



Government of Nepal
Ministry of Forest and Environment
Department of Environment
Babarmahal, Kathmandu

Air quality status of Nepal 2016-2020

Volume XIX

Bharatpur air quality monitoring station



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ANNEX

1 Bharatpur Air Quality Monitoring Station

- Address : Bharatpur Metropolitan city
- Location: 27.672503 latitude, 84.438393 longitude
- Surrounding of the station
 2. East: North: Metallic Road
 3. South: DAO Office compound
 4. North: Vegetable market
 5. West: DAO office security force building
- Establish year: 2020 (2077)
- Brief introduction of the instruments installed in the station (should include- brief specification; number of instrument)
 1. PM instrument- GRIMM EDM 180
 2. Met sensor luffth WS 700
 3. Data logging and data transmission and power backup system

2 Air Quality Status of Bharatpur station (2020)

2.1 Air quality status, 2020

2.1.1 Temporal variation of PM1

Annual average of PM1, PM_{2.5}, PM₁₀ and TSP

The annual average of PM1, PM_{2.5}, PM₁₀ and TSP of the Bharatpur monitoring station was calculated as shown in Figure 1.

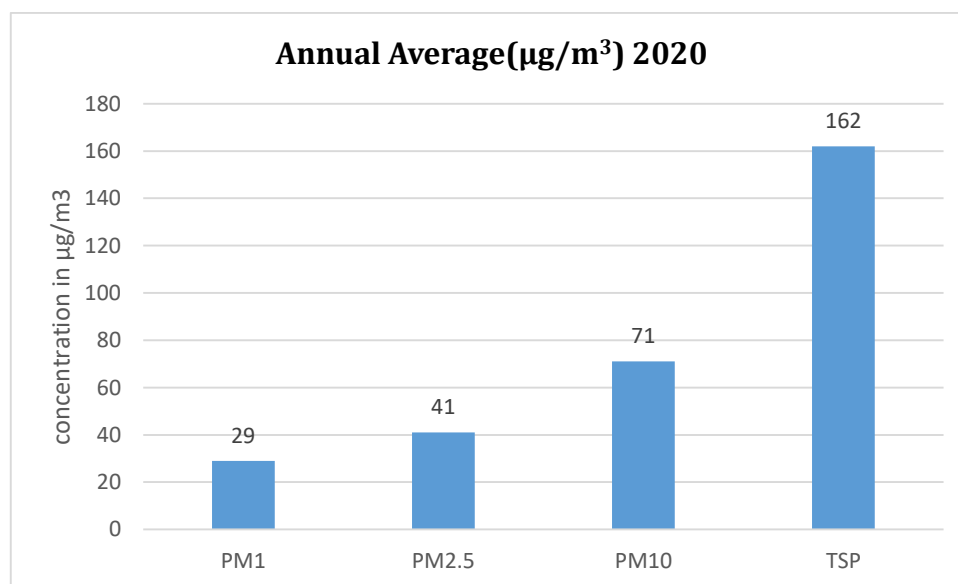


Figure 1: Annual average of Pm1, PM_{2.5}, PM₁₀ and TSP in 2020

Annual average of PM₁

The annual average of PM₁ at Bharatpur station was found to be 29 $\mu\text{g}/\text{m}^3$. Histogram of hourly average PM₁ is shown in the figure below.

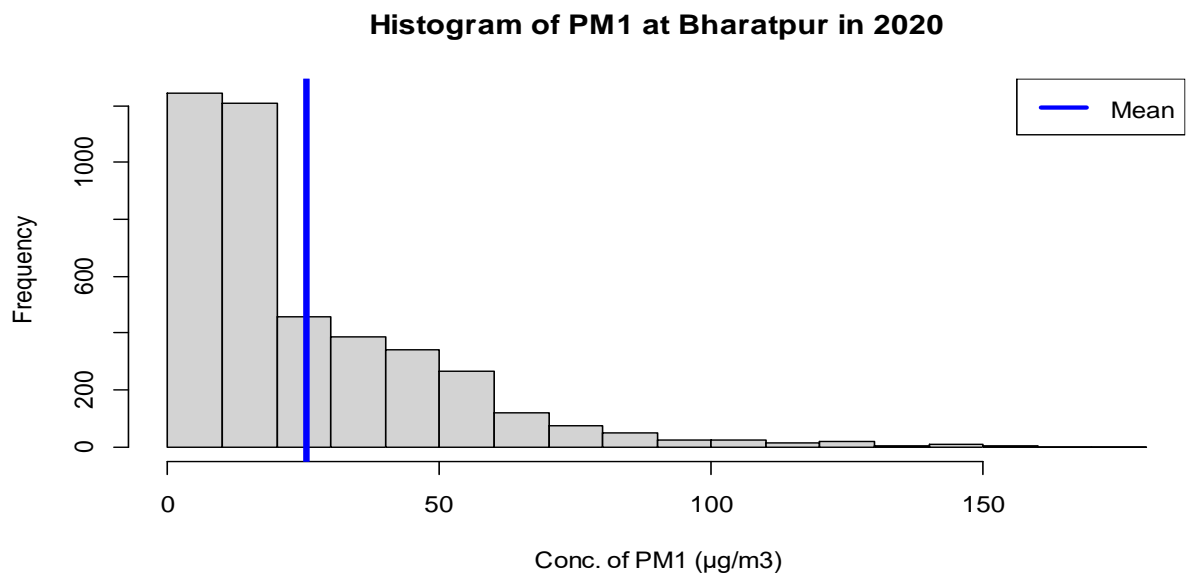


Figure 2 : Histogram of PM₁

Daily average of PM₁:

Daily average concentration of PM₁ was high during September and was found low during August (Figure 9).

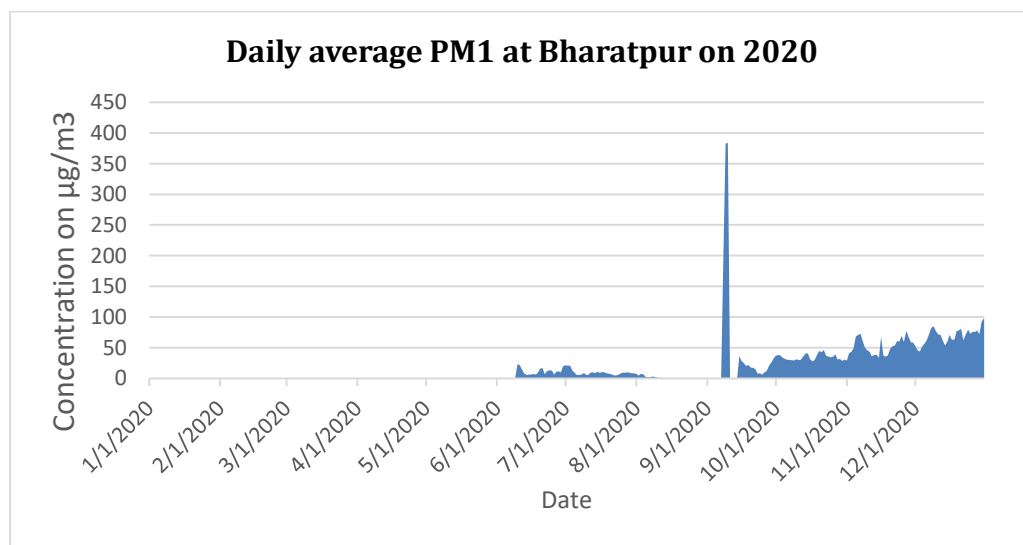


Figure 3: Daily average of PM₁

Monthly average of PM₁

The highest and the lowest monthly average of PM₁ was found during December (69.63 $\mu\text{g}/\text{m}^3$) and august (1.5 $\mu\text{g}/\text{m}^3$) respectively as shown in figure below.

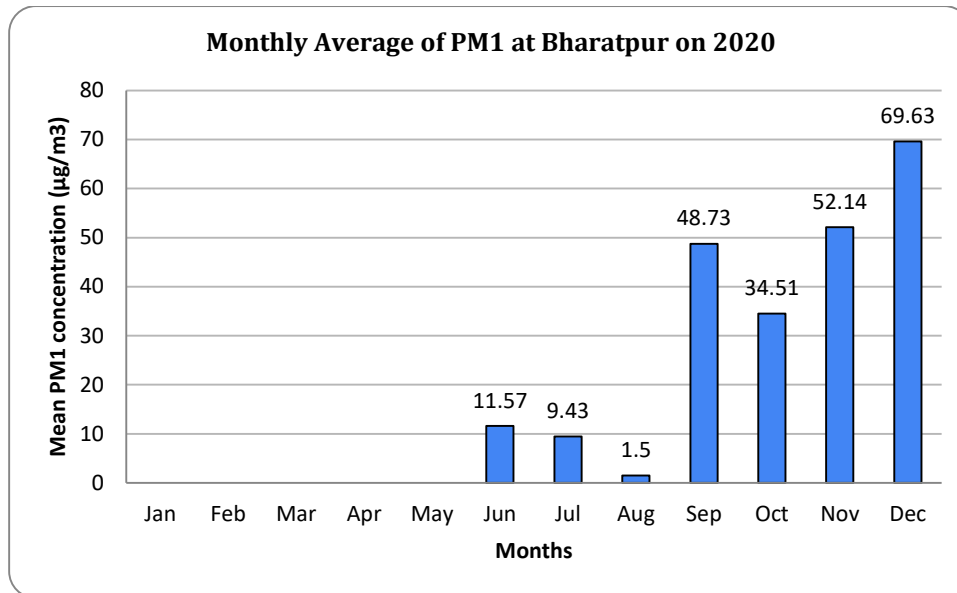


Figure 4: Monthly Average of PM₁

Monthly variation of PM₁

Variation in concentration of PM₁ was found more during October whereas low during July as shown in figure below.

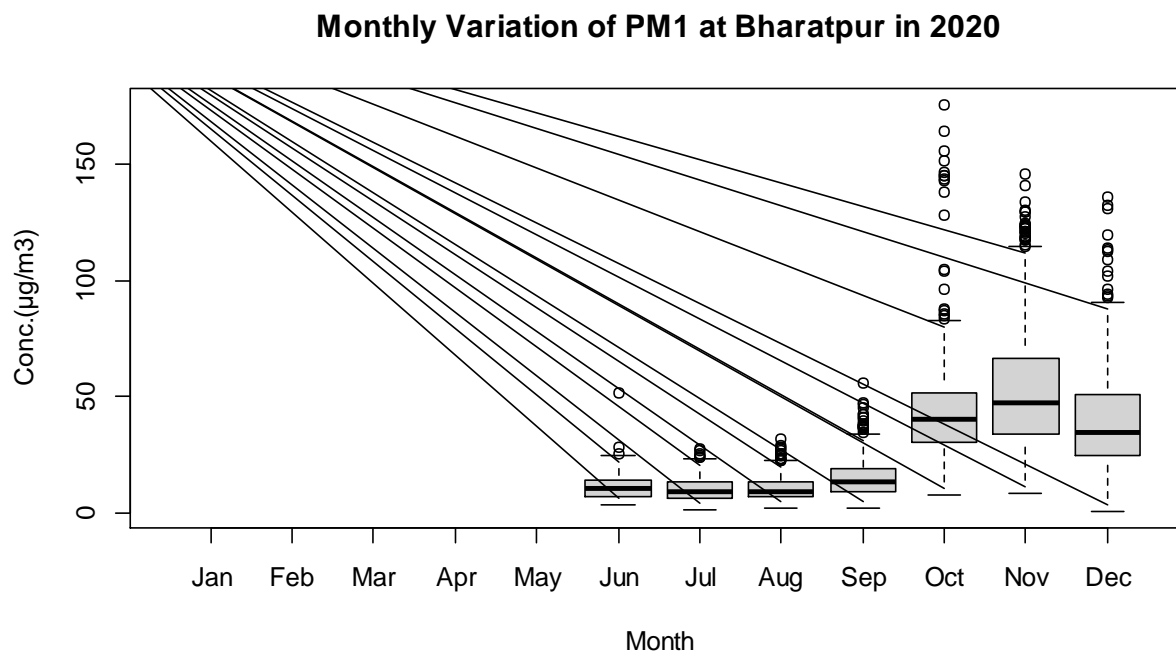


Figure 5: Monthly Variation of PM₁

Seasonal variation of average PM₁ concentration

Ambient concentration of average PM₁ during monsoon (June-September), and post-monsoon (October-November) can be shown in the Figure 12 below. The concentration of PM₁ was found higher during post monsoon (45.13 $\mu\text{g}/\text{m}^3$) than monsoon season (7.5 $\mu\text{g}/\text{m}^3$) Figure 12: Seasonal variation of PM_{2.5} as shown in figure below.

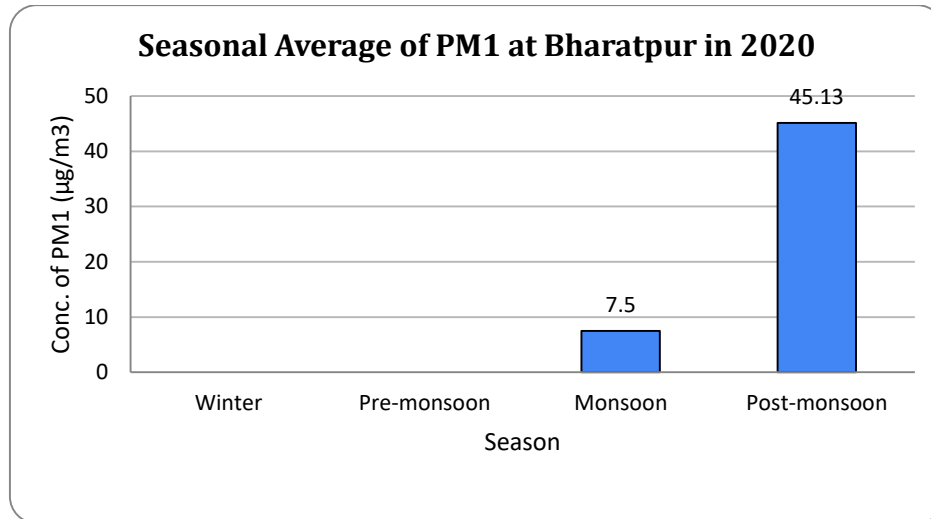


Figure 6: Seasonal variation of PM₁

Diurnal variation of average PM₁ concentration

The diurnal variation of average PM₁ concentrations can be shown in the Figure 13 below. The variation in PM₁ concentration was high at around 5 pm.

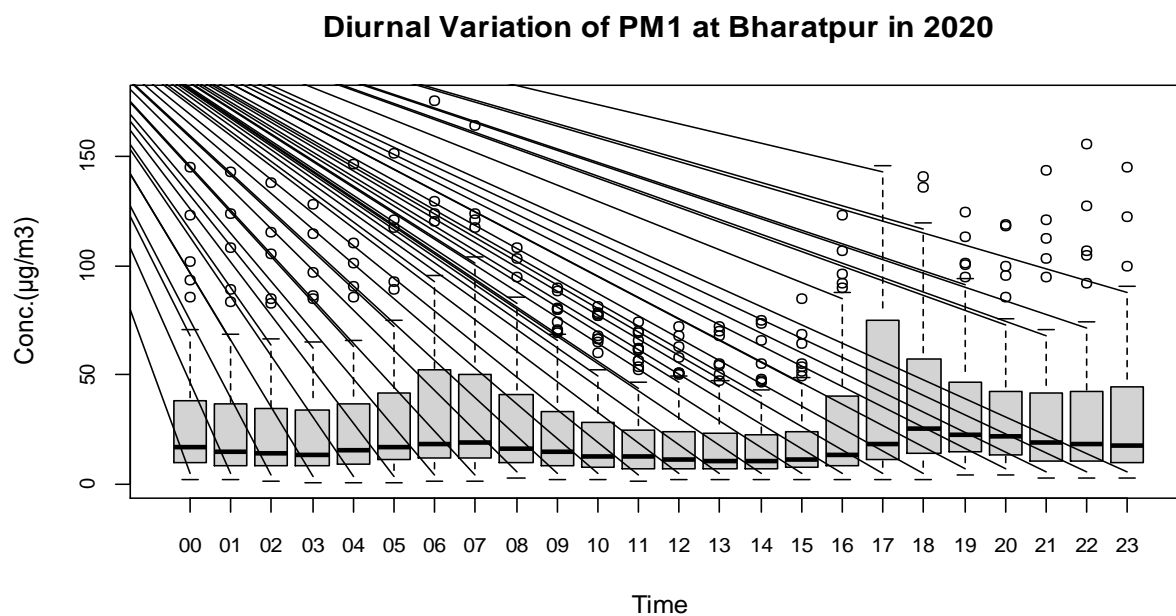


Figure 7: Diurnal variation of PM₁

2.1.2 Temporal Variation of PM_{2.5}

Annual average of PM_{2.5}

The annual average of PM_{2.5} at Bharatpur station was found to be 41 $\mu\text{g}/\text{m}^3$. Histogram of hourly average PM_{2.5} is shown in the figure below.

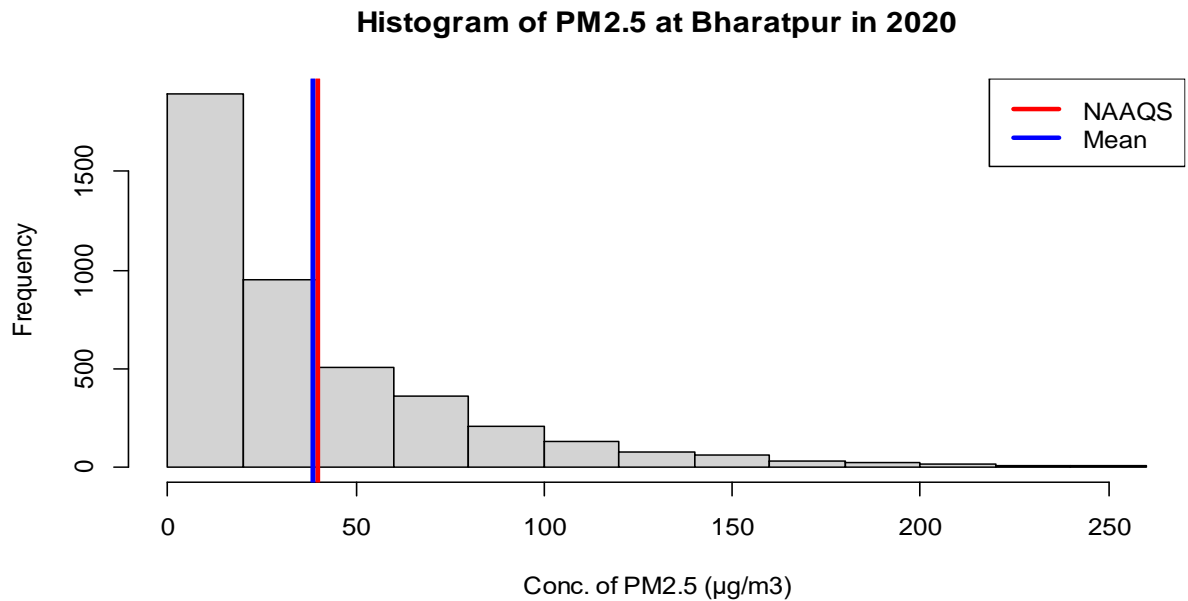


Figure 8 : Histogram of PM_{2.5}.

Daily average of PM_{2.5}:

Daily average concentration of PM_{2.5} was high during October and was found low during July as shown in figure below.

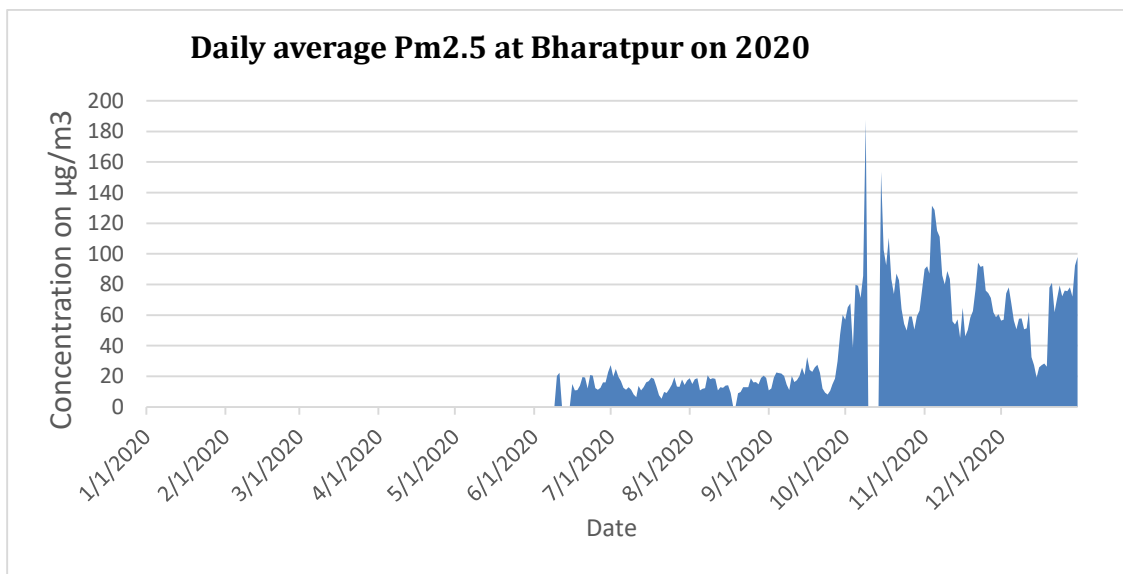


Figure 9: Daily average of PM_{2.5}

Monthly average of PM_{2.5}

The highest and the lowest monthly average of PM_{2.5} was found during October (79 µg/m³) and July (14 µg/m³) respectively (Figure 10).

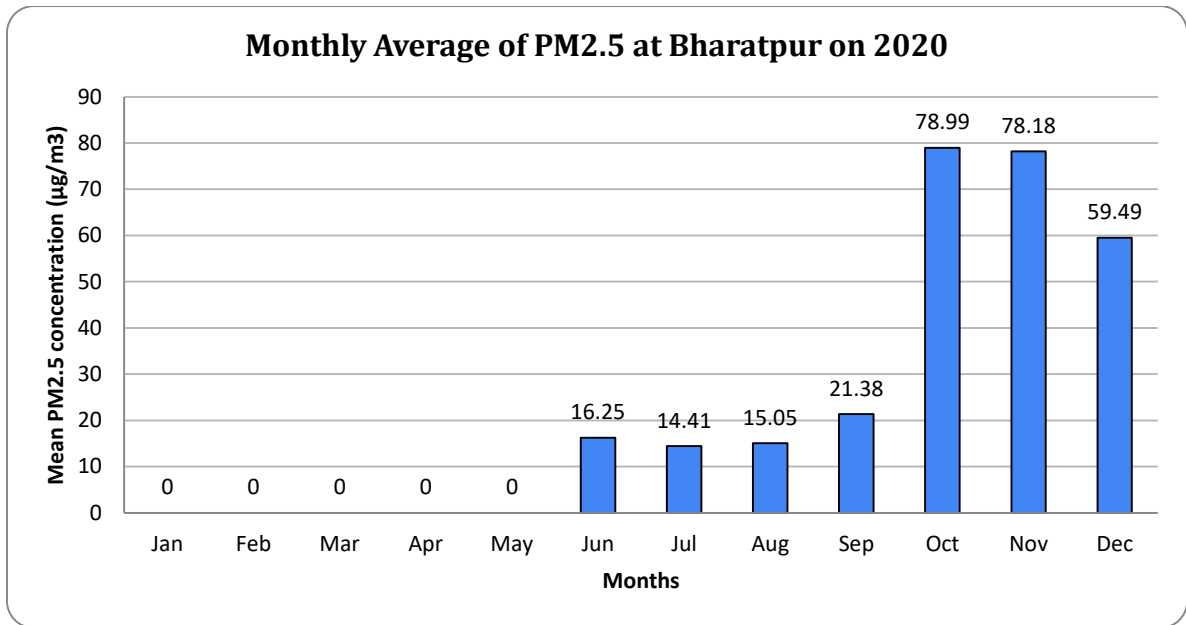


Figure 10: Monthly Average of PM_{2.5}

Monthly variation of PM_{2.5}

Variation in concentration of PM_{2.5} was found more during November whereas low during August as shown in figure below.

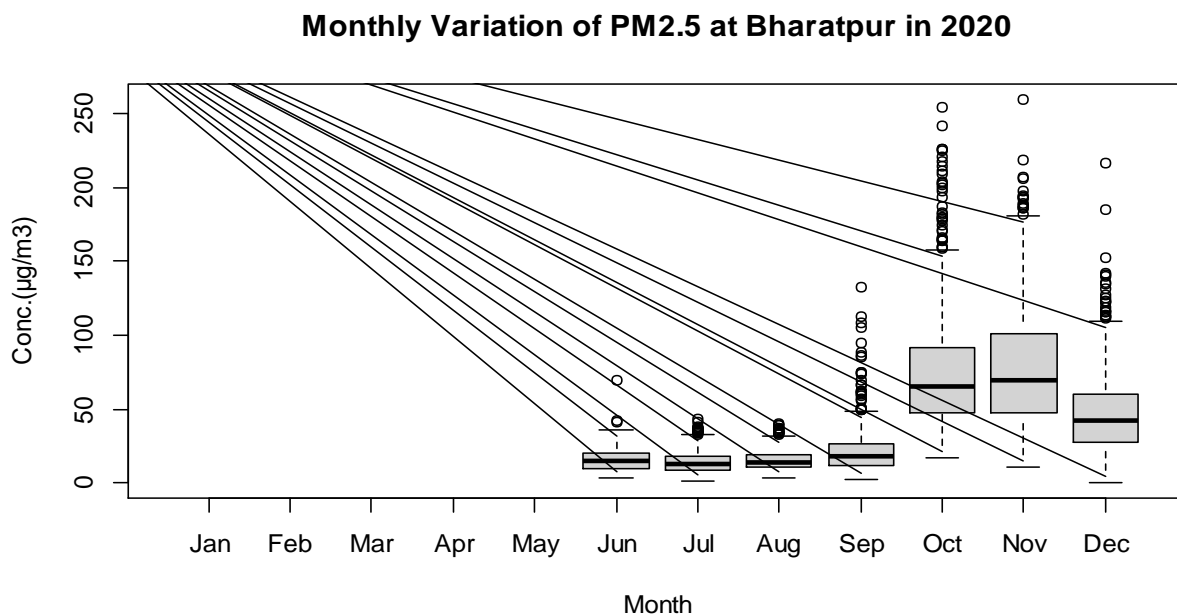


Figure 11: Monthly Variation of PM_{2.5}

Seasonal variation of average PM_{2.5} concentration

Ambient concentration of average PM_{2.5} during monsoon (June-September), and post-monsoon (October-November) can be shown in the Figure 12 below. The concentration of PM_{2.5} was found higher during post monsoon (59.52 $\mu\text{g}/\text{m}^3$) than monsoon season (15.23 $\mu\text{g}/\text{m}^3$) Figure 12: Seasonal variation of PM_{2.5} as shown in figure below. .

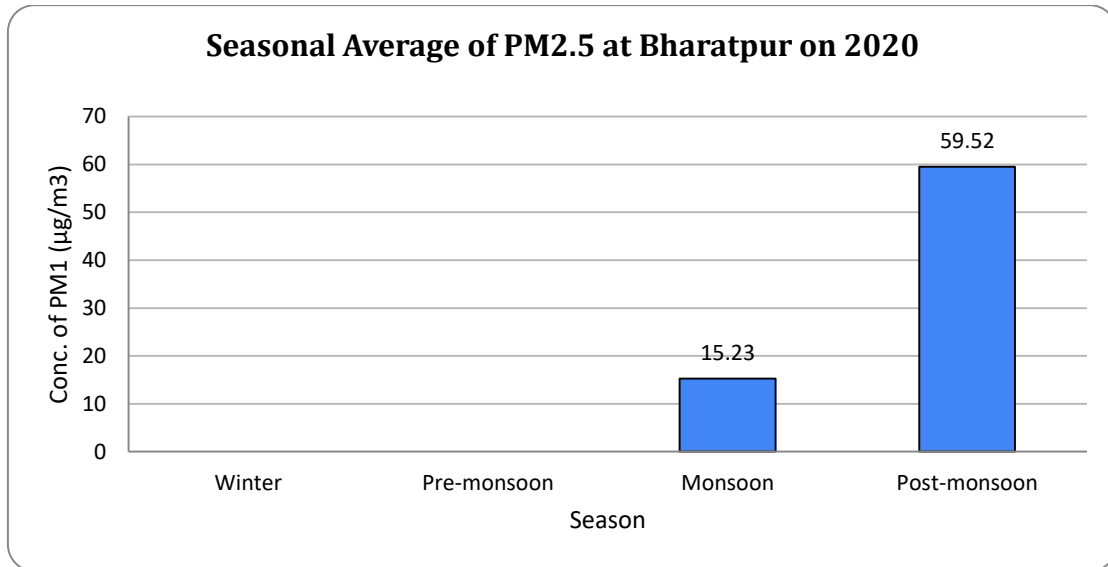


Figure 12: Seasonal variation of PM_{2.5}

Diurnal variation of average PM_{2.5} concentration

The diurnal variation of average PM_{2.5} concentrations can be shown in the Figure 13 below. The variation in PM_{2.5} concentration was high at around 5 pm and low at 2 pm.

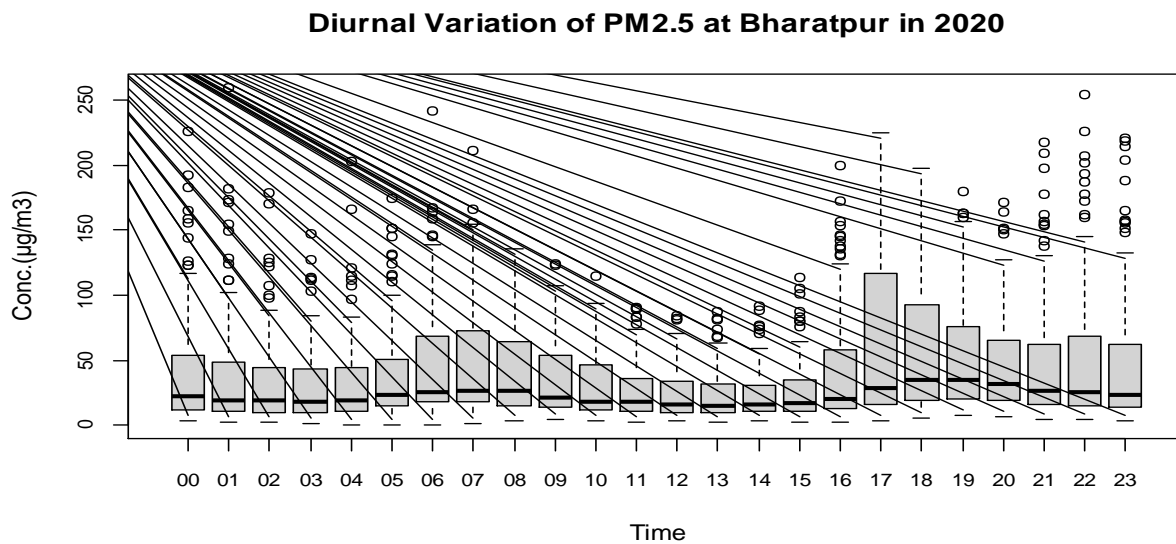


Figure 13: Diurnal variation of PM_{2.5}

Compliance status of PM_{2.5}

The total days of PM_{2.5} monitored in the year 2020 counts 193, of which 80 days exceed the NAAQS guideline as shown in figure below. Figure 14.

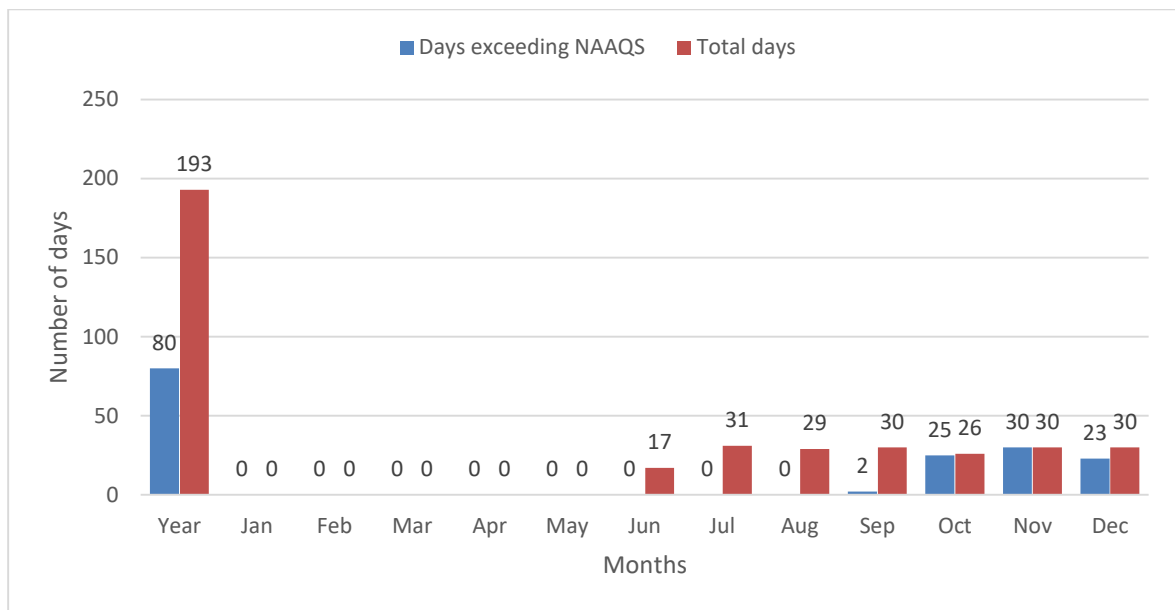


Figure 14: Compliance status of PM_{2.5}

2.1.3 Temporal variation of PM₁₀

Annual average of PM₁₀

The annual average of PM₁₀ at Bharatpur station was found to be 71 µg/m³. Histogram of hourly average PM₁₀ is shown in the figure below.

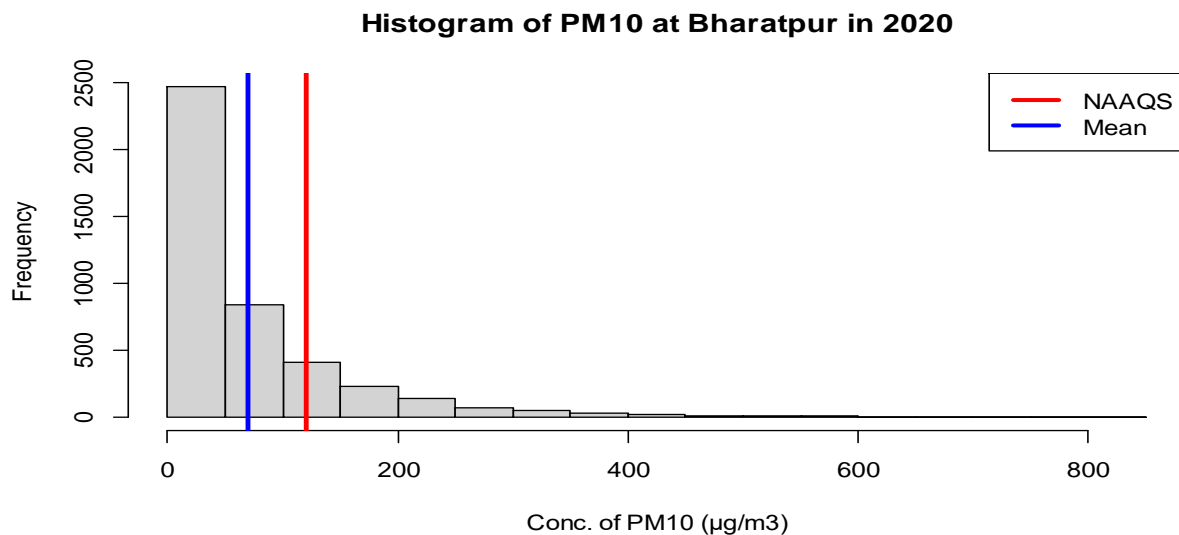


Figure 15 : Histogram for the ambient concentration of PM₁₀.

Daily average of PM₁₀:

Daily average concentration of PM₁₀ was high during October and November and was found low during July and August (Figure 16).

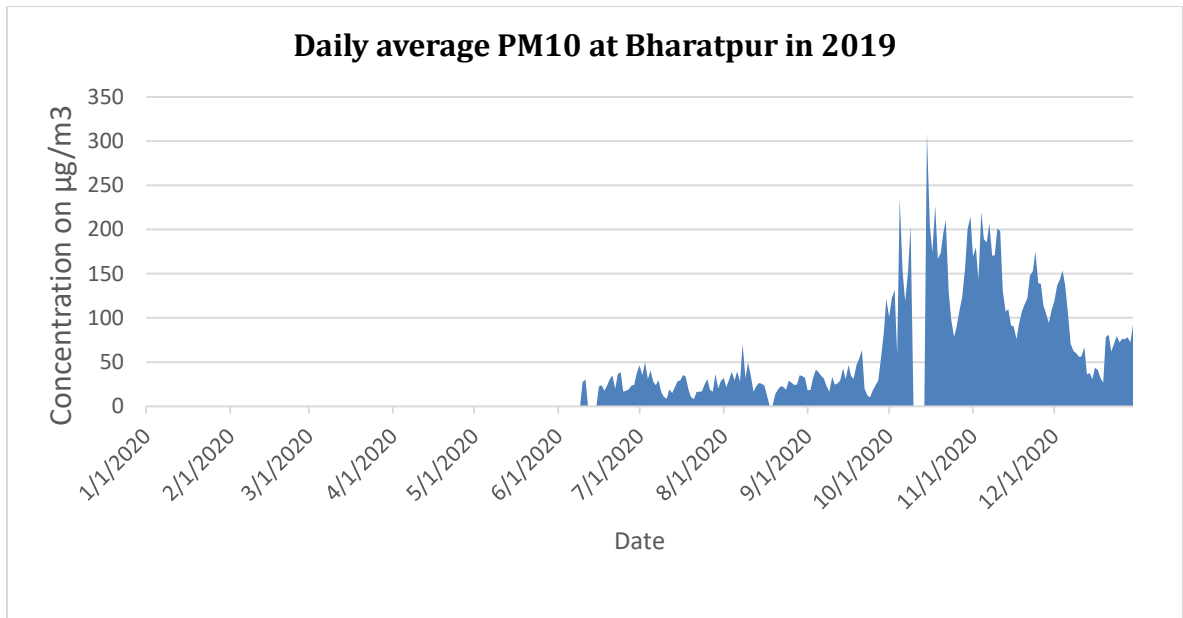


Figure 16: Daily average of PM₁₀

Monthly average of PM₁₀

The highest and the lowest monthly average of PM_{2.5} was found during December (158.93 µg/m³) and July (24.62 µg/m³) respectively (Figure 17).

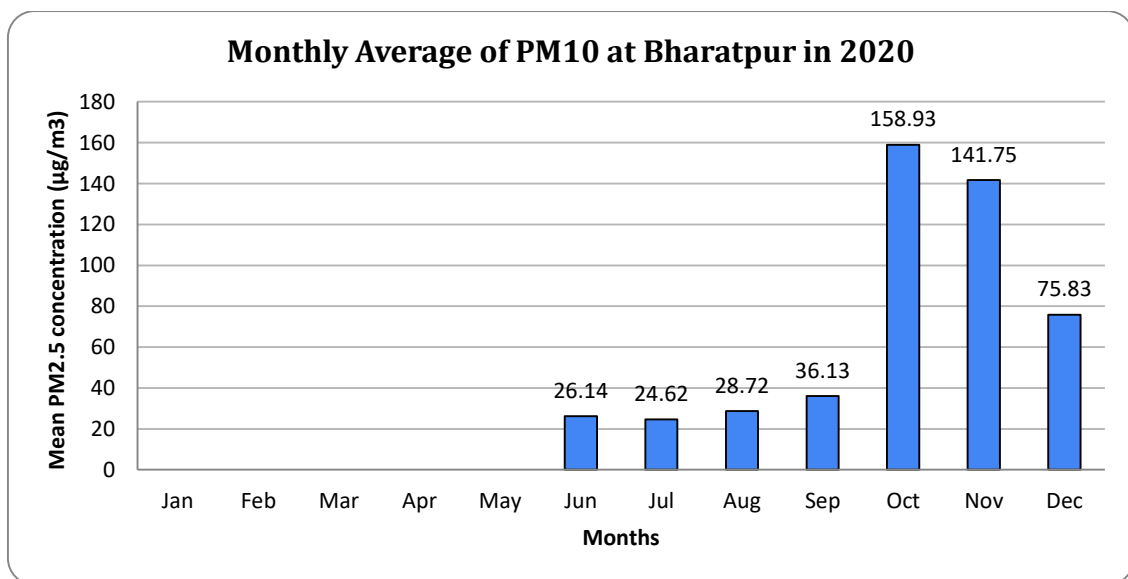


Figure 17: Monthly average of Pm₁₀

Monthly variation of PM10

Variation in concentration of PM₁₀ was found more during October and low during June, July. (Figure 18).

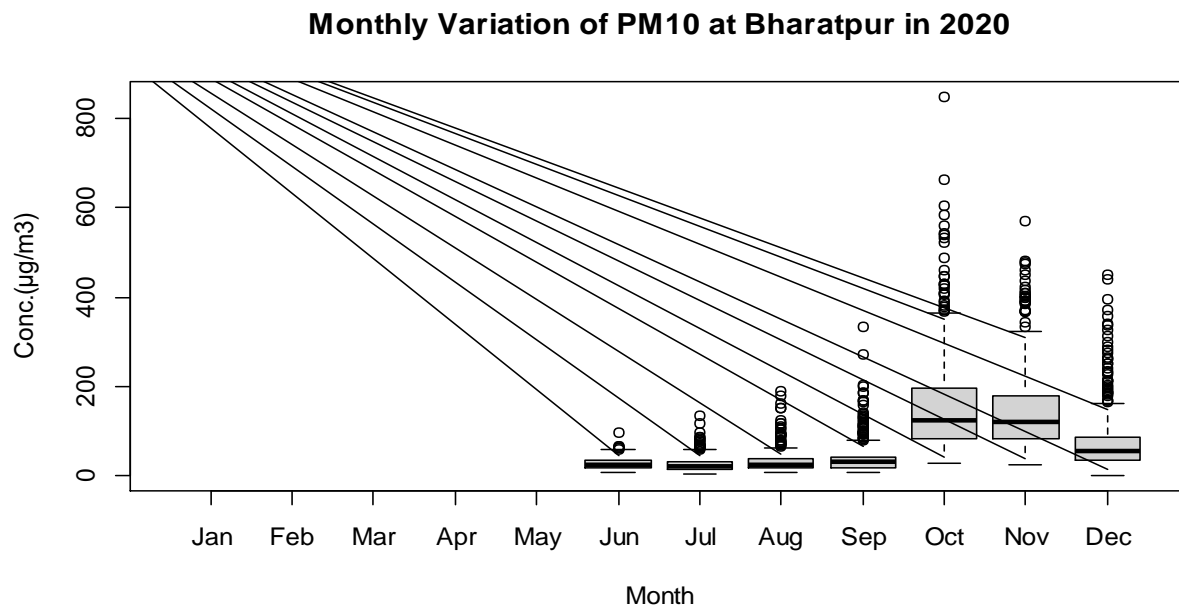


Figure 18: Monthly Variation of PM₁₀

Seasonal variation of average PM₁₀ concentration:

Ambient concentration of average PM₁₀ during monsoon (June-September), and post-monsoon (October-November) can be shown in the figure below. The concentration of PM₁₀ was found higher during post monsoon (112 µg/m³) than monsoon season (26 µg/m³) (Figure 19).

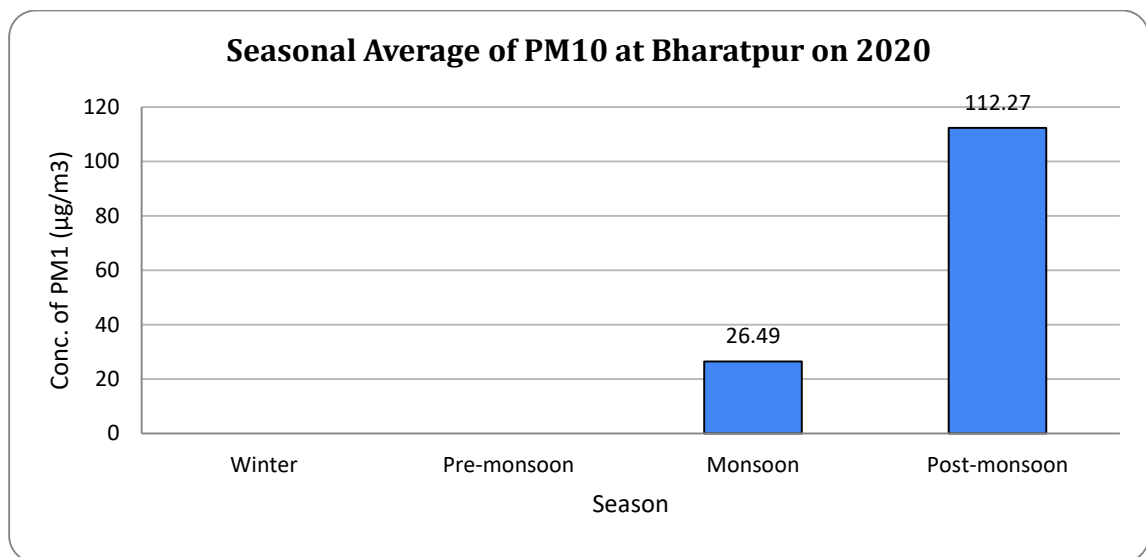


Figure 19: Seasonal variation of PM₁₀.

Diurnal variation of average PM₁₀ concentration

The diurnal variation of average PM₁₀ concentrations can be shown in the Figure 20 below. The variation in PM₁₀ concentration was high at around 5 pm and low at 2 to 3 am.

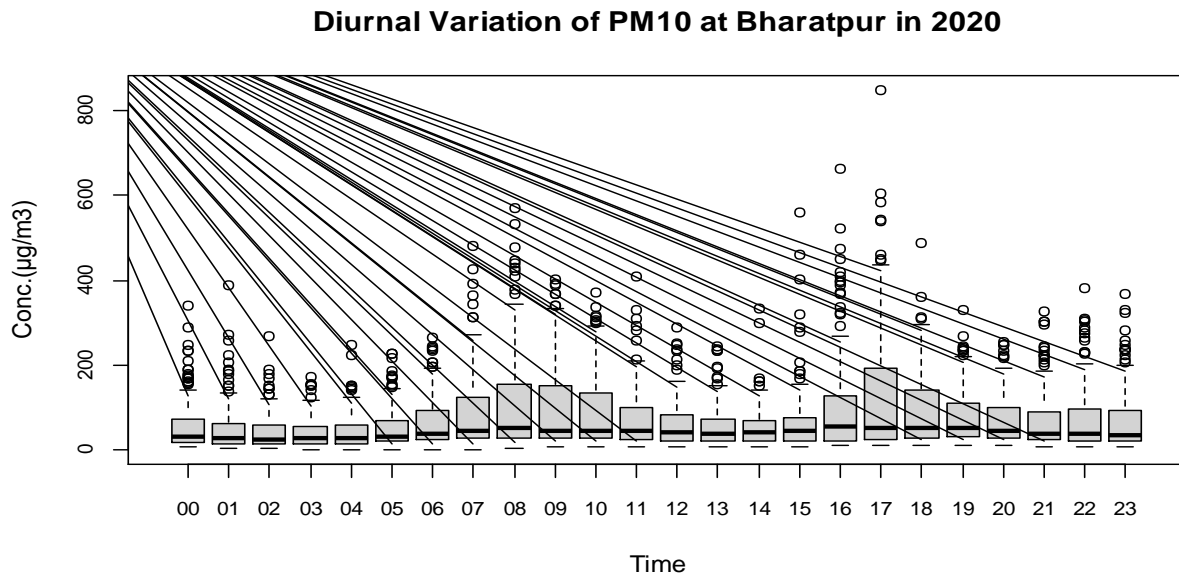


Figure 20: Diurnal variation of PM₁₀ concentration

The total days of PM₁₀ monitored in the year 2020 counts 193, of which 42 days exceed the NAAQS guideline *Figure 21*.

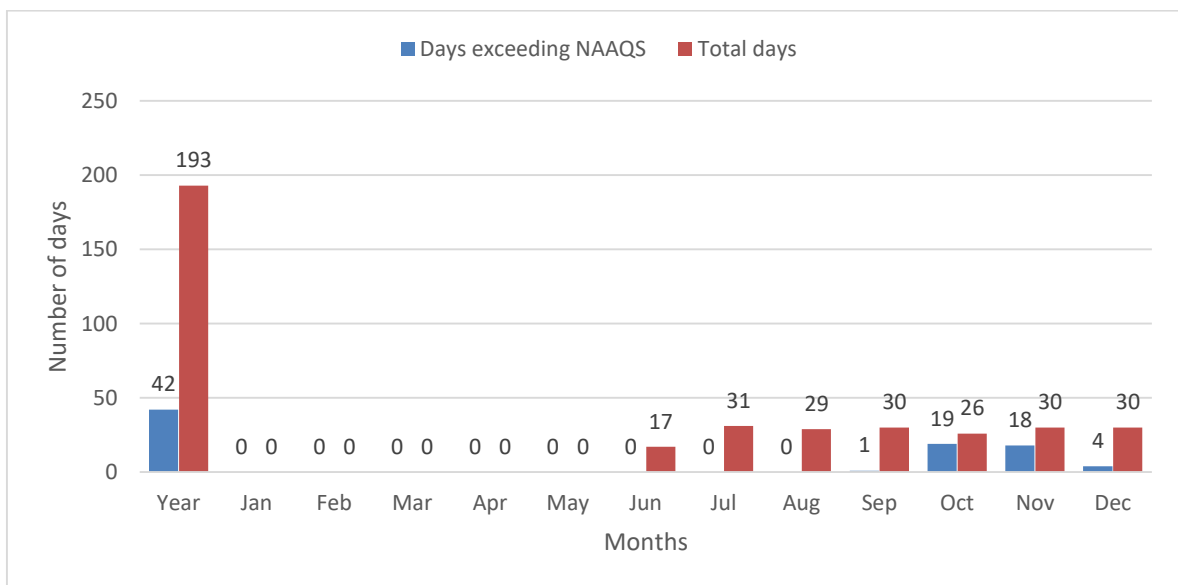


Figure 21: Compliance status of PM₁₀

2.1.4 Temporal Variation of TSP

Annual average of TSP

The annual average of TSP at Bharatpur station was found to be $162 \mu\text{g}/\text{m}^3$. Histogram of hourly average TSP is shown in the figure below (Figure 22).

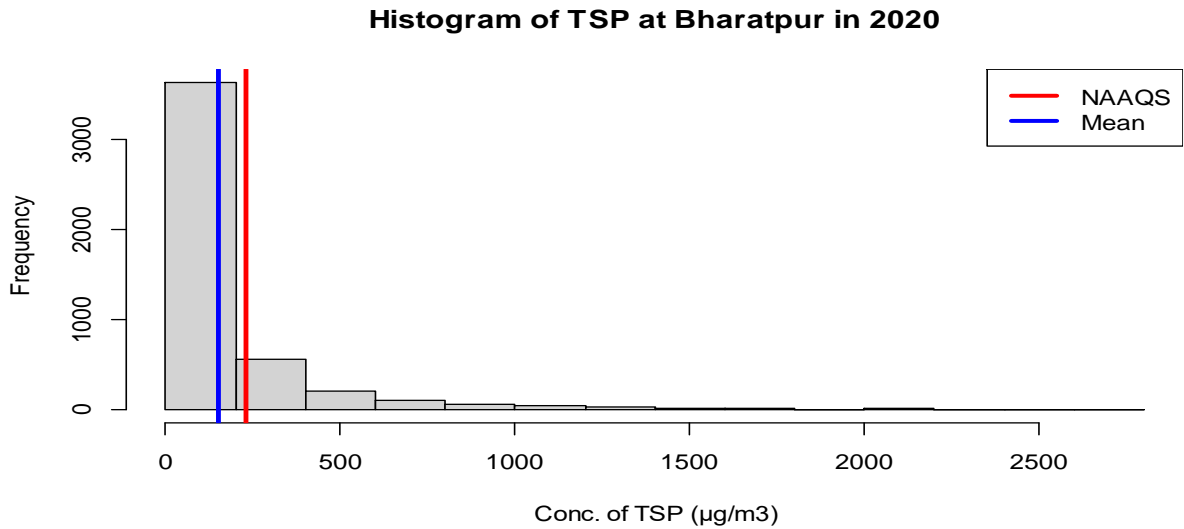


Figure 22 : Histogram for the ambient concentration of TSP

Daily average of TSP:

Daily average concentration of TSP was high during October and November and was found low during July and August (Figure 23).

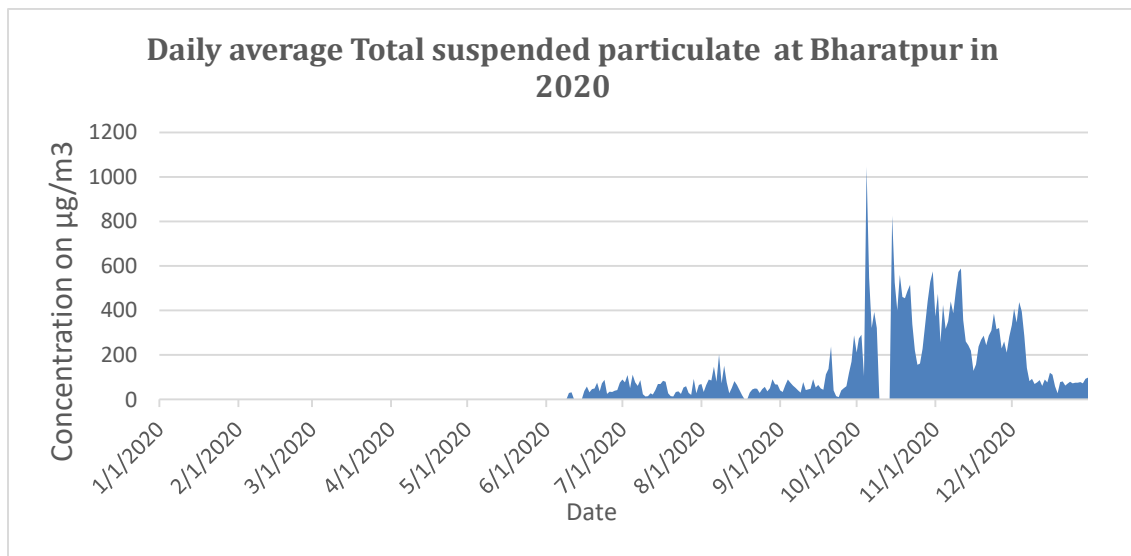


Figure 23: Daily average of TSP

Monthly average of TSP

The highest and the lowest monthly average of PM_{2.5} was found during October (412 µg/m³) and June (47 µg/m³) respectively (Figure 24).

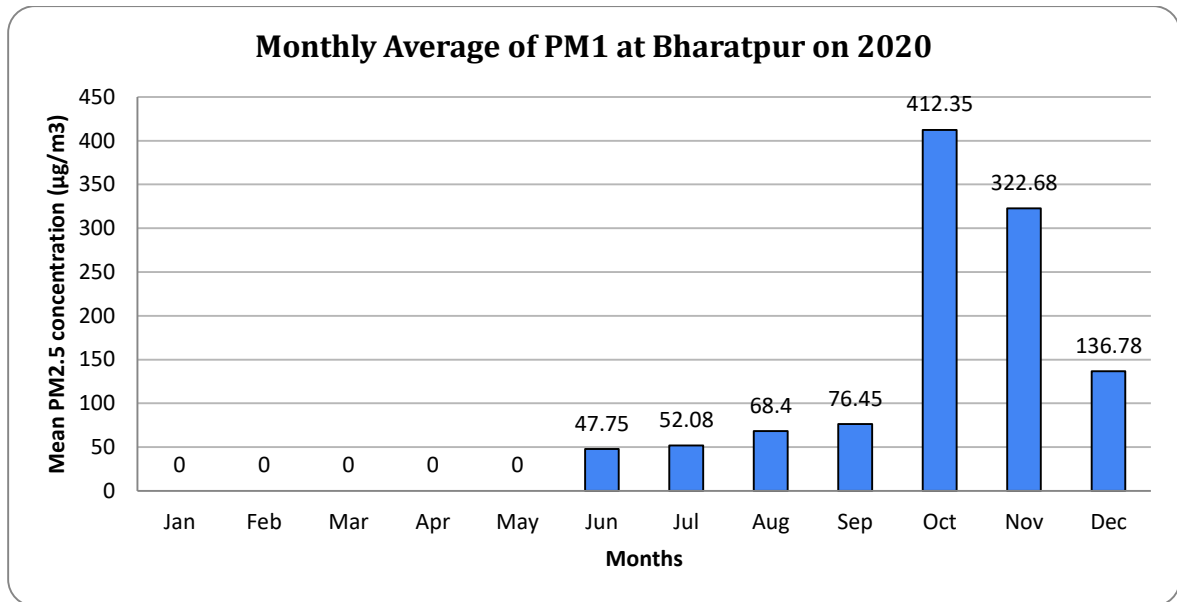


Figure 24: Monthly Average of TSP

Monthly variation of TSP

Variation in concentration of TSP was found more during October and low during May (Figure 25).

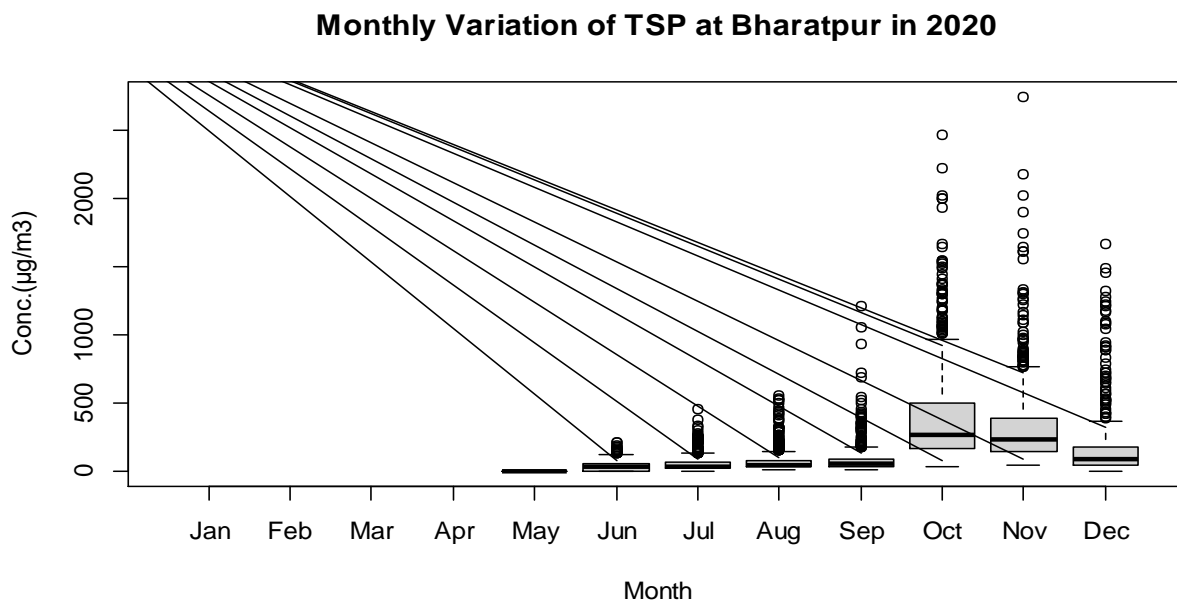


Figure 25: Monthly Variation of TSP.

Seasonal variation of average TSP concentration

Ambient concentration of average TSP during monsoon (June-September), and post-monsoon (October-November) can be shown in the Figure 26 below. The concentration of TSP was found higher during post monsoon ($270 \mu\text{g}/\text{m}^3$) than monsoon season ($56 \mu\text{g}/\text{m}^3$) (Figure 26).

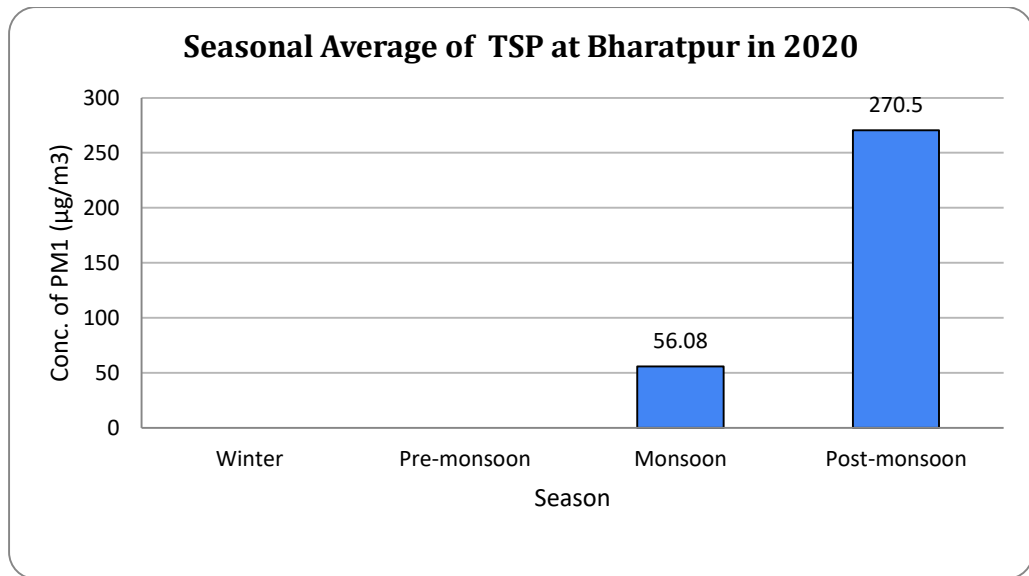


Figure 26: Seasonal variation of TSP

Diurnal variation of average TSP concentration

The diurnal variation of average TSP concentrations can be shown in the Figure 27 below. The variation in TSP concentration was high at around 8-10 am and low at 2 to 3 am.

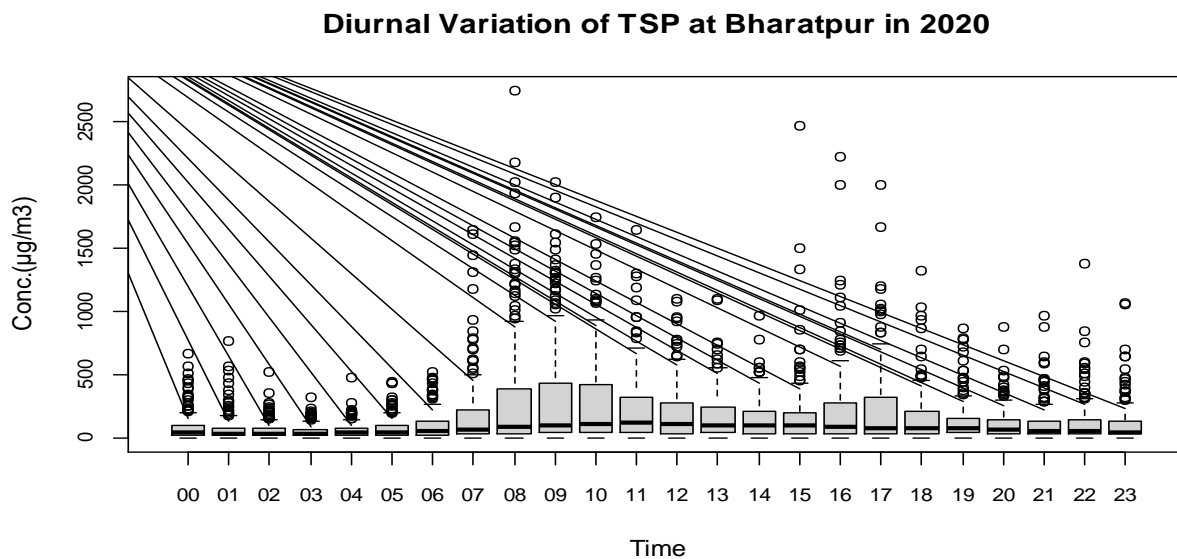


Figure 27: Diurnal Variation of TSP

Compliance status of TSP

The total days of PM_{2.5} monitored in the year 2020 counts 193, of which 53 days exceed the NAAQS guideline (*Figure 28*).

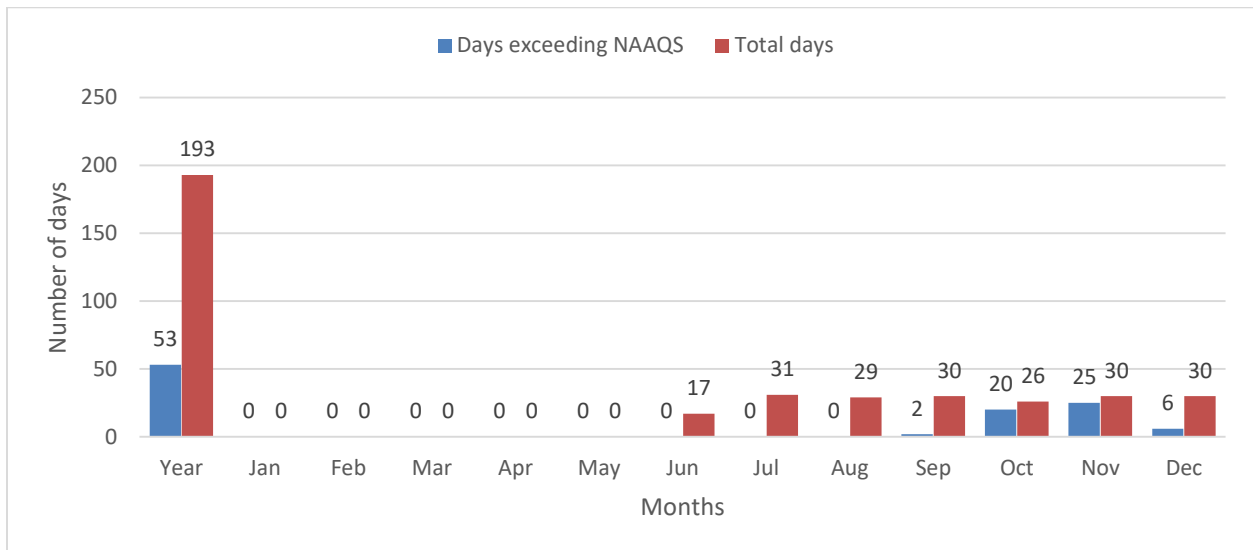


Figure 28: Compliance status of TSP

Annex

Daily Average

Date	PM1	PM2.5	PM10	TSP
6/10/2020	17.78204	20.49909	27.08358	29.31936
6/11/2020	19.55112	22.77683	32.21399	34.04089
6/12/2020				
6/13/2020				
6/14/2020				
6/15/2020				
6/16/2020	8.257994	14.40596	21.54682	38.38651
6/17/2020	5.868195	9.458195	21.56639	53.87313
6/18/2020	7.646528	11.01521	17.58847	31.46993
6/19/2020	11.53088	17.07184	28.15612	54.77802
6/20/2020	11.50743	18.12097	28.35146	48.04181
6/21/2020	11.06958	17.85847	33.2159	70.99438
6/22/2020	7.968264	12.71069	20.40993	37.70528
6/23/2020	12.73993	21.9882	38.16806	76.37722
6/24/2020	12.65694	20.44215	38.42306	85.51111
6/25/2020	8.434722	10.46313	13.84153	22.6975
6/26/2020	8.607153	11.00757	17.66625	34.17083
6/27/2020	10.07465	14.28875	21.66458	37.25611
6/28/2020	8.190695	14.74167	21.45958	38.11653
6/29/2020	12.77201	17.06097	25.34611	44.53847
6/30/2020	16.64153	25.73215	43.30736	80.71764
7/1/2020	17.13132	27.8925	46.88653	92.02174
7/2/2020	11.29681	18.04944	32.44201	73.21597
7/3/2020	14.39556	24.04229	48.7091	107.5515
7/4/2020	14.18535	20.56625	31.58799	51.68924
7/5/2020	8.084375	14.58083	37.23451	106.2804
7/6/2020	6.654375	12.1641	27.33708	76.28792
7/7/2020	5.52875	11.29139	23.74715	62.31139
7/8/2020	7.791458	12.89819	29.44604	85.76715
7/9/2020	8.498472	10.90514	15.19139	21.7625
7/10/2020	5.870833	7.575833	10.28521	13.05132
7/11/2020	4.993264	6.748195	9.260555	15.30271
7/12/2020	10.52917	14.11889	19.32132	28.73604
7/13/2020	9.440695	11.93986	16.42854	23.35896
7/14/2020	9.919573	12.86293	21.3976	44.69856
7/15/2020	10.43715	16.66639	30.00736	72.12937
7/16/2020	12.70333	16.95604	28.90271	68.47347
7/17/2020	13.21882	19.35521	35.94986	83.08861
7/18/2020	11.2941	17.06368	31.37389	76.76889
7/19/2020	8.226111	11.81868	16.56826	24.31576
7/20/2020	5.217084	7.821736	10.66056	15.33604
7/21/2020	4.078125	5.830486	8.809444	15.02618
7/22/2020	5.649097	9.459861	15.45604	31.575

7/23/2020	7.100972	9.779653	17.05882	37.17965
7/24/2020	9.230556	12.22056	17.39104	28.20556
7/25/2020	11.47028	15.66264	26.08063	55.7191
7/26/2020	12.82382	17.74514	28.32236	56.06639
7/27/2020	12.82056	15.22986	21.1434	32.58792
7/28/2020	9.589723	11.78271	15.1734	21.01993
7/29/2020	12.38729	19.52361	39.05813	96.73257
7/30/2020	10.97444	13.39611	18.06889	26.47125
7/31/2020	13.35458	17.75271	29.10396	63.6134
8/1/2020	12.49299	17.70778	30.81153	67.55402
8/2/2020	11.52215	15.41417	22.23069	36.14285
8/3/2020	13.33132	19.66382	32.77063	68.08153
8/4/2020	10.46882	16.31972	35.35924	85.44104
8/5/2020	5.389931	10.70792	28.78486	85.1457
8/6/2020	5.296042	12.77632	40.83736	150.9548
8/7/2020	6.087222	11.4109	26.52965	75.48451
8/8/2020	11.08146	22.26597	73.11979	206.5326
8/9/2020	13.9341	18.90438	32.80646	73.35111
8/10/2020	9.898681	17.61639	47.70646	150.8414
8/11/2020	9.601806	17.2484	32.36118	72.88278
8/12/2020	9.068611	11.42417	17.36202	28.58695
8/13/2020	9.142222	12.82569	22.03181	52.87097
8/14/2020	8.003125	13.04076	27.28931	83.22452
8/15/2020	8.564028	13.44118	24.8782	64.7775
8/16/2020	8.888457	14.23059	24.06912	44.61723
8/17/2020				
8/18/2020				
8/19/2020				
8/20/2020	5.6744	9.620827	15.68792	34.66883
8/21/2020	5.013423	9.007232	16.30823	38.44227
8/22/2020	8.562847	12.86229	22.52347	48.91035
8/23/2020	8.734028	12.76368	21.69875	46.8909
8/24/2020	11.06542	14.43354	21.05139	33.07257
8/25/2020	14.29403	19.54875	30.00743	49.6166
8/26/2020	10.7257	14.82938	24.64465	54.67917
8/27/2020	10.81563	15.63868	22.99861	35.24188
8/28/2020	10.73111	14.99007	24.87986	51.38028
8/29/2020	13.8241	20.52146	37.37229	94.05701
8/30/2020	16.88986	22.00021	36.45215	70.17764
8/31/2020	10.92304	14.9396	26.35255	58.69169
9/1/2020	7.608125	10.66597	18.25847	41.40528
9/2/2020	10.62486	13.78403	20.70993	37.21285
9/3/2020	14.45488	20.26039	33.45596	65.01029
9/4/2020	15.73243	22.66681	41.31688	90.55306
9/5/2020	15.26764	21.49688	37.74625	74.2441
9/6/2020	16.12958	22.63694	35.65278	63.645
9/7/2020	12.95083	17.5416	27.15021	48.43576
9/8/2020	11.06771	14.83049	21.99813	38.575
9/9/2020	8.927292	11.76722	18.03715	35.49667
9/10/2020	14.49451	20.37771	33.51139	78.33472

9/11/2020	11.30667	15.22729	22.84708	38.78326
9/12/2020	14.72757	19.11097	28.39702	48.79903
9/13/2020	17.28847	21.92917	31.52118	51.66757
9/14/2020	16.8884	22.90368	38.69743	84.95355
9/15/2020	17.13688	23.20618	34.43375	58.89278
9/16/2020	25.32174	32.44695	45.60569	62.87257
9/17/2020	18.62521	22.44035	31.81069	46.23299
9/18/2020	19.92132	25.47368	35.43479	51.21563
9/19/2020	16.9284	24.85062	45.37861	112.9345
9/20/2020	13.42403	30.35653	57.92305	148.4583
9/21/2020	9.557917	16.90597	54.99243	222.0396
9/22/2020	8.082708	12.22715	20.49868	40.34382
9/23/2020	6.896458	8.428542	10.87583	12.18563
9/24/2020	6.813681	8.335139	10.51806	11.87785
9/25/2020	6.852014	11.28445	18.56632	42.81326
9/26/2020	10.60028	15.86146	24.88993	52.89993
9/27/2020	15.52528	20.30313	31.35854	63.59417
9/28/2020	20.34444	31.85049	56.21215	125.2301
9/29/2020	29.74035	51.02292	87.0359	178.592
9/30/2020	32.92722	58.99653	119.5532	283.7317
10/1/2020	33.89743	60.58472	107.3082	221.9373
10/2/2020	35.33069	66.85069	123.4542	278.0577
10/3/2020	29.63764	61.97618	123.4557	274.9407
10/4/2020	23.88417	33.81375	56.47875	109.0133
10/5/2020	47.40695	76.82231	200.4921	849.5491
10/6/2020	55.54709	78.51695	149.7733	527.0066
10/7/2020	53.26174	69.75278	116.7454	319.1228
10/8/2020	82.43169	110.0694	174.365	412.1525
10/9/2020	163.925	208.7825	226.2786	373.1889
10/10/2020				
10/11/2020				
10/12/2020				
10/13/2020				
10/14/2020				
10/15/2020	44.05833	145.9086	271.6068	676.5597
10/16/2020	38.81396	92.53423	188.3667	493.0078
10/17/2020	40.86417	96.31778	180.2475	409.7566
10/18/2020	42.42458	114.0338	232.2446	571.4001
10/19/2020	44.82	73.06223	151.1148	425.8404
10/20/2020	50.26125	76.76646	177.4564	461.0918
10/21/2020	52.04535	87.21965	195.9714	491.7628
10/22/2020	43.61611	78.51312	204.351	502.4218
10/23/2020	39.09937	61.55632	124.7972	328.7394
10/24/2020	40.15382	53.83701	96.39528	216.1516
10/25/2020	42.10729	52.09611	80.42132	156.7885
10/26/2020	48.44944	60.56958	92.81479	163.5124
10/27/2020	37.43681	53.59423	102.8917	225.3518
10/28/2020	31.90556	51.13222	123.6574	335.41
10/29/2020	30.65479	62.98077	160.915	456.9921
10/30/2020	25.9141	60.87146	197.028	525.1091

10/31/2020	26.0625	83.47437	225.405	597.7516
11/1/2020	37.19903	105.4528	192.5022	417.8553
11/2/2020	43.73966	73.47202	151.0198	409.8949
11/3/2020	78.46417	97.30979	156.0375	268.4149
11/4/2020	108.544	134.6829	220.912	424.6648
11/5/2020	95.62417	124.1119	186.2447	318.3442
11/6/2020	85.91812	113.4372	182.865	346.7908
11/7/2020	71.14514	104.2864	198.1373	431.7588
11/8/2020	52.69521	85.86618	170.7392	388.3516
11/9/2020	44.80799	78.29298	168.4634	485.6708
11/10/2020	38.46264	88.19173	200.3227	573.924
11/11/2020	34.66139	83.51959	198.1566	588.121
11/12/2020	31.07924	52.32438	125.0777	344.6281
11/13/2020	34.63556	54.60569	107.457	262.3307
11/14/2020	33.18604	53.96528	105.3866	236.8455
11/15/2020	31.7541	46.13285	92.60091	219.0774
11/16/2020	55.33688	65.77812	90.52361	126.9906
11/17/2020	30.80952	45.36528	76.47076	160.1639
11/18/2020	37.52021	53.72472	98.22701	244.5998
11/19/2020	39.66056	58.25535	106.9404	267.391
11/20/2020	45.29396	62.82653	114.3078	283.8557
11/21/2020	63.26111	82.02368	129.8056	251.3339
11/22/2020	64.01202	101.8262	161.1415	321.6424
11/23/2020	61.58292	86.85111	146.8456	298.5723
11/24/2020	58.4884	86.12055	164.3064	361.3479
11/25/2020	55.93507	75.53535	138.6886	315.3052
11/26/2020	51.69361	71.36931	134.5239	315.0295
11/27/2020	55.89826	70.80882	112.1424	224.8886
11/28/2020	46.47465	61.58958	103.9126	261.4671
11/29/2020	46.24597	59.95375	96.94021	215.1672
11/30/2020	41.82604	58.29028	106.432	279.6754
12/1/2020	40.11202	56.04417	118.037	332.4057
12/2/2020	34.72854	57.66555	137.7552	409.5286
12/3/2020	50.55667	76.10042	145.6395	350.4963
12/4/2020	48.13271	76.66271	150.9124	433.4167
12/5/2020	45.40736	67.24854	135.4923	393.4387
12/6/2020	42.44465	54.28931	101.6392	282.3741
12/7/2020	50.0207	54.47712	73.46066	142.2733
12/8/2020	50.53062	51.75708	56.36715	75.98063
12/9/2020	61.55756	62.76127	65.38651	97.94642
12/10/2020	42.36479	44.18368	49.24875	61.87118
12/11/2020	57.40993	58.81187	64.14195	85.77889
12/12/2020	55.66769	57.46285	62.22437	81.73396
12/13/2020	30.97341	31.79447	35.28419	59.9425
12/14/2020	22.07396	24.89076	35.42833	88.11945
12/15/2020	16.42486	19.65674	31.11722	78.19063
12/16/2020	21.97	26.16003	43.6281	123.6697
12/17/2020	26.0925	29.42736	43.17229	109.9353
12/18/2020	23.79701	24.60285	28.49236	55.26215
12/19/2020	5.675513	6.083461	6.764487	9.196667

12/20/2020				
12/21/2020	17.78204	20.49909	27.08358	29.31936
12/22/2020	19.55112	22.77683	32.21399	34.04089
12/23/2020				
12/24/2020				
12/25/2020				
12/26/2020				
12/27/2020	8.257994	14.40596	21.54682	38.38651
12/28/2020	5.868195	9.458195	21.56639	53.87313
12/29/2020	7.646528	11.01521	17.58847	31.46993
12/30/2020	11.53088	17.07184	28.15612	54.77802
	11.50743	18.12097	28.35146	48.04181