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Supplementary Materials: Assessment of COVID-19 Lockdown Impact on the Air Quality in Eastern Spain: PM and BTX in Urban, Suburban and Rural Sites Exposed to Different Emissions

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Table S1. Summary of AQCs considered in this work and environmental and pollutant data reported.

STATION NUMBER	ABB	NAME	PROVINCE	LATITUDE / LONGITUDE	ENVIRONMENT TYPE	EMISSIONS TYPE	SITE	PM_{10} and $PM_{2.5}$	BTX	TEMP	RH	RF	RAD	WS & WD
1	**ALC2**	**L'ALCORA**	Castellon	40°4'4.90"N 0°12'23.71"W	URB	IND	COA	**X**		**X**	**X**	**X**	**X**	**X**
2	**ALGA**	**ALGAR**	Valencia	39°46'56.46"N 0°21'33.08"W	RUR	BK	COA	**X**						
3	**ALM2**	**ALMASSORA**	Castellon	39°56'39.05"N 0°3'26.54"W	URB	IND	COA	**X**						**X**
4	**BENC**	**BENICASSIM**	Castellon	40°3'39.87"N 0°4'18.01"E	SUB	IND	COA	**X**						
5	**BURR**	**BURRIANA**	Castellon	39°54'27.90"N 0°3'58.35"W	RUR	IND	COA	**X**		**X**	**X**	**X**	**X**	**X**
6	**CAUD**	**CAUDETE**	Valencia	39°33'35.73"N 1°16'58.11"W	RUR	BK	INN	**X**						
7	**CEAS**	**SAGUNTO-CEA**	Valencia	39°37'58.95"N 0°16'0.11"W	SUB	IND	COA	**X**		**X**	**X**		**X**	**X**
8	**CEME**	**BUÑOL-CEME**	Valencia	39°25'35.10"N 0°47'22.70"W	SUB	IND	INN	**X**		**X**	**X**	**X**	**X**	**X**
9	**FRAN**	**AV.FRANCIA**	Valencia	39°27'26.96"N 0°20'33.84"W	URB	TRA	COA	**X**		**X**	**X**	**X**		**X**
10	**LACY**	**ELDA-LACY**	Alicante	38°26'43.48"N 0°48'21.84"W	SUB	BK	INN	**X**						
11	**MOLI**	**MOLI**	Valencia	39°28'52.05"N 0°24'30.51"W	SUB	TRA	COA	**X**						
12	**PNAT**	**PATRONAT**	Castellon	39°59'19.30"N 0°1'35.29"W	URB	TRA	COA		**X**					
13	**PENY**	**PEÑETA**	Castellon	40°0'46.44"N 0°3'29.29"W	SUB	IND	COA	**X**		**X**	**X**	**X**	**X**	**X**
14	**PIST**	**P.SILLA**	Valencia	39°27'29.05"N 0°22'36.12"W	URB	TRA	COA	**X**	**X**					
15	**PLA**	**PLA**	Alicante	38°21'30.60"N 0°28'15.96"W	URB	TRA	COA		**X**					
16	**POLI**	**POLITECNIC**	Valencia	39°28'46.73"N 0°20'14.51"W	SUB	BK	COA	**X**						
17	**RABA**	**RABASA**	Alicante	38°22'3.75"N 0°30'50.05"W	SUB	IND	COA	**X**		**X**	**X**	**X**	**X**	**X**
18	**TARO**	**ALBALAT**	Valencia	39°42'18.39"N 0°20'10.27"W	SUB	IND	COA	**X**		**X**	**X**	**X**	**X**	**X**
19	**VILL**	**VILLAR**	Valencia	39°42'28.96"N 0°49'54.98"W	RUR	BK	INN	**X**		**X**	**X**	**X**	**X**	**X**
20	**VVER**	**VIVER**	Castellon	39°55'35.04"N 0°36'11.57"W	SUB	BK	INN	**X**						
21	**ZORI**	**ZORITA**	Castellon	40°43'59.16"N 0°10'12.86"W	RUR	BK	INN	**X**		**X**	**X**	**X**	**X**	**X**

Table S2. Statistics of PM_{10} data set of each Air Quality cabin during reference and lockdown periods and their percentage variation. Values showed in $\mu g \cdot m^{-3}$.

PM_{10}		**Reference Period**								**Lockdown Period**								
Station NUMBER	Station NAME	n	MEAN	SD	MEDIAN	P25	P75	MIN	MAX	n	MEAN	SD	MEDIAN	P25	P75	MIN	MAX	% variation
1	ALC2	236	23.9	10.0	22.5	17.0	29.0	10.0	70.0	41	14.5	3.6	14.0	12.5	16.5	5.0	25.0	-39.4
2	ALGA	235	7.3	4.1	7.0	4.0	10.0	1.0	20.0	36	5.4	2.8	5.5	3.0	8.0	1.0	10.0	-26.0
3	ALM2	229	8.9	6.9	7.0	4.0	12.0	1.0	46.0	41	5.6	2.7	5.0	3.0	8.0	1.0	11.0	-37.0
4	BENC	251	7.9	5.2	6.0	4.0	11.0	1.0	33.0	41	5.7	2.2	5.0	4.0	7.0	1.0	12.0	-28.1
5	BURR	238	8.0	4.7	7.0	4.0	10.0	1.0	25.0	43	7.0	3.6	6.0	4.0	10.0	1.0	14.0	-12.4
6	CAUD	248	9.4	6.9	8.0	4.0	14.0	1.0	32.0	40	6.8	4.5	6.0	2.3	9.0	1.0	16.0	-27.1
7	CEAS	246	8.2	4.9	7.0	4.0	12.0	1.0	22.0	43	10.9	4.8	11.0	6.0	15.0	3.0	20.0	32.9
8	CEME	251	7.8	5.3	7.0	4.0	10.0	1.0	27.0	40	10.2	6.0	9.0	4.0	16.0	2.0	22.0	30.3
9	FRAN	139	16.4	8.4	15.0	10.0	21.0	4.0	41.0	43	8.6	3.9	7.0	6.0	12.0	3.0	20.0	-47.3
10	LACY	241	9.9	5.8	9.0	6.0	13.0	1.0	31.0	42	9.6	4.4	10.0	5.0	13.0	3.0	18.0	-3.0
11	MOLI	248	13.4	8.2	11.0	7.0	17.0	3.0	42.0	43	13.2	8.7	10.0	6.0	22.0	3.0	32.0	-1.6
13	PENY	247	7.9	5.3	7.0	4.0	11.0	1.0	27.0	43	9.0	4.3	9.0	5.0	13.0	2.0	18.0	13.6
14	PIST	248	22.0	13.9	18.5	12.0	28.8	2.0	92.0	42	8.2	4.8	8.5	4.0	12.0	1.0	20.0	-62.7
16	POLI	244	13.8	7.7	13.0	8.0	17.0	3.0	42.0	43	11.3	5.7	10.0	7.0	16.0	3.0	25.0	-18.0
17	RABA	242	10.2	6.9	9.0	6.0	12.3	2.0	56.0	41	11.9	3.9	12.0	9.0	14.5	3.0	20.0	17.2
18	TARO	248	6.0	4.0	5.0	3.0	8.0	1.0	23.0	26	5.7	2.8	6.0	3.0	8.3	1.0	10.0	-5.1
19	VILL	250	12.0	8.1	11.0	5.0	17.0	1.0	43.0	41	13.5	6.5	13.0	7.5	20.0	4.0	26.0	12.8
20	VVER	252	8.5	5.0	8.0	4.0	12.0	0.0	32.0	43	7.7	3.9	7.0	4.0	10.0	2.0	15.0	-9.0
21	ZORI	252	7.8	4.7	7.0	4.0	11.0	1.0	30.0	37	5.2	4.8	3.0	2.0	5.5	1.0	18.0	-32.7

Table S3. Statistics of $PM_{2.5}$ data set of each Air Quality cabin during reference and lockdown periods and their percentage variation. Values showed in $\mu g \cdot m^{-3}$.

$PM_{2.5}$		**Reference Period**								**Lockdown Period**								% variation
Station NUMBER	Station NAME	n	MEAN	SD	MEDIAN	P25	P75	MIN	MAX	n	MEAN	SD	MEDIAN	P25	P75	MIN	MAX	
1	ALC2	239	6.1	3.8	5.0	4.0	7.0	1.0	30.0	41	5.5	1.4	6.0	4.5	6.0	2.0	9.0	-10.4
2	ALGA	235	5.3	3.7	4.0	2.0	8.0	1.0	17.0	36	4.6	2.8	5.0	2.0	7.0	1.0	9.0	-13.2
3	ALM2	229	5.3	3.4	5.0	3.0	7.0	1.0	22.0	41	4.8	2.6	5.0	2.0	7.0	1.0	11.0	-9.6
4	BENC	251	4.9	3.8	4.0	2.0	6.0	1.0	28.0	41	4.5	2.0	4.0	3.0	6.0	1.0	10.0	-9.3
5	BURR	238	6.3	3.8	6.0	3.0	8.0	1.0	21.0	43	5.9	3.2	5.0	4.0	9.0	1.0	12.0	-6.4
6	CAUD	248	6.6	4.9	5.0	3.0	10.0	1.0	23.0	40	5.5	3.7	4.5	2.0	7.0	1.0	14.0	-16.8
7	CEA_	246	5.9	4.1	5.0	3.0	8.0	1.0	21.0	43	8.5	4.6	9.0	4.0	12.0	2.0	17.0	44.8
8	CEME	251	5.3	3.8	4.0	2.0	7.0	1.0	19.0	40	7.7	4.5	7.5	3.0	12.8	2.0	16.0	43.7
9	FRAN	139	10.7	5.7	10.0	6.0	14.0	2.0	28.0	43	6.0	2.9	5.0	3.0	8.0	2.0	14.0	-44.2
10	LACY	241	6.6	4.6	6.0	3.0	9.0	1.0	26.0	42	8.0	4.3	8.0	4.0	11.0	2.0	16.0	21.7
11	MOLI	248	11.6	7.7	9.0	6.0	16.0	2.0	38.0	43	12.1	8.5	9.0	5.0	21.0	3.0	31.0	5.0
13	PENY	247	5.9	4.3	5.0	3.0	8.0	1.0	21.0	43	7.3	4.1	7.0	3.0	11.0	1.0	16.0	24.1
14	PIST	248	10.3	6.7	9.0	5.0	13.0	1.0	42.0	42	6.5	4.7	7.0	2.0	10.3	1.0	18.0	-36.2
16	POLI	244	9.1	5.5	8.0	5.0	12.0	1.0	27.0	43	9.9	6.0	9.0	4.0	15.0	2.0	24.0	8.7
17	RABA	242	4.9	3.4	4.0	3.0	6.0	1.0	22.0	41	5.5	2.7	5.0	3.0	7.5	1.0	11.0	12.2
18	TARO	248	3.5	2.5	3.0	2.0	5.0	1.0	12.0	26	4.7	2.5	5.0	2.0	7.0	1.0	8.0	33.8
19	VILL	250	6.6	4.9	5.0	3.0	9.0	1.0	22.0	41	8.8	5.7	7.0	3.0	14.0	2.0	19.0	33.2
20	VVER	252	5.6	3.8	4.5	2.0	8.0	0.0	21.0	43	6.4	3.8	6.0	3.0	9.0	1.0	13.0	14.9
21	ZORI	252	5.3	3.7	4.0	2.0	7.0	1.0	23.0	37	3.9	3.0	3.0	1.0	5.0	1.0	11.0	-25.3

Table S4. Overall mean, standard deviation (Sd), median, 5th and 95th percentiles (P05 and P95), mínimum (Min) and maximum (Max) values for PM_{10}, $PM_{2.5}$ and BTX for reference and lockdown periods considering all the AQCs in this study. Values expressed in $\mu g \cdot m^{-3}$.

	Reference period (2015-2019)					Lockdown period (2020)				
	PM10	PM2.5	Benzene	Toluene	Xylenes	PM10	PM2.5	Benzene	Toluene	Xylenes
Mean	10.9	6.5	1.6	3.9	2.2	9.1	6.7	0.4	1.7	0.8
SD	8.5	5.0	1.2	3.2	2.3	5.5	4.7	0.3	1.2	0.7
Median	9.0	5.0	1.3	3.0	1.6	8.0	6.0	0.3	1.4	0.7
P05	2.0	1.0	0.4	0.7	0.2	2.0	1.0	0.1	0.4	0.2
P95	27.0	16.0	3.6	10.5	6.8	19.0	15.0	0.8	3.9	2.4
Min	0.0	0.0	0.1	0.1	0.0	1.0	1.0	0.1	0.3	0.0
Max	92.0	42.0	9.0	23.4	18.1	32.0	31.0	3.2	5.7	4.3

Table S5. Mean PM concentrations and standard deviations for all Air Quality Cabins and grouped by type of environment and emission for both periods of study and PM percentage variation during lockdown compared to the reference period. Values shown in $\mu g \cdot m..^{-3}$

	Reference Period				Lock-down period				% Variation	
	PM_{10}		$PM_{2.5}$		PM_{10}		$PM_{2.5}$		PM_{10}	$PM_{2.5}$
	MEAN	SD	MEAN	SD	MEAN	SD	MEAN	SD	MEAN	SD
ALL	10.9	8.5	6.5	5.0	9.1	5.5	6.7	4.7	-16.5	3.1
URB	18.1	12.0	7.8	5.6	9.2	5.0	5.7	3.2	-49.0	-27.3
SUB	9.3	6.4	6.3	5.1	9.7	5.5	7.6	5.2	3.6	20.2
RURAL	8.9	6.2	6.0	4.3	7.7	5.5	5.8	4.2	-13.6	-3.4
TRAFFIC	17.4	11.5	10.9	6.9	10.0	6.5	8.2	6.4	-42.4	-24.3
IND	9.8	7.9	5.3	3.8	9.1	4.9	6.1	3.5	-7.5	14.3
BK	9.8	6.6	6.4	4.7	8.6	5.5	6.9	4.8	-11.9	6.4

Table S6. Statistical summary of environmental parameters of each Air Quality cabin during reference and lockdown periods.

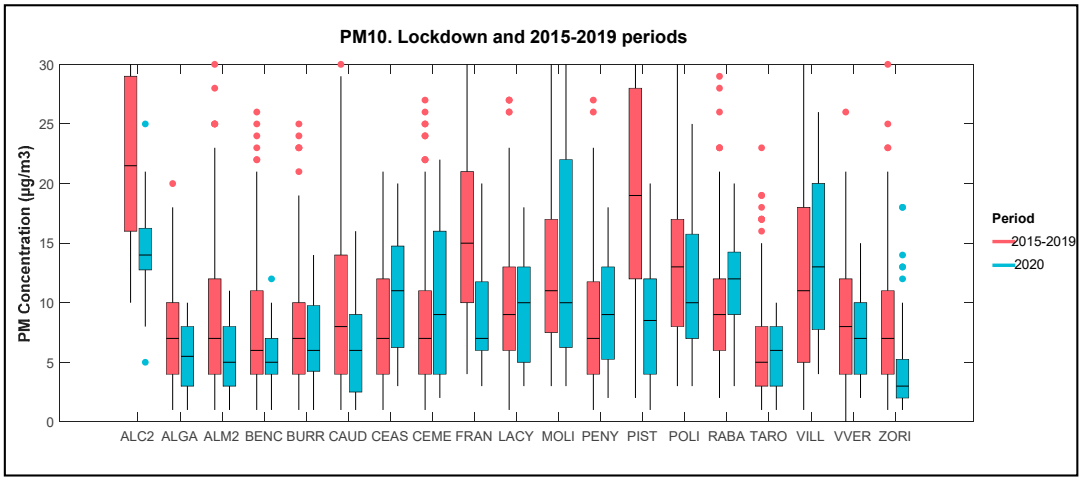
		Reference Period								Lockdown Period							
		TEMP (ºC)		RH (%)		RF (L/m2)	RAD (W/m2)	WS (m/s)		WD (Degrees)	TEMP (ºC)		RH (%)		RF (L/m2)	RAD (W/m2)	WS (m/s)		WD (Degrees)
STATION NUMBER	STATION NAME	MEAN	SD	MEAN	SD	SUM	MEAN	MEAN	SD	MEAN	MEAN	SD	MEAN	SD	SUM	MEAN	MEAN	SD	MEAN
1	ALC2	11.1	4.7	68.4	16.6	18.6	194.3	4.0	1.9	296	11.7	4.3	73.6	13.0	78.4	163.4	1.5	0.7	67
3	ALM2	-	-	-	-	-	-	0.9	0.4	128	-	-	-	-	-	-	1.5	0.6	86
5	BURR	16.6	2.7	68.2	11.5	6.1	232.7	1.4	0.8	130	17.1	3.4	77.0	11.5	38.9	187.7	1.1	0.6	94
7	CEAS	16.4	2.8	64.5	12.7	0.0	250.6	1.6	0.8	42	16.2	3.3	77.2	11.7	0	223.7	0.9	0.4	40
8	CEME	14.3	3.7	59.4	13.8	19.7	229.5	2.3	1.6	343	13.5	3.7	75.7	11.7	22.3	157.5	1.1	0.4	58
9	FRAN	16.8	2.8	57.6	12.5	36.0	-	1.5	0.9	105	17.7	3.4	75.1	12.4	15	-	1.3	0.5	91
13	PENY	16.7	2.8	76.6	12.8	10.7	222.8	1.3	0.6	107	17.1	3.3	89.2	7.8	50.2	180.3	1.8	1.1	82
17	RABA	16.9	2.9	64.1	13.6	2.8	250.4	1.7	1.4	91	15.9	3.3	73.6	12.7	16.3	187.7	0.9	0.5	39
18	TARO	14.8	3.2	56.4	14.4	14.2	230.6	1.3	1.0	105	14.5	3.7	71.2	12.6	31.5	184.9	1.0	0.6	93
19	VILL	14.2	3.5	55.7	13.8	9.9	233.0	2.8	1.9	180	14.0	3.9	74.1	13.0	12.3	160.0	1.5	0.8	134
21	ZORI	11.8	3.7	62.7	11.1	16.1	212.4	1.8	1.1	358	12.2	3.9	75.6	11.0	34.4	186.4	1.6	1.5	31
	ALL	14.74	3.9	62.1	14.4	134.1*	234.3	1.9	1.5	84	14.7	4.1	74.9	13.2	299.3*	185.3	1.6	1.1	74

Table S7. Pearson's correlation coefficient, R, between PM_{10} and $PM_{2.5}$ and meteorological variables. Cells with R>|0.5| are marked in pink

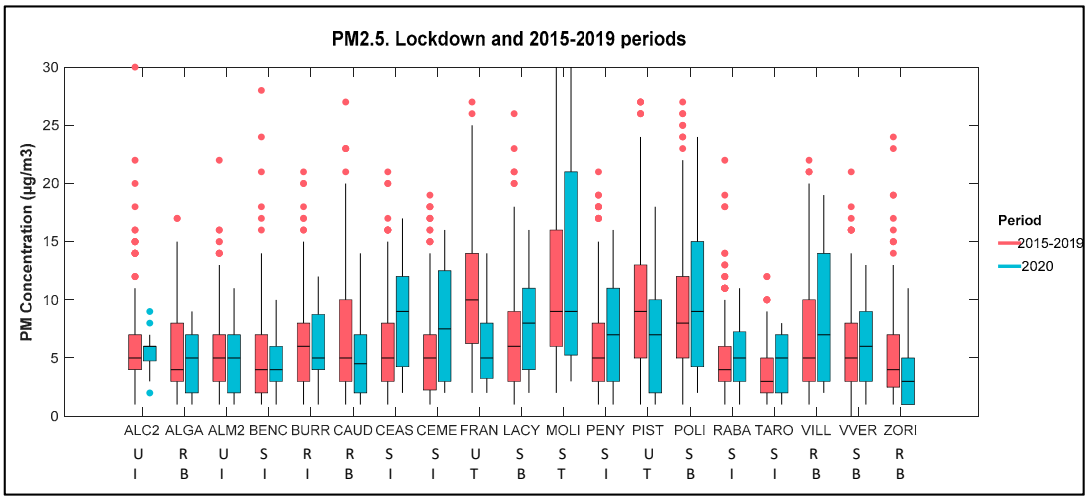
		ZORI	ALC2	PENY	ALM2	BURR	TARO	CEAS	VILL	FRAN	CEME	RABA
PM_{10}	HR	0.1477	−0.0055	0.4864	NaN	0.3252	0.2579	0.4149	0.3760	0.1529	0.5922	−0.4625
	PLU	−0.1161	−0.1034	−0.3113	NaN	−0.1247	−0.5148	NaN	−0.0183	0.0102	0.1428	−0.2851
	RAD	−0.2757	0.0767	−0.1882	NaN	−0.1340	−0.082	−0.1767	−0.1343	NaN	−0.4020	0.2496
	WIND	−0.0281	NaN	−0.5272	−0.5845	−0.6839	NaN	−0.5846	−0.6555	NaN	−0.6651	0.2403
	TEMP	−0.6788	0.1275	−0.2519	NaN	−0.2334	−0.2361	−0.3012	−0.2809	−0.1403	−0.4515	0.4918
PM_{25}	HR	0.0314	−0.2307	0.5804	NaN	0.3274	0.2666	0.481	0.3614	0.3132	0.503	0.393
	PLU	−0.2141	−0.2352	−0.2307	NaN	−0.1402	−0.4527	NaN	−0.1341	0.0587	0.1489	−0.0829
	RAD	−0.2405	0.1326	−0.2171	NaN	−0.1273	−0.1423	−0.2461	−0.0968	NaN	−0.3274	−0.2435
	WIND	−0.0067	NaN	−0.4864	−0.6428	−0.6931	NaN	−0.6321	−0.6626	NaN	−0.6854	−0.4927
	TEMP	−0.6838	0.1357	−0.3424	NaN	−0.2471	−0.3325	−0.4119	−0.3579	−0.2742	−0.4567	−0.4196

Table S8. P-values between PM_{10} and $PM_{2.5}$ and meteorological variables. Cells with p-value <0.05 are marked in pink.

		ZORI	ALC2	PENY	ALM2	BURR	TARO	CEAS	VILL	FRAN	CEME	RABA
PM10	HR	0.383	0.976	0.001	NaN	0.038	0.213	0.006	0.017	0.328	0.000	0.002
	PLU	0.494	0.525	0.042	NaN	0.426	0.012	NaN	0.927	0.948	0.380	0.071
	RAD	0.099	0.638	0.227	NaN	0.404	0.690	0.269	0.403	NaN	0.010	0.116
	WIND	0.869	NaN	0.000	0.000	0.000	NaN	0.000	0.000	NaN	0.000	0.130
	TEMP	0.000	0.433	0.103	NaN	0.142	0.246	0.050	0.075	0.370	0.004	0.001
PM25	HR	0.854	0.196	0.000	NaN	0.037	0.198	0.001	0.022	0.041	0.001	0.011
	PLU	0.203	0.144	0.137	NaN	0.370	0.030	NaN	0.496	0.709	0.359	0.606
	RAD	0.152	0.415	0.162	NaN	0.428	0.488	0.121	0.547	NaN	0.039	0.125
	WIND	0.969	NaN	0.001	0.000	0.000	NaN	0.000	0.000	NaN	0.000	0.001
	TEMP	0.000	0.404	0.025	NaN	0.119	0.097	0.006	0.022	0.075	0.003	0.006



a



b

Figure S1. Box plot of a) PM_{10} and b) $PM_{2.5}$ concentration in the AQCs for reference and lockdown periods. The marker inside the box plot is the median, and lower and upper box boundaries are the 25th (Q1) and 75th (Q3) percentiles, respectively. Lower and upper whiskers represent Q1 - 1.5·IQR and Q3 + 1.5·IQR, respectively. Dots are outliers. Codes below ACQ names refer to their type of environment, U: urban, S: suburban, R: rural; and type of environment, T: traffic, I: industrial, B: background.

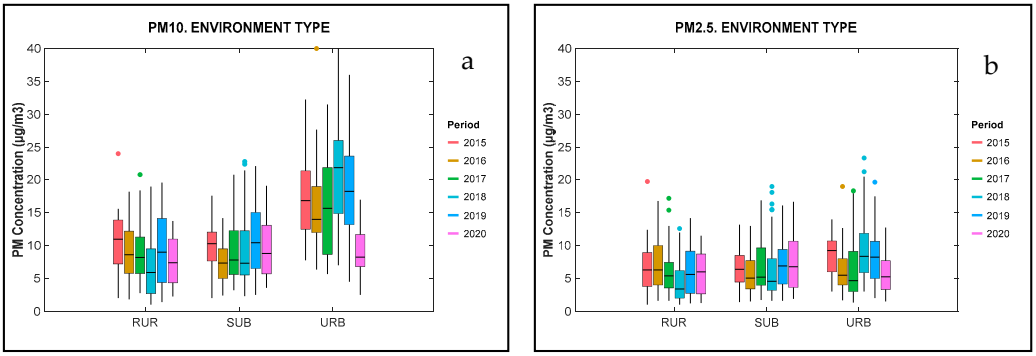


Figure S2. a) b) Box plots by environment type. a) and b) represent PM_{10} and $PM_{2.5}$ respectively in the reference, sorted by year, and the lockdown periods. The marker inside the boxplot is the median, and lower and upper box boundaries are the 25th (Q1) and 75th (Q3) percentiles, respectively. Lower and upper whiskers represent Q1 - 1.5·IQR and Q3 + 1.5·IQR, respectively. Dots are outliers.

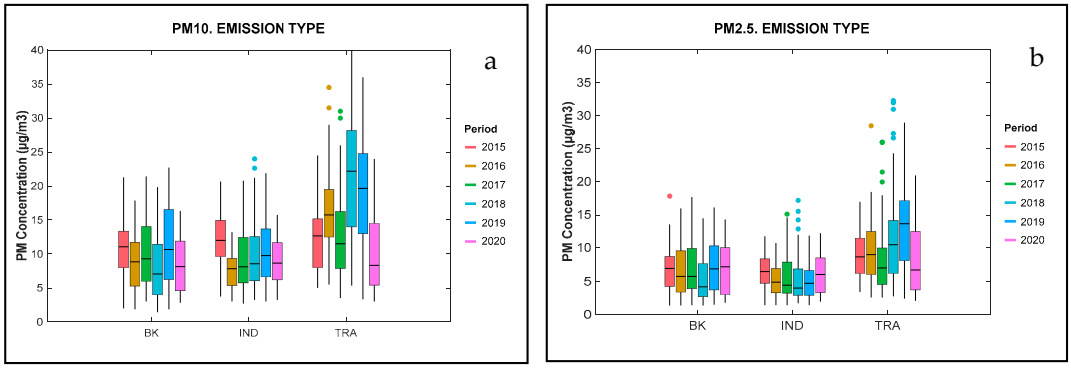


Figure S3. a) b) Box plots by emission type. a) and b) represent PM_{10} and $PM_{2.5}$ respectively in the reference, sorted by year, and the lockdown periods. The marker inside the box plot is the median, and lower and upper box boundaries are the 25th (Q1) and 75th (Q3) percentiles, respectively. Lower and upper whiskers represent Q1 - 1.5·IQR and Q3 + 1.5·IQR, respectively. Dots are outliers.

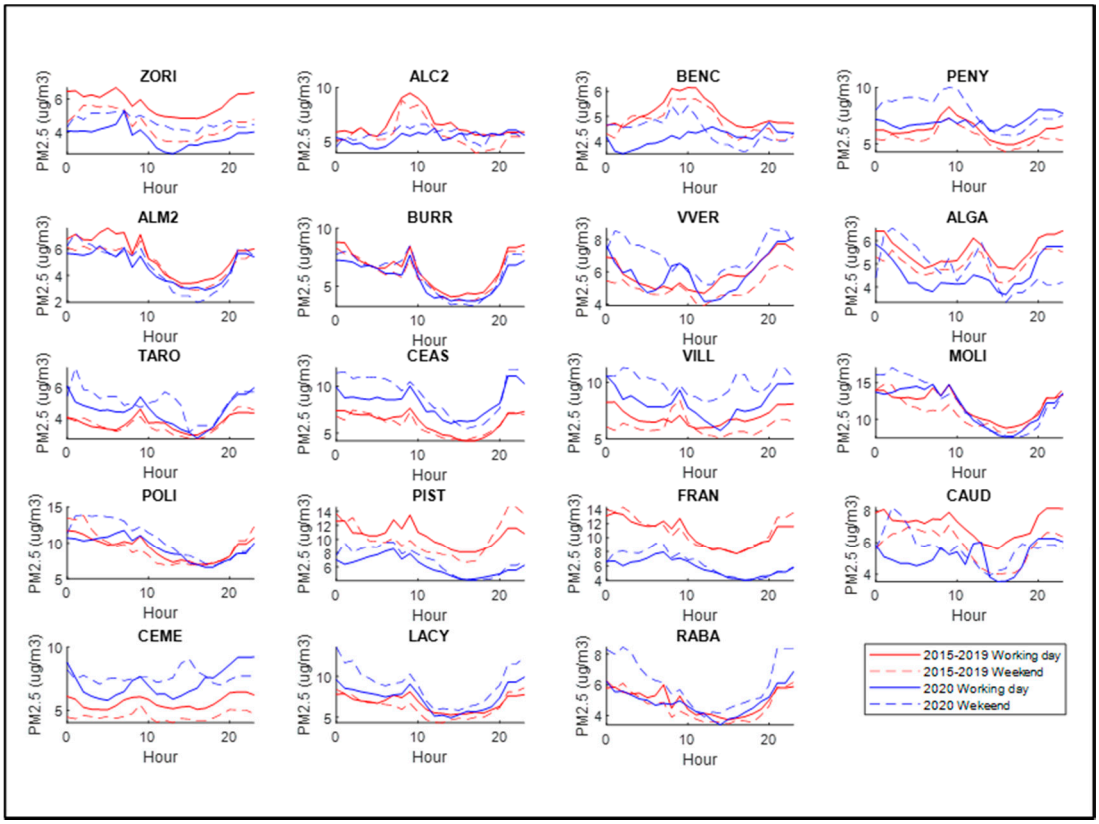


Figure S4. Hourly $PM_{2.5}$ profile comparing reference and lockdown periods. Individual Y-axis upper limit of each AQC has been set to according to maximum concentration.

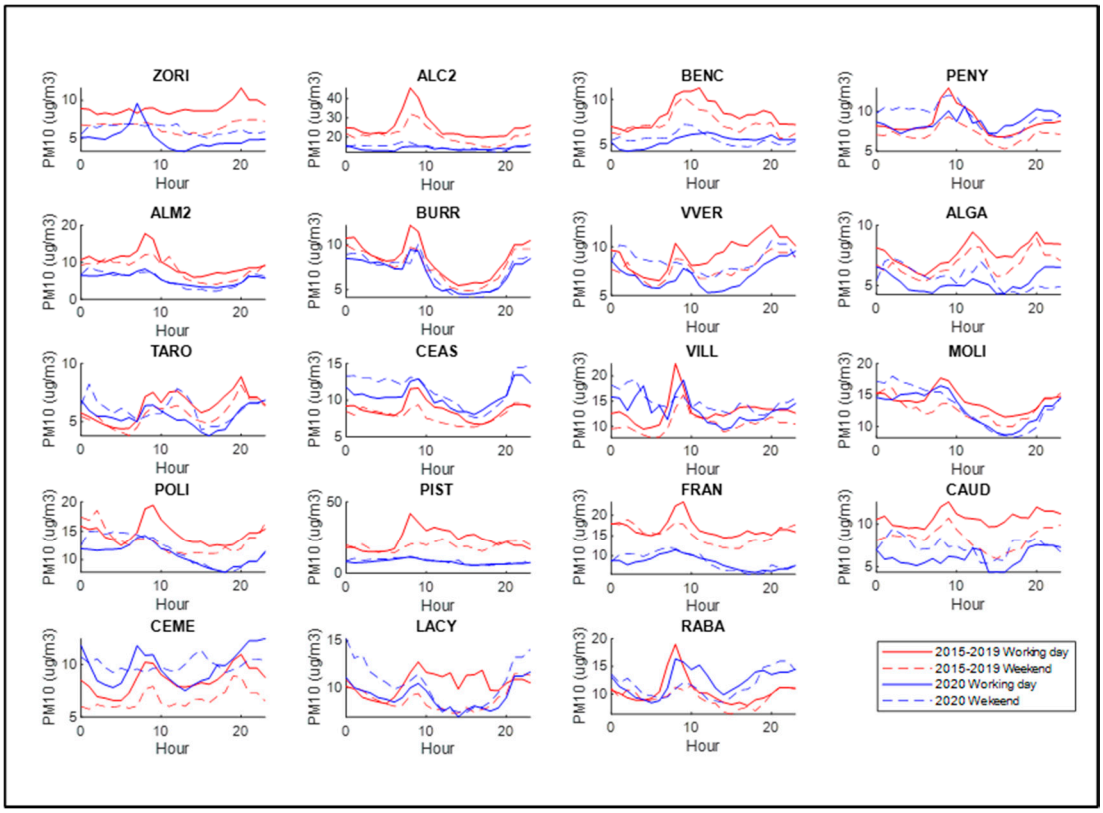


Figure S5. Hourly PM_{10} profile comparing reference and lockdown periods. Individual Y-axis limit of each AQC has been set considering maximum concentration.

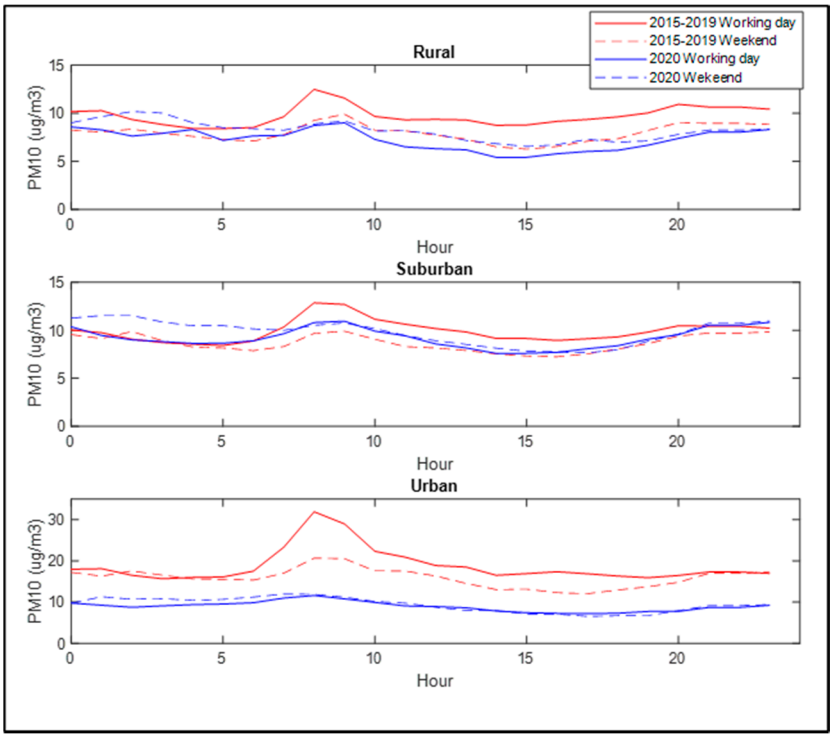


Figure S6. Hourly PM_{10} concentration profile by environment type for reference and lockdown periods.

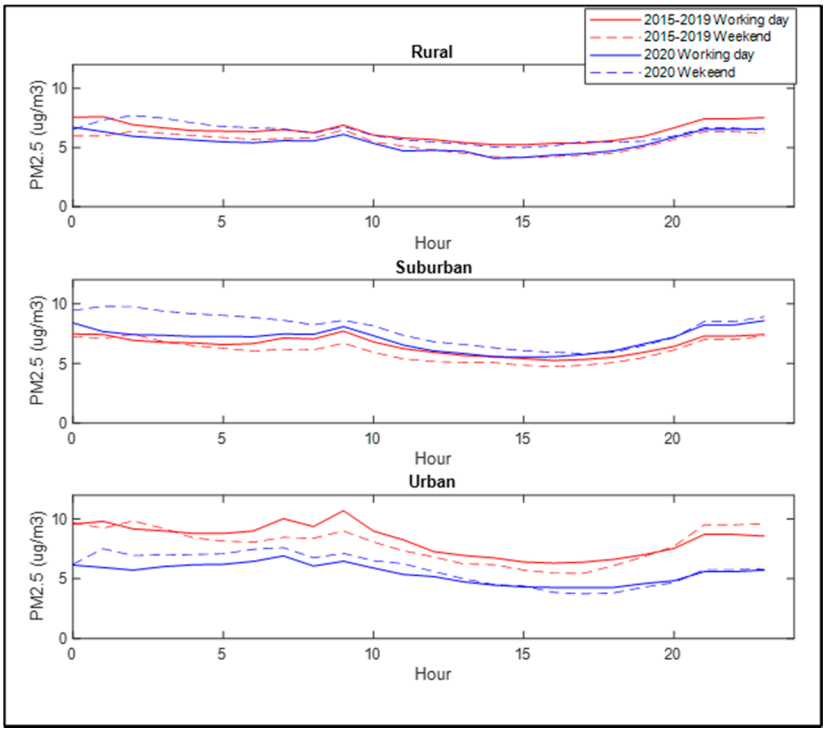


Figure S7. Hourly $PM_{2.5}$ concentration profile by environment type for reference and lockdown periods.

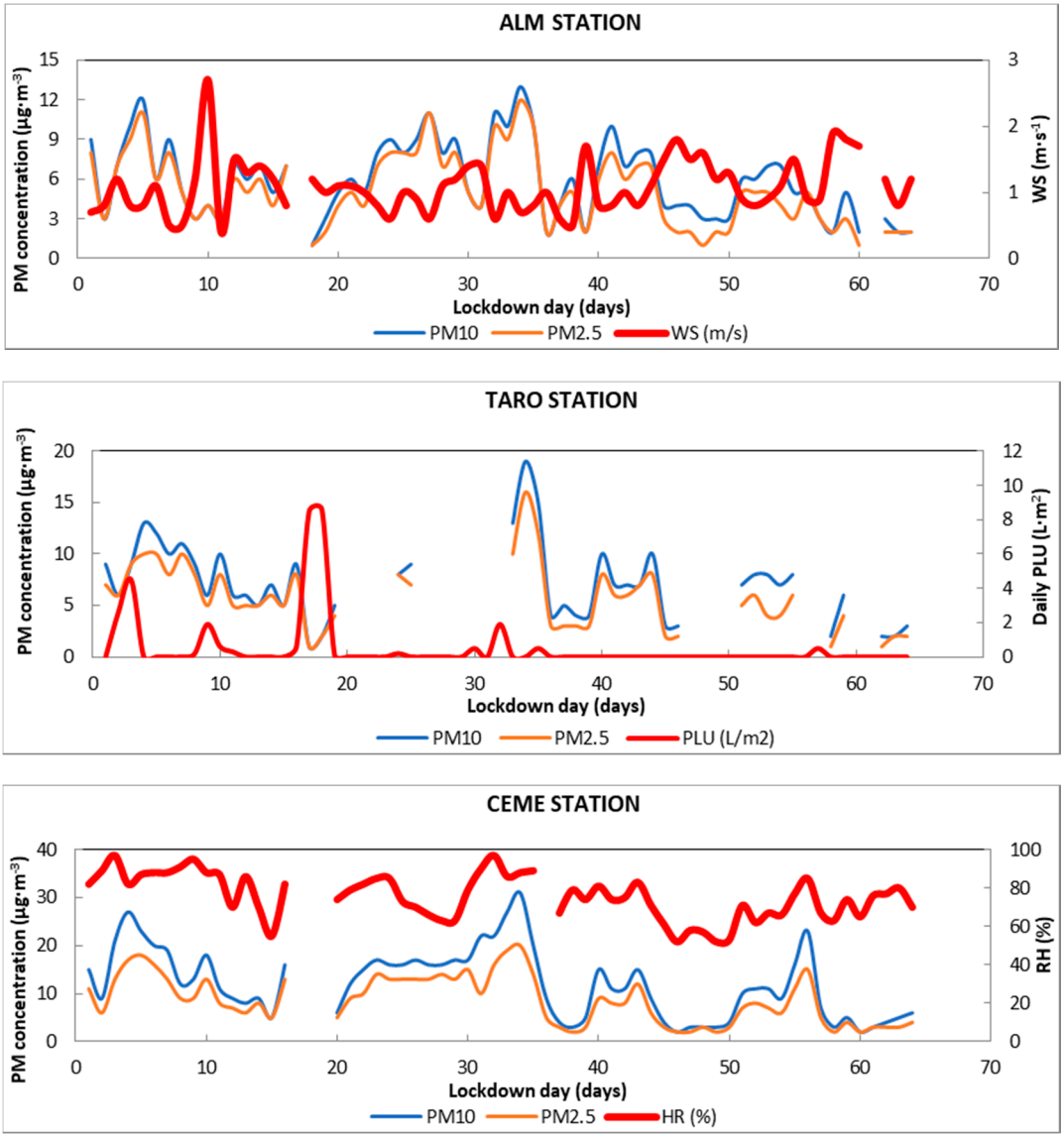


Figure S8. PM and meteorological variables time series to illustrate anticorrelation in a)ALM and b)TARO and correlation in c)CEME stations during lockdown.