

Appendix

1 Location of CAAQMS considered in the study.



Fig 1 Bangalore BBMP area with 7 Station location equipped with CAAQMS.

2 Percentage relative Change in Concentration of Pollutants

Seven stations in the BBMP area of Bengaluru that are managed by the Karnataka State Pollution Control Board (KSPCB), equipped with CAAQMS as shown in Fig 1.

The relative change in concentration of pollutants in terms of percentage:

$$CC (i) = \frac{(Conc. (i, 2020) - Conc. (i, 2019))}{Conc. (i, 2019)} \quad (1)$$

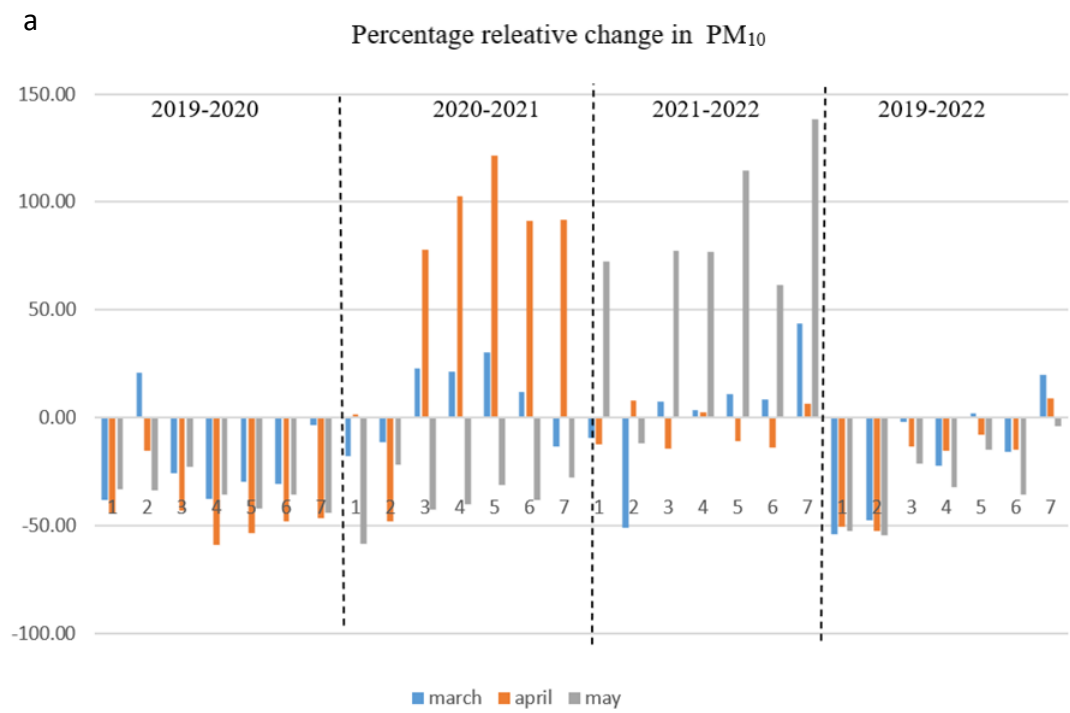
$$CC (ii) = \frac{(Conc. (i, 2021) - Conc. (i, 2020))}{Conc. (i, 2020)} \quad (2)$$

$$CC (iii) = \frac{(Conc. (i, 2022) - Conc. (i, 2021))}{Conc. (i, 2021)} \quad (3)$$

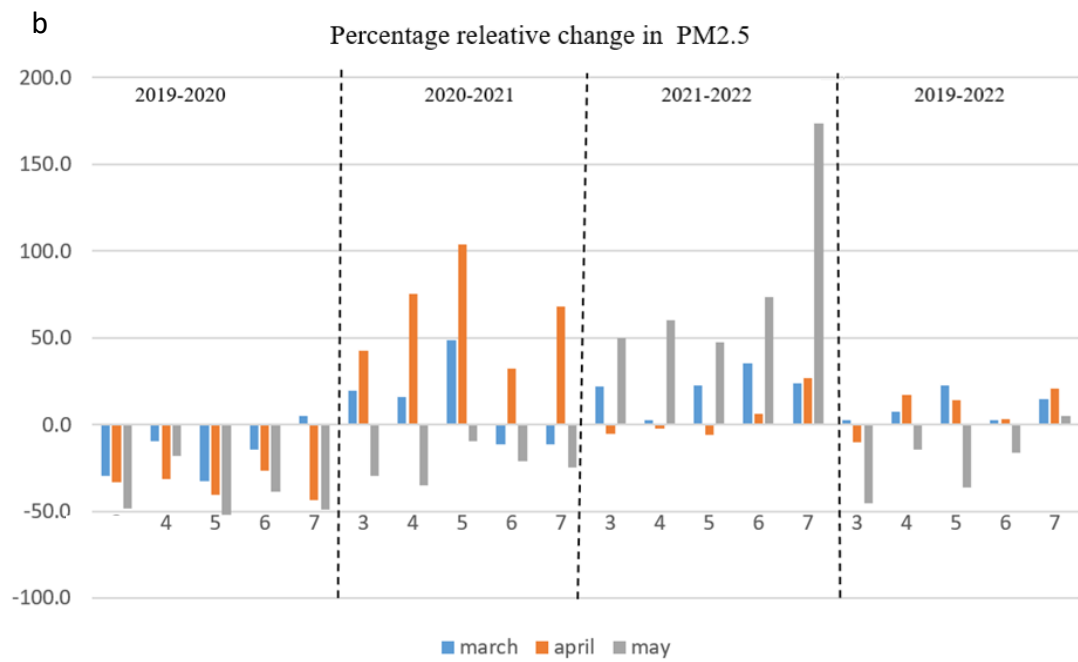
$$CC (iv) = \frac{(Conc. (i, 2022) - Conc. (i, 2019))}{Conc. (i, 2019)} \quad (4)$$

Considering March, April, and May and the corresponding lockdown condition. The percentage change in concentration of individual pollutant is illustrated below:

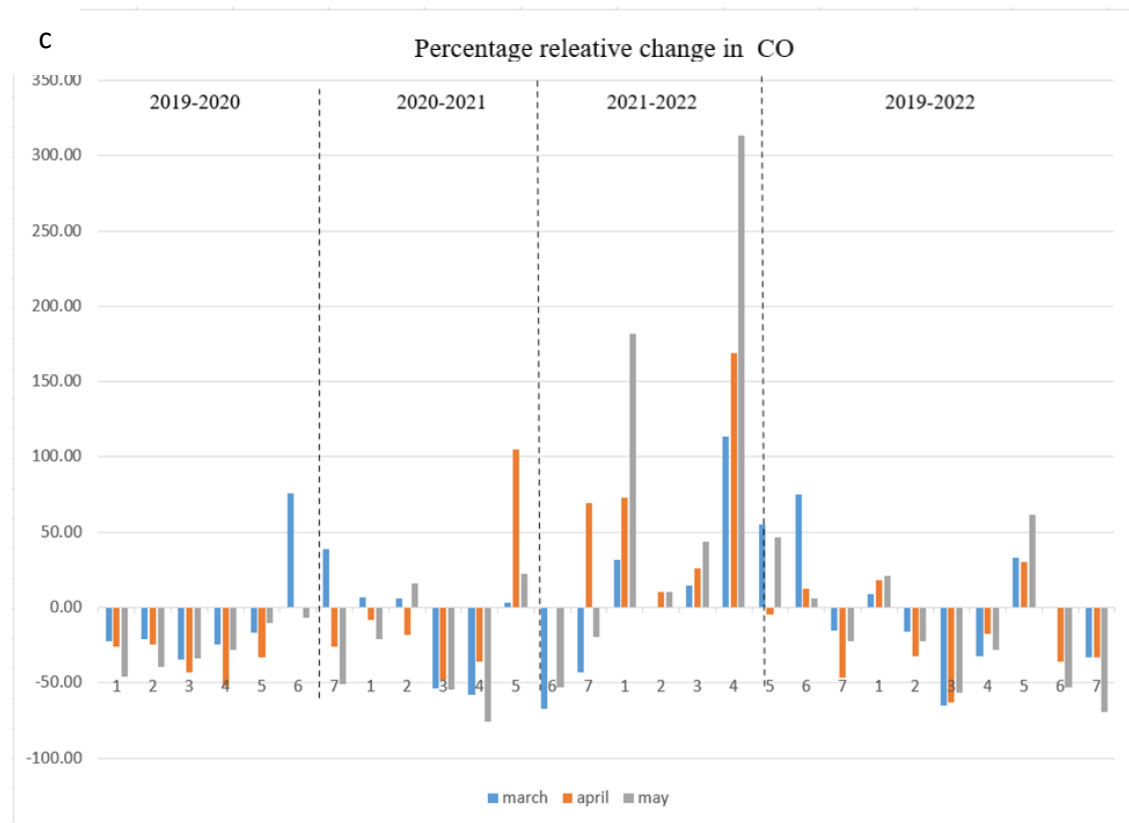
19 (a) Particulate matter (PM₁₀)



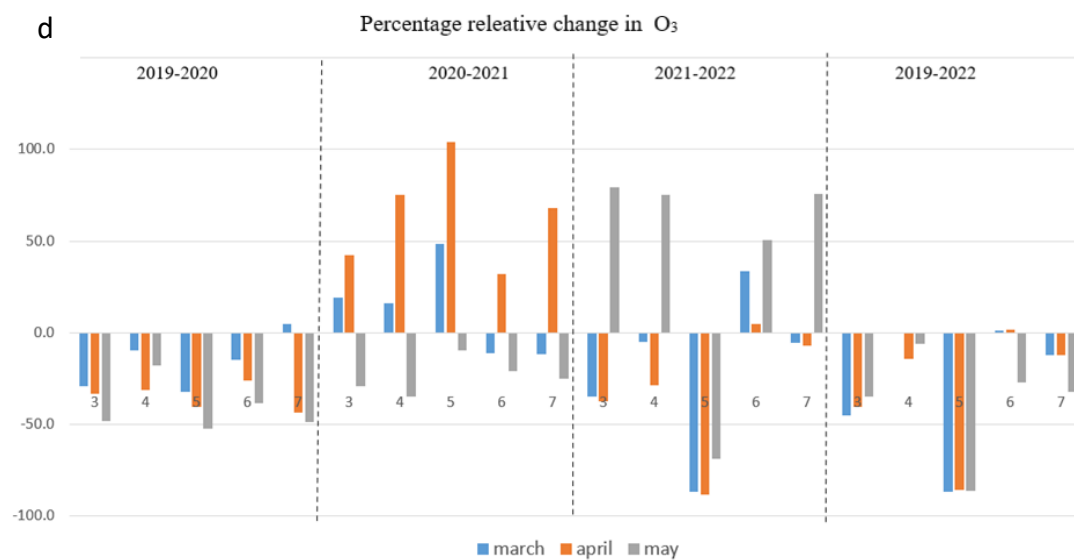
(b) Particulate Matter (PM_{2.5})



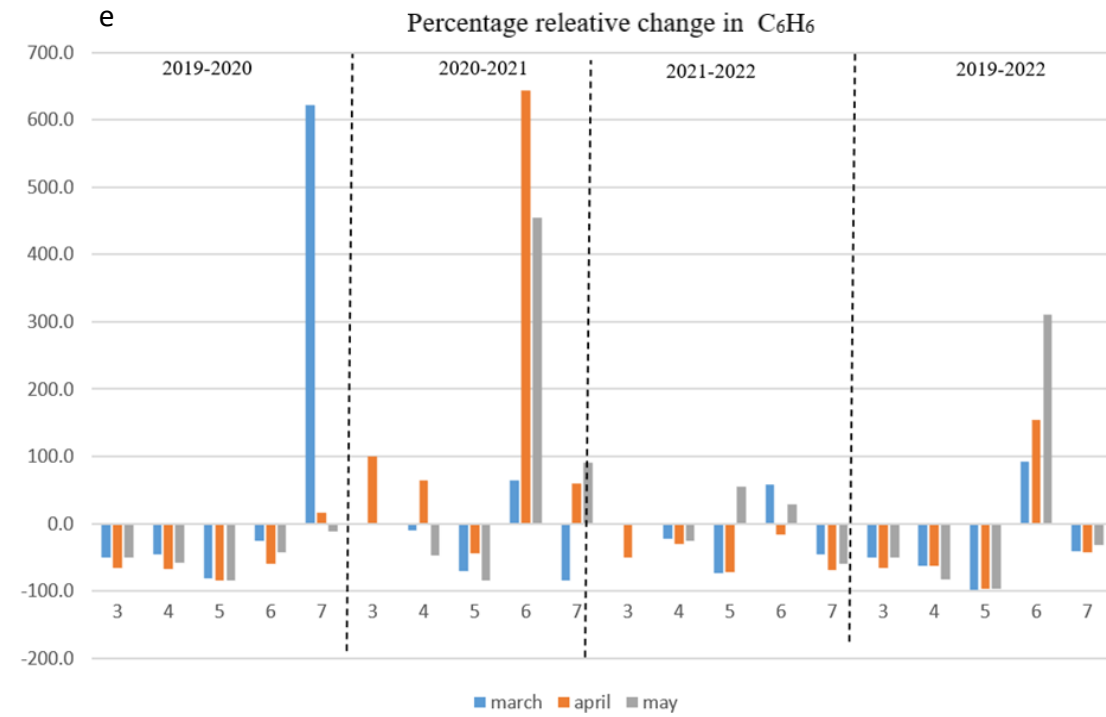
(c) Carbon Monoxide (CO)



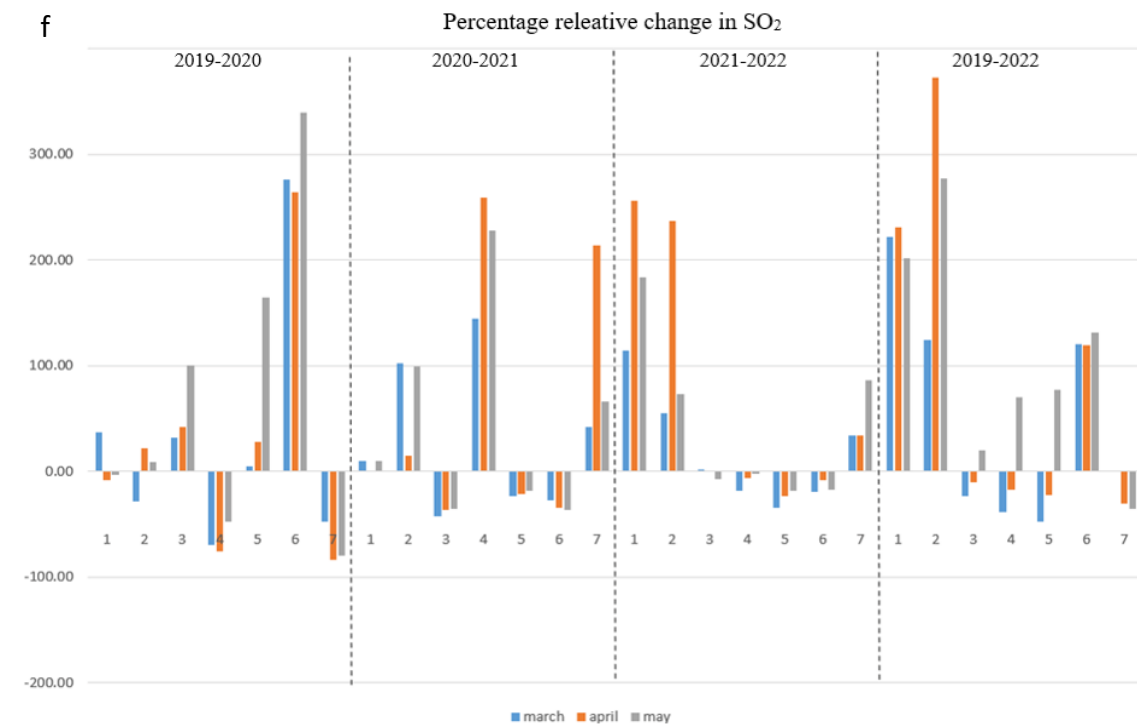
(d) Ozone (O₃)



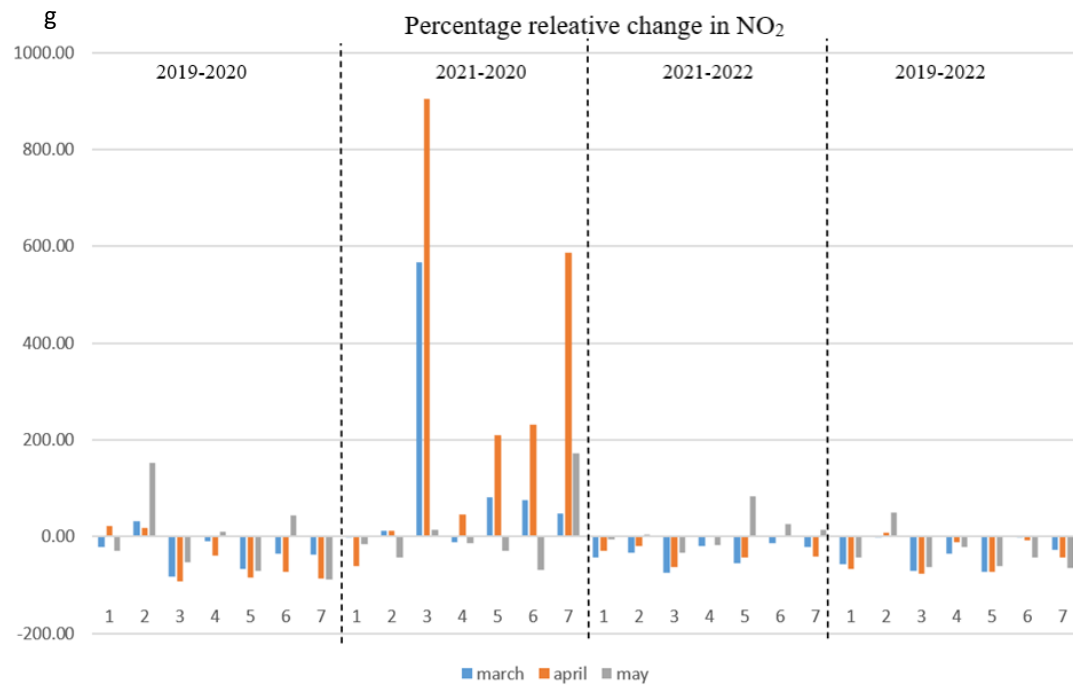
(e) Benzene (C₆H₆)



(f) Sulphur dioxide (SO₂)



(g) Nitrogen dioxide (NO₂)



(h) Ammonia (NH₃)

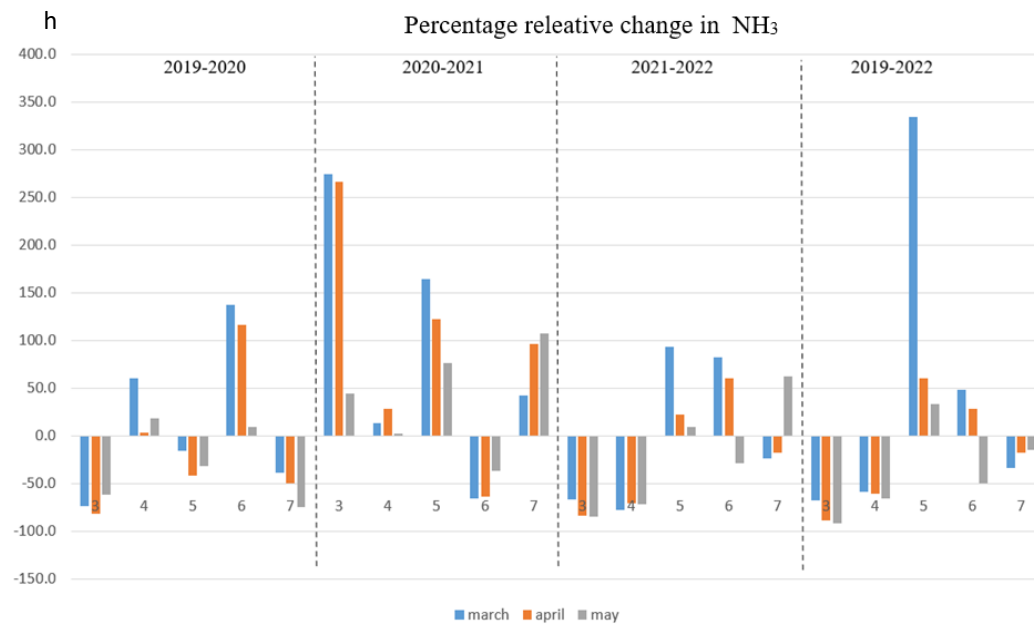


Fig 2 The percentage relative change in concentration of pollutants -a PM₁₀ b PM_{2.5} c O₃ d C₆H₆ e SO₂ f NO₂ h NH₃ air pollutants in 7 stations in the month of March, April and May.

3 Exceedance factor

The Exceedance factor calculated as per Central Pollution Control Board (CPCB):

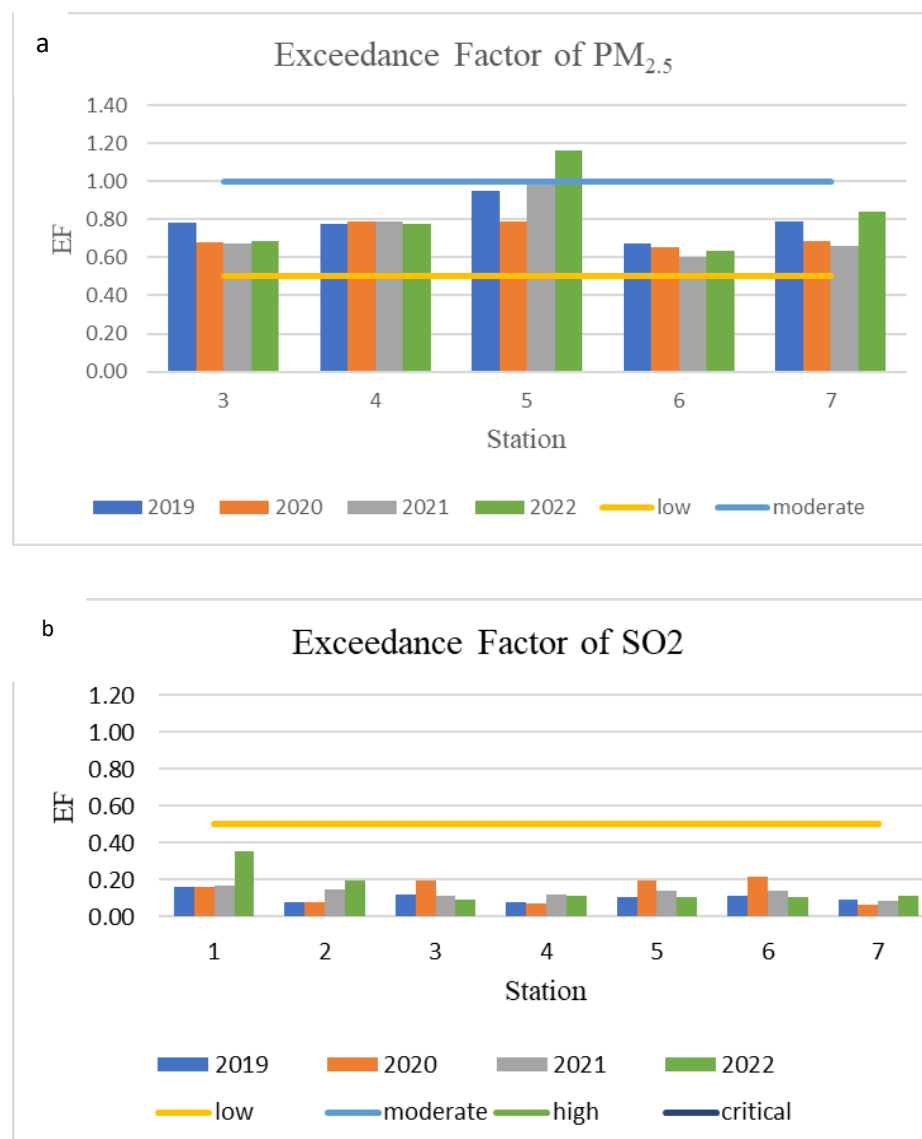


Fig 3 a Calculated exceedance factor for PM_{2.5}, **b**, SO₂ levels at 7 stations in Bangalore, 2019–2023

Particulate Matter 2.5 (PM_{2.5}) : The PM_{2.5} pollutant level is not monitored in station 1 and 2. The Exceedance factor is calculated for station 3, 4, 5, 6, and 7 it is found that the highest pollution is witnessed in station 5 i.e., Kavika Mysore road. In 2021 even though lockdowns were imposed in the end of April 2021, the obtained EF value is 1.01 which fell in High pollution level category and it also witnessed an increase in pollution level in 2021 compared to previous years. The EF of rest of the stations over the entire time period remained in ‘Moderate’ pollution levels as represented in Fig.11 a.

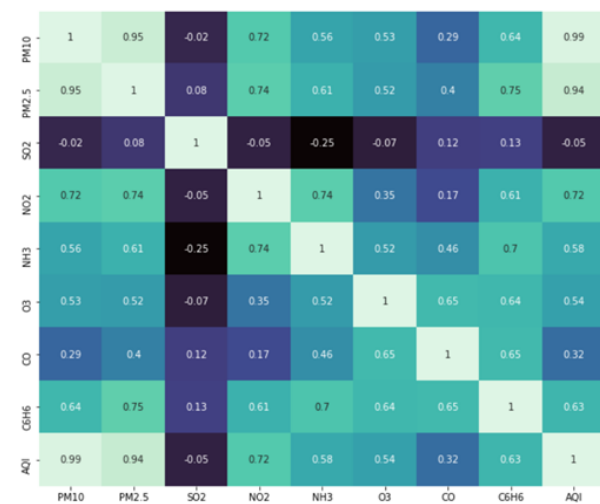
In the seven stations considered Sulphur dioxide has the least impact and the pollution level is below set norms, the calculated corresponding Exceedance factor, Fig 11 b, indicated all the stations were well below 0.5 and falls under ‘Low’ pollution category.

4 Pearson correlation coefficient

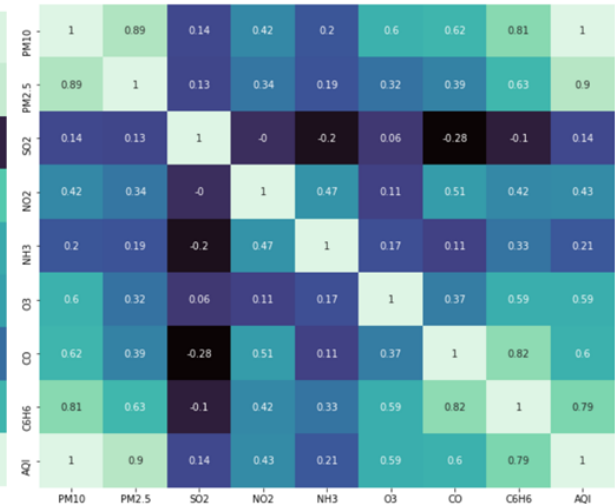
Table 1 Range and associativity between variables:

Sl. No.	Range	Association
1	-1.0 to -0.7	Strong negative associations
2	-0.7 to -0.3	Weak negative association
3	-0.3 to +0.3	Little or no association
4	+0.3 to +0.7	Weak positive association
5	+0.7 to +1.0	Strong positive association

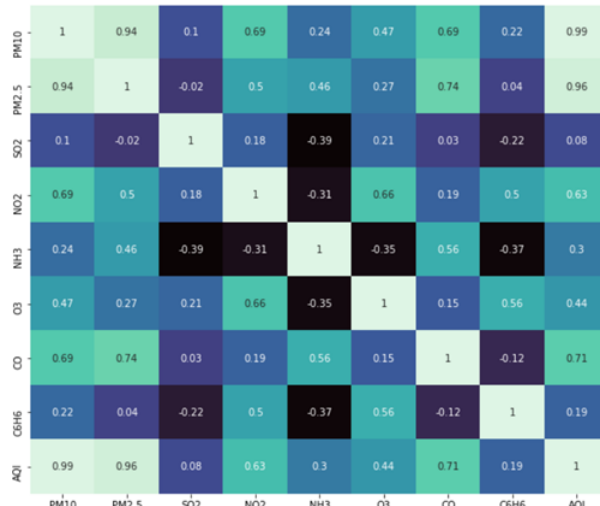
(a) Station 3



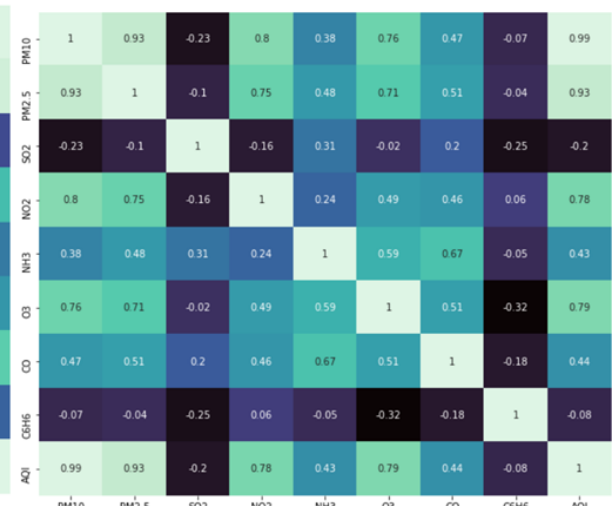
(b) Station 4



(c) Station 5



(d) Station 6



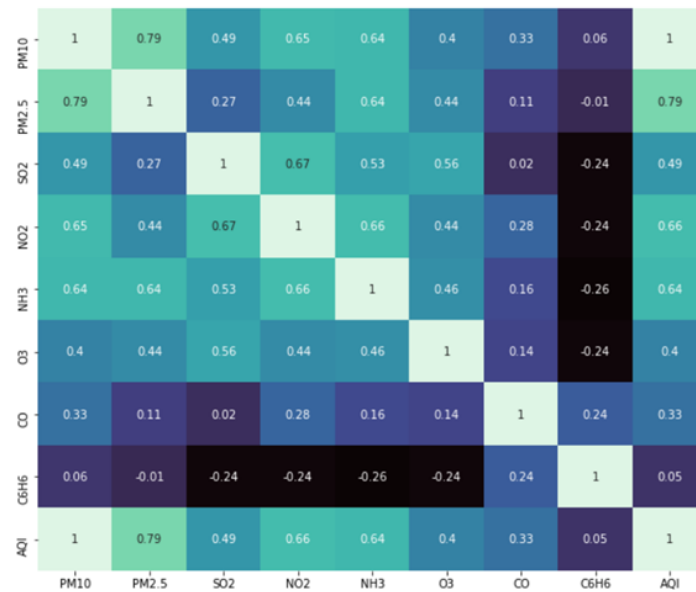


Fig 4 Pearson correlation analysis between different individual air pollutants and AQI in station 1 to 7.

5 Discussion

Colour coding of PM₁₀ & PM_{2.5} concentration in each quarters across 4 years. The concentration of PM₁₀ and PM_{2.5} measured along four years in 4 quarters indicated the concentrations dropped in 2020 and 2021 compared to 2020 and 2021, as shown in Fig 13 a&b .

(a) Particulate Matter (PM₁₀)

Year	Station 1 PM10	Station 2 PM10	Station 3 PM10	Station 4 PM10	Station 5 PM10	Station 6 PM10	Station 7 PM10
2019	1,475	573	802	941	934	781	990
Qtr 1	468	167	300	357	326	301	301
Qtr 2	399	159	200	235	238	210	269
Qtr 3	303	125	94	120	140	100	221
Qtr 4	305	122	208	229	230	170	199
2020	1,165	530	720	782	789	676	810
Qtr 1	324	150	245	281	246	240	282
Qtr 2	290	145	145	128	131	128	159
Qtr 3	282	129	105	143	138	99	158
Qtr 4	268	106	225	230	274	209	211
2021	890	459	764	733	892	679	877
Qtr 1	308	121	285	271	300	233	254
Qtr 2	185	95	163	157	175	158	197
Qtr 3	179	145	108	103	156	108	211
Qtr 4	218	98	208	202	261	180	215
2022	897	501	785	778	981	678	1204
Qtr 1	234	135	283	267	295	256	335
Qtr 2	208	96	167	177	206	149	293
Qtr 3	218	122	125	113	183	86	276
Qtr 4	236	148	210	221	297	187	300
Total	4,426	2,065	3071	3234	3596	2814	3881

(b) Particulate Matter (PM_{2.5})

Year	Station 3 PM2.5	Station 4 PM2.5	Station 5 PM2.5	Station 6 PM2.5	Station 7 PM2.5
2019	377	373	457	324	380
Qtr 1	151	145	158	132	134
Qtr 2	88	80	121	80	100
Qtr 3	37	37	70	31	60
Qtr 4	101	111	108	81	86
2020	325	380	378	314	331
Qtr 1	107	118	104	108	118
Qtr 2	61	65	63	58	54
Qtr 3	47	71	71	49	57
Qtr 4	110	126	140	99	102
2021	324	380	485	289	318
Qtr 1	116	145	154	92	121
Qtr 2	65	74	89	63	68
Qtr 3	42	48	90	54	43
Qtr 4	101	113	152	80	86
2022	331	374	557	304	404
Qtr 1	114	127	175	119	122
Qtr 2	65	80	95	71	106
Qtr 3	52	50	90	36	58
Qtr 4	100	117	197	78	118
Total	1357	1507	1877	1231	1433

Fig 5 a PM₁₀, b, PM_{2.5} Range in 4 Quarters from 2019-2022.

Time series Trend of Particulate Matter (PM_{2.5})

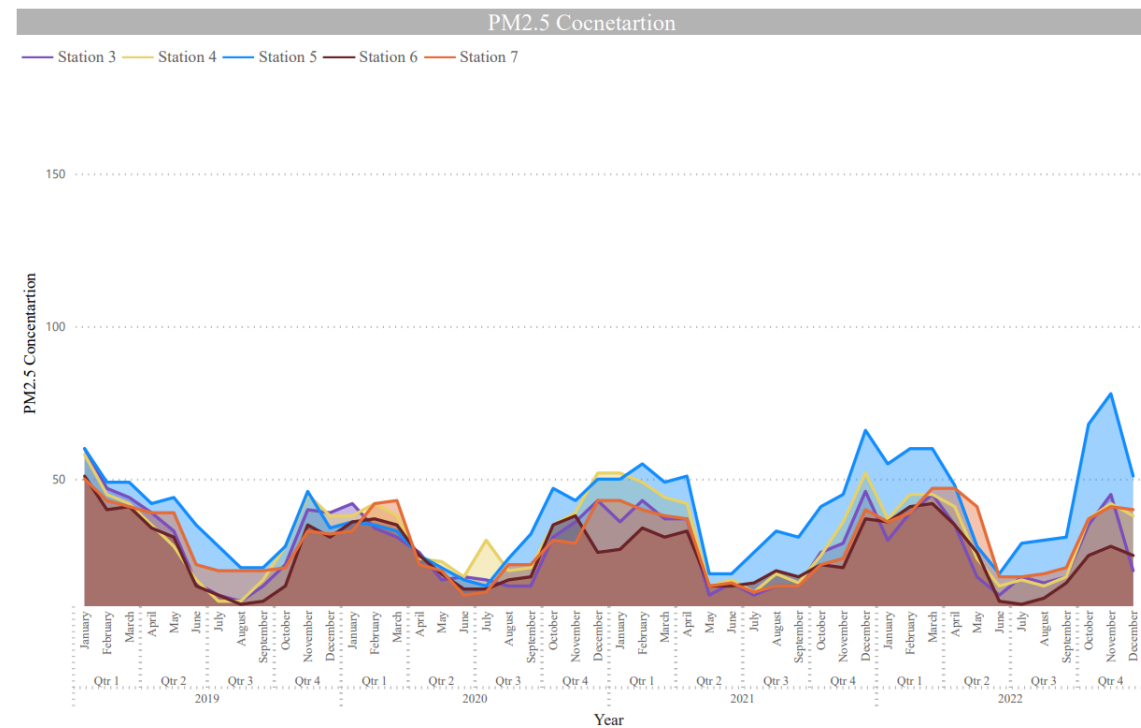


Fig 6 Seasonal variation of AQI, PM₁₀, PM_{2.5} pollutants in station