	2705	0.0011	21	9.2	0.002	3.8	0.051	2.40
Bordeaux	O_3	Pooled	BLH	2705	0.0686	21	548.9	1.2×10^{-110}	168.4	1.6×10^{-39}	3.26
Lyon	O_3	Pooled	Wind	2914	0.0012	22	15.3	9.3×10^{-5}	6.6	0.010	2.32
Lyon	O_3	Pooled	BLH	2914	0.0131	22	162.1	3.6×10^{-36}	49.7	1.8×10^{-12}	3.26
Strasbourg	O_3	Pooled	Wind	2843	0.0017	25	20.5	6.3×10^{-6}	5.0	0.026	4.11
Strasbourg	O_3	Pooled	BLH	2843	0.0329	25	393.8	3.6×10^{-82}	68.5	1.3×10^{-16}	5.75
Nice	O_3	Pooled	Wind	2885	0.0023	25	14.1	1.8×10^{-4}	8.1	0.005	1.74
Nice	O_3	Pooled	BLH	2885	0.0473	25	285.1	4.6×10^{-61}	109.0	1.6×10^{-25}	2.62
Nantes	O_3	Pooled	Wind	2894	0.0013	28	8.8	0.003	3.1	0.078	2.86
Nantes	O_3	Pooled	BLH	2894	0.0424	28	299.8	5.6×10^{-64}	75.6	3.6×10^{-18}	3.97
Lille	O_3	Pooled	Wind	1346	0.0004	19	1.5	0.226	0.5	0.459	2.68
Lille	O_3	Pooled	BLH	1346	0.0079	19	30.2	4.7×10^{-8}	7.2	0.007	4.21
Paris	O_3	Pooled	Wind	2922	0.0046	27	42.3	9.0×10^{-11}	10.8	0.001	3.93
Paris	O_3	Pooled	BLH	2922	0.0390	27	362.2	3.3×10^{-76}	66.1	4.3×10^{-16}	5.48
Marseille	PM_{10}	Pooled	Wind	2913	0.0002	19	0.7	0.414	0.2	0.645	3.15
Marseille	PM_{10}	Pooled	BLH	2913	0.0171	19	57.5	4.6×10^{-14}	25.0	5.6×10^{-7}	2.30
Toulouse	PM_{10}	Pooled	Wind	2850	0.0036	22	13.8	2.1×10^{-4}	5.3	0.021	2.59
Toulouse	PM_{10}	Pooled	BLH	2850	0.0981	22	374.1	2.1×10^{-78}	177.2	2.0×10^{-40}	2.11
Montpellier	PM_{10}	Pooled	Wind	2814	0.0005	16	1.8	0.182	0.4	0.513	4.16
Montpellier	PM_{10}	Pooled	BLH	2814	0.0139	16	51.9	7.6×10^{-10}	29.3	6.3×10^{-8}	1.77
Bordeaux	PM_{10}	Pooled	Wind	2516	0.0021	21	7.4	0.007	3.6	0.059	2.07
Bordeaux	PM_{10}	Pooled	BLH	2516	0.0557	21	192.5	3.2×10^{-42}	81.4	1.8×10^{-19}	2.36
Lyon	PM_{10}	Pooled	Wind	2922	0.0018	25	7.1	0.008	3.6	0.059	1.99
Lyon	PM_{10}	Pooled	BLH	2922	0.0817	25	323.8	9.7×10^{-69}	148.0	4.9×10^{-35}	2.19
Strasbourg	PM_{10}	Pooled	Wind	2895	0.0020	15	9.7	0.002	3.9	0.048	2.49
Strasbourg	PM_{10}	Pooled	BLH	2895	0.0680	15	333.8	1.2×10^{-76}	118.6	1.3×10^{-27}	2.81

City	Pollutant	Frame	Term	n	sr^2	Lag (days)	F (classical)	p (F)	W (HAC)	p (HAC)	Variance ratio
Nice	PM_{10}	Pooled	Wind	2865	0.0182	20	60.0	1.3×10^{-14}	15.5	8.1×10^{-5}	3.86
Nice	PM_{10}	Pooled	BLH	2865	0.0288	20	95.0	4.2×10^{-22}	26.8	2.3×10^{-7}	3.55
Nantes	PM_{10}	Pooled	Wind	2886	0.0405	24	149.1	$1.8 \times 10^{-$illegible$}$	74.9	5.0×10^{-18}	1.99
Nantes	PM_{10}	Pooled	BLH	2886	0.0951	24	350.4	7.0×10^{-74}	129.6	$5.0 \times 10^{-$illegible$}$	2.70
Lille	PM_{10}	Pooled	Wind	1327	0.0017	16	3.5	0.063	2.0	0.156	1.72
Lille	PM_{10}	Pooled	BLH	1327	0.0794	16	162.3	$3.8 \times 10^{-$illegible$}$	92.7	6.0×10^{-22}	1.75
Paris	PM_{10}	Pooled	Wind	2916	0.0012	21	5.8	0.016	2.6	0.105	2.19
Paris	PM_{10}	Pooled	BLH	2916	0.0687	21	319.2	8.1×10^{-68}	142.3	$8.6 \times 10^{-$illegible$}$	2.24
Marseille	$PM_{2.5}$	Pooled	Wind	2889	0.0107	21	42.6	7.8×10^{-11}	15.7	7.3×10^{-5}	2.71
Marseille	$PM_{2.5}$	Pooled	BLH	2889	0.0186	21	74.2	1.1×10^{-17}	35.7	2.3×10^{-9}	2.08
Toulouse	$PM_{2.5}$	Pooled	Wind	2838	0.0018	24	7.8	0.005	4.9	0.028	1.61
Toulouse	$PM_{2.5}$	Pooled	BLH	2838	0.0705	24	300.2	5.4×10^{-64}	242.2	1.3×10^{-54}	1.24
Montpellier	$PM_{2.5}$	Pooled	Wind	2754	0.0025	16	9.7	0.002	3.1	0.078	3.11
Montpellier	$PM_{2.5}$	Pooled	BLH	2754	0.0113	16	43.9	4.2×10^{-11}	24.3	8.1×10^{-7}	1.80
Bordeaux	$PM_{2.5}$	Pooled	Wind	2510	0.0002	21	0.7	0.399	0.3	0.566	2.16
Bordeaux	$PM_{2.5}$	Pooled	BLH	2510	0.0428	21	172.9	$3.0 \times 10^{-$illegible$}$	79.7	4.4×10^{-19}	2.17
Lyon	$PM_{2.5}$	Pooled	Wind	2900	0.0008	25	3.7	0.053	2.2	0.138	1.70
Lyon	$PM_{2.5}$	Pooled	BLH	2900	0.0479	25	225.2	4.5×10^{-49}	124.9	5.4×10^{-29}	1.80
Strasbourg	$PM_{2.5}$	Pooled	Wind	2903	0.0122	15	61.3	7.0×10^{-15}	29.0	7.4×10^{-8}	2.12
Strasbourg	$PM_{2.5}$	Pooled	BLH	2903	0.0312	15	156.8	$4.5 \times 10^{-$illegible$}$	88.6	4.8×10^{-21}	1.77
Nice	$PM_{2.5}$	Pooled	Wind	2865	0.0022	25	7.9	0.005	2.8	0.095	2.84
Nice	$PM_{2.5}$	Pooled	BLH	2865	0.0210	25	75.5	6.0×10^{-18}	18.8	1.4×10^{-5}	4.01
Nantes	$PM_{2.5}$	Pooled	Wind	2822	0.0165	25	69.2	1.4×10^{-16}	34.4	4.5×10^{-9}	2.01
Nantes	$PM_{2.5}$	Pooled	BLH	2822	0.0913	25	382.8	5.1×10^{-8}illegible	147.6	$5.7 \times 10^{-$illegible$}$	2.59
Lille	$PM_{2.5}$	Pooled	Wind	1239	0.0001	9	0.3	0.617	0.2	0.680	1.48
Lille	$PM_{2.5}$	Pooled	BLH	1239	0.0711	9	139.4	$1.5 \times 10^{-$illegible$}$	106.7	5.2×10^{-25}	1.31
Paris	$PM_{2.5}$	Pooled	Wind	2727	0.0002	19	0.7	0.413	0.3	0.572	2.10
Paris	$PM_{2.5}$	Pooled	BLH	2727	0.0551	19	245.1	5.9×10^{-5}illegible	117.4	2.3×10^{-27}	2.09
Marseille	NO_2	Rung 3	Wind	2922	0.1083	20	795.8	5.3×10^{-155}	438.4	2.4×10^{-97}	1.82
Marseille	NO_2	Rung 3	BLH	2922	0.0105	20	77.0	2.8×10^{-18}	47.3	6.2×10^{-12}	1.63
Toulouse	NO_2	Rung 3	Wind	2866	0.0970	19	535.6	9.5×10^{-1}illegible	257.6	5.8×10^{-58}	2.08
Toulouse	NO_2	Rung 3	BLH	2866	0.0257	19	141.6	$6.5 \times 10^{-$illegible$}$	105.6	8.9×10^{-25}	1.34
Montpellier	NO_2	Rung 3	Wind	2817	0.0425	21	202.4	2.1×10^{-44}	126.7	2.1×10^{-29}	1.60
Montpellier	NO_2	Rung 3	BLH	2817	0.0216	21	102.8	9.3×10^{-24}	84.0	4.9×10^{-2}illegible	1.22
Bordeaux	NO_2	Rung 3	Wind	2690	0.0325	15	158.4	$2.4 \times 10^{-$illegible$}$	107.8	3.0×10^{-25}	1.47
Bordeaux	NO_2	Rung 3	BLH	2690	0.0285	15	139.2	$2.4 \times 10^{-$illegible$}$	83.6	6.0×10^{-2}illegible	1.66
Lyon	NO_2	Rung 3	Wind	2919	0.0407	24	179.7	8.5×10^{-4}illegible	129.6	$5.0 \times 10^{-$illegible$}$	1.39
Lyon	NO_2	Rung 3	BLH	2919	0.0355	24	156.6	$5.0 \times 10^{-$illegible$}$	86.8	1.2×10^{-2}illegible	1.80
Strasbourg	NO_2	Rung 3	Wind	2918	0.0258	23	133.0	$4.0 \times 10^{-$illegible$}$	66.3	3.8×10^{-16}	2.01
Strasbourg	NO_2	Rung 3	BLH	2918	0.0425	23	219.4	6.5×10^{-48}	96.2	1.1×10^{-22}	2.28
Nice	NO_2	Rung 3	Wind	2879	0.0075	11	26.5	2.8×10^{-7}	12.2	4.8×10^{-4}	2.17
Nice	NO_2	Rung 3	BLH	2879	0.0498	11	176.8	$3.4 \times 10^{-$illegible$}$	89.4	3.3×10^{-21}	1.98
Nantes	NO_2	Rung 3	Wind	2889	0.0098	22	49.9	2.0×10^{-12}	27.3	1.7×10^{-7}	1.83
Nantes	NO_2	Rung 3	BLH	2889	0.0628	22	318.9	9.8×10^{-68}	162.7	$2.9 \times 10^{-$illegible$}$	1.96
Lille	NO_2	Rung 3	Wind	1337	0.0165	19	37.7	1.1×10^{-9}	18.3	1.9×10^{-5}	2.06
Lille	NO_2	Rung 3	BLH	1337	0.0230	19	52.7	6.7×10^{-1}illegible	22.9	1.7×10^{-6}	2.29
Paris	NO_2	Rung 3	Wind	2922	0.0143	25	76.3	4.0×10^{-18}	32.7	1.1×10^{-8}	2.34
Paris	NO_2	Rung 3	BLH	2922	0.0472	25	251.2	2.5×10^{-54}	100.2	1.4×10^{-2}illegible	2.51
Marseille	O_3	Rung 3	Wind	2816	0.0003	21	1.1	0.294	0.6	0.436	1.82
Marseille	O_3	Rung 3	BLH	2816	0.0217	21	88.2	1.2×10^{-2}illegible	44.4	2.6×10^{-11}	1.98
Toulouse	O_3	Rung 3	Wind	2903	0.0848	16	495.0	2.3×10^{-1}illegible	354.7	4.0×10^{-79}	1.40
Toulouse	O_3	Rung 3	BLH	2903	0.0046	16	26.7	2.5×10^{-7}	20.9	4.7×10^{-6}	1.28
Montpellier	O_3	Rung 3	Wind	2870	0.0126	25	51.0	1.2×10^{-12}	26.4	2.8×10^{-7}	1.93
Montpellier	O_3	Rung 3	BLH	2870	0.0090	25	36.6	1.6×10^{-9}	23.0	1.7×10^{-6}	1.59
Bordeaux	O_3	Rung 3	Wind	2705	0.0004	21	2.0	0.155	1.6	0.211	1.29
Bordeaux	O_3	Rung 3	BLH	2705	0.0644	21	365.9	1.4×10^{-76}	228.1	1.5×10^{-51}	1.60
Lyon	O_3	Rung 3	Wind	2914	0.0142	23	98.7	6.9×10^{-2}illegible	68.3	1.4×10^{-16}	1.44
Lyon	O_3	Rung 3	BLH	2914	0.0087	23	60.1	1.2×10^{-14}	33.1	8.9×10^{-9}	1.82
Strasbourg	O_3	Rung 3	Wind	2843	0.0007	23	5.0	0.025	2.8	0.092	1.76
Strasbourg	O_3	Rung 3	BLH	2843	0.0327	23	237.0	2.0×10^{-51}	76.0	2.8×10^{-18}	3.12
Nice	O_3	Rung 3	Wind	2885	0.0001	16	0.2	0.631	0.1	0.739	2.08
Nice	O_3	Rung 3	BLH	2885	0.0421	16	158.4	$2.2 \times 10^{-$illegible$}$	77.2	1.5×10^{-18}	2.05

City	Pollutant	Frame	Term	n	sr^2	Lag (days)	F (classical)	p (F)	W (HAC)	p (HAC)	Variance ratio
Nantes	O_3	Rung 3	Wind	2894	0.0030	24	19.8	8.8×10^{-6}	13.0	3.2×10^{-4}	1.53
Nantes	O_3	Rung 3	BLH	2894	0.0647	24	434.2	6.1×10^{-96}	183.1	1.0×10^{-41}	2.37
Lille	O_3	Rung 3	Wind	1346	0.0000	18	0.0	0.824	0.0	0.882	2.25
Lille	O_3	Rung 3	BLH	1346	0.0098	18	28.4	1.2×10^{-7}	10.3	0.001	2.76
Paris	O_3	Rung 3	Wind	2922	0.0022	27	13.7	2.2×10^{-4}	6.4	0.011	2.14
Paris	O_3	Rung 3	BLH	2922	0.0531	27	330.2	5.6×10^{-76}	114.9	8.1×10^{-27}	2.87
Marseille	PM_{10}	Rung 3	Wind	2913	0.0001	21	0.4	0.517	0.2	0.670	2.32
Marseille	PM_{10}	Rung 3	BLH	2913	0.0166	21	55.8	1.1×10^{-16}	26.6	2.5×10^{-7}	2.10
Toulouse	PM_{10}	Rung 3	Wind	2850	0.0002	27	1.0	0.328	0.6	0.448	1.66
Toulouse	PM_{10}	Rung 3	BLH	2850	0.0607	27	232.8	1.4×10^{-56}	123.7	1.0×10^{-28}	1.88
Montpellier	PM_{10}	Rung 3	Wind	2814	0.0018	18	7.1	0.008	1.7	0.188	4.09
Montpellier	PM_{10}	Rung 3	BLH	2814	0.0219	18	84.0	9.5×10^{-26}	41.6	1.1×10^{-16}	2.02
Bordeaux	PM_{10}	Rung 3	Wind	2516	0.0013	21	4.3	0.039	3.2	0.072	1.32
Bordeaux	PM_{10}	Rung 3	BLH	2516	0.0216	21	70.0	9.8×10^{-17}	36.4	1.6×10^{-9}	1.92
Lyon	PM_{10}	Rung 3	Wind	2922	0.0000	26	0.1	0.756	0.1	0.785	1.30
Lyon	PM_{10}	Rung 3	BLH	2922	0.0513	26	198.1	1.4×10^{-46}	99.4	2.1×10^{-26}	1.99
Strasbourg	PM_{10}	Rung 3	Wind	2895	0.0068	15	33.6	7.6×10^{-9}	22.4	2.2×10^{-6}	1.50
Strasbourg	PM_{10}	Rung 3	BLH	2895	0.0408	15	200.6	4.4×10^{-44}	120.9	3.9×10^{-28}	1.66
Nice	PM_{10}	Rung 3	Wind	2865	0.0041	19	14.1	1.8×10^{-4}	5.4	0.021	2.63
Nice	PM_{10}	Rung 3	BLH	2865	0.0066	19	22.7	2.0×10^{-6}	10.9	9.4×10^{-4}	2.07
Nantes	PM_{10}	Rung 3	Wind	2886	0.0102	24	36.9	1.4×10^{-9}	24.1	9.3×10^{-7}	1.53
Nantes	PM_{10}	Rung 3	BLH	2886	0.0543	24	196.0	3.9×10^{-46}	104.4	1.6×10^{-24}	1.88
Lille	PM_{10}	Rung 3	Wind	1327	0.0006	15	1.4	0.245	1.0	0.307	1.30
Lille	PM_{10}	Rung 3	BLH	1327	0.0654	15	136.5	4.4×10^{-36}	86.7	1.3×10^{-26}	1.57
Paris	PM_{10}	Rung 3	Wind	2916	0.0000	21	0.2	0.655	0.1	0.744	1.88
Paris	PM_{10}	Rung 3	BLH	2916	0.0517	21	238.8	7.8×10^{-52}	136.9	1.3×10^{-30}	1.74
Marseille	$PM_{2.5}$	Rung 3	Wind	2889	0.0099	22	38.6	6.0×10^{-16}	21.1	4.3×10^{-6}	1.83
Marseille	$PM_{2.5}$	Rung 3	BLH	2889	0.0162	22	63.4	2.4×10^{-15}	33.5	7.3×10^{-9}	1.90
Toulouse	$PM_{2.5}$	Rung 3	Wind	2838	0.0014	25	5.7	0.017	4.9	0.027	1.16
Toulouse	$PM_{2.5}$	Rung 3	BLH	2838	0.0662	25	262.6	1.5×10^{-56}	150.6	1.3×10^{-30}	1.74
Montpellier	$PM_{2.5}$	Rung 3	Wind	2754	0.0005	19	2.0	0.157	0.7	0.403	2.86
Montpellier	$PM_{2.5}$	Rung 3	BLH	2754	0.0183	19	69.9	9.7×10^{-17}	35.8	2.2×10^{-9}	1.95
Bordeaux	$PM_{2.5}$	Rung 3	Wind	2510	0.0021	21	7.1	0.008	5.2	0.023	1.36
Bordeaux	$PM_{2.5}$	Rung 3	BLH	2510	0.0303	21	104.2	5.3×10^{-24}	52.2	5.0×10^{-16}	2.00
Lyon	$PM_{2.5}$	Rung 3	Wind	2900	0.0015	26	6.2	0.013	4.5	0.033	1.37
Lyon	$PM_{2.5}$	Rung 3	BLH	2900	0.0442	26	178.8	1.3×10^{-39}	84.1	4.7×10^{-26}	2.13
Strasbourg	$PM_{2.5}$	Rung 3	Wind	2903	0.0127	15	59.8	1.5×10^{-14}	39.0	4.2×10^{-16}	1.53
Strasbourg	$PM_{2.5}$	Rung 3	BLH	2903	0.0254	15	119.9	2.3×10^{-27}	88.7	4.5×10^{-21}	1.35
Nice	$PM_{2.5}$	Rung 3	Wind	2865	0.0002	24	0.7	0.405	0.4	0.515	1.63
Nice	$PM_{2.5}$	Rung 3	BLH	2865	0.0035	24	13.2	2.9×10^{-4}	8.6	0.003	1.53
Nantes	$PM_{2.5}$	Rung 3	Wind	2822	0.0118	26	44.1	3.7×10^{-11}	28.9	7.7×10^{-8}	1.53
Nantes	$PM_{2.5}$	Rung 3	BLH	2822	0.0868	26	325.6	5.9×10^{-69}	152.7	4.4×10^{-36}	2.13
Lille	$PM_{2.5}$	Rung 3	Wind	1239	0.0002	12	0.5	0.482	0.4	0.537	1.30
Lille	$PM_{2.5}$	Rung 3	BLH	1239	0.0665	12	131.6	5.1×10^{-29}	103.2	3.0×10^{-24}	1.28
Paris	$PM_{2.5}$	Rung 3	Wind	2727	0.0001	18	0.3	0.581	0.2	0.661	1.58
Paris	$PM_{2.5}$	Rung 3	BLH	2727	0.0536	18	223.6	1.2×10^{-48}	133.9	5.7×10^{-30}	1.67
Marseille	NO_2	Rung 4	Wind	2922	0.0982	17	778.4	5.0×10^{-152}	464.1	6.2×10^{-16}	1.68
Marseille	NO_2	Rung 4	BLH	2922	0.0140	17	110.8	1.8×10^{-25}	74.9	5.0×10^{-18}	1.48
Toulouse	NO_2	Rung 4	Wind	2866	0.0986	18	592.1	5.0×10^{-119}	246.4	1.6×10^{-55}	2.40
Toulouse	NO_2	Rung 4	BLH	2866	0.0324	18	194.5	8.2×10^{-46}	143.4	4.8×10^{-36}	1.36
Montpellier	NO_2	Rung 4	Wind	2817	0.0444	23	236.5	2.6×10^{-51}	140.5	2.1×10^{-30}	1.68
Montpellier	NO_2	Rung 4	BLH	2817	0.0246	23	131.2	1.0×10^{-29}	99.8	1.6×10^{-26}	1.31
Bordeaux	NO_2	Rung 4	Wind	2690	0.0293	14	151.6	6.4×10^{-34}	106.3	6.3×10^{-25}	1.43
Bordeaux	NO_2	Rung 4	BLH	2690	0.0365	14	189.1	1.2×10^{-41}	112.1	3.5×10^{-26}	1.69
Lyon	NO_2	Rung 4	Wind	2919	0.0380	23	187.8	1.8×10^{-41}	158.2	2.7×10^{-36}	1.19
Lyon	NO_2	Rung 4	BLH	2919	0.0470	23	232.0	1.8×10^{-56}	123.8	9.2×10^{-29}	1.87
Strasbourg	NO_2	Rung 4	Wind	2918	0.0221	21	118.8	3.8×10^{-27}	56.1	6.9×10^{-14}	2.12
Strasbourg	NO_2	Rung 4	BLH	2918	0.0501	21	269.3	6.1×10^{-58}	111.3	5.1×10^{-26}	2.42
Nice	NO_2	Rung 4	Wind	2879	0.0140	5	55.2	1.4×10^{-16}	29.4	5.8×10^{-8}	1.88
Nice	NO_2	Rung 4	BLH	2879	0.0594	5	233.6	9.2×10^{-51}	129.0	6.7×10^{-36}	1.81
Nantes	NO_2	Rung 4	Wind	2889	0.0084	23	46.5	1.1×10^{-11}	26.0	3.4×10^{-7}	1.79
Nantes	NO_2	Rung 4	BLH	2889	0.0774	23	430.7	2.8×10^{-89}	222.2	2.9×10^{-56}	1.94

City	Pollutant	Frame	Term	n	sr^2	Lag (days)	F (classical)	p (F)	W (HAC)	p (HAC)	Variance ratio
Lille	NO_2	Rung 4	Wind	1337	0.0244	15	65.1	1.6×10^{-15}	36.2	1.8×10^{-9}	1.80
Lille	NO_2	Rung 4	BLH	1337	0.0198	15	52.8	6.4×10^{-1}	23.0	1.6×10^{-6}	2.29
Paris	NO_2	Rung 4	Wind	2922	0.0161	26	100.4	2.9×10^{-2}	43.6	4.0×10^{-11}	2.30
Paris	NO_2	Rung 4	BLH	2922	0.0575	26	358.5	1.7×10^{-75}	131.2	$2.3 \times 10^{-}$	2.73
Marseille	O_3	Rung 4	Wind	2816	0.0001	23	0.3	0.564	0.2	0.663	1.75
Marseille	O_3	Rung 4	BLH	2816	0.0228	23	93.9	7.2×10^{-22}	47.6	5.3×10^{-12}	1.97
Toulouse	O_3	Rung 4	Wind	2903	0.0816	15	496.4	1.2×10^{-1}	328.1	2.4×10^{-7}	1.51
Toulouse	O_3	Rung 4	BLH	2903	0.0058	15	35.4	3.0×10^{-9}	27.4	1.7×10^{-7}	1.29
Montpellier	O_3	Rung 4	Wind	2870	0.0126	25	51.5	9.2×10^{-1}	27.3	1.7×10^{-7}	1.88
Montpellier	O_3	Rung 4	BLH	2870	0.0089	25	36.6	1.6×10^{-9}	22.7	1.9×10^{-6}	1.62
Bordeaux	O_3	Rung 4	Wind	2705	0.0003	21	1.5	0.225	1.2	0.283	1.28
Bordeaux	O_3	Rung 4	BLH	2705	0.0659	21	376.3	1.4×10^{-78}	248.5	5.6×10^{-56}	1.51
Lyon	O_3	Rung 4	Wind	2914	0.0140	23	98.0	9.7×10^{-2}	74.9	5.0×10^{-18}	1.31
Lyon	O_3	Rung 4	BLH	2914	0.0091	23	63.4	2.4×10^{-15}	35.8	2.2×10^{-9}	1.77
Strasbourg	O_3	Rung 4	Wind	2843	0.0006	23	4.2	0.040	2.5	0.111	1.66
Strasbourg	O_3	Rung 4	BLH	2843	0.0340	23	245.0	4.9×10^{-5}	81.0	2.3×10^{-19}	3.03
Nice	O_3	Rung 4	Wind	2885	0.0003	16	1.2	0.281	0.6	0.438	1.93
Nice	O_3	Rung 4	BLH	2885	0.0418	16	155.1	$1.0 \times 10^{-}$	79.4	5.1×10^{-19}	1.95
Nantes	O_3	Rung 4	Wind	2894	0.0030	23	20.5	6.4×10^{-6}	14.7	1.3×10^{-4}	1.40
Nantes	O_3	Rung 4	BLH	2894	0.0659	23	450.5	5.1×10^{-9}	191.9	1.2×10^{-4}	2.35
Lille	O_3	Rung 4	Wind	1346	0.0000	19	0.0	0.852	0.0	0.904	2.41
Lille	O_3	Rung 4	BLH	1346	0.0092	19	26.6	2.9×10^{-7}	9.0	0.003	2.95
Paris	O_3	Rung 4	Wind	2922	0.0026	27	17.0	3.7×10^{-5}	7.7	0.006	2.22
Paris	O_3	Rung 4	BLH	2922	0.0545	27	352.8	2.2×10^{-74}	116.3	4.1×10^{-27}	3.03
Marseille	PM_{10}	Rung 4	Wind	2913	0.0000	19	0.0	0.852	0.0	0.900	2.20
Marseille	PM_{10}	Rung 4	BLH	2913	0.0186	19	62.6	3.6×10^{-15}	31.3	2.2×10^{-8}	2.00
Toulouse	PM_{10}	Rung 4	Wind	2850	0.0003	27	1.3	0.259	0.9	0.350	1.46
Toulouse	PM_{10}	Rung 4	BLH	2850	0.0636	27	244.8	5.4×10^{-5}	144.3	$3.0 \times 10^{-}$	1.70
Montpellier	PM_{10}	Rung 4	Wind	2814	0.0016	19	6.2	0.013	1.5	0.214	4.00
Montpellier	PM_{10}	Rung 4	BLH	2814	0.0214	19	82.2	2.2×10^{-19}	41.6	1.1×10^{-1}	1.98
Bordeaux	PM_{10}	Rung 4	Wind	2516	0.0010	21	3.1	0.077	2.5	0.117	1.28
Bordeaux	PM_{10}	Rung 4	BLH	2516	0.0238	21	77.1	3.0×10^{-18}	41.4	1.2×10^{-1}	1.86
Lyon	PM_{10}	Rung 4	Wind	2922	0.0000	26	0.0	0.990	0.0	0.992	1.33
Lyon	PM_{10}	Rung 4	BLH	2922	0.0527	26	203.3	1.2×10^{-44}	99.3	2.1×10^{-2}	2.05
Strasbourg	PM_{10}	Rung 4	Wind	2895	0.0045	14	22.5	2.2×10^{-6}	14.4	1.5×10^{-4}	1.56
Strasbourg	PM_{10}	Rung 4	BLH	2895	0.0469	14	233.7	8.7×10^{-51}	140.4	$2.2 \times 10^{-}$	1.66
Nice	PM_{10}	Rung 4	Wind	2865	0.0026	18	9.3	0.002	3.8	0.051	2.44
Nice	PM_{10}	Rung 4	BLH	2865	0.0060	18	21.3	4.0×10^{-6}	10.2	0.001	2.09
Nantes	PM_{10}	Rung 4	Wind	2886	0.0127	24	45.8	1.6×10^{-11}	31.1	2.4×10^{-8}	1.47
Nantes	PM_{10}	Rung 4	BLH	2886	0.0622	24	225.3	4.4×10^{-49}	122.5	1.8×10^{-28}	1.84
Lille	PM_{10}	Rung 4	Wind	1327	0.0005	14	1.0	0.312	0.8	0.357	1.21
Lille	PM_{10}	Rung 4	BLH	1327	0.0626	14	131.4	4.5×10^{-29}	89.3	3.4×10^{-21}	1.47
Paris	PM_{10}	Rung 4	Wind	2916	0.0000	22	0.1	0.713	0.1	0.783	1.77
Paris	PM_{10}	Rung 4	BLH	2916	0.0524	22	241.2	2.6×10^{-52}	142.3	$8.5 \times 10^{-}$	1.70
Marseille	$PM_{2.5}$	Rung 4	Wind	2889	0.0068	22	27.1	2.1×10^{-7}	15.4	8.5×10^{-5}	1.75
Marseille	$PM_{2.5}$	Rung 4	BLH	2889	0.0186	22	74.1	1.2×10^{-17}	41.6	1.1×10^{-1}	1.78
Toulouse	$PM_{2.5}$	Rung 4	Wind	2838	0.0012	25	5.0	0.026	4.7	0.030	1.06
Toulouse	$PM_{2.5}$	Rung 4	BLH	2838	0.0676	25	270.4	4.3×10^{-58}	160.7	$8.0 \times 10^{-}$	1.68
Montpellier	$PM_{2.5}$	Rung 4	Wind	2754	0.0007	19	2.8	0.095	1.0	0.329	2.93
Montpellier	$PM_{2.5}$	Rung 4	BLH	2754	0.0163	19	62.5	3.9×10^{-15}	31.4	2.1×10^{-8}	1.99
Bordeaux	$PM_{2.5}$	Rung 4	Wind	2510	0.0015	20	5.3	0.021	4.1	0.044	1.32
Bordeaux	$PM_{2.5}$	Rung 4	BLH	2510	0.0334	20	116.0	1.8×10^{-26}	61.2	5.2×10^{-15}	1.90
Lyon	$PM_{2.5}$	Rung 4	Wind	2900	0.0010	26	4.2	0.041	3.0	0.083	1.40
Lyon	$PM_{2.5}$	Rung 4	BLH	2900	0.0453	26	184.3	9.6×10^{-41}	84.6	3.7×10^{-2}	2.18
Strasbourg	$PM_{2.5}$	Rung 4	Wind	2903	0.0095	15	45.5	1.9×10^{-11}	31.0	2.5×10^{-8}	1.47
Strasbourg	$PM_{2.5}$	Rung 4	BLH	2903	0.0299	15	143.8	$2.2 \times 10^{-}$	107.6	3.2×10^{-25}	1.34
Nice	$PM_{2.5}$	Rung 4	Wind	2865	0.0008	22	3.0	0.084	1.9	0.169	1.57
Nice	$PM_{2.5}$	Rung 4	BLH	2865	0.0034	22	13.0	3.1×10^{-4}	8.1	0.005	1.62
Nantes	$PM_{2.5}$	Rung 4	Wind	2822	0.0128	25	48.2	4.7×10^{-12}	32.0	1.5×10^{-8}	1.51
Nantes	$PM_{2.5}$	Rung 4	BLH	2822	0.0916	25	344.6	1.2×10^{-72}	163.5	$1.9 \times 10^{-}$	2.11
Lille	$PM_{2.5}$	Rung 4	Wind	1239	0.0000	8	0.0	0.828	0.0	0.846	1.26
Lille	$PM_{2.5}$	Rung 4	BLH	1239	0.0601	8	119.0	1.6×10^{-26}	103.1	3.1×10^{-24}	1.15

City	Pollutant	Frame	Term	n	sr^2	Lag (days)	F (classical)	p (F)	W (HAC)	p (HAC)	Variance ratio
Paris	$PM_{2.5}$	Rung 4	Wind	2727	0.0000	21	0.2	0.669	0.1	0.724	1.47
Paris	$PM_{2.5}$	Rung 4	BLH	2727	0.0555	21	233.6	1.2×10^{-5}	147.6	5.8×10^{-34}	1.58

(b) Number of the 40 city × pollutant models with $p < 0.05$: classical F-test, HAC Wald test with the automatic lag, then with fixed lags of 15, 30 and 60 days.

Frame	Term	Classical F	HAC, automatic lag	HAC, lag 15	HAC, lag 30	HAC, lag 60
Pooled	Wind	30	20	22	19	19
Pooled	BLH	40	40	40	40	40
Rung 3	Wind	27	24	24	24	24
Rung 3	BLH	40	40	40	40	40
Rung 4	Wind	26	22	23	22	22
Rung 4	BLH	40	40	40	40	40

Table S7. Sensitivity of the decomposition to the treatment of the multi-year trend. Ten-city means on deseasonalized anomalies. Row 1 of each block is the third rung, which removes nothing. Row 2 is the fourth rung as defined in Section 2.2.4. Row 3 carries year indicator variables without adjusting the variance being decomposed, and differs from row 2 by the factor $1/(1 - R^2_t)$ alone, where R^2_t is the share of the pollutant variance taken by the year indicators, an identity verified city by city. Row 4 removes the seasonal cycle and the decline in one operation, by subtracting the mean of each year-and-month cell, and is the most aggressive of the four. The ordering of wind and BLH is the same in rows 2 to 4 for every pollutant.

Pollutant	Treatment of the multi-year decline	Wind sr^2	BLH sr^2	R^2
NO_2	None (third rung)	0.039	0.035	0.422
NO_2	Calendar-year means removed (fourth rung)	0.039	0.042	0.477
NO_2	Year indicators, denominator not adjusted	0.035	0.036	0.546
NO_2	Month-by-year cell anomalies	0.040	0.045	0.486
O_3	None (third rung)	0.012	0.031	0.470
O_3	Calendar-year means removed (fourth rung)	0.012	0.032	0.475
O_3	Year indicators, denominator not adjusted	0.011	0.031	0.488
O_3	Month-by-year cell anomalies	0.011	0.033	0.478
PM_{10}	None (third rung)	0.003	0.039	0.265
PM_{10}	Calendar-year means removed (fourth rung)	0.002	0.041	0.269
PM_{10}	Year indicators, denominator not adjusted	0.002	0.039	0.296
PM_{10}	Month-by-year cell anomalies	0.002	0.040	0.243
$PM_{2.5}$	None (third rung)	0.004	0.041	0.299
$PM_{2.5}$	Calendar-year means removed (fourth rung)	0.003	0.042	0.306
$PM_{2.5}$	Year indicators, denominator not adjusted	0.003	0.041	0.331
$PM_{2.5}$	Month-by-year cell anomalies	0.003	0.041	0.287

Table S8. Wind speed versus the wind-direction block, in sample and cross-validated, and the wind/BLH balance with and without the block. Model: the seven predictors plus four Fourier terms of the daily direction θ (sin θ, cos θ, sin 2θ, cos 2θ), θ being the direction of the daily vector-mean wind, computed from the hourly ERA5 components u10 and v10. The Fourier terms enter as computed, without deseasonalization, in every frame. Block = joint sr² of the four terms. H1 = first harmonic only (sin θ, cos θ). Adjusted = difference of adjusted R^2. CV = difference of leave-one-year-out cross-validated R^2 (eight folds, four at Lille). Chance gain = expected in-sample R^2 gain from one pure-noise regressor, $(1 - R^2)/(n - 12)$. Rung 3, deseasonalized anomalies. Rung 4, the same with the calendar-year means removed.

(a) Pooled frame, ten-city means.

Pollutant	Speed, in-sample	Block, in-sample	H1, in-sample	Speed, adjusted	Block, adjusted	H1, adjusted	Speed, CV	Block, CV	H1, CV	Cities with block > speed (adjusted)	Cities with block > speed (CV)	Cities with H1 > speed (CV)	Chance gain per term
NO_2	0.0154	0.0243	0.0202	0.0153	0.0236	0.0199	0.0148	0.0191	0.0167	7	6	5	0.0002
O_3	0.0047	0.0415	0.0399	0.0046	0.0411	0.0398	0.0043	0.0399	0.0391	9	9	9	0.0001
PM_{10}	0.0040	0.0195	0.0168	0.0037	0.0184	0.0163	0.0029	0.0138	0.0131	8	7	6	0.0003
$PM_{2.5}$	0.0045	0.0246	0.0211	0.0043	0.0236	0.0207	0.0035	0.0189	0.0172	9	7	6	0.0003

(b) Ten-city means by frame, sr² in the augmented model. Joint test of the four Fourier terms: HAC Wald test (Newey–West, Bartlett kernel, automatic lag), χ^2 with 4 degrees of freedom. The block is significant ($p < 0.05$) in 116 of the 120 models. The four exceptions (block sr² below 0.004) are Strasbourg $PM_{2.5}$ and Nice $PM_{2.5}$ in the pooled frame, and Nice PM_{10} on both rungs. Out of sample, the block exceeds speed for O_3 and particulate matter in every frame, and for NO_2 in the pooled frame only.

Frame	Pollutant	Speed sr²	Block sr²	H1 sr²	BLH sr²	Cities with block > speed (of 10)	Cities with block p < 0.05 (of 10)	Cities with speed p < 0.05 (of 10)	Speed, CV	Block, CV	H1, CV	Cities with block > speed, CV (of 10)	Cities with H1 > speed, CV (of 10)
Pooled	NO_2	0.0154	0.0243	0.0202	0.0376	7	10	7	0.0148	0.0191	0.0167	6	5
Pooled	O_3	0.0047	0.0415	0.0399	0.0208	9	10	4	0.0043	0.0399	0.0391	9	9
Pooled	PM_{10}	0.0040	0.0195	0.0168	0.0329	8	10	3	0.0029	0.0138	0.0131	7	6
Pooled	$PM_{2.5}$	0.0045	0.0246	0.0211	0.0227	9	8	6	0.0035	0.0189	0.0172	7	6
Rung 3	NO_2	0.0343	0.0180	0.0131	0.0251	3	10	10	0.0337	0.0106	0.0076	3	3
Rung 3	O_3	0.0068	0.0460	0.0439	0.0201	9	10	4	0.0064	0.0431	0.0424	8	8
Rung 3	PM_{10}	0.0016	0.0203	0.0166	0.0232	10	9	3	0.0007	0.0146	0.0127	9	8
Rung 3	$PM_{2.5}$	0.0043	0.0267	0.0225	0.0214	9	10	7	0.0037	0.0205	0.0176	8	6
Rung 4	NO_2	0.0351	0.0194	0.0139	0.0293	4	10	10	0.0336	0.0148	0.0108	4	3
Rung 4	O_3	0.0065	0.0474	0.0453	0.0207	9	10	5	0.0060	0.0450	0.0442	8	8
Rung 4	PM_{10}	0.0013	0.0215	0.0175	0.0242	10	9	3	0.0003	0.0170	0.0146	10	8
Rung 4	$PM_{2.5}$	0.0037	0.0273	0.0230	0.0220	9	10	8	0.0029	0.0219	0.0189	8	6

(c) Per city, pollutant and frame. W = HAC Wald statistic of the four Fourier terms (χ^2, 4 df). p (speed) = HAC Wald test of the speed coefficient in the same model (χ^2, 1 df).

City	Type	Pollutant	Frame	n	R^2	Speed sr²	Block sr²	H1 sr²	BLH sr²	W (block)	p (block)	Lag (days)	p (speed)
Marseille	A	NO_2	Pooled	2922	0.605	0.0698	0.0051	0.0028	0.0217	19.4	6.4×10^{-4}	21	1.8×10^{-47}
Toulouse	A	NO_2	Pooled	2866	0.600	0.0332	0.0220	0.0074	0.0254	91.5	6.4×10^{-19}	13	2.0×10^{-6}
Montpellier	A	NO_2	Pooled	2817	0.542	0.0137	0.0104	0.0089	0.0421	33.7	8.4×10^{-7}	22	1.0×10^{-6}
Bordeaux	B	NO_2	Pooled	2690	0.569	0.0027	0.0096	0.0030	0.0448	53.8	5.7×10^{-11}	18	0.002
Lyon	B	NO_2	Pooled	2919	0.464	0.0153	0.0630	0.0613	0.0263	141.1	1.6×10^{-29}	27	1.9×10^{-14}

City	Type	Pollutant	Frame	n	R^2	Speed sr^2	Block sr^2	H1 sr^2	BLH sr^2	W (block)	p (block)	Lag (days)	p (speed)
Lille	B	NO_2	Pooled	1337	0.507	0.0016	0.0073	0.0027	0.0378	13.3	0.010	7	0.116
Strasbourg	C	NO_2	Pooled	2918	0.559	0.0036	0.0560	0.0518	0.0461	118.3	1.3×10^{-24}	22	0.002
Nice	C	NO_2	Pooled	2879	0.367	0.0137	0.0425	0.0407	0.0236	85.3	1.3×10^{-17}	19	2.1×10^{-8}
Nantes	C	NO_2	Pooled	2889	0.570	0.0002	0.0185	0.0180	0.0474	48.1	9.0×10^{-1}	28	0.419
Paris	C	NO_2	Pooled	2922	0.494	0.0003	0.0084	0.0057	0.0607	22.2	1.8×10^{-4}	25	0.473
Marseille	A	O_3	Pooled	2816	0.709	0.0049	0.1408	0.1407	0.0345	576.4	2.0×10^{-12}	17	3.0×10^{-6}
Toulouse	A	O_3	Pooled	2903	0.627	0.0230	0.0073	0.0055	0.0096	28.2	1.2×10^{-5}	15	4.5×10^{-26}
Montpellier	A	O_3	Pooled	2870	0.626	0.0140	0.1253	0.1235	0.0717	303.5	1.9×10^{-64}	21	9.5×10^{-11}
Bordeaux	B	O_3	Pooled	2705	0.675	0.0001	0.0125	0.0094	0.0223	58.5	6.0×10^{-12}	13	0.645
Lyon	B	O_3	Pooled	2914	0.777	0.0028	0.0124	0.0118	0.0042	95.6	8.6×10^{-2}	13	2.5×10^{-5}
Lille	B	O_3	Pooled	1346	0.676	0.0004	0.0282	0.0277	0.0033	52.5	1.1×10^{-1}	15	0.406
Strasbourg	C	O_3	Pooled	2843	0.778	0.0000	0.0151	0.0131	0.0145	97.9	2.7×10^{-2}	14	0.668
Nice	C	O_3	Pooled	2885	0.569	0.0001	0.0467	0.0442	0.0153	110.1	6.9×10^{-2}	23	0.543
Nantes	C	O_3	Pooled	2894	0.610	0.0002	0.0184	0.0149	0.0128	75.2	1.8×10^{-15}	18	0.483
Paris	C	O_3	Pooled	2922	0.695	0.0013	0.0086	0.0081	0.0199	35.1	4.4×10^{-7}	18	0.051
Marseille	A	PM_{10}	Pooled	2913	0.151	0.0008	0.0144	0.0107	0.0107	33.1	1.1×10^{-6}	19	0.344
Toulouse	A	PM_{10}	Pooled	2850	0.267	0.0000	0.0120	0.0093	0.0390	25.7	3.7×10^{-5}	20	0.968
Montpellier	A	PM_{10}	Pooled	2814	0.284	0.0001	0.0384	0.0357	0.0077	59.4	4.0×10^{-12}	15	0.819
Bordeaux	B	PM_{10}	Pooled	2516	0.283	0.0009	0.0085	0.0024	0.0265	15.4	0.004	21	0.208
Lyon	B	PM_{10}	Pooled	2922	0.294	0.0001	0.0284	0.0253	0.0316	51.5	1.7×10^{-1}	26	0.673
Lille	B	PM_{10}	Pooled	1327	0.399	0.0021	0.0437	0.0423	0.0509	48.7	6.8×10^{-1}	14	0.080
Strasbourg	C	PM_{10}	Pooled	2895	0.416	0.0009	0.0039	0.0018	0.0532	11.1	0.025	14	0.141
Nice	C	PM_{10}	Pooled	2865	0.138	0.0119	0.0036	0.0023	0.0209	10.3	0.036	20	6.3×10^{-4}
Nantes	C	PM_{10}	Pooled	2886	0.229	0.0213	0.0099	0.0089	0.0437	21.6	2.4×10^{-4}	22	1.4×10^{-1}
Paris	C	PM_{10}	Pooled	2916	0.406	0.0016	0.0318	0.0291	0.0451	52.4	1.2×10^{-1}	25	0.036
Marseille	A	$PM_{2.5}$	Pooled	2889	0.296	0.0143	0.0172	0.0097	0.0106	47.9	9.8×10^{-1}	21	2.8×10^{-6}
Toulouse	A	$PM_{2.5}$	Pooled	2838	0.343	0.0056	0.0077	0.0039	0.0332	24.0	7.9×10^{-5}	22	8.9×10^{-5}
Montpellier	A	$PM_{2.5}$	Pooled	2754	0.315	0.0048	0.0217	0.0203	0.0058	40.5	3.4×10^{-8}	10	0.007
Bordeaux	B	$PM_{2.5}$	Pooled	2510	0.393	0.0003	0.0127	0.0043	0.0192	30.3	4.3×10^{-6}	21	0.400
Lyon	B	$PM_{2.5}$	Pooled	2900	0.402	0.0039	0.0172	0.0166	0.0177	43.0	1.0×10^{-8}	25	0.002
Lille	B	$PM_{2.5}$	Pooled	1239	0.465	0.0002	0.0929	0.0895	0.0368	73.9	3.3×10^{-15}	14	0.583
Strasbourg	C	$PM_{2.5}$	Pooled	2903	0.427	0.0091	0.0036	0.0020	0.0224	8.5	0.074	12	6.2×10^{-7}
Nice	C	$PM_{2.5}$	Pooled	2865	0.207	0.0007	0.0032	0.0017	0.0154	9.1	0.059	24	0.284
Nantes	C	$PM_{2.5}$	Pooled	2822	0.363	0.0059	0.0342	0.0300	0.0343	72.9	5.4×10^{-15}	23	2.7×10^{-4}
Paris	C	$PM_{2.5}$	Pooled	2727	0.424	0.0001	0.0352	0.0328	0.0321	49.5	4.6×10^{-1}	23	0.607
Marseille	A	NO_2	Rung 3	2922	0.607	0.0890	0.0035	0.0021	0.0113	15.2	0.004	18	4.9×10^{-8}
Toulouse	A	NO_2	Rung 3	2866	0.501	0.0614	0.0186	0.0041	0.0222	74.0	3.3×10^{-15}	16	1.6×10^{-4}
Montpellier	A	NO_2	Rung 3	2817	0.417	0.0354	0.0064	0.0044	0.0245	17.1	0.002	25	3.8×10^{-24}
Bordeaux	B	NO_2	Rung 3	2690	0.464	0.0350	0.0134	0.0014	0.0229	56.7	1.5×10^{-11}	18	$7.2 \times 10^{-}$
Lyon	B	NO_2	Rung 3	2919	0.373	0.0379	0.0326	0.0312	0.0168	56.4	1.6×10^{-11}	22	7.3×10^{-28}
Lille	B	NO_2	Rung 3	1337	0.431	0.0152	0.0115	0.0024	0.0260	16.2	0.003	12	4.0×10^{-6}
Strasbourg	C	NO_2	Rung 3	2918	0.473	0.0268	0.0370	0.0341	0.0279	64.2	3.8×10^{-1}	19	2.0×10^{-18}
Nice	C	NO_2	Rung 3	2879	0.224	0.0138	0.0334	0.0309	0.0281	72.6	6.4×10^{-15}	15	1.5×10^{-6}

City	Type	Pollutant	Frame	n	R^2	Speed sr^2	Block sr^2	H1 sr^2	BLH sr^2	W (block)	p (block)	Lag (days)	p (speed)
Nantes	C	NO_2	Rung 3	2889	0.453	0.0151	0.0200	0.0198	0.0352	49.2	5.2×10^{-1}	28	1.3×10^{-1}
Paris	C	NO_2	Rung 3	2922	0.456	0.0138	0.0040	0.0006	0.0357	14.5	0.006	22	7.2×10^{-9}
Marseille	A	O_3	Rung 3	2816	0.489	0.0000	0.1790	0.1767	0.0323	569.7	5.5×10^{-122}	18	0.711
Toulouse	A	O_3	Rung 3	2903	0.510	0.0480	0.0062	0.0053	0.0093	20.5	4.0×10^{-4}	14	3.0×10^{-5}
Montpellier	A	O_3	Rung 3	2870	0.398	0.0008	0.1038	0.1024	0.0264	217.4	6.9×10^{-46}	15	0.142
Bordeaux	B	O_3	Rung 3	2705	0.544	0.0019	0.0189	0.0183	0.0248	57.3	1.1×10^{-11}	16	0.006
Lyon	B	O_3	Rung 3	2914	0.598	0.0138	0.0159	0.0139	0.0039	68.2	5.5×10^{-14}	13	2.6×10^{-15}
Lille	B	O_3	Rung 3	1346	0.574	0.0002	0.0376	0.0349	0.0085	66.0	1.6×10^{-1}	13	0.586
Strasbourg	C	O_3	Rung 3	2843	0.625	0.0014	0.0158	0.0136	0.0205	56.8	1.4×10^{-11}	12	0.007
Nice	C	O_3	Rung 3	2885	0.273	0.0017	0.0377	0.0341	0.0254	94.9	1.2×10^{-19}	13	0.072
Nantes	C	O_3	Rung 3	2894	0.601	0.0001	0.0310	0.0274	0.0172	155.1	1.6×10^{-2}	17	0.594
Paris	C	O_3	Rung 3	2922	0.545	0.0005	0.0137	0.0128	0.0324	42.4	1.4×10^{-8}	20	0.168
Marseille	A	PM_{10}	Rung 3	2913	0.148	0.0007	0.0151	0.0095	0.0100	30.6	3.6×10^{-6}	21	0.314
Toulouse	A	PM_{10}	Rung 3	2850	0.267	0.0005	0.0085	0.0045	0.0329	18.6	9.4×10^{-4}	25	0.250
Montpellier	A	PM_{10}	Rung 3	2814	0.310	0.0000	0.0407	0.0364	0.0091	74.6	2.4×10^{-15}	16	0.886
Bordeaux	B	PM_{10}	Rung 3	2516	0.239	0.0021	0.0132	0.0026	0.0121	27.6	1.5×10^{-5}	23	0.024
Lyon	B	PM_{10}	Rung 3	2922	0.263	0.0005	0.0180	0.0153	0.0294	30.3	4.2×10^{-6}	26	0.218
Lille	B	PM_{10}	Rung 3	1327	0.413	0.0002	0.0449	0.0435	0.0387	54.3	4.6×10^{-11}	14	0.548
Strasbourg	C	PM_{10}	Rung 3	2895	0.419	0.0051	0.0060	0.0038	0.0344	15.3	0.004	15	2.0×10^{-5}
Nice	C	PM_{10}	Rung 3	2865	0.171	0.0024	0.0037	0.0028	0.0047	8.8	0.066	21	0.069
Nantes	C	PM_{10}	Rung 3	2886	0.217	0.0045	0.0150	0.0124	0.0264	28.7	8.9×10^{-6}	23	0.002
Paris	C	PM_{10}	Rung 3	2916	0.408	0.0000	0.0380	0.0349	0.0343	68.4	4.9×10^{-14}	23	0.837
Marseille	A	$PM_{2.5}$	Rung 3	2889	0.283	0.0135	0.0197	0.0112	0.0091	39.8	4.8×10^{-8}	23	1.1×10^{-7}
Toulouse	A	$PM_{2.5}$	Rung 3	2838	0.297	0.0051	0.0097	0.0042	0.0380	25.8	3.4×10^{-5}	23	6.0×10^{-5}
Montpellier	A	$PM_{2.5}$	Rung 3	2754	0.307	0.0024	0.0261	0.0241	0.0089	48.5	7.5×10^{-1}	12	0.039
Bordeaux	B	$PM_{2.5}$	Rung 3	2510	0.291	0.0031	0.0187	0.0066	0.0145	41.0	2.7×10^{-8}	22	0.003
Lyon	B	$PM_{2.5}$	Rung 3	2900	0.303	0.0031	0.0168	0.0161	0.0241	31.8	2.1×10^{-6}	25	0.003
Lille	B	$PM_{2.5}$	Rung 3	1239	0.458	0.0000	0.0799	0.0773	0.0329	72.4	7.2×10^{-15}	13	0.883
Strasbourg	C	$PM_{2.5}$	Rung 3	2903	0.392	0.0115	0.0062	0.0044	0.0185	12.5	0.014	13	4.4×10^{-1}
Nice	C	$PM_{2.5}$	Rung 3	2865	0.240	0.0009	0.0043	0.0025	0.0023	10.2	0.037	24	0.147
Nantes	C	$PM_{2.5}$	Rung 3	2822	0.293	0.0035	0.0441	0.0394	0.0341	81.8	7.1×10^{-17}	24	0.002
Paris	C	$PM_{2.5}$	Rung 3	2727	0.390	0.0003	0.0416	0.0389	0.0313	61.2	1.7×10^{-12}	20	0.327
Marseille	A	NO_2	Rung 4	2922	0.636	0.0798	0.0038	0.0019	0.0150	20.9	3.4×10^{-4}	14	9.0×10^{-87}
Toulouse	A	NO_2	Rung 4	2866	0.539	0.0648	0.0147	0.0015	0.0247	66.2	1.5×10^{-1}	10	1.3×10^{-46}
Montpellier	A	NO_2	Rung 4	2817	0.479	0.0368	0.0068	0.0037	0.0277	27.0	2.0×10^{-5}	21	9.4×10^{-27}
Bordeaux	B	NO_2	Rung 4	2690	0.497	0.0338	0.0153	0.0018	0.0249	64.7	3.0×10^{-1}	17	4.7×10^{-4}
Lyon	B	NO_2	Rung 4	2919	0.455	0.0368	0.0448	0.0438	0.0224	118.4	1.1×10^{-24}	20	2.9×10^{-5}
Lille	B	NO_2	Rung 4	1337	0.517	0.0230	0.0153	0.0039	0.0243	30.9	3.3×10^{-6}	6	1.0×10^{-1}
Strasbourg	C	NO_2	Rung 4	2918	0.502	0.0230	0.0442	0.0407	0.0337	112.3	2.4×10^{-2}	16	2.6×10^{-17}
Nice	C	NO_2	Rung 4	2879	0.294	0.0213	0.0238	0.0198	0.0394	77.0	7.6×10^{-16}	5	1.3×10^{-11}
Nantes	C	NO_2	Rung 4	2889	0.502	0.0152	0.0203	0.0197	0.0404	69.3	3.2×10^{-14}	27	3.3×10^{-1}
Paris	C	NO_2	Rung 4	2922	0.538	0.0169	0.0054	0.0018	0.0401	30.6	3.7×10^{-6}	22	2.2×10^{-12}
Marseille	A	O_3	Rung 4	2816	0.501	0.0002	0.1834	0.1815	0.0338	567.4	1.8×10^{-121}	16	0.383

City	Type	Pollutant	Frame	n	R^2	Speed sr^2	Block sr^2	H1 sr^2	BLH sr^2	W (block)	p (block)	Lag (days)	p (speed)
Toulouse	A	O_3	Rung 4	2903	0.531	0.0446	0.0070	0.0061	0.0113	23.5	1.0×10^{-4}	13	4.5×10^{-46}
Montpellier	A	O_3	Rung 4	2870	0.409	0.0006	0.1073	0.1057	0.0267	221.7	8.2×10^{-47}	16	0.185
Bordeaux	B	O_3	Rung 4	2705	0.549	0.0015	0.0212	0.0203	0.0251	70.6	1.7×10^{-14}	14	0.013
Lyon	B	O_3	Rung 4	2914	0.599	0.0139	0.0152	0.0136	0.0041	66.7	1.1×10^{-1}	12	8.3×10^{-16}
Lille	B	O_3	Rung 4	1346	0.577	0.0002	0.0413	0.0384	0.0077	69.3	3.1×10^{-14}	13	0.543
Strasbourg	C	O_3	Rung 4	2843	0.623	0.0012	0.0158	0.0135	0.0217	56.9	1.3×10^{-11}	12	0.012
Nice	C	O_3	Rung 4	2885	0.260	0.0023	0.0358	0.0315	0.0263	92.3	4.3×10^{-19}	11	0.029
Nantes	C	O_3	Rung 4	2894	0.611	0.0001	0.0328	0.0285	0.0182	175.7	$6.4 \times 10^{-}$	19	0.452
Paris	C	O_3	Rung 4	2922	0.564	0.0006	0.0142	0.0135	0.0325	46.6	1.8×10^{-9}	17	0.128
Marseille	A	PM_{10}	Rung 4	2913	0.150	0.0001	0.0155	0.0103	0.0118	32.1	1.8×10^{-6}	20	0.690
Toulouse	A	PM_{10}	Rung 4	2850	0.270	0.0004	0.0083	0.0046	0.0345	19.9	5.3×10^{-4}	24	0.272
Montpellier	A	PM_{10}	Rung 4	2814	0.309	0.0001	0.0401	0.0359	0.0090	73.5	4.2×10^{-15}	16	0.792
Bordeaux	B	PM_{10}	Rung 4	2516	0.242	0.0017	0.0158	0.0046	0.0122	31.6	2.3×10^{-6}	23	0.037
Lyon	B	PM_{10}	Rung 4	2922	0.264	0.0004	0.0190	0.0164	0.0299	32.8	1.3×10^{-6}	26	0.306
Lille	B	PM_{10}	Rung 4	1327	0.418	0.0001	0.0466	0.0446	0.0373	68.7	4.4×10^{-14}	12	0.624
Strasbourg	C	PM_{10}	Rung 4	2895	0.427	0.0034	0.0059	0.0032	0.0393	16.3	0.003	16	5.0×10^{-4}
Nice	C	PM_{10}	Rung 4	2865	0.194	0.0015	0.0027	0.0016	0.0053	8.4	0.077	20	0.125
Nantes	C	PM_{10}	Rung 4	2886	0.225	0.0054	0.0202	0.0172	0.0288	49.3	5.1×10^{-1}	23	4.2×10^{-4}
Paris	C	PM_{10}	Rung 4	2916	0.408	0.0000	0.0402	0.0371	0.0338	81.2	9.7×10^{-17}	23	0.985
Marseille	A	$PM_{2.5}$	Rung 4	2889	0.295	0.0095	0.0194	0.0118	0.0114	41.5	2.1×10^{-8}	23	4.9×10^{-6}
Toulouse	A	$PM_{2.5}$	Rung 4	2838	0.302	0.0048	0.0094	0.0042	0.0385	26.1	3.1×10^{-5}	23	4.4×10^{-5}
Montpellier	A	$PM_{2.5}$	Rung 4	2754	0.310	0.0026	0.0250	0.0232	0.0076	50.2	3.2×10^{-1}	11	0.030
Bordeaux	B	$PM_{2.5}$	Rung 4	2510	0.301	0.0025	0.0226	0.0100	0.0150	48.2	8.8×10^{-1}	22	0.008
Lyon	B	$PM_{2.5}$	Rung 4	2900	0.307	0.0024	0.0179	0.0172	0.0248	34.4	6.1×10^{-7}	25	0.010
Lille	B	$PM_{2.5}$	Rung 4	1239	0.454	0.0001	0.0759	0.0727	0.0305	96.6	5.1×10^{-2}	10	0.613
Strasbourg	C	$PM_{2.5}$	Rung 4	2903	0.403	0.0090	0.0055	0.0034	0.0217	12.8	0.012	15	9.9×10^{-9}
Nice	C	$PM_{2.5}$	Rung 4	2865	0.266	0.0016	0.0032	0.0009	0.0030	10.1	0.039	22	0.041
Nantes	C	$PM_{2.5}$	Rung 4	2822	0.302	0.0040	0.0501	0.0452	0.0361	103.8	1.5×10^{-21}	23	8.0×10^{-4}
Paris	C	$PM_{2.5}$	Rung 4	2727	0.398	0.0004	0.0440	0.0411	0.0311	74.7	2.3×10^{-15}	21	0.231

(d) Per city, pooled frame: adjusted and cross-validated comparisons.

City	Pollutant	n	Folds	Speed, in-sample	Block, in-sample	H1, in-sample	Speed, adjusted	Block, adjusted	H1, adjusted	Speed, CV	Block, CV	H1, CV
Marseille	NO_2	2922	8	0.0698	0.0052	0.0028	0.0699	0.0046	0.0025	0.0717	0.0025	0.0012
Toulouse	NO_2	2866	8	0.0332	0.0220	0.0074	0.0332	0.0215	0.0071	0.0341	0.0206	0.0063
Montpellier	NO_2	2817	8	0.0137	0.0104	0.0089	0.0136	0.0098	0.0086	0.0117	0.0085	0.0076
Bordeaux	NO_2	2690	8	0.0027	0.0096	0.0030	0.0025	0.0090	0.0027	0.0023	0.0054	0.0001
Lyon	NO_2	2919	8	0.0153	0.0630	0.0613	0.0152	0.0624	0.0611	0.0154	0.0592	0.0597
Lille	NO_2	1337	4	0.0016	0.0073	0.0027	0.0012	0.0058	0.0019	−0.0007	−0.0199	−0.0169
Strasbourg	NO_2	2918	8	0.0036	0.0560	0.0518	0.0034	0.0555	0.0516	0.0028	0.0504	0.0473
Nice	NO_2	2879	8	0.0137	0.0425	0.0407	0.0135	0.0417	0.0404	0.0122	0.0416	0.0409
Nantes	NO_2	2889	8	0.0002	0.0185	0.0180	0.0001	0.0180	0.0178	−0.0006	0.0178	0.0186

City	Pollutant	n	Folds	Speed, in-sample	Block, in-sample	H1, in-sample	Speed, adjusted	Block, adjusted	H1, adjusted	Speed, CV	Block, CV	H1, CV
Paris	NO_2	2922	8	0.0003	0.0084	0.0057	0.0001	0.0077	0.0054	−0.0012	0.0045	0.0023
Marseille	O_3	2816	8	0.0049	0.1408	0.1407	0.0049	0.1408	0.1408	0.0050	0.1408	0.1412
Toulouse	O_3	2903	8	0.0230	0.0073	0.0055	0.0230	0.0068	0.0053	0.0236	0.0053	0.0045
Montpellier	O_3	2870	8	0.0140	0.1253	0.1235	0.0139	0.1251	0.1236	0.0133	0.1230	0.1218
Bordeaux	O_3	2705	8	0.0001	0.0125	0.0094	−0.0001	0.0120	0.0091	−0.0005	0.0094	0.0073
Lyon	O_3	2914	8	0.0028	0.0124	0.0118	0.0027	0.0121	0.0117	0.0025	0.0111	0.0110
Lille	O_3	1346	4	0.0004	0.0282	0.0277	0.0001	0.0274	0.0274	0.0001	0.0267	0.0278
Strasbourg	O_3	2843	8	0.0000	0.0151	0.0131	0.0000	0.0148	0.0130	−0.0003	0.0143	0.0131
Nice	O_3	2885	8	0.0001	0.0467	0.0442	−0.0001	0.0462	0.0441	−0.0007	0.0464	0.0447
Nantes	O_3	2894	8	0.0002	0.0184	0.0149	0.0000	0.0179	0.0147	−0.0004	0.0151	0.0129
Paris	O_3	2922	8	0.0013	0.0086	0.0081	0.0012	0.0082	0.0079	0.0006	0.0070	0.0071
Marseille	PM_{10}	2913	8	0.0008	0.0144	0.0107	0.0005	0.0133	0.0101	0.0000	0.0080	0.0063
Toulouse	PM_{10}	2850	8	0.0000	0.0120	0.0093	−0.0003	0.0110	0.0088	−0.0005	0.0088	0.0071
Montpellier	PM_{10}	2814	8	0.0001	0.0384	0.0357	−0.0002	0.0374	0.0353	−0.0036	0.0359	0.0350
Bordeaux	PM_{10}	2516	8	0.0008	0.0085	0.0024	0.0006	0.0074	0.0018	0.0001	0.0003	−0.0024
Lyon	PM_{10}	2922	8	0.0001	0.0284	0.0253	−0.0002	0.0275	0.0249	−0.0009	0.0260	0.0236
Lille	PM_{10}	1327	4	0.0021	0.0437	0.0423	0.0017	0.0421	0.0416	0.0026	0.0287	0.0322
Strasbourg	PM_{10}	2895	8	0.0009	0.0039	0.0018	0.0007	0.0031	0.0014	−0.0004	−0.0021	−0.0019
Nice	PM_{10}	2865	8	0.0119	0.0036	0.0023	0.0117	0.0024	0.0017	0.0093	0.0013	0.0013
Nantes	PM_{10}	2886	8	0.0213	0.0099	0.0089	0.0211	0.0089	0.0084	0.0210	0.0037	0.0049
Paris	PM_{10}	2916	8	0.0016	0.0318	0.0291	0.0014	0.0310	0.0287	0.0013	0.0272	0.0252
Marseille	$PM_{2.5}$	2889	8	0.0143	0.0172	0.0097	0.0141	0.0163	0.0092	0.0132	0.0132	0.0068
Toulouse	$PM_{2.5}$	2838	8	0.0056	0.0077	0.0039	0.0054	0.0068	0.0035	0.0051	0.0047	0.0017
Montpellier	$PM_{2.5}$	2754	8	0.0048	0.0217	0.0203	0.0046	0.0207	0.0199	0.0014	0.0175	0.0182
Bordeaux	$PM_{2.5}$	2510	8	0.0003	0.0127	0.0043	0.0001	0.0118	0.0038	−0.0004	0.0038	−0.0013
Lyon	$PM_{2.5}$	2900	8	0.0039	0.0172	0.0166	0.0037	0.0164	0.0162	0.0032	0.0150	0.0154
Lille	$PM_{2.5}$	1239	4	0.0002	0.0929	0.0895	−0.0003	0.0916	0.0891	0.0006	0.0804	0.0801
Strasbourg	$PM_{2.5}$	2903	8	0.0091	0.0036	0.0020	0.0090	0.0028	0.0016	0.0079	−0.0025	−0.0022
Nice	$PM_{2.5}$	2865	8	0.0007	0.0032	0.0017	0.0005	0.0021	0.0012	0.0002	−0.0005	0.0002
Nantes	$PM_{2.5}$	2822	8	0.0059	0.0342	0.0300	0.0057	0.0333	0.0296	0.0052	0.0276	0.0251
Paris	$PM_{2.5}$	2727	8	0.0001	0.0352	0.0328	−0.0001	0.0344	0.0325	−0.0010	0.0297	0.0278

(e) Former daily direction (arithmetic mean of the hourly directions, as in the submitted dataset) against the corrected one (direction of the vector-mean wind): ten-city means. The former definition is wrong for a circular variable (350° and 10° average to 180°). Cross-validated values in the pooled frame only.

Frame	Pollutant	Speed sr^2, former	Block sr^2, former	H1 sr^2, former	Speed sr^2, vector	Block sr^2, vector	H1 sr^2, vector	Speed CV, former	Block CV, former	Speed CV, vector	Block CV, vector
Pooled	NO_2	0.0123	0.0183	0.0166	0.0154	0.0243	0.0202	0.0115	0.0150	0.0148	0.0191
Pooled	O_3	0.0029	0.0314	0.0295	0.0047	0.0415	0.0399	0.0026	0.0298	0.0043	0.0399
Pooled	PM_{10}	0.0045	0.0187	0.0161	0.0040	0.0195	0.0168	0.0032	0.0143	0.0029	0.0138

Frame	Pollutant	Speed sr², former	Block sr², former	H1 sr², former	Speed sr², vector	Block sr², vector	H1 sr², vector	Speed CV, former	Block CV, former	Speed CV, vector	Block CV, vector
Pooled	$PM_{2.5}$	0.0034	0.0190	0.0165	0.0045	0.0246	0.0211	0.0023	0.0145	0.0035	0.0189
Rung 3	NO_2	0.0299	0.0132	0.0107	0.0343	0.0180	0.0131				
Rung 3	O_3	0.0074	0.0390	0.0369	0.0068	0.0460	0.0439				
Rung 3	PM_{10}	0.0015	0.0179	0.0150	0.0016	0.0203	0.0166				
Rung 3	$PM_{2.5}$	0.0034	0.0212	0.0180	0.0043	0.0267	0.0225				
Rung 4	NO_2	0.0306	0.0142	0.0111	0.0351	0.0194	0.0139				
Rung 4	O_3	0.0071	0.0400	0.0378	0.0065	0.0474	0.0453				
Rung 4	PM_{10}	0.0013	0.0189	0.0159	0.0013	0.0215	0.0175				
Rung 4	$PM_{2.5}$	0.0029	0.0218	0.0186	0.0037	0.0273	0.0230				

(f) Per city, anomaly frames: cross-validated comparisons, with the models and folds of part (d). Computed from the deposited daily direction, rounded to 0.1°, which reproduces the values of part (c) to 0.0001.

City	Pollutant	Frame	n	Folds	Speed, in-sample	Block, in-sample	H1, in-sample	Speed, CV	Block, CV	H1, CV
Marseille	NO_2	Rung 3	2922	8	0.0890	0.0035	0.0021	0.0931	−0.0001	−0.0007
Toulouse	NO_2	Rung 3	2866	8	0.0614	0.0186	0.0041	0.0624	0.0164	0.0020
Montpellier	NO_2	Rung 3	2817	8	0.0354	0.0064	0.0044	0.0342	0.0038	0.0030
Bordeaux	NO_2	Rung 3	2690	8	0.0350	0.0134	0.0014	0.0363	0.0072	−0.0021
Lyon	NO_2	Rung 3	2919	8	0.0380	0.0326	0.0312	0.0381	0.0250	0.0272
Lille	NO_2	Rung 3	1337	4	0.0152	0.0115	0.0024	0.0094	−0.0216	−0.0253
Strasbourg	NO_2	Rung 3	2918	8	0.0268	0.0370	0.0341	0.0269	0.0288	0.0275
Nice	NO_2	Rung 3	2879	8	0.0138	0.0334	0.0309	0.0114	0.0325	0.0310
Nantes	NO_2	Rung 3	2889	8	0.0151	0.0200	0.0198	0.0144	0.0146	0.0170
Paris	NO_2	Rung 3	2922	8	0.0138	0.0040	0.0006	0.0110	−0.0004	−0.0033
Marseille	O_3	Rung 3	2816	8	0.0000	0.1790	0.1767	−0.0005	0.1760	0.1746
Toulouse	O_3	Rung 3	2903	8	0.0480	0.0062	0.0053	0.0498	0.0035	0.0037
Montpellier	O_3	Rung 3	2870	8	0.0008	0.1038	0.1024	−0.0001	0.0986	0.0983
Bordeaux	O_3	Rung 3	2705	8	0.0019	0.0189	0.0183	0.0013	0.0149	0.0156
Lyon	O_3	Rung 3	2914	8	0.0138	0.0159	0.0139	0.0137	0.0128	0.0123
Lille	O_3	Rung 3	1346	4	0.0002	0.0376	0.0349	−0.0007	0.0346	0.0340
Strasbourg	O_3	Rung 3	2843	8	0.0014	0.0158	0.0136	0.0013	0.0135	0.0130
Nice	O_3	Rung 3	2885	8	0.0017	0.0377	0.0341	0.0001	0.0366	0.0341
Nantes	O_3	Rung 3	2894	8	0.0001	0.0310	0.0274	−0.0010	0.0286	0.0264
Paris	O_3	Rung 3	2922	8	0.0005	0.0137	0.0128	−0.0002	0.0124	0.0120
Marseille	PM_{10}	Rung 3	2913	8	0.0007	0.0151	0.0095	−0.0003	0.0079	0.0047
Toulouse	PM_{10}	Rung 3	2850	8	0.0005	0.0085	0.0045	0.0002	0.0045	0.0018
Montpellier	PM_{10}	Rung 3	2814	8	0.0000	0.0407	0.0364	−0.0018	0.0384	0.0357

City	Pollutant	Frame	n	Folds	Speed, in-sample	Block, in-sample	H1, in-sample	Speed, CV	Block, CV	H1, CV
Bordeaux	PM_{10}	Rung 3	2516	8	0.0021	0.0132	0.0026	0.0016	0.0038	−0.0036
Lyon	PM_{10}	Rung 3	2922	8	0.0005	0.0180	0.0153	−0.0004	0.0146	0.0127
Lille	PM_{10}	Rung 3	1327	4	0.0002	0.0449	0.0435	−0.0004	0.0314	0.0329
Strasbourg	PM_{10}	Rung 3	2895	8	0.0051	0.0060	0.0038	0.0044	0.0012	0.0011
Nice	PM_{10}	Rung 3	2865	8	0.0024	0.0037	0.0028	0.0006	0.0023	0.0024
Nantes	PM_{10}	Rung 3	2886	8	0.0045	0.0150	0.0124	0.0042	0.0076	0.0074
Paris	PM_{10}	Rung 3	2916	8	0.0000	0.0380	0.0349	−0.0008	0.0339	0.0317
Marseille	$PM_{2.5}$	Rung 3	2889	8	0.0135	0.0197	0.0112	0.0135	0.0132	0.0058
Toulouse	$PM_{2.5}$	Rung 3	2838	8	0.0051	0.0097	0.0042	0.0047	0.0065	0.0018
Montpellier	$PM_{2.5}$	Rung 3	2754	8	0.0024	0.0261	0.0241	0.0010	0.0225	0.0228
Bordeaux	$PM_{2.5}$	Rung 3	2510	8	0.0031	0.0187	0.0066	0.0030	0.0071	−0.0018
Lyon	$PM_{2.5}$	Rung 3	2900	8	0.0031	0.0168	0.0161	0.0022	0.0135	0.0137
Lille	$PM_{2.5}$	Rung 3	1239	4	0.0000	0.0800	0.0774	−0.0009	0.0682	0.0659
Strasbourg	$PM_{2.5}$	Rung 3	2903	8	0.0115	0.0062	0.0044	0.0115	0.0004	0.0003
Nice	$PM_{2.5}$	Rung 3	2865	8	0.0009	0.0043	0.0025	0.0000	0.0011	0.0010
Nantes	$PM_{2.5}$	Rung 3	2822	8	0.0035	0.0441	0.0394	0.0033	0.0352	0.0323
Paris	$PM_{2.5}$	Rung 3	2727	8	0.0003	0.0416	0.0389	−0.0010	0.0369	0.0345
Marseille	NO_2	Rung 4	2922	8	0.0798	0.0038	0.0019	0.0800	0.0007	−0.0004
Toulouse	NO_2	Rung 4	2866	8	0.0648	0.0147	0.0015	0.0641	0.0118	−0.0004
Montpellier	NO_2	Rung 4	2817	8	0.0368	0.0068	0.0037	0.0353	0.0043	0.0023
Bordeaux	NO_2	Rung 4	2690	8	0.0338	0.0153	0.0018	0.0334	0.0114	−0.0009
Lyon	NO_2	Rung 4	2919	8	0.0368	0.0448	0.0438	0.0353	0.0391	0.0403
Lille	NO_2	Rung 4	1337	4	0.0230	0.0153	0.0039	0.0187	0.0002	−0.0062
Strasbourg	NO_2	Rung 4	2918	8	0.0230	0.0442	0.0407	0.0213	0.0405	0.0381
Nice	NO_2	Rung 4	2879	8	0.0213	0.0238	0.0198	0.0194	0.0211	0.0181
Nantes	NO_2	Rung 4	2889	8	0.0152	0.0203	0.0197	0.0138	0.0160	0.0167
Paris	NO_2	Rung 4	2922	8	0.0169	0.0054	0.0018	0.0151	0.0031	0.0004
Marseille	O_3	Rung 4	2816	8	0.0002	0.1834	0.1815	−0.0002	0.1823	0.1813
Toulouse	O_3	Rung 4	2903	8	0.0446	0.0070	0.0061	0.0452	0.0038	0.0041
Montpellier	O_3	Rung 4	2870	8	0.0006	0.1072	0.1057	−0.0005	0.1028	0.1024
Bordeaux	O_3	Rung 4	2705	8	0.0015	0.0212	0.0203	0.0008	0.0181	0.0185
Lyon	O_3	Rung 4	2914	8	0.0139	0.0152	0.0136	0.0136	0.0123	0.0121
Lille	O_3	Rung 4	1346	4	0.0002	0.0413	0.0384	−0.0007	0.0400	0.0396
Strasbourg	O_3	Rung 4	2843	8	0.0012	0.0158	0.0135	0.0009	0.0131	0.0127
Nice	O_3	Rung 4	2885	8	0.0023	0.0358	0.0315	0.0011	0.0342	0.0308
Nantes	O_3	Rung 4	2894	8	0.0001	0.0328	0.0285	−0.0007	0.0307	0.0275
Paris	O_3	Rung 4	2922	8	0.0006	0.0142	0.0135	0.0002	0.0127	0.0127
Marseille	PM_{10}	Rung 4	2913	8	0.0001	0.0156	0.0103	−0.0012	0.0101	0.0068
Toulouse	PM_{10}	Rung 4	2850	8	0.0004	0.0083	0.0046	0.0001	0.0051	0.0026
Montpellier	PM_{10}	Rung 4	2814	8	0.0001	0.0401	0.0359	−0.0016	0.0375	0.0350

City	Pollutant	Frame	n	Folds	Speed, in-sample	Block, in-sample	H1, in-sample	Speed, CV	Block, CV	H1, CV
Bordeaux	PM_{10}	Rung 4	2516	8	0.0017	0.0158	0.0046	0.0010	0.0093	0.0003
Lyon	PM_{10}	Rung 4	2922	8	0.0004	0.0190	0.0164	−0.0006	0.0162	0.0143
Lille	PM_{10}	Rung 4	1327	4	0.0001	0.0466	0.0446	−0.0005	0.0358	0.0357
Strasbourg	PM_{10}	Rung 4	2895	8	0.0034	0.0059	0.0032	0.0023	0.0027	0.0015
Nice	PM_{10}	Rung 4	2865	8	0.0015	0.0027	0.0016	−0.0011	0.0003	0.0001
Nantes	PM_{10}	Rung 4	2886	8	0.0054	0.0202	0.0172	0.0051	0.0162	0.0147
Paris	PM_{10}	Rung 4	2916	8	0.0000	0.0402	0.0371	−0.0007	0.0370	0.0351
Marseille	$PM_{2.5}$	Rung 4	2889	8	0.0095	0.0194	0.0118	0.0084	0.0140	0.0078
Toulouse	$PM_{2.5}$	Rung 4	2838	8	0.0048	0.0094	0.0042	0.0043	0.0067	0.0022
Montpellier	$PM_{2.5}$	Rung 4	2754	8	0.0026	0.0250	0.0232	0.0014	0.0209	0.0214
Bordeaux	$PM_{2.5}$	Rung 4	2510	8	0.0025	0.0226	0.0100	0.0020	0.0147	0.0044
Lyon	$PM_{2.5}$	Rung 4	2900	8	0.0024	0.0179	0.0172	0.0012	0.0150	0.0151
Lille	$PM_{2.5}$	Rung 4	1239	4	0.0001	0.0759	0.0727	−0.0004	0.0621	0.0593
Strasbourg	$PM_{2.5}$	Rung 4	2903	8	0.0090	0.0055	0.0034	0.0080	0.0016	0.0008
Nice	$PM_{2.5}$	Rung 4	2865	8	0.0016	0.0032	0.0009	0.0007	−0.0003	−0.0011
Nantes	$PM_{2.5}$	Rung 4	2822	8	0.0040	0.0501	0.0452	0.0039	0.0441	0.0406
Paris	$PM_{2.5}$	Rung 4	2727	8	0.0004	0.0440	0.0411	−0.0006	0.0406	0.0384

(g) Wind/BLH balance with and without the direction block, ten-city means. Seven predictors = primary model (Tables S6 and S7). With block = the same model plus the four Fourier terms. Change = relative change of the ten-city mean sr^2 when the block is added. Cities with BLH > speed = cities in which the BLH sr^2 exceeds the speed sr^2. $p < 0.05$ = HAC Wald test in the model with the block. Spearman = rank correlation across the ten cities of (BLH − speed), with against without the block.

Frame	Pollutant	Speed sr^2, 7 predictors	BLH sr^2, 7 predictors	Ratio BLH/speed, 7 predictors	Speed sr^2, with block	BLH sr^2, with block	Ratio BLH/speed, with block	Change of speed sr^2	Change of BLH sr^2	Cities with BLH > speed, 7 predictors (of 10)	Cities with BLH > speed, with block (of 10)	Cities with speed $p < 0.05$, with block (of 10)	Cities with BLH $p < 0.05$, with block (of 10)	Spearman of the balance
Pooled	NO_2	0.0175	0.0667	3.8	0.0154	0.0376	2.4	−12%	−44%	8	8	7	10	0.90
Pooled	O_3	0.0080	0.0352	4.4	0.0047	0.0208	4.5	−41%	−41%	9	9	4	10	0.72
Pooled	PM_{10}	0.0072	0.0606	8.4	0.0040	0.0329	8.3	−45%	−46%	10	10	3	10	0.76
Pooled	$PM_{2.5}$	0.0047	0.0461	9.8	0.0045	0.0227	5.1	−5%	−51%	10	9	6	10	0.88
Rung 3	NO_2	0.0395	0.0347	0.9	0.0343	0.0251	0.7	−13%	−28%	5	5	10	10	0.92
Rung 3	O_3	0.0118	0.0311	2.6	0.0068	0.0201	2.9	−42%	−35%	7	8	4	10	0.43
Rung 3	PM_{10}	0.0025	0.0391	15.4	0.0016	0.0232	14.6	−37%	−41%	10	10	3	10	0.94
Rung 3	$PM_{2.5}$	0.0040	0.0411	10.2	0.0043	0.0214	4.9	8%	−48%	10	9	7	10	0.89
Rung 4	NO_2	0.0394	0.0419	1.1	0.0351	0.0293	0.8	−11%	−30%	6	5	10	10	0.90
Rung 4	O_3	0.0115	0.0318	2.8	0.0065	0.0207	3.2	−43%	−35%	7	8	5	10	0.43
Rung 4	PM_{10}	0.0023	0.0410	17.7	0.0013	0.0242	18.4	−44%	−41%	10	10	3	10	0.81
Rung 4	$PM_{2.5}$	0.0034	0.0422	12.2	0.0037	0.0220	5.9	8%	−48%	10	10	8	10	0.96

(h) NO_2 per city: wind/BLH balance with and without the direction block (Figure S3). Speed − BLH > 0: speed carries the larger unique share. p = HAC Wald test of the coefficient in the model with the block (χ^2, 1 df). p (BLH) was computed from the deposited dataset, in which the daily direction is rounded to 0.1°. That computation reproduces the truncation lags of part (c) exactly, and p (speed) within 2% (relative).

City	Type	Frame	Speed sr², 7 predictors	BLH sr², 7 predictors	Speed − BLH, 7 predictors	Speed sr², with block	BLH sr², with block	Speed − BLH, with block	Larger term, 7 predictors	Larger term, with block	p (speed), with block	p (BLH), with block
Marseille	A	Pooled	0.0881	0.0204	0.0676	0.0698	0.0217	0.0482	Speed	Speed	1.8×10^{-47}	1.9×10^{-19}
Toulouse	A	Pooled	0.0541	0.0464	0.0077	0.0332	0.0254	0.0078	Speed	Speed	2.0×10^{-9}	5.1×10^{-27}
Montpellier	A	Pooled	0.0182	0.0359	−0.0177	0.0137	0.0421	−0.0284	BLH	BLH	1.0×10^{-6}	1.8×10^{-28}
Bordeaux	B	Pooled	0.0008	0.0861	−0.0853	0.0027	0.0448	−0.0421	BLH	BLH	0.002	2.5×10^{-9}
Lyon	B	Pooled	0.0065	0.0889	−0.0823	0.0153	0.0263	−0.0109	BLH	BLH	1.9×10^{-14}	5.2×10^{-17}
Lille	B	Pooled	0.0015	0.0405	−0.0389	0.0016	0.0378	−0.0362	BLH	BLH	0.116	6.5×10^{-14}
Strasbourg	C	Pooled	0.0002	0.0935	−0.0934	0.0036	0.0461	−0.0425	BLH	BLH	0.002	1.8×10^{-22}
Nice	C	Pooled	0.0045	0.0630	−0.0585	0.0137	0.0236	−0.0099	BLH	BLH	2.1×10^{-8}	9.3×10^{-15}
Nantes	C	Pooled	0.0008	0.0950	−0.0942	0.0002	0.0474	−0.0472	BLH	BLH	0.419	6.3×10^{-9}
Paris	C	Pooled	0.0000	0.0978	−0.0978	0.0003	0.0607	−0.0604	BLH	BLH	0.473	1.0×10^{-2}
Marseille	A	Rung 3	0.1083	0.0105	0.0979	0.0890	0.0113	0.0777	Speed	Speed	4.9×10^{-8}	2.0×10^{-12}
Toulouse	A	Rung 3	0.0970	0.0257	0.0714	0.0614	0.0222	0.0392	Speed	Speed	1.6×10^{-4}	1.6×10^{-21}
Montpellier	A	Rung 3	0.0425	0.0216	0.0209	0.0354	0.0245	0.0108	Speed	Speed	3.8×10^{-24}	2.1×10^{-25}
Bordeaux	B	Rung 3	0.0325	0.0285	0.0039	0.0350	0.0229	0.0121	Speed	Speed	7.2×10^{-6}	1.6×10^{-21}
Lyon	B	Rung 3	0.0407	0.0355	0.0052	0.0379	0.0168	0.0211	Speed	Speed	7.3×10^{-28}	1.1×10^{-1}
Lille	B	Rung 3	0.0165	0.0230	−0.0066	0.0152	0.0260	−0.0108	BLH	BLH	4.0×10^{-6}	5.3×10^{-9}
Strasbourg	C	Rung 3	0.0258	0.0425	−0.0167	0.0268	0.0279	−0.0011	BLH	BLH	2.0×10^{-18}	1.1×10^{-18}
Nice	C	Rung 3	0.0075	0.0498	−0.0424	0.0138	0.0281	−0.0142	BLH	BLH	1.5×10^{-6}	1.8×10^{-14}
Nantes	C	Rung 3	0.0098	0.0628	−0.0529	0.0151	0.0352	−0.0201	BLH	BLH	1.3×10^{-1}	2.5×10^{-24}
Paris	C	Rung 3	0.0143	0.0472	−0.0329	0.0138	0.0357	−0.0219	BLH	BLH	7.2×10^{-9}	5.2×10^{-21}
Marseille	A	Rung 4	0.0982	0.0140	0.0842	0.0798	0.0150	0.0648	Speed	Speed	9.0×10^{-87}	4.2×10^{-19}
Toulouse	A	Rung 4	0.0986	0.0324	0.0662	0.0648	0.0247	0.0401	Speed	Speed	1.3×10^{-46}	1.1×10^{-25}
Montpellier	A	Rung 4	0.0444	0.0246	0.0198	0.0368	0.0277	0.0092	Speed	Speed	9.4×10^{-27}	4.0×10^{-27}
Bordeaux	B	Rung 4	0.0293	0.0365	−0.0073	0.0338	0.0249	0.0089	BLH	Speed	4.7×10^{-9}	2.2×10^{-24}
Lyon	B	Rung 4	0.0380	0.0470	−0.0090	0.0368	0.0224	0.0144	BLH	Speed	2.9×10^{-9}	4.7×10^{-21}
Lille	B	Rung 4	0.0244	0.0198	0.0046	0.0230	0.0243	−0.0013	Speed	BLH	1.0×10^{-1}	5.3×10^{-1}
Strasbourg	C	Rung 4	0.0221	0.0501	−0.0280	0.0230	0.0337	−0.0107	BLH	BLH	2.6×10^{-17}	5.2×10^{-24}
Nice	C	Rung 4	0.0140	0.0594	−0.0454	0.0213	0.0394	−0.0181	BLH	BLH	1.3×10^{-11}	2.6×10^{-22}
Nantes	C	Rung 4	0.0084	0.0774	−0.0691	0.0152	0.0404	−0.0252	BLH	BLH	3.3×10^{-1}	4.0×10^{-9}
Paris	C	Rung 4	0.0161	0.0575	−0.0414	0.0169	0.0401	−0.0232	BLH	BLH	2.2×10^{-12}	4.6×10^{-26}

Table S9. Bootstrap 95% confidence intervals of the NO_2 wind and BLH sr^2 and of their difference, third and fourth rungs. Stationary block bootstrap of the daily series, mean block length 10 days, 2000 resamples, percentile intervals. D = wind sr^2 − BLH sr^2 is computed in each resample, so its interval accounts for the correlation between the two estimates. Ten-city mean: joint calendar bootstrap, with the same resampled dates for all cities. Lille = Lille Fives, 2018–2021. Rung 3, deseasonalized anomalies. Rung 4, the same with the calendar-year means removed.

(a) Per city and ten-city mean.

City	Type	Frame	Wind sr^2	Wind 2.5%	Wind 97.5%	BLH sr^2	BLH 2.5%	BLH 97.5%	D = wind − BLH	D 2.5%	D 97.5%	Share of resamples with D > 0	Corr(wind, BLH) across resamples	CI of D excludes 0
Marseille	A	Rung 3	0.108	0.087	0.130	0.010	0.006	0.017	0.098	0.071	0.123	1.000	−0.68	Yes
Toulouse	A	Rung 3	0.097	0.079	0.117	0.026	0.017	0.036	0.071	0.046	0.098	1.000	−0.54	Yes
Montpellier	A	Rung 3	0.043	0.031	0.057	0.022	0.013	0.032	0.021	0.001	0.042	0.980	−0.66	Yes
Bordeaux	B	Rung 3	0.032	0.021	0.046	0.029	0.018	0.041	0.004	−0.018	0.026	0.639	−0.69	No
Lyon	B	Rung 3	0.041	0.027	0.055	0.035	0.024	0.049	0.005	−0.020	0.029	0.648	−0.71	No
Strasbourg	C	Rung 3	0.026	0.014	0.040	0.042	0.029	0.059	−0.017	−0.043	0.009	0.101	−0.81	No
Nice	C	Rung 3	0.007	0.002	0.018	0.050	0.031	0.072	−0.042	−0.069	−0.015	0.001	−0.72	Yes
Nantes	C	Rung 3	0.010	0.004	0.019	0.063	0.045	0.083	−0.053	−0.078	−0.028	0.000	−0.77	Yes
Lille	B	Rung 3	0.016	0.005	0.033	0.023	0.009	0.043	−0.007	−0.036	0.023	0.343	−0.80	No
Paris	C	Rung 3	0.014	0.006	0.026	0.047	0.031	0.065	−0.033	−0.057	−0.007	0.006	−0.81	Yes
Marseille	A	Rung 4	0.098	0.080	0.117	0.014	0.009	0.021	0.084	0.061	0.107	1.000	−0.61	Yes
Toulouse	A	Rung 4	0.099	0.079	0.119	0.032	0.022	0.044	0.066	0.038	0.094	1.000	−0.53	Yes
Montpellier	A	Rung 4	0.044	0.033	0.058	0.025	0.016	0.034	0.020	0.001	0.041	0.979	−0.68	Yes
Bordeaux	B	Rung 4	0.029	0.019	0.041	0.037	0.025	0.050	−0.007	−0.030	0.014	0.266	−0.70	No
Lyon	B	Rung 4	0.038	0.026	0.052	0.047	0.035	0.060	−0.009	−0.032	0.014	0.218	−0.66	No
Strasbourg	C	Rung 4	0.022	0.012	0.035	0.050	0.035	0.067	−0.028	−0.054	−0.001	0.021	−0.82	Yes
Nice	C	Rung 4	0.014	0.006	0.026	0.059	0.040	0.082	−0.045	−0.075	−0.016	0.001	−0.65	Yes
Nantes	C	Rung 4	0.008	0.003	0.016	0.077	0.059	0.098	−0.069	−0.094	−0.044	0.000	−0.78	Yes
Lille	B	Rung 4	0.024	0.011	0.042	0.020	0.007	0.039	0.005	−0.027	0.033	0.620	−0.78	No
Paris	C	Rung 4	0.016	0.008	0.027	0.057	0.042	0.075	−0.041	−0.065	−0.016	0.002	−0.79	Yes
Ten-city mean		Rung 3	0.039	0.034	0.046	0.035	0.028	0.042	0.005	−0.008	0.017	0.781		No
Ten-city mean		Rung 4	0.039	0.034	0.046	0.042	0.036	0.049	−0.003	−0.014	0.009	0.306		No

(b) Sensitivity of the interval of D to the mean block length (5, 10 and 20 days), same resampling scheme.

City	Frame	Mean block (days)	D	D 2.5%	D 97.5%	Share D > 0	CI excludes 0
Marseille	Rung 3	5	0.098	0.074	0.123	1.000	Yes
Marseille	Rung 3	10	0.098	0.071	0.123	1.000	Yes
Marseille	Rung 3	20	0.098	0.072	0.124	1.000	Yes
Toulouse	Rung 3	5	0.071	0.047	0.095	1.000	Yes
Toulouse	Rung 3	10	0.071	0.046	0.098	1.000	Yes
Toulouse	Rung 3	20	0.071	0.047	0.097	1.000	Yes
Montpellier	Rung 3	5	0.021	0.001	0.041	0.980	Yes

City	Frame	Mean block (days)	D	D 2.5%	D 97.5%	Share D > 0	CI excludes 0
Montpellier	Rung 3	10	0.021	0.001	0.042	0.980	Yes
Montpellier	Rung 3	20	0.021	0.001	0.042	0.983	Yes
Bordeaux	Rung 3	5	0.004	−0.019	0.026	0.639	No
Bordeaux	Rung 3	10	0.004	−0.018	0.026	0.639	No
Bordeaux	Rung 3	20	0.004	−0.020	0.027	0.634	No
Lyon	Rung 3	5	0.005	−0.018	0.030	0.682	No
Lyon	Rung 3	10	0.005	−0.020	0.029	0.648	No
Lyon	Rung 3	20	0.005	−0.021	0.030	0.651	No
Strasbourg	Rung 3	5	−0.017	−0.041	0.008	0.096	No
Strasbourg	Rung 3	10	−0.017	−0.043	0.009	0.101	No
Strasbourg	Rung 3	20	−0.017	−0.044	0.011	0.116	No
Nice	Rung 3	5	−0.042	−0.069	−0.017	0.001	Yes
Nice	Rung 3	10	−0.042	−0.069	−0.015	0.001	Yes
Nice	Rung 3	20	−0.042	−0.071	−0.016	0.001	Yes
Nantes	Rung 3	5	−0.053	−0.076	−0.029	0.000	Yes
Nantes	Rung 3	10	−0.053	−0.078	−0.028	0.000	Yes
Nantes	Rung 3	20	−0.053	−0.081	−0.027	0.000	Yes
Lille	Rung 3	5	−0.007	−0.035	0.020	0.321	No
Lille	Rung 3	10	−0.007	−0.036	0.023	0.343	No
Lille	Rung 3	20	−0.007	−0.039	0.026	0.348	No
Paris	Rung 3	5	−0.033	−0.055	−0.009	0.002	Yes
Paris	Rung 3	10	−0.033	−0.057	−0.007	0.006	Yes
Paris	Rung 3	20	−0.033	−0.059	−0.006	0.009	Yes
Marseille	Rung 4	5	0.084	0.061	0.106	1.000	Yes
Marseille	Rung 4	10	0.084	0.061	0.107	1.000	Yes
Marseille	Rung 4	20	0.084	0.062	0.107	1.000	Yes
Toulouse	Rung 4	5	0.066	0.041	0.091	1.000	Yes
Toulouse	Rung 4	10	0.066	0.038	0.094	1.000	Yes
Toulouse	Rung 4	20	0.066	0.039	0.094	1.000	Yes
Montpellier	Rung 4	5	0.020	0.000	0.040	0.973	No
Montpellier	Rung 4	10	0.020	0.001	0.041	0.979	Yes
Montpellier	Rung 4	20	0.020	0.000	0.040	0.978	Yes
Bordeaux	Rung 4	5	−0.007	−0.029	0.015	0.255	No
Bordeaux	Rung 4	10	−0.007	−0.030	0.014	0.266	No
Bordeaux	Rung 4	20	−0.007	−0.031	0.016	0.293	No
Lyon	Rung 4	5	−0.009	−0.031	0.015	0.237	No
Lyon	Rung 4	10	−0.009	−0.032	0.014	0.218	No
Lyon	Rung 4	20	−0.009	−0.032	0.014	0.227	No

City	Frame	Mean block (days)	D	D 2.5%	D 97.5%	Share D > 0	CI excludes 0
Strasbourg	Rung 4	5	−0.028	−0.052	−0.003	0.016	Yes
Strasbourg	Rung 4	10	−0.028	−0.054	−0.001	0.021	Yes
Strasbourg	Rung 4	20	−0.028	−0.054	0.002	0.033	No
Nice	Rung 4	5	−0.045	−0.074	−0.017	0.000	Yes
Nice	Rung 4	10	−0.045	−0.075	−0.016	0.001	Yes
Nice	Rung 4	20	−0.045	−0.074	−0.018	0.001	Yes
Nantes	Rung 4	5	−0.069	−0.091	−0.045	0.000	Yes
Nantes	Rung 4	10	−0.069	−0.094	−0.044	0.000	Yes
Nantes	Rung 4	20	−0.069	−0.098	−0.043	0.000	Yes
Lille	Rung 4	5	0.005	−0.025	0.032	0.614	No
Lille	Rung 4	10	0.005	−0.027	0.033	0.620	No
Lille	Rung 4	20	0.005	−0.027	0.032	0.613	No
Paris	Rung 4	5	−0.041	−0.063	−0.018	0.000	Yes
Paris	Rung 4	10	−0.041	−0.065	−0.016	0.002	Yes
Paris	Rung 4	20	−0.041	−0.068	−0.015	0.002	Yes

Table S10. Unique contributions of wind and BLH after averaging the anomalies over windows of 1 to 30 days. Non-overlapping windows anchored on 1 January 2018, each the mean of the daily anomalies of the frame (windows with at least half of their days valid). Seven-predictor OLS on the window means. Ten-city means. n = median number of windows per city. R^2 = mean explained variance of the seven-predictor model on the window means. Chance sr^2 per term = $(1 - R^2)/(n - 8)$, the expected in-sample gain from one pure-noise regressor, as in Table S8. A term close to this level cannot be told from noise. Rung 3, deseasonalized anomalies. Rung 4, the same with the calendar-year means removed. The per-city values (640 rows) are given in the Excel workbook provided as a separate supplementary file.

Frame	Pollutant	Window (days)	n (median)	Wind sr^2	BLH sr^2	Ratio BLH/wind	Cities with BLH > wind (of 10)	R^2 (mean)	Chance sr^2 per term (mean)
Rung 3	NO_2	1	2884	0.0395	0.0347	0.9	5	0.422	0.0002
Rung 3	NO_2	2	1451	0.0353	0.0326	0.9	5	0.431	0.0004
Rung 3	NO_2	3	969	0.0332	0.0311	0.9	6	0.433	0.0007
Rung 3	NO_2	5	583	0.0336	0.0256	0.8	5	0.412	0.0012
Rung 3	NO_2	7	417	0.0315	0.0253	0.8	6	0.400	0.0017
Rung 3	NO_2	10	291	0.0389	0.0144	0.4	4	0.356	0.0026
Rung 3	NO_2	15	195	0.0413	0.0094	0.2	4	0.300	0.0043
Rung 3	NO_2	30	97	0.0423	0.0111	0.3	3	0.272	0.0093
Rung 3	O_3	1	2877	0.0118	0.0311	2.6	7	0.470	0.0002
Rung 3	O_3	2	1451	0.0133	0.0301	2.3	8	0.493	0.0004
Rung 3	O_3	3	971	0.0142	0.0295	2.1	8	0.505	0.0006
Rung 3	O_3	5	584	0.0129	0.0274	2.1	8	0.522	0.0009
Rung 3	O_3	7	418	0.0142	0.0280	2.0	8	0.523	0.0013
Rung 3	O_3	10	292	0.0179	0.0301	1.7	8	0.511	0.0019
Rung 3	O_3	15	195	0.0205	0.0249	1.2	8	0.502	0.0029
Rung 3	O_3	30	97	0.0211	0.0300	1.4	8	0.463	0.0066
Rung 3	PM_{10}	1	2875	0.0025	0.0391	15.4	10	0.265	0.0003
Rung 3	PM_{10}	2	1447	0.0034	0.0411	12.0	10	0.313	0.0005
Rung 3	PM_{10}	3	970	0.0035	0.0404	11.6	10	0.353	0.0007
Rung 3	PM_{10}	5	582	0.0053	0.0450	8.5	10	0.392	0.0012
Rung 3	PM_{10}	7	417	0.0047	0.0436	9.2	9	0.420	0.0016
Rung 3	PM_{10}	10	292	0.0035	0.0360	10.2	10	0.423	0.0023
Rung 3	PM_{10}	15	195	0.0020	0.0414	21.0	10	0.463	0.0032
Rung 3	PM_{10}	30	97	0.0111	0.0441	4.0	9	0.452	0.0069
Rung 3	$PM_{2.5}$	1	2830	0.0040	0.0411	10.2	10	0.299	0.0003
Rung 3	$PM_{2.5}$	2	1429	0.0048	0.0420	8.7	10	0.348	0.0005
Rung 3	$PM_{2.5}$	3	959	0.0052	0.0401	7.7	10	0.381	0.0007
Rung 3	$PM_{2.5}$	5	575	0.0071	0.0416	5.9	9	0.417	0.0012
Rung 3	$PM_{2.5}$	7	412	0.0083	0.0439	5.3	9	0.448	0.0015
Rung 3	$PM_{2.5}$	10	288	0.0095	0.0344	3.6	8	0.435	0.0023
Rung 3	$PM_{2.5}$	15	194	0.0104	0.0462	4.4	9	0.479	0.0032
Rung 3	$PM_{2.5}$	30	96	0.0152	0.0550	3.6	9	0.459	0.0069
Rung 4	NO_2	1	2884	0.0394	0.0419	1.1	6	0.477	0.0002
Rung 4	NO_2	2	1451	0.0346	0.0427	1.2	6	0.505	0.0004
Rung 4	NO_2	3	969	0.0321	0.0434	1.4	7	0.522	0.0006
Rung 4	NO_2	5	583	0.0311	0.0408	1.3	8	0.527	0.0009
Rung 4	NO_2	7	417	0.0291	0.0449	1.5	8	0.537	0.0013
Rung 4	NO_2	10	291	0.0377	0.0297	0.8	5	0.503	0.0020
Rung 4	NO_2	15	195	0.0426	0.0244	0.6	5	0.445	0.0034
Rung 4	NO_2	30	97	0.0546	0.0220	0.4	2	0.402	0.0077
Rung 4	O_3	1	2877	0.0115	0.0318	2.8	7	0.475	0.0002
Rung 4	O_3	2	1451	0.0129	0.0312	2.4	8	0.501	0.0004
Rung 4	O_3	3	971	0.0138	0.0307	2.2	8	0.514	0.0006
Rung 4	O_3	5	584	0.0126	0.0288	2.3	8	0.535	0.0009
Rung 4	O_3	7	418	0.0140	0.0296	2.1	8	0.538	0.0012
Rung 4	O_3	10	292	0.0184	0.0323	1.8	8	0.531	0.0018
Rung 4	O_3	15	195	0.0209	0.0262	1.3	8	0.524	0.0028
Rung 4	O_3	30	97	0.0231	0.0307	1.3	8	0.496	0.0062
Rung 4	PM_{10}	1	2875	0.0023	0.0410	17.7	10	0.269	0.0003
Rung 4	PM_{10}	2	1447	0.0031	0.0437	14.1	10	0.319	0.0005
Rung 4	PM_{10}	3	970	0.0030	0.0435	14.7	10	0.362	0.0007
Rung 4	PM_{10}	5	582	0.0050	0.0491	9.8	10	0.406	0.0011

Frame	Pollutant	Window (days)	n (median)	Wind sr^2	BLH sr^2	Ratio BLH/wind	Cities with BLH > wind (of 10)	R^2 (mean)	Chance sr^2 per term (mean)
Rung 4	PM_{10}	7	417	0.0042	0.0487	11.6	10	0.438	0.0015
Rung 4	PM_{10}	10	292	0.0035	0.0418	12.0	10	0.446	0.0022
Rung 4	PM_{10}	15	195	0.0020	0.0486	23.9	10	0.502	0.0030
Rung 4	PM_{10}	30	97	0.0113	0.0548	4.9	10	0.499	0.0063
Rung 4	$PM_{2.5}$	1	2830	0.0034	0.0422	12.2	10	0.306	0.0003
Rung 4	$PM_{2.5}$	2	1429	0.0039	0.0436	11.2	10	0.358	0.0005
Rung 4	$PM_{2.5}$	3	959	0.0040	0.0420	10.5	10	0.395	0.0007
Rung 4	$PM_{2.5}$	5	575	0.0055	0.0440	8.0	10	0.435	0.0011
Rung 4	$PM_{2.5}$	7	412	0.0058	0.0463	8.0	10	0.471	0.0015
Rung 4	$PM_{2.5}$	10	288	0.0076	0.0365	4.8	10	0.461	0.0022
Rung 4	$PM_{2.5}$	15	194	0.0079	0.0488	6.2	9	0.519	0.0029
Rung 4	$PM_{2.5}$	30	96	0.0100	0.0592	5.9	10	0.509	0.0063

Table S11. Diagnostics of the daily wind direction. ERA5 = hourly 10 m wind at the grid point of each city, 2018–2025. Observed = hourly 10 m wind at the city airport (NOAA Integrated Surface Database, part b). Direction from which the wind blows.

(a) Correction of the daily direction, steadiness and breezes. Prevailing sectors: share of hours per 45° sector, calms (below 0.5 m s^{-1}) excluded. Hours from NW to NE = share of hours in the five 22.5° sectors NW, NNW, N, NNE and NE. Steadiness = |daily vector-mean wind|/daily mean speed. Former direction = arithmetic mean of the hourly directions, as in the submitted dataset. Northerly day = vector-mean direction between 270° and 90° through north. Across the ten cities, the share of days with |vector − former| > 90° has a rank correlation of 0.93 with the share of hours from NW to NE, and 98.6% of these days are northerly. Reversal = afternoon (12–17 UTC) and night (00–05 UTC) mean winds turned by at least 120°, both at least 1 m s^{-1} (3.6 km h^{-1}), as a share of the June–August days on which both windows have at least 4 valid hours. Afternoon anomaly = value at 15 UTC of the first diurnal harmonic of u and v, June–August, given as a speed and the direction from which it blows.

City	Type	Prevailing sectors (ERA5)	Hours from NW to NE (ERA5)	Mean steadiness	Days with steadiness < 0.5	Median |vector − former| (°)	Days with |vector − former| > 90°	Same, northerly days	Same, southerly days	Summer reversal, ERA5	Summer reversal, observed	Afternoon anomaly ERA5 (m s^{-1})	From (°)	Afternoon anomaly observed (m s^{-1})	From (°)
Marseille	A	NW 28%, N 13%	0.44	0.77	0.16	13.5	0.138	0.234	0.013	0.21	0.12	1.41	226	2.01	233
Toulouse	A	W 31%, SE 19%	0.17	0.80	0.15	4.5	0.063	0.123	0.001	0.10	0.13	0.63	18	0.77	0
Montpellier	A	NW 29%, W 15%	0.41	0.76	0.17	8.7	0.123	0.195	0.007	0.28	0.43	1.95	187	2.02	190
Bordeaux	B	W 18%, NW 15%	0.34	0.84	0.08	5.2	0.121	0.225	0.001	0.07	0.05	0.58	312	1.10	322
Lyon	B	S 23%, NW 22%	0.42	0.80	0.13	13.9	0.199	0.368	0.003	0.08	0.04	0.65	48	0.62	4
Lille	B	SW 23%, S 17%	0.25	0.88	0.05	2.3	0.075	0.191	0.000	0.04	0.04	0.55	315	0.76	283
Strasbourg	C	S 25%, SW 23%	0.33	0.83	0.09	5.1	0.117	0.277	0.002	0.03	0.04	0.47	356	0.46	356
Nice	C	N 19%, NE 15%	0.38	0.58	0.40	24.0	0.158	0.306	0.010	0.41	0.75	1.39	178	2.85	151
Nantes	C	SW 19%, W 18%	0.30	0.88	0.05	2.6	0.097	0.195	0.001	0.06	0.05	0.89	253	1.04	260
Paris	C	SW 21%, NE 14%	0.33	0.88	0.04	2.5	0.089	0.192	0.000	0.03	0.03	0.32	263	0.37	239
Ten cities, all days pooled							0.118	0.231	0.003						

(b) ERA5 against the hourly observations at the city airport. One observation per UTC hour (METAR, else SYNOP), 1 January 2018 to 24 August 2025. Variable winds reported with a mean direction are kept. Calms, and variable winds without direction up to 2 m s^{-1}, are set to zero. Suspect or erroneous values are discarded. Daily values require at least 18 valid hours. Windy days: daily vector-mean wind of at least 1.5 m s^{-1} (5.4 km h^{-1}) in both sources. Windy hours: at least 2 m s^{-1} (7.2 km h^{-1}) in both.

City	Airport (ISD station)	Days compared	r(u), daily	r(v), daily	Windy days	Daily direction within 45°	Median daily difference (°)	Windy hours	Hourly direction within 45°	Median hourly difference (°)
Marseille	Marseille-Marignane (07650099999)	2761	0.95	0.94	1686	0.963	9.7	40354	0.873	14.0
Toulouse	Toulouse-Blagnac (07630099999)	2759	0.98	0.94	1908	0.998	8.2	42330	0.926	13.5
Montpellier	Montpellier-Méditerranée (07643099999)	2756	0.92	0.90	1789	0.965	10.2	49361	0.830	17.3
Bordeaux	Bordeaux-Mérignac (07510099999)	2760	0.97	0.97	2025	0.998	6.4	41335	0.952	11.8
Lyon	Lyon-Bron (07480099999)	2742	0.73	0.97	1580	0.991	7.6	33011	0.919	12.5
Lille	Lille-Lesquin (07015099999)	2756	0.95	0.97	2320	0.998	13.0	50699	0.957	15.6
Strasbourg	Strasbourg-Entzheim (07190099999)	2758	0.91	0.96	1440	0.992	8.3	28934	0.917	14.7
Nice	Nice-Côte d'Azur (07690099999)	2762	0.75	0.57	641	0.785	19.0	22338	0.689	27.6
Nantes	Nantes-Atlantique (07222099999)	2760	0.98	0.98	2275	1.000	5.5	49201	0.970	10.3

City	Airport (ISD station)	Days compared	r(u), daily	r(v), daily	Windy days	Daily direction within 45°	Median daily difference (°)	Windy hours	Hourly direction within 45°	Median hourly difference (°)
Paris	Paris-Orly (07149099999)	2762	0.98	0.98	2242	1.000	4.4	47583	0.976	9.7

(c) Direction block sr² (pooled frame) on steady days and with the observed direction. Seven predictors plus the direction block. Steady days: steadiness of at least 0.6. Last three columns: days with both an ERA5 and an observed daily direction. The block is computed once with the ERA5 direction and once with the observed direction, all other predictors unchanged.

City	Pollutant	n, all days	Speed sr², all days	Block sr², all days	n, steady days	Block sr², steady days	n, days with observations	Block sr², ERA5 direction	Block sr², observed direction
Marseille	NO_2	2922	0.0698	0.0052	2227	0.0117	2761	0.0060	0.0213
Toulouse	NO_2	2866	0.0332	0.0220	2310	0.0351	2703	0.0214	0.0191
Montpellier	NO_2	2817	0.0137	0.0104	2118	0.0133	2663	0.0102	0.0090
Bordeaux	NO_2	2690	0.0027	0.0096	2364	0.0104	2532	0.0099	0.0078
Lyon	NO_2	2919	0.0153	0.0630	2376	0.0794	2739	0.0625	0.0657
Lille	NO_2	1337	0.0016	0.0073	1219	0.0077	1327	0.0068	0.0073
Strasbourg	NO_2	2918	0.0036	0.0560	2531	0.0629	2754	0.0545	0.0540
Nice	NO_2	2879	0.0137	0.0425	1393	0.0531	2721	0.0450	0.1046
Nantes	NO_2	2889	0.0002	0.0185	2676	0.0195	2732	0.0184	0.0255
Paris	NO_2	2922	0.0003	0.0084	2708	0.0117	2762	0.0094	0.0114
Marseille	O_3	2816	0.0049	0.1408	2142	0.1584	2660	0.1406	0.1088
Toulouse	O_3	2903	0.0230	0.0073	2342	0.0101	2740	0.0076	0.0102
Montpellier	O_3	2870	0.0140	0.1253	2158	0.1307	2706	0.1240	0.1159
Bordeaux	O_3	2705	0.0001	0.0125	2380	0.0173	2546	0.0123	0.0114
Lyon	O_3	2914	0.0028	0.0124	2373	0.0146	2738	0.0118	0.0078
Lille	O_3	1346	0.0004	0.0282	1228	0.0342	1336	0.0283	0.0239
Strasbourg	O_3	2843	0.0000	0.0151	2464	0.0191	2691	0.0158	0.0106
Nice	O_3	2885	0.0001	0.0467	1395	0.1251	2728	0.0475	0.0955
Nantes	O_3	2894	0.0002	0.0184	2682	0.0251	2737	0.0180	0.0209
Paris	O_3	2922	0.0013	0.0086	2708	0.0114	2762	0.0089	0.0083
Marseille	$PM_{2.5}$	2889	0.0143	0.0172	2200	0.0334	2728	0.0168	0.0039
Toulouse	$PM_{2.5}$	2838	0.0056	0.0077	2292	0.0073	2675	0.0087	0.0032
Montpellier	$PM_{2.5}$	2754	0.0048	0.0217	2061	0.0328	2596	0.0199	0.0248
Bordeaux	$PM_{2.5}$	2510	0.0003	0.0127	2213	0.0168	2351	0.0149	0.0099
Lyon	$PM_{2.5}$	2900	0.0039	0.0172	2361	0.0222	2720	0.0173	0.0091
Lille	$PM_{2.5}$	1239	0.0002	0.0929	1130	0.1021	1236	0.0924	0.0779
Strasbourg	$PM_{2.5}$	2903	0.0091	0.0036	2517	0.0039	2739	0.0039	0.0058
Nice	$PM_{2.5}$	2865	0.0007	0.0032	1386	0.0104	2707	0.0028	0.0038
Nantes	$PM_{2.5}$	2822	0.0059	0.0342	2616	0.0434	2667	0.0345	0.0354
Paris	$PM_{2.5}$	2727	0.0001	0.0352	2527	0.0450	2567	0.0374	0.0379

(d) Summary of part (c), counts over the ten cities.

Pollutant	Cities where the block is larger on steady days	Mean block sr², ERA5 direction	Mean block sr², observed direction	Cities where the observed direction explains more
NO_2	10	0.0244	0.0326	6
O_3	10	0.0415	0.0413	3
$PM_{2.5}$	9	0.0249	0.0212	5

(e) Direction response on rung 3 (deseasonalized anomalies): peak and trough of the fitted direction effect. Effect of the four Fourier terms in the model with the seven predictors, centred on its mean over the days of the period, evaluated every 5°. SE = HAC standard error (Newey–West). The NO_2 curves are drawn in Figure S2.

City	Pollutant	Peak (µg m⁻³)	Peak direction (°)	SE at peak	Trough (µg m⁻³)	Trough direction (°)	SE at trough	Peak minus trough
Marseille	NO_2	1.77	240	0.54	−1.18	130	0.43	2.95
Toulouse	NO_2	2.83	225	0.36	−1.34	315	0.34	4.17
Montpellier	NO_2	1.11	260	0.31	−1.25	15	0.41	2.36
Bordeaux	NO_2	1.20	250	0.28	−1.27	345	0.30	2.47
Lyon	NO_2	2.59	215	0.75	−2.50	345	0.54	5.09
Lille	NO_2	1.33	15	0.82	−3.14	120	0.82	4.47
Strasbourg	NO_2	2.10	170	0.35	−2.53	40	0.34	4.63
Nice	NO_2	2.44	355	0.47	−3.01	135	0.38	5.45
Nantes	NO_2	1.25	185	0.27	−1.47	0	0.29	2.71
Paris	NO_2	1.38	170	0.51	−1.19	70	0.55	2.57
Marseille	O_3	10.12	140	0.67	−8.42	330	0.51	18.54
Toulouse	O_3	2.47	130	0.66	−1.75	240	0.65	4.23
Montpellier	O_3	10.24	145	0.72	−5.59	300	0.60	15.82
Bordeaux	O_3	2.97	285	0.56	−4.51	140	0.64	7.48
Lyon	O_3	3.18	95	1.12	−4.29	215	0.76	7.47
Lille	O_3	4.86	345	0.78	−4.08	210	0.79	8.94
Strasbourg	O_3	3.29	40	0.62	−3.93	160	0.68	7.23
Nice	O_3	4.97	140	0.62	−4.24	275	0.57	9.21
Nantes	O_3	4.03	255	0.46	−7.31	120	0.68	11.34
Paris	O_3	2.16	15	0.62	−3.46	165	0.56	5.62
Marseille	PM_{10}	2.89	30	0.65	−2.35	275	0.51	5.24
Toulouse	PM_{10}	1.44	95	0.49	−1.95	345	0.45	3.39
Montpellier	PM_{10}	3.27	145	0.46	−2.58	275	0.44	5.85
Bordeaux	PM_{10}	2.16	95	0.63	−1.90	200	0.43	4.06
Lyon	PM_{10}	2.94	140	0.60	−2.55	20	0.65	5.49
Lille	PM_{10}	4.21	65	0.57	−2.08	225	0.60	6.29
Strasbourg	PM_{10}	1.69	350	0.47	−1.37	100	0.65	3.06

City	Pollutant	Peak (μg m⁻³)	Peak direction (°)	SE at peak	Trough (μg m⁻³)	Trough direction (°)	SE at trough	Peak minus trough
Nice	PM_{10}	0.82	35	0.33	−0.90	155	0.40	1.72
Nantes	PM_{10}	1.93	60	0.40	−1.11	295	0.33	3.04
Paris	PM_{10}	3.16	30	0.45	−2.09	255	0.31	5.25
Marseille	$PM_{2.5}$	1.89	20	0.40	−1.71	265	0.30	3.60
Toulouse	$PM_{2.5}$	0.91	100	0.32	−1.68	355	0.30	2.59
Montpellier	$PM_{2.5}$	1.37	40	0.33	−1.53	260	0.29	2.90
Bordeaux	$PM_{2.5}$	2.28	100	0.56	−1.77	210	0.33	4.04
Lyon	$PM_{2.5}$	1.72	150	0.37	−1.61	15	0.48	3.33
Lille	$PM_{2.5}$	4.83	60	0.53	−2.22	250	0.46	7.05
Strasbourg	$PM_{2.5}$	1.16	0	0.38	−0.89	255	0.41	2.05
Nice	$PM_{2.5}$	0.49	40	0.18	−0.63	150	0.24	1.13
Nantes	$PM_{2.5}$	2.70	70	0.32	−1.36	210	0.26	4.06
Paris	$PM_{2.5}$	2.69	35	0.41	−2.01	260	0.31	4.70