

Supplementary Report

Examining effects of the COVID-19 national lockdown on ambient air quality across urban India

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Table S1: Ambient air quality monitoring station details

Region	City	Station	Latitude	Longitude
North	Delhi	Anand Vihar, Delhi - DPCC	28.647	77.313
	Ambala	Patti Mehar, Ambala - HSPCB	30.378	76.774
	Amritsar	Golden Temple, Amritsar - PPCB	31.620	74.876
	Jaipur	Police Commissionerate, Jaipur - RSPCB	26.916	75.801
	Lucknow	Central School, Lucknow - CPCB	26.791	80.934
East	Patna	IGSC Planetarium Complex, Patna - BSPCB	25.610	85.131
	Jorapokhar	Tata Stadium, Jorapokhar - JSPCB	23.708	86.412
	Kolkata	Victoria, Kolkata - WBPCB	22.544	88.343
West	Ahmedabad	Maninagar, Ahmedabad - GPCB	22.991	72.606
	Dewas	Bhopal Chauraha, Dewas - MPPCB	22.967	76.063
	Mumbai	Bandra, Mumbai - MPCB	19.056	72.829
	Nagpur	Opp GPO Civil Lines, Nagpur - MPCB	21.152	79.069
South	Amaravati	Secretariat, Amaravati - APPCB	16.513	80.514
	Bangalore	Silk Board, Bengaluru - KSPCB	12.917	77.623
	Trivandrum	Plammoodu, Thiruvananthapuram - Kerala PCB	8.4929	76.947
	Chennai	Manali, Chennai - CPCB	13.174	80.277
	Hyderabad	Zoo Park, Hyderabad - TSPCB	17.350	78.451

Table S2: Percentage change in meteorological parameter between time frames P19 vs L19 w.r.t. P19, and P20 vs L20 w.r.t. P20. The % change is normalized to P19 and P20 levels i.e. $(L19-P19)/P19 * 100$ and $(L20-P20)/P20 * 100$. Bold number indicates p-value < 0.0125. ND = No data.

Region	City	WS		T		RH	
		P19 vs L19	P20 vs L20	P19 vs L19	P20 vs L20	P19 vs L19	P20 vs L20
North	Delhi	8.3	-0.1	ND	ND	-33.3	-17.9
	Ambala	27.4	8.0	ND	ND	-36.4	-28.5
	Amritsar	20.0	12.8	69.5	42.0	-38.3	-22.8
	Jaipur	5.2	26.9	ND	ND	-41.1	-14.7
	Lucknow	20.2	-0.2	ND	ND	-33.8	-33.0
East	Patna	67.2	-22.4	-0.8	ND	-4.7	11.9
	<u>Jorapokhar</u>	ND	ND	27.6	32.6	14.3	-12.2
	Kolkata	111.1	81.4	22.0	24.6	8.7	0.0
West	Ahmedabad	110.9	27.1	ND	ND	55.2	-14.3
	<u>Dewas</u>	-6.2	1.4	-1.3	6.1	-42.4	-33.2
	Mumbai	-24.6	-52.8	16.3	10.9	11.9	22.8
	Nagpur	-4.9	-13.4	23.7	29.4	-31.8	8.1
South	Amaravati	18.3	13.7	-2.4	-8.5	-8.0	-5.4
	Bangalore	-2.4	-14.3	0.7	-3.8	-3.9	-5.1
	Trivandrum	11.2	6.5	-2.8	-2.2	1.7	3.8
	Chennai	28.0	13.7	ND	ND	-11.2	3.9
	Hyderabad	-8.8	-12.9	3.7	-3.9	-11.0	-14.7

Table S3: Percentage change in pollutant level between time frames P19 vs L19 w.r.t. P19, and P20 vs L20 w.r.t. P20. The % change is normalized to P19 and P20 levels i.e. $(L19-P19)/P19 * 100$ and $(L20-P20)/P20 * 100$. Bold number indicates p-value < 0.0125. ND = No data.

Region	City	PM _{2.5}		PM ₁₀		SO ₂		NO ₂		CO	
		P19 vs L19	P20 vs L20	P19 vs L19	P20 vs L20	P19 vs L19	P20 vs L20	P19 vs L19	P20 vs L20	P19 vs L19	P20 vs L20
North	Delhi	-17.2	-59.8	15.4	-62.5	53.6	37.2	3.3	-70.3	11.2	-29.7
	Ambala	13.9	-50.6	32.4	-50.5	-40.9	-27.0	24.6	-38.7	-10.8	-48.5
	Amritsar	12.6	-57.7	19.8	-43.1	ND	-27.8	51.5	12.4	41.8	7.5
	Jaipur	9.6	-48.0	29.5	-43.1	20.0	-10.3	19.5	-70.0	-1.2	-50.6
	Lucknow	-9.1	-35.2	ND	ND	-23.9	55.8	-77.0	-66.8	29.2	-35.0
East	Patna	-51.7	-36.2	ND	ND	11.7	24.4	-17.3	128.7	-16.6	19.1
	<u>Jorapokhar</u>	-24.0	-38.7	-19.1	-36.7	-77.9	-2.0	-6.0	7.5	ND	-29.8
	Kolkata	-58.0	-63.7	-57.2	-67.2	-53.8	-27.5	-63.8	-79.9	-42.3	-18.8
West	Ahmedabad	54.9	-50.6	ND	-39.0	-18.9	-48.9	-1.3	-52.9	34.9	-40.4
	<u>Dewas</u>	15.0	6.1	8.2	-15.1	-0.5	42.6	-11.0	-30.3	-1.6	-3.5
	Mumbai	-47.4	-36.5	-38.2	-37.8	73.7	131.6	-10.2	-85.5	-15.1	-60.1
	Nagpur	-15.6	-32.9	-4.3	-30.9	21.6	-82.8	-31.8	-57.2	18.8	-40.8
South	Amaravati	-44.5	-35.4	-27.4	-20.4	25.5	-14.6	-43.4	-58.3	-15.4	-1.1
	Bangalore	-8.1	-47.0	-4.7	-50.2	58.2	-39.5	31.0	-73.8	-14.2	-51.6
	Trivandrum	-24.2	-59.1	-17.3	-37.5	-55.8	-17.7	-21.8	-69.2	15.7	-45.8
	Chennai	-42.3	-45.5	ND	ND	-57.1	-86.7	-12.7	-31.6	10.1	-37.9
	Hyderabad	-8.3	-17.8	-7.3	-27.0	7.4	44.7	-32.8	-24.2	-2.0	-40.2

Table S4. Summary of 2x17 factorial ANOVA analysis for meteorological variables and air pollutants. Here δP (P20-P19) and δL (L20-L19) are difference between 2020 and 2019 for pre-lockdown and lockdown periods, respectively. Results are only shown for two different time periods. Statistically significant difference is shown in bold (p-value < 0.05).

Parameters		p-values δP vs δL
Meteorology	WS	0.190
	T	0.112
	RH	0.246
Pollutants	PM _{2.5}	3E-07
	PM ₁₀	5E-16
	SO ₂	0.501
	NO ₂	8E-12
	CO	2E-17

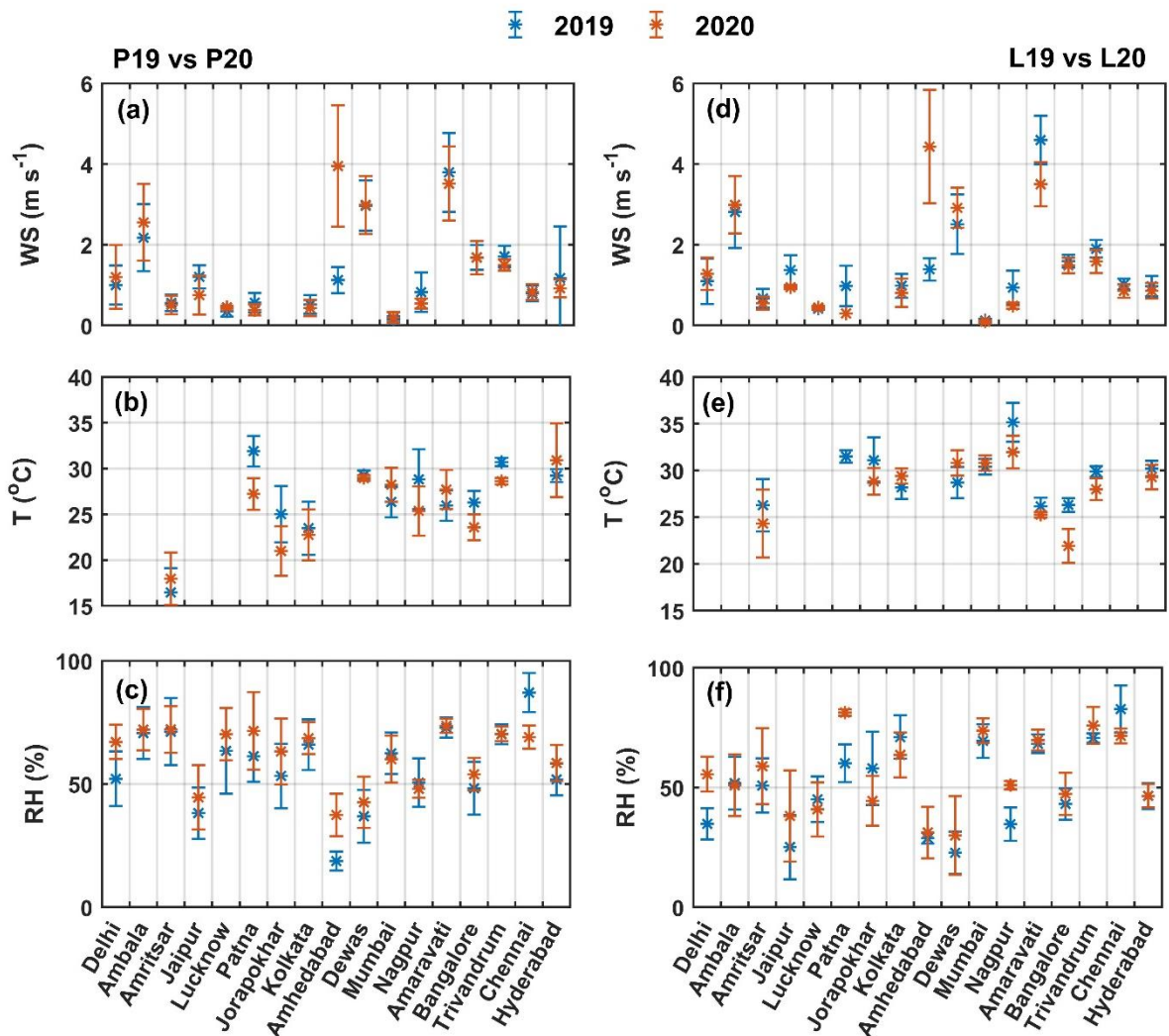


Figure S1. Station to station variation in meteorological variable during the four time periods. Here (a), (b), and (c) show the mean station values for P19 vs P20 periods, while (d), (e), and (f) correspond to L19 vs L20 for wind speed, temperature, and relative humidity, respectively. Error bars show the standard deviation. Temperature data is missing for station 1, 2, 4, 5, 9 and 16.

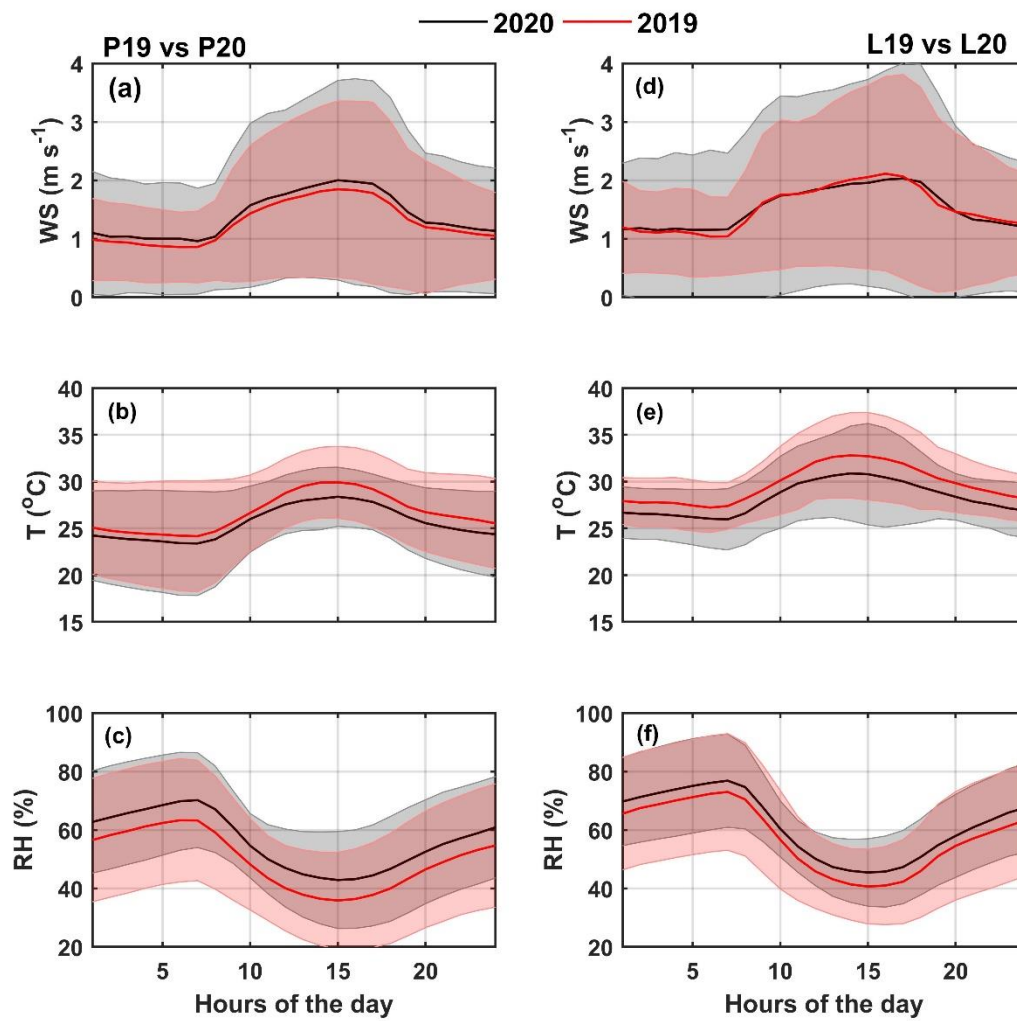


Figure S2. Diurnal variation of (a), (d) wind speed, (b), (e) temperature, and (c), (f) relative humidity for P20 vs P19 and L20 vs L19 averaged over 17 stations respectively. Where, L19, P19 are in red and L20, P20 are in black. Shaded area shows standard deviation.

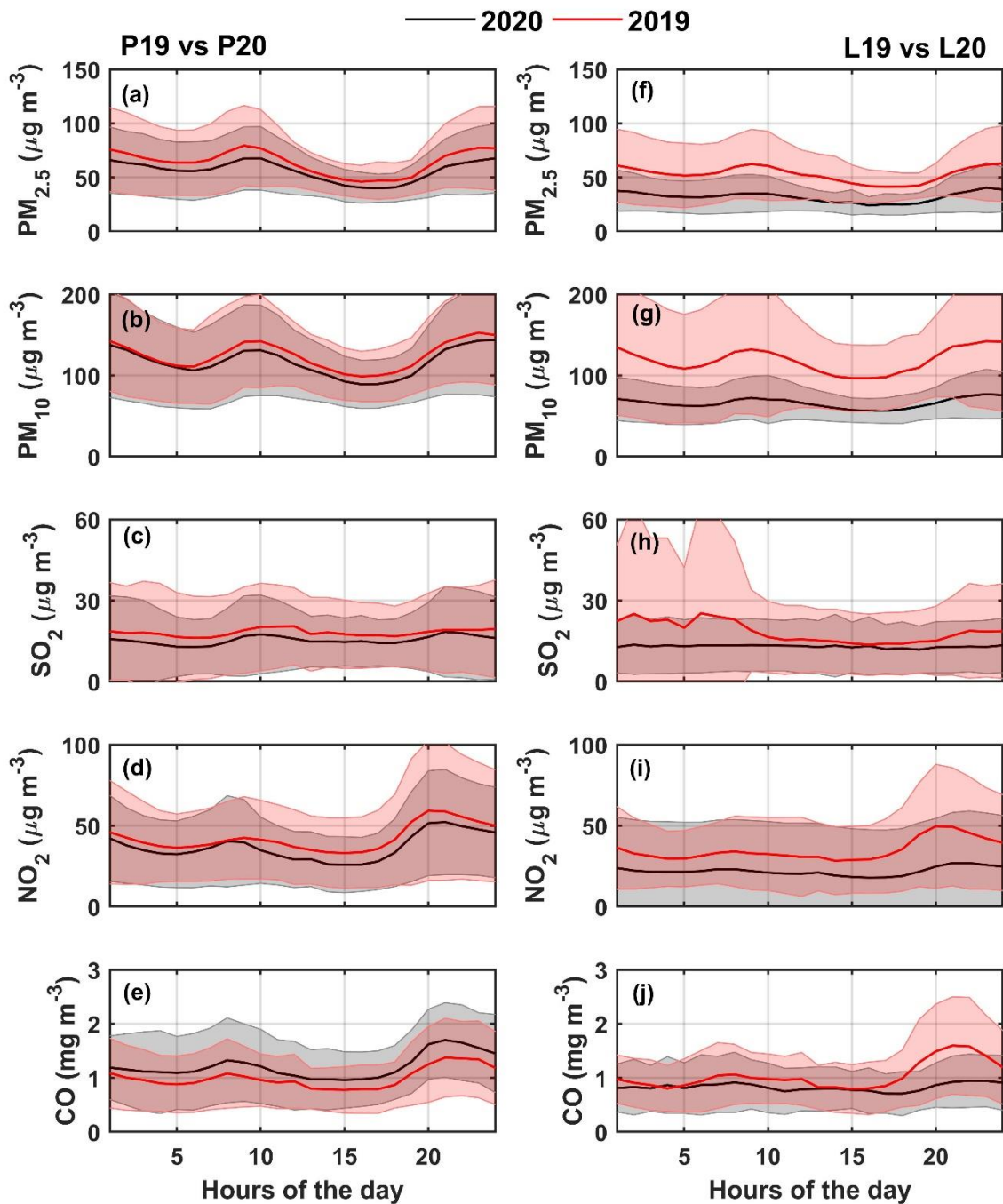


Figure S3. Diurnal variation of (a), (f) $\text{PM}_{2.5}$, (b), (g) PM_{10} , (c), (h) SO_2 , (d), (i) NO_2 , and (e), (j) CO for P20 vs P19 and L20 vs L19 averaged over 17 stations, respectively. Where, L19, P19 are in red and L20, P20 are in black. Shaded area shows standard deviation.