

A stylized illustration of air pollution in Delhi. The background is a light beige color. At the top center is a large, semi-circular sun or moon with a pattern of thin, parallel lines. On the left and right sides, there are industrial buildings with tall smokestacks. The smokestacks are orange-brown, and the buildings are dark brown with white rectangular windows. Thick, dark brown smoke is rising from the smokestacks, filling the upper part of the image. The overall style is minimalist and modern.

AIR POLLUTION IN DELHI

Dipesh Malhotra

2018CSC1040

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AIR POLLUTION

| 01 |

What is air pollution?



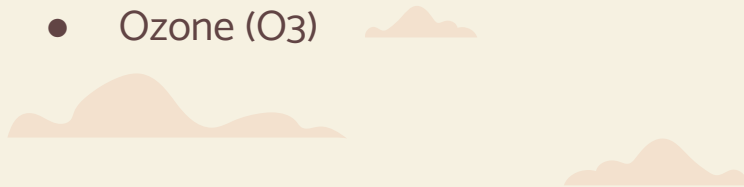
WHAT IS AIR POLLUTION?

- Pure air is a mixture of various gases such as nitrogen, oxygen, argon, carbon dioxide, and small amount of other gases in a fixed proportion. If the composition of air alters by any means; it is known as air pollution, which can lead to effects on human health, environment, and other living creatures.
- “Air pollution is the presence of any solid, liquid, or gaseous substance in the atmosphere in such concentration as may be or tend to be injurious to human beings or other living creatures or plants or property or environment”.



MAIN POLLUTANTS

- Particulate matter (PM) - PM below 10 μ m (PM10)
- PM below 2.5 μ m (PM2.5)
- Nitrogen oxides (NO_x) – nitric oxide (NO) and nitrogen dioxide (NO₂)
- Sulfur dioxide (SO₂)
- Carbon monoxide (CO)
- Ozone (O₃)





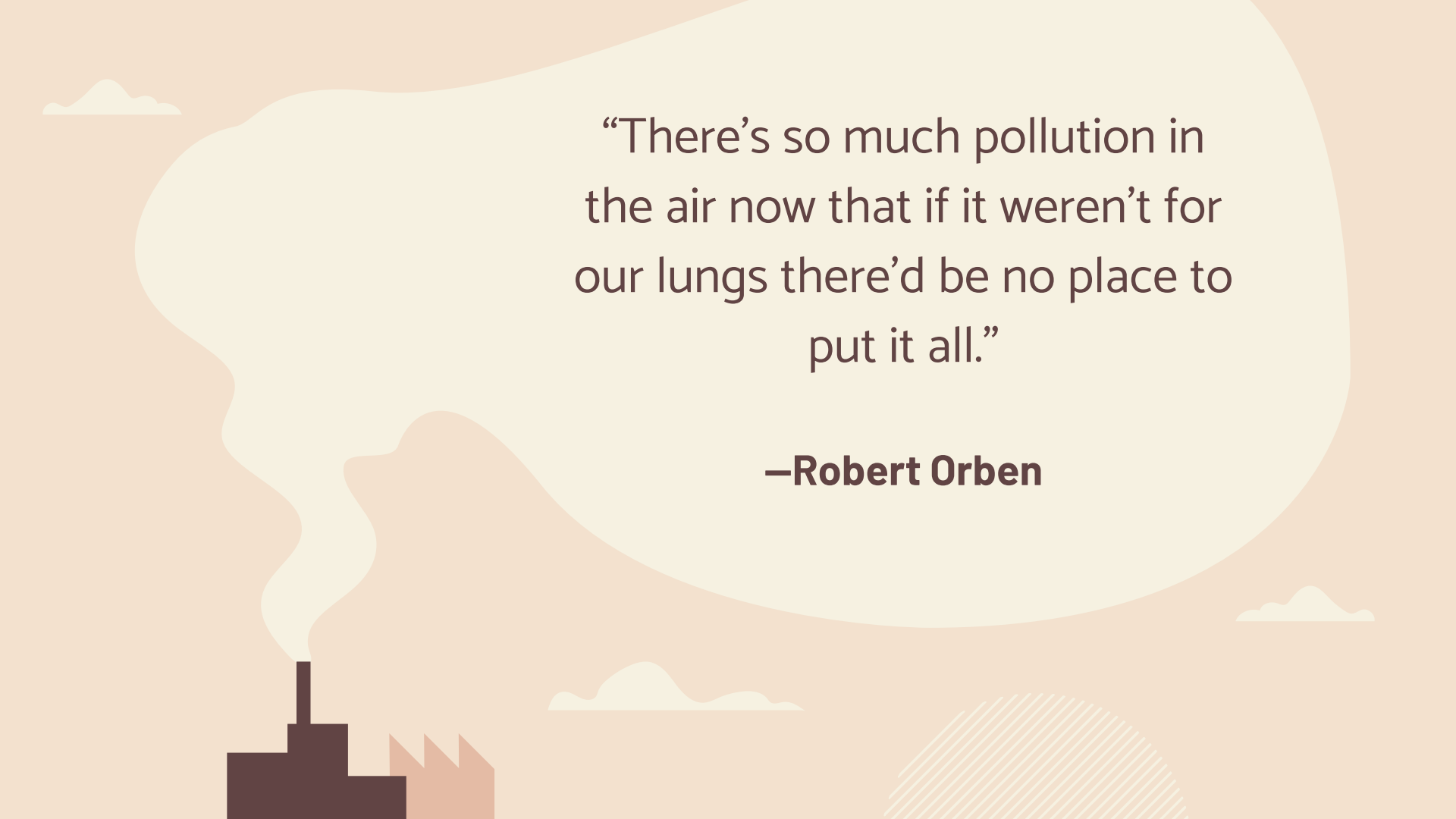
WHY IS IT A PROBLEM?

ILL EFFECTS ON HEALTH

Harsh effects on health including the increased risk of lung cancer.

PROBLEM TO MOTHER EARTH

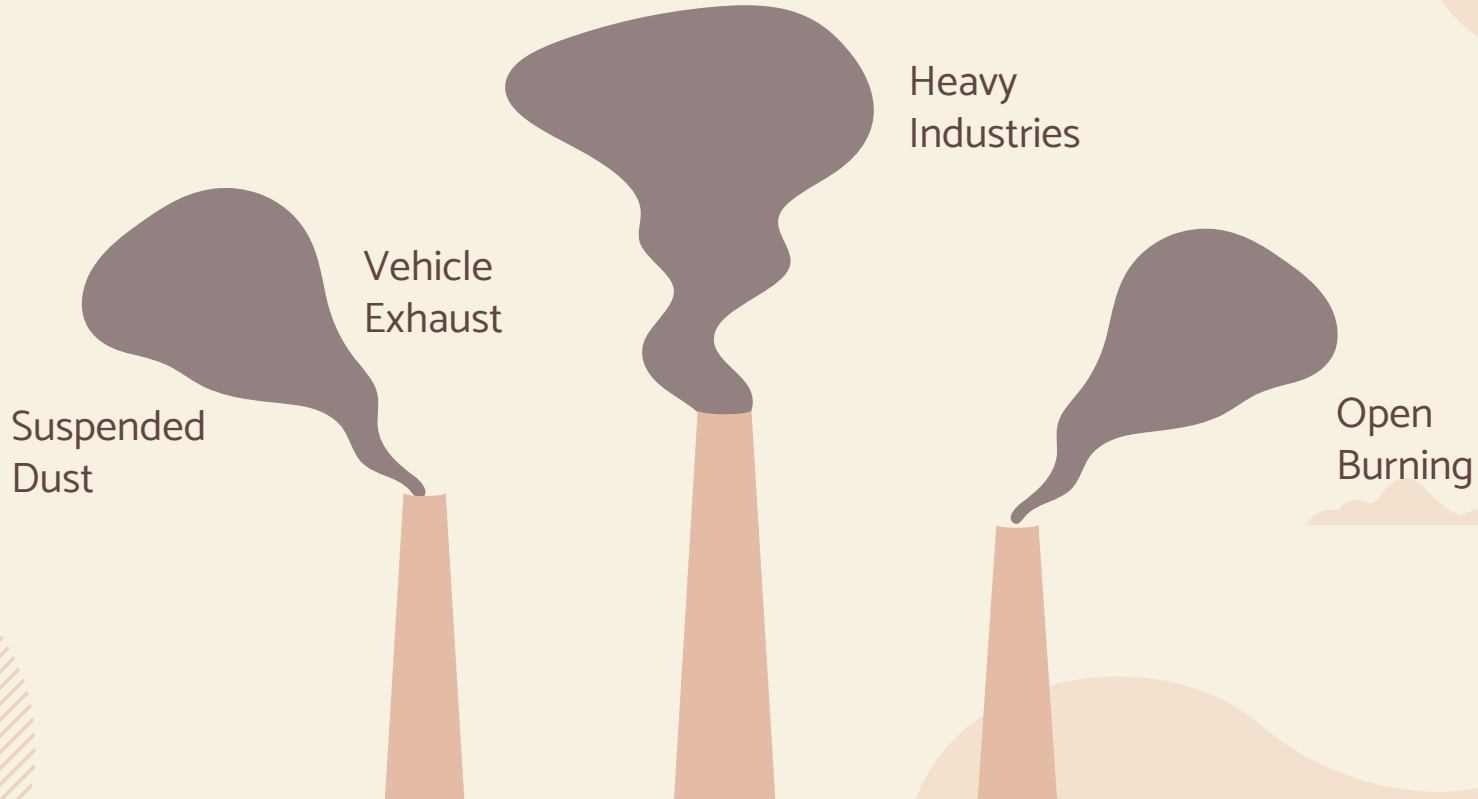
Depletion of the ozone layer, harm to plants and trees, acid rains.



“There’s so much pollution in
the air now that if it weren’t for
our lungs there’d be no place to
put it all.”

—Robert Orben

SOURCES OF POLLUTION



The main sources of air pollution in Delhi are:

- Vehicle exhaust
- Heavy industry such as power generation
- Small-scale industries like brick kilns
- Suspended dust on the roads due to vehicle movement and construction activities
- Open waste burning
- Combustion of fuels for cooking, lighting, and heating, and in-situ power generation via diesel generator sets
- Seasonal emissions from dust storms, forest fires
- Open field fires during harvest season

EFFECTS

| 02 |

Effects of air pollution on
various subjects



ON HUMANS

AGE: 20

GENDER: Male

STUDIES: Degree in Comp. Sci

LOCATION: Delhi, India

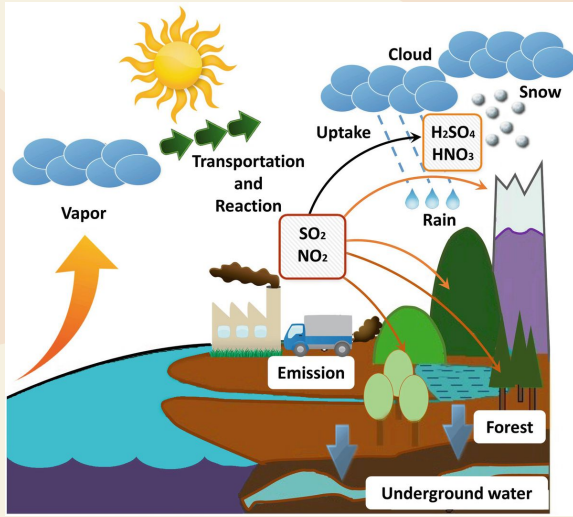


LUNGS: In bad shape

REASON: Smoking 5 cigarettes per day

SHOCKING FACT: Hasn't touched a cigarette in his life

Travel	■	■	■	■	■
Curious	■	■	■	■	■
Friendly	■	■	■	■	■
Healthy	■	■	■	■	■



ACID RAIN

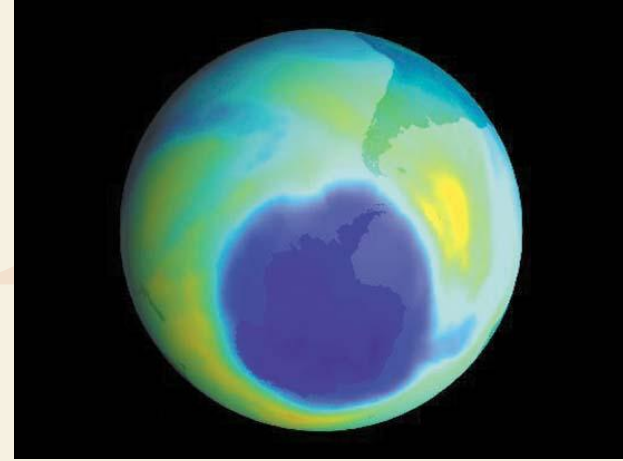
Acid rain causes harm to trees, humans and animals in the same like.

ON NATURE



CROP AND FOREST DAMAGE

Air pollution can also cause damage to crops and trees. Ground level ozone interferes with the yield.



OZONE DEPLETION

Ozone depletion causes a number of defects, ranging from increased risk of cancer to damaging of crops.

DATASET EXTRACTION

| 03 |

How did I extract the dataset
(manually)



**THANKS TO THEJESH GN
FOR THE SCRIPT**

@<https://thejeshgn.com/>

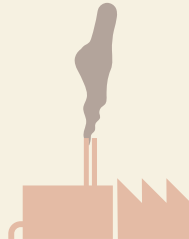
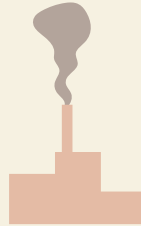
THE EXTRACTION METHOD

PREPARE SCRIPT

The original script was outdated. I had to upgrade certain code blocks to make it compatible with the current version of Python (Python 3).

CHOOSE PARAMETERS

I picked only 5 parameters namely PM 2.5, PM 10, CO, SO₂, Ozone



SETUP THE PULL

Then I ran the setting up of pull. It basically put all requests in the database in the form of queries (used SQLite)

PULL AND PARSE

The queries were then executed, the data pulled and then parsed according to the rules defined

```
42     print (fromDate)
43     print (toDate)
44
45
46     query_name = run_name + label + objFromDate.strftime("%Y%m%d")
47
48     print (query_name)
49
50     #prompt_pm25= '{"draw":1,"columns":[{"data":0,"name":"","searchable":true,"orderable":false,"search":-
{"value":"","regex":false}}],"order":[],"start":0,"length":50,"search":{"value":"","regex":false},"filtersToApply":-
{"parameter_list":[{"id":7,"itemName":"PM2.5","itemValue":"parameter_193"}],"criteria":"4
Hours","reportFormat":"Tabular","fromDate":"' + fromDate + '", "toDate":"' + toDate + '", "state":"' + state + '", "city":"' + city + '"
["parameter_193"],"parameterNames":["PM2.5"]},"pagination":1}'
51     prompt_both= '{"draw":2,"columns":[{"data":0,"name":"","searchable":true,"orderable":false,"search":-
{"value":"","regex":false}}],"order":[],"start":10,"length":10,"search":-
{"value":"","regex":false},"filtersToApply": {"parameter_list":[{"id":-
0,"itemName":"PM2.5","itemValue":"parameter_193"}, {"id":1,"itemName":"PM10","itemValue":"parameter_215"}, {"id":-
6,"itemName":"SO2","itemValue":"parameter_312"}, {"id":11,"itemName":"CO","itemValue":"parameter_203"}, {"id":-
12,"itemName":"Ozone","itemValue":"parameter_222"}],"criteria":"24
Hours","reportFormat":"Tabular","fromDate":"' + fromDate + '", "toDate":"' + toDate + '", "state":"' + state + '", "city":"' + city + '"
["parameter_193","parameter_215","parameter_312","parameter_203","parameter_222"],"parameterNames":-
["PM2.5","PM10","SO2","CO","Ozone"]},"pagination":1}'
52
53 #6: {id: "parameter_312", name: "SO2"}
54
55 #8: {id: "parameter_194", name: "NO2"}
56
57 #11: {id: "parameter_203", name: "CO"}
58 #12: {id: "parameter_222", name: "Ozone"}
```



```
31 headers['Referer'] = "https://app.cpcbccr.com/ccr/"
32 headers['Connection'] = "keep-alive"
33 headers['Host'] = "app.cpcbccr.com"
34
35 r = requests.post("https://app.cpcbccr.com/caaqms/fetch_table_data", headers=headers, data=encoded_data,
verify=False)
36 if r.status_code == 200:
37     print("Awesome response code 200")
38     json_data = json.dumps(r.json())
39
40     json_data_hash = hashlib.md5(json_data.encode())
41     row_exists['json_data'] = json_data
42     row_exists['json_data_hash'] = json_data_hash.hexdigest()
43     row_exists['status_code'] = r.status_code
44 else:
45     row_exists['json_data'] = ""
46     row_exists['status_code'] = r.status_code
47
48 print("UPDATING")
49 table.update(row_exists, ['id'])
50 db.commit()
51
52 time.sleep(2)
53 row_exists = table.find_one(status_code=status_code)
54 if row_exists:
55     pass
56 else:
57     break
58
```

```
33     insert_row = {}
34     insert_row["state"] = parse_row["state"]
35     insert_row["city"] = parse_row["city"]
36     insert_row["site"] = parse_row["site"]
37     insert_row["site_name"] = parse_row["site_name"]
38     insert_row["query_name"] = parse_row["query_name"]
39
40     #dateformat : 14-Oct-2017 - 08:00"
41     #print str(row)
42     if row.__contains__("to date"):
43         to_date = row["to date"]
44         to_date_array = to_date.split(" - ")
45         insert_row["to_date"] = to_date_array[0]
46         insert_row["to_time"] = to_date_array[1]
47
48     if row.__contains__("from date"):
49         from_date = row["from date"]
50         from_date_array = from_date.split(" - ")
51         insert_row["from_date"] = from_date_array[0]
52         insert_row["from_time"] = from_date_array[1]
53
54     if row.__contains__("PM2.5"):
55         pm25 = row["PM2.5"]
56         if pm25 and pm25 != "":
57             insert_row["pm25"] = pm25
58
59     if row.__contains__("PM10"):
60         pm10 = row["PM10"]
61         if pm10 and pm10 != "":
```

EXPLORATORY DATA ANALYSIS | 04 |

On Kaggle



Total count of entries



```
count(data)
```

A

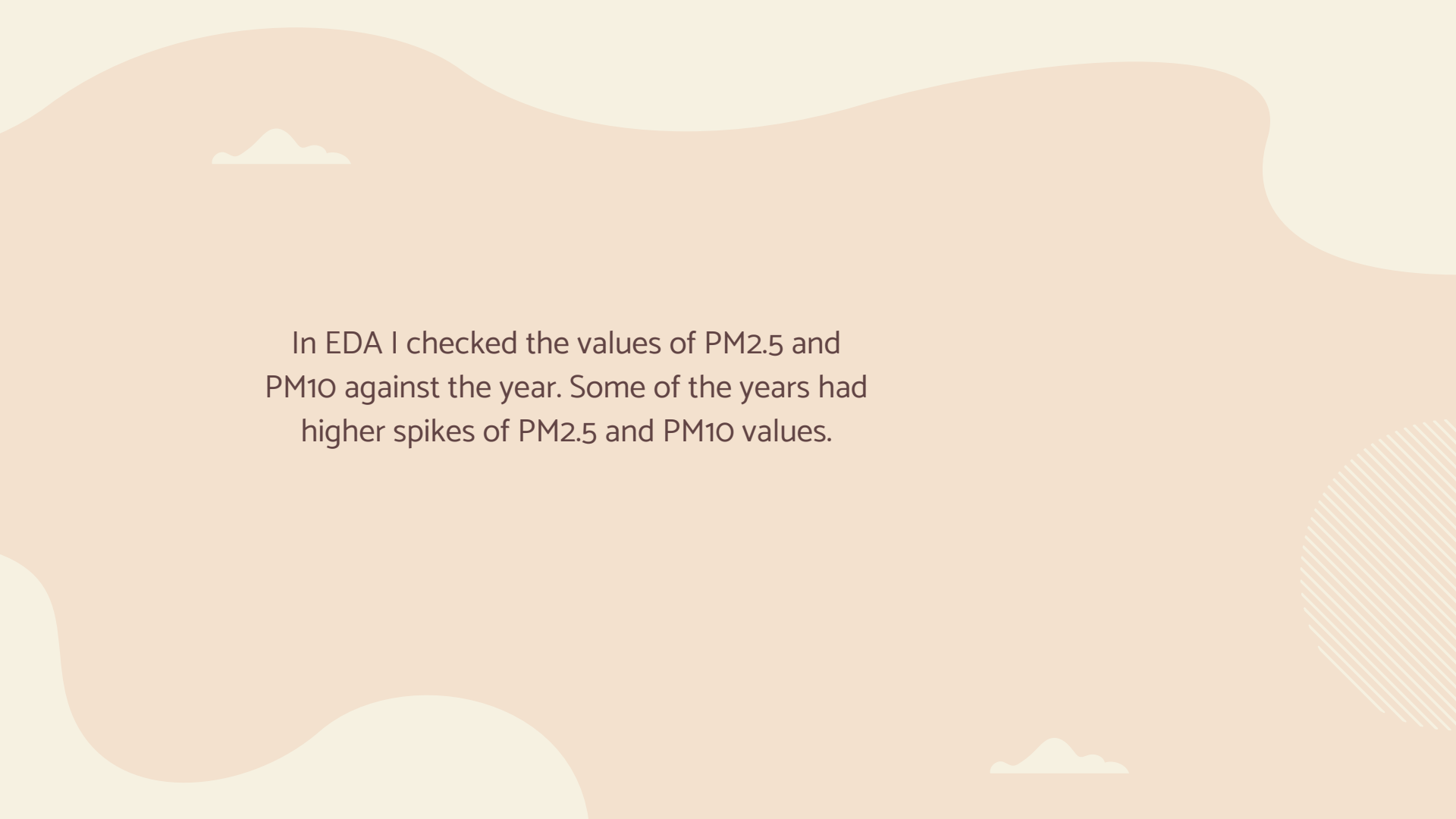
data.frame:

1 × 1

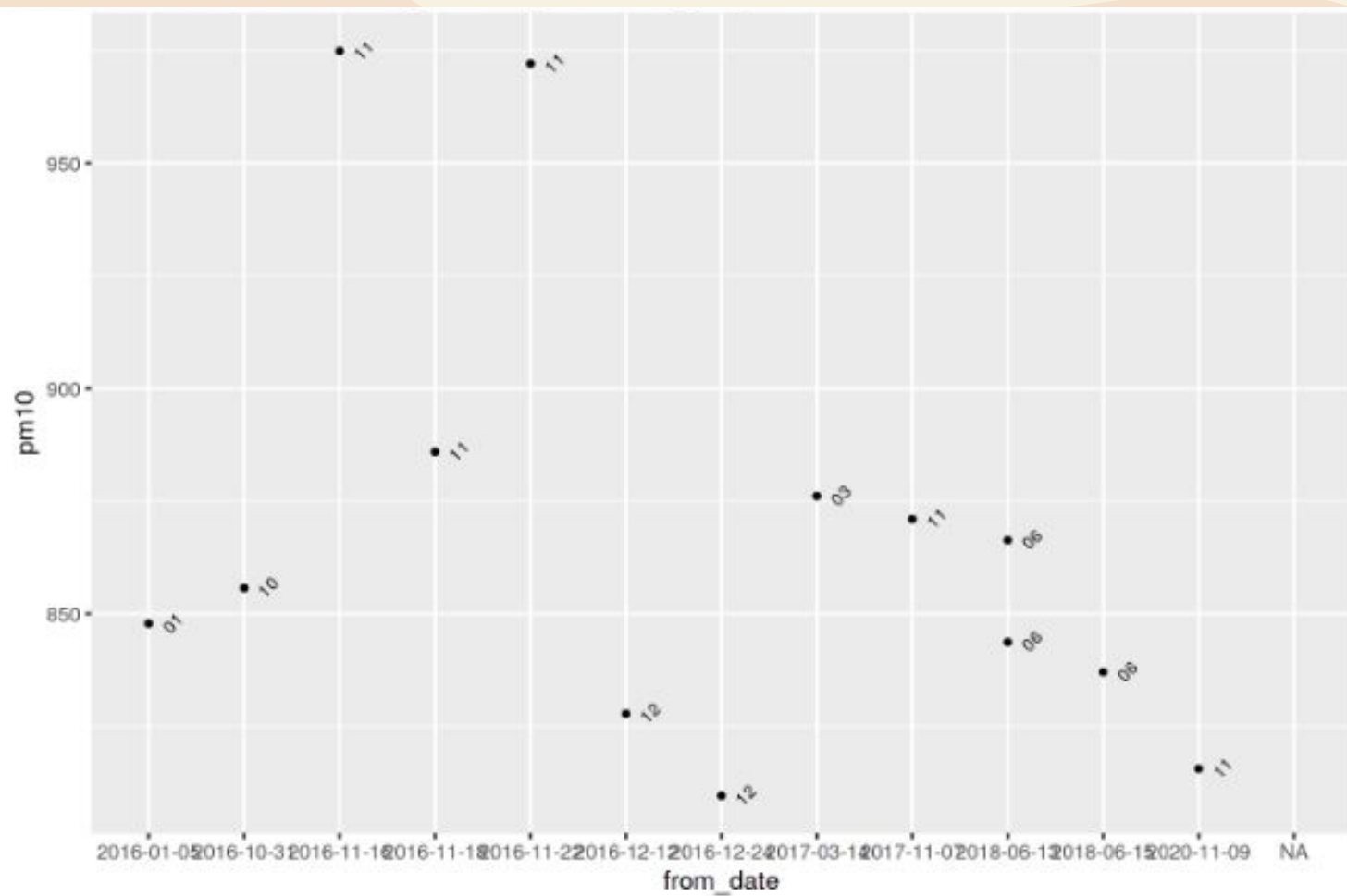
n

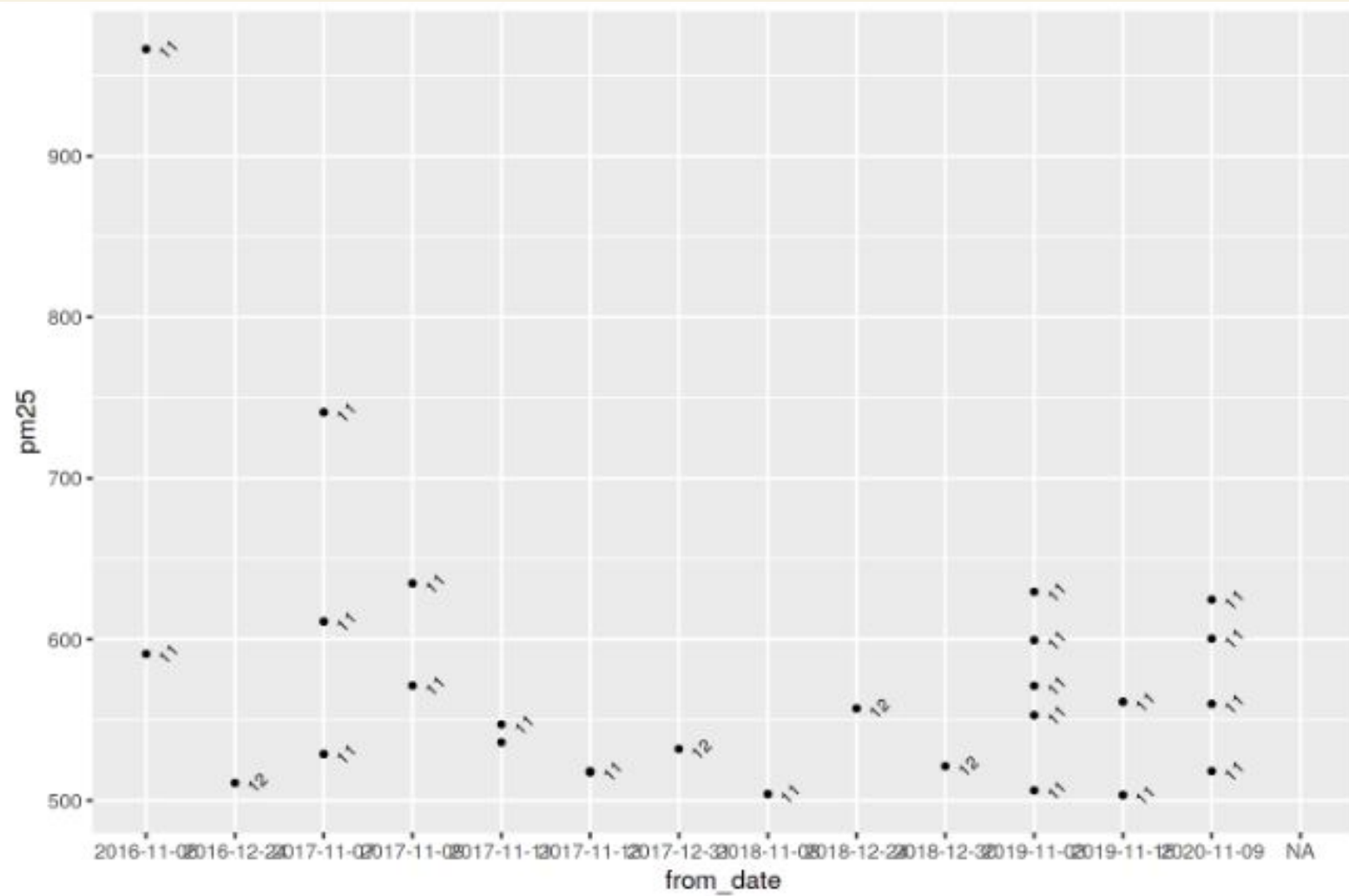
<int>

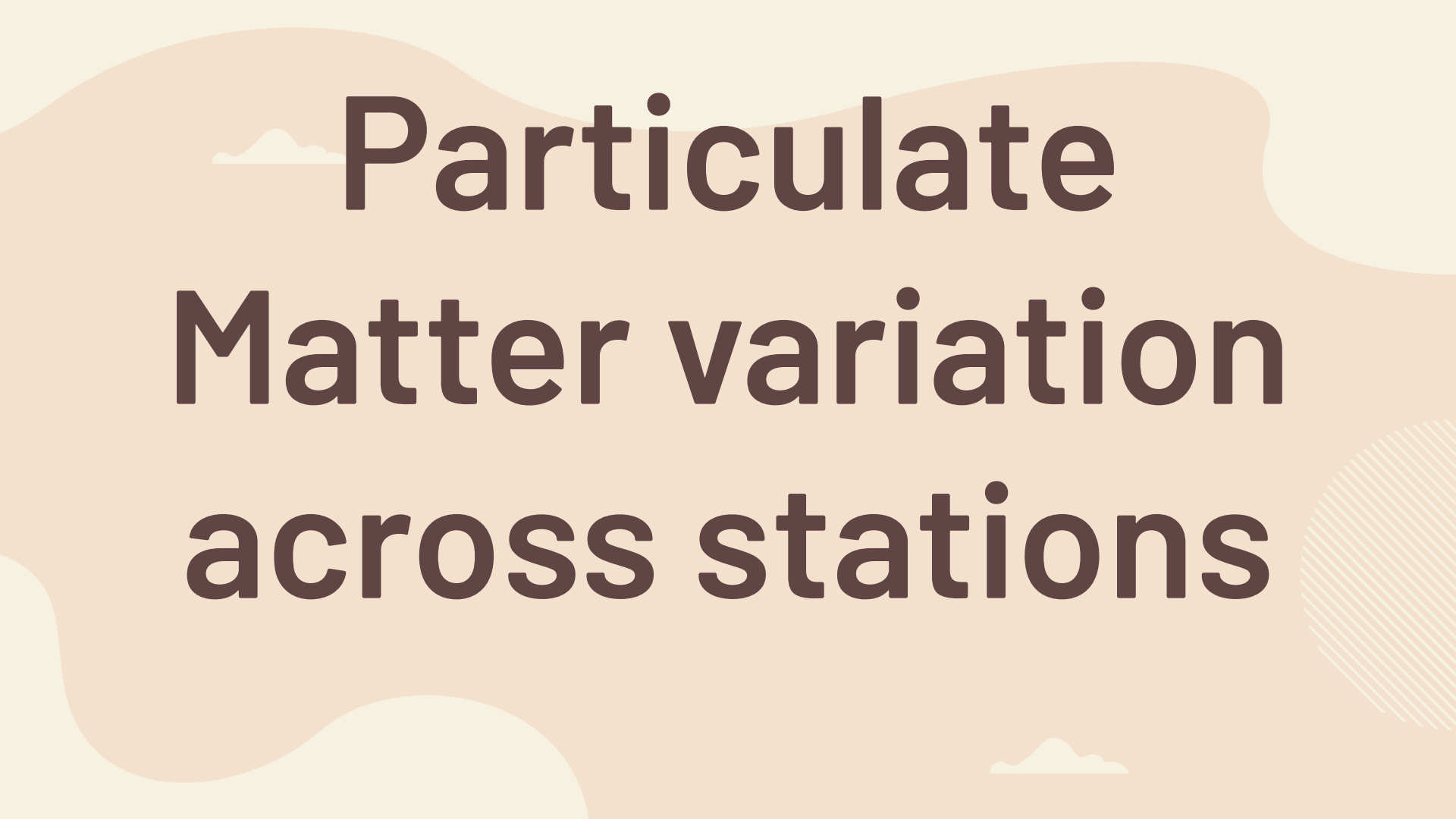
4530

The background features a light beige color with large, flowing, wavy shapes in a slightly darker shade of beige. There are two small, stylized white cloud icons, one in the upper left and one in the lower right. On the right side, there is a circular area with diagonal hatching lines.

In EDA I checked the values of PM2.5 and PM10 against the year. Some of the years had higher spikes of PM2.5 and PM10 values.

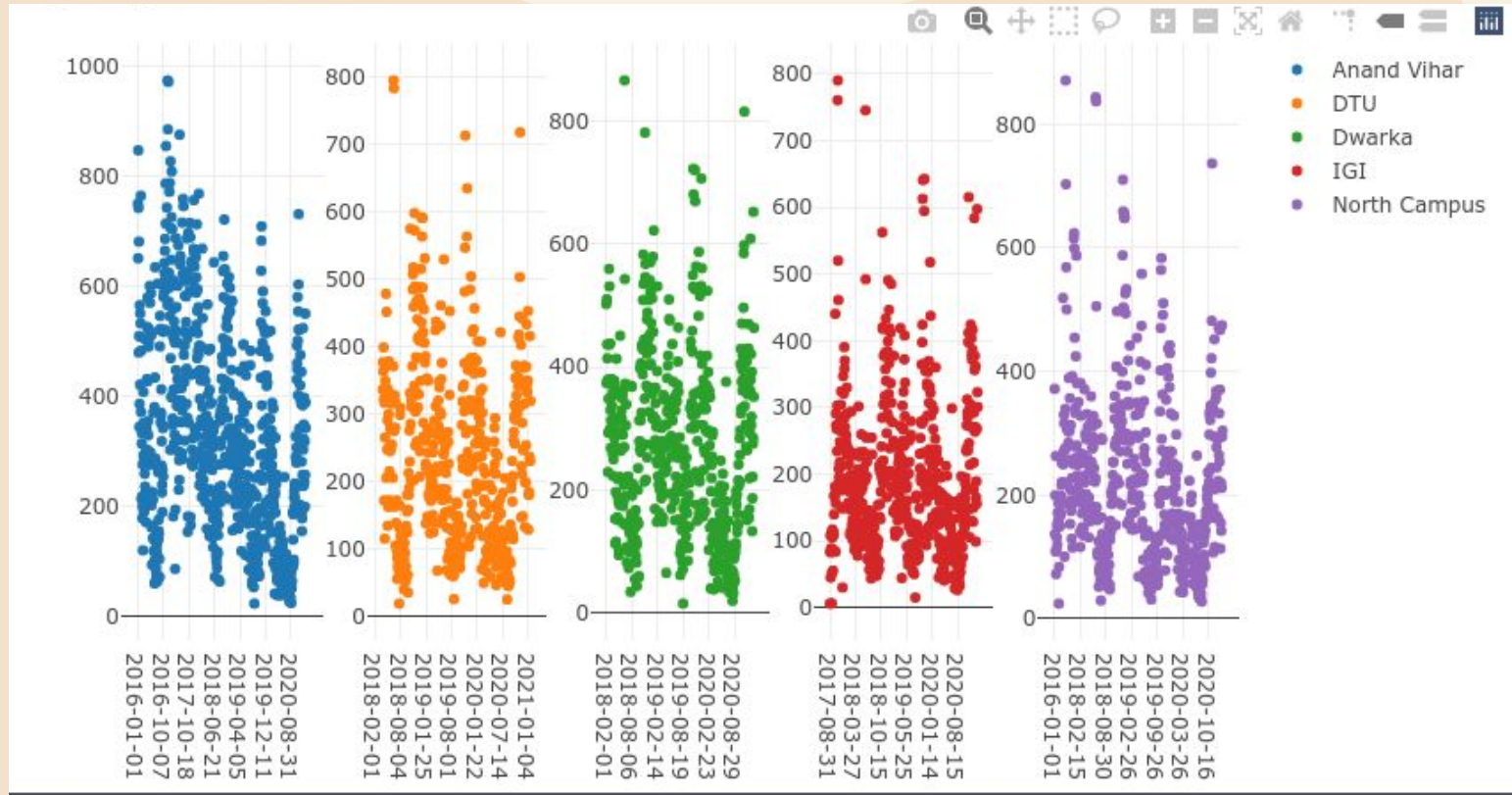




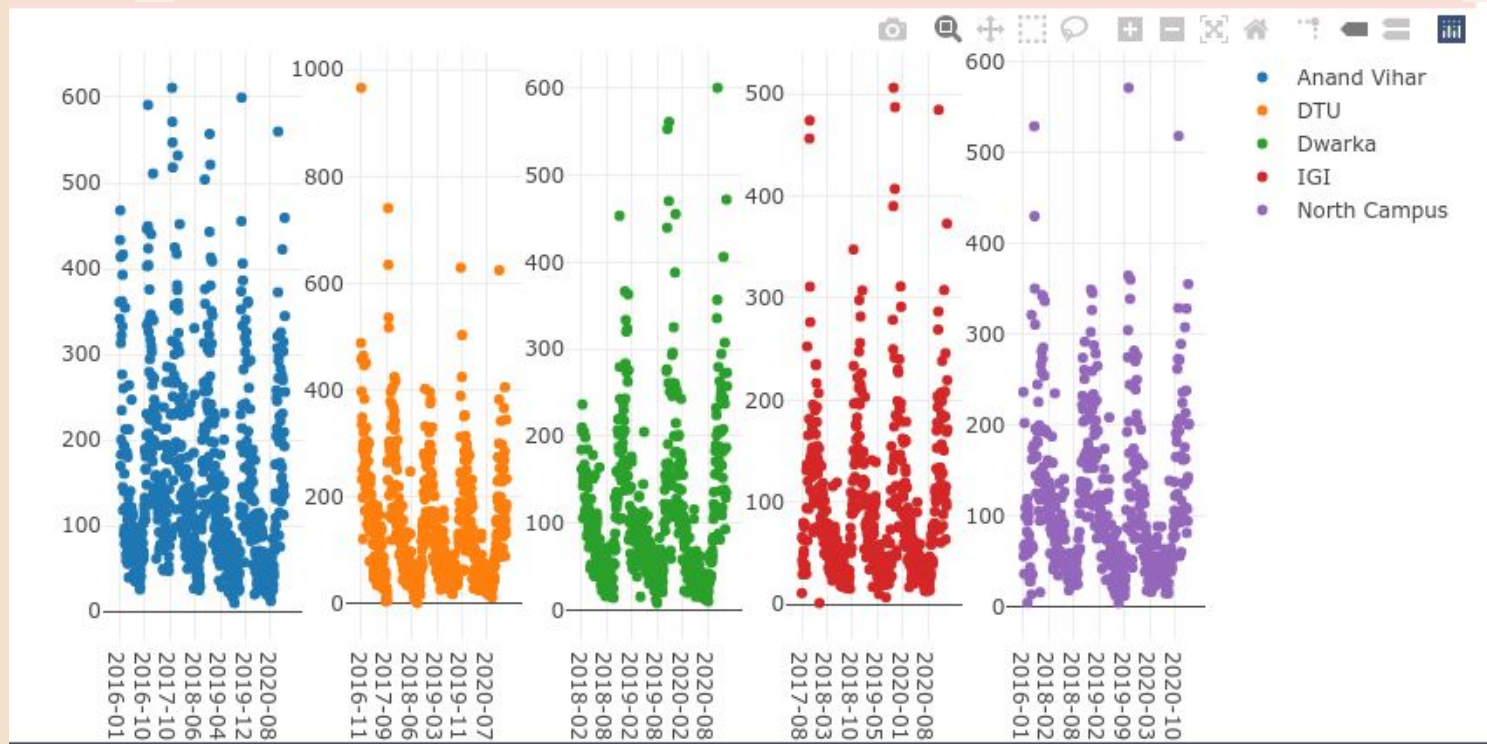
The background features a light beige color with large, soft-edged, wavy shapes in a slightly darker shade of beige. Small, stylized white clouds are scattered across the background, including one near the top left and another near the bottom right. On the right side, there is a circular area with a fine, diagonal hatched pattern.

Particulate Matter variation across stations

Particulate Matter 10 across stations



Particulate Matter 2.5 across stations



The number of viable sensor entries after removing all NA values came out to this.

	site_name	n
	<fct>	<int>
	Anand Vihar, Delhi - DPCC	789
	DTU, New Delhi - CPCB	704
	IGI Airport (T3), New Delhi - IMD	579
	North Campus, DU, New Delhi - IMD	564
	Dwarka-Sector 8, Delhi - DPCC	536

Count of values after removing NA values

```
count(da)
```

A

data.frame:

1 × 1

n

<int>

3172

AQI ACCORDING TO DIFFERENT PARAMETERS | 05 |

The number of bad days
according to a particular
parameter



AQI Category, Pollutants and Health Breakpoints

AQI Category (Range)	PM ₁₀ (24hr)	PM _{2.5} (24hr)	NO ₂ (24hr)	O ₃ (8hr)	CO (8hr)	SO ₂ (24hr)	NH ₃ (24hr)	Pb (24hr)
Good (0–50)	0–50	0–30	0–40	0–50	0–1.0	0–40	0–200	0–0.5
Satisfactory (51–100)	51–100	31–60	41–80	51–100	1.1–2.0	41–80	201–400	0.5–1.0
Moderately polluted (101–200)	101–250	61–90	81–180	101–168	2.1–10	81–380	401–800	1.1–2.0
Poor (201–300)	251–350	91–120	181–280	169–208	10–17	381–800	801–1200	2.1–3.0
Very poor (301–400)	351–430	121–250	281–400	209–748	17–34	801–1600	1200–1800	3.1–3.5
Severe (401–500)	430+	250+	400+	748+	34+	1600+	1800+	3.5+

Particulate Matter 2.5

```
bd=0
gd=0
for (x in da[!is.na(da$pm25),4]){

  if(x<=60){
    gd=gd+1;
  } else if (x>60){
    bd=bd+1;
  }
}
sprintf("Bad AQI number of days- %i",bd)
sprintf("Good AQI number of days- %i",gd)
```

'Bad AQI number of days- 2119'

'Good AQI number of days- 1040'

Particulate Matter 10

```
bd=0
gd=0
for (x in da[!is.na(da$pm10),5]){

  if(x<=100){
    gd=gd+1;
  } else if (x>100){
    bd=bd+1;
  }
}
sprintf("Bad AQI number of days- %i",bd)
sprintf("Good AQI number of days- %i",gd)
```

'Bad AQI number of days- 2445'

'Good AQI number of days- 483'

Ozone

```
bd=0
gd=0
for (x in da[!is.na(da$Ozone),8]){

  if(x<=100){
    gd=gd+1;
  } else if (x>100){
    bd=bd+1;
  }
}
sprintf("Bad AQI number of days- %i",bd)
sprintf("Good AQI number of days- %i",gd)
```

'Bad AQI number of days- 31'

'Good AQI number of days- 2920'

SO2

```
bd=0
gd=0
for (x in da[!is.na(da$SO2),6]){

  if(x<=80){
    gd=gd+1;
  } else if (x>80){
    bd=bd+1;
  }
}
sprintf("Bad AQI number of days- %i",bd)
sprintf("Good AQI number of days- %i",gd)
```

'Bad AQI number of days- 4'

'Good AQI number of days- 1803'

CO

```
bd=0
gd=0
for (x in da[!is.na(da$CO),7]){

  if(x<=2.0){
    gd=gd+1;
  } else if (x>2.0){
    bd=bd+1;
  }
}
sprintf("Bad AQI number of days- %i",bd)
sprintf("Good AQI number of days- %i",gd)
```

'Bad AQI number of days- 877'

'Good AQI number of days- 2076'

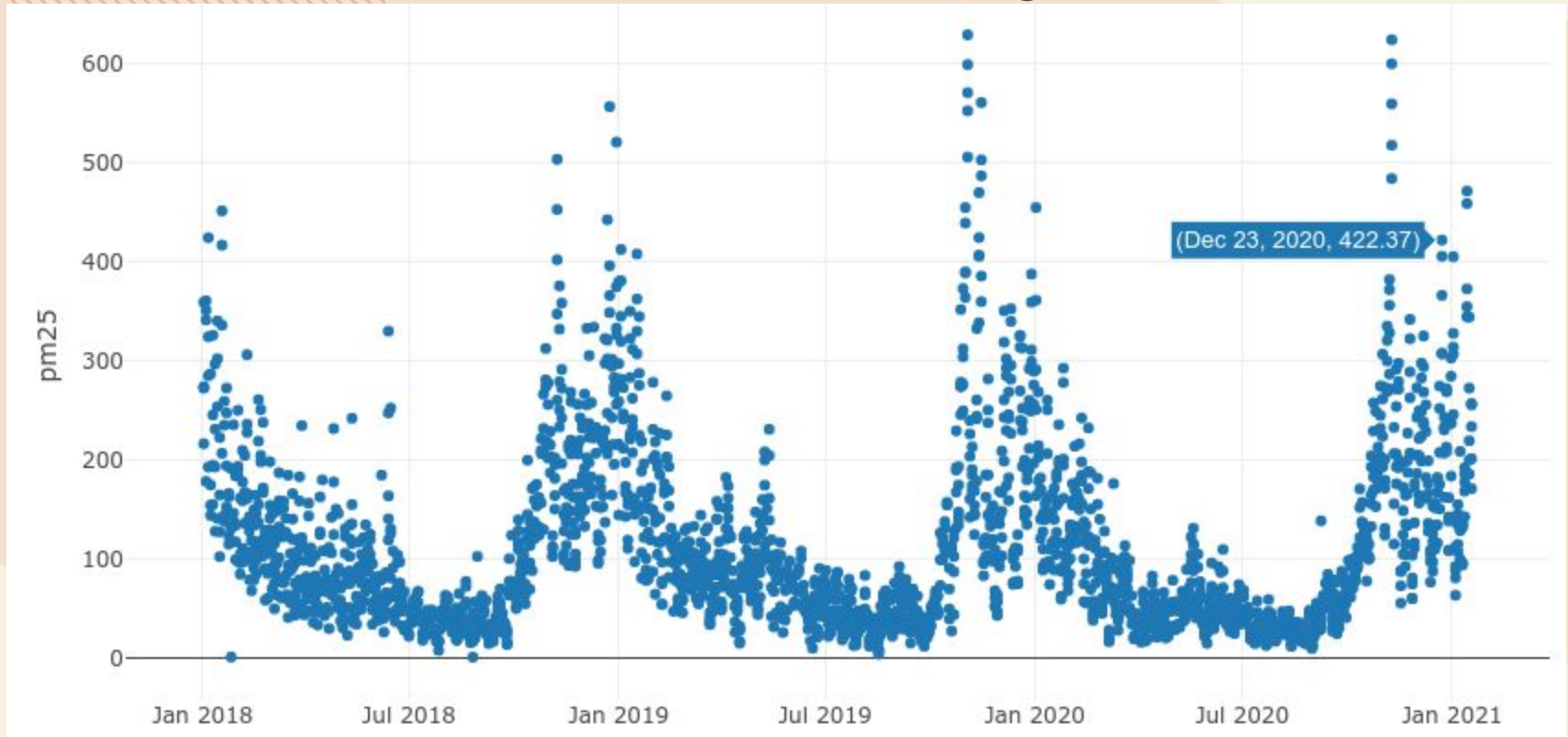
LOCKDOWN AND AIR POLLUTION

| 06 |

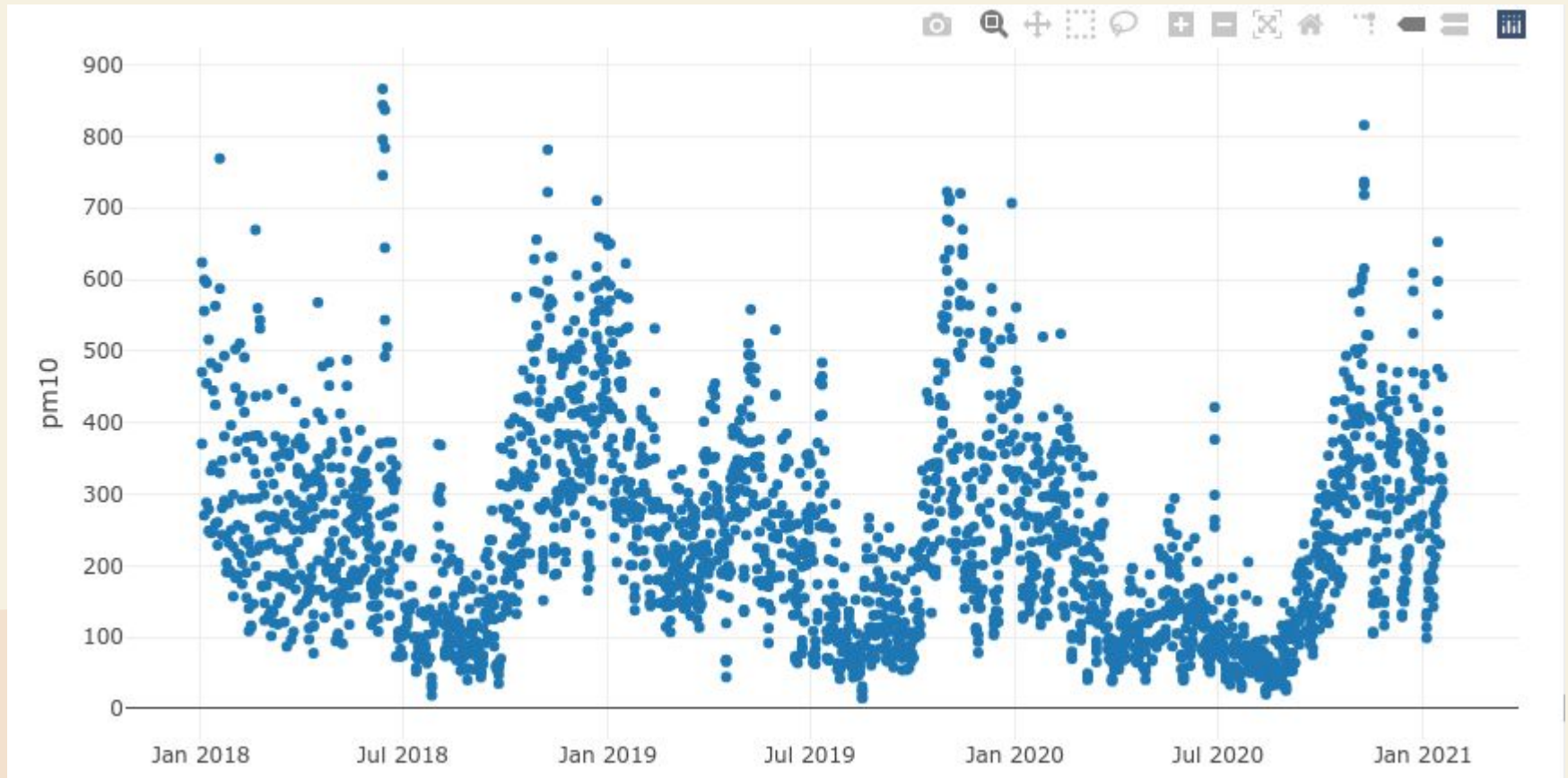
Did lockdown have
detrimental effects on air
pollution levels?



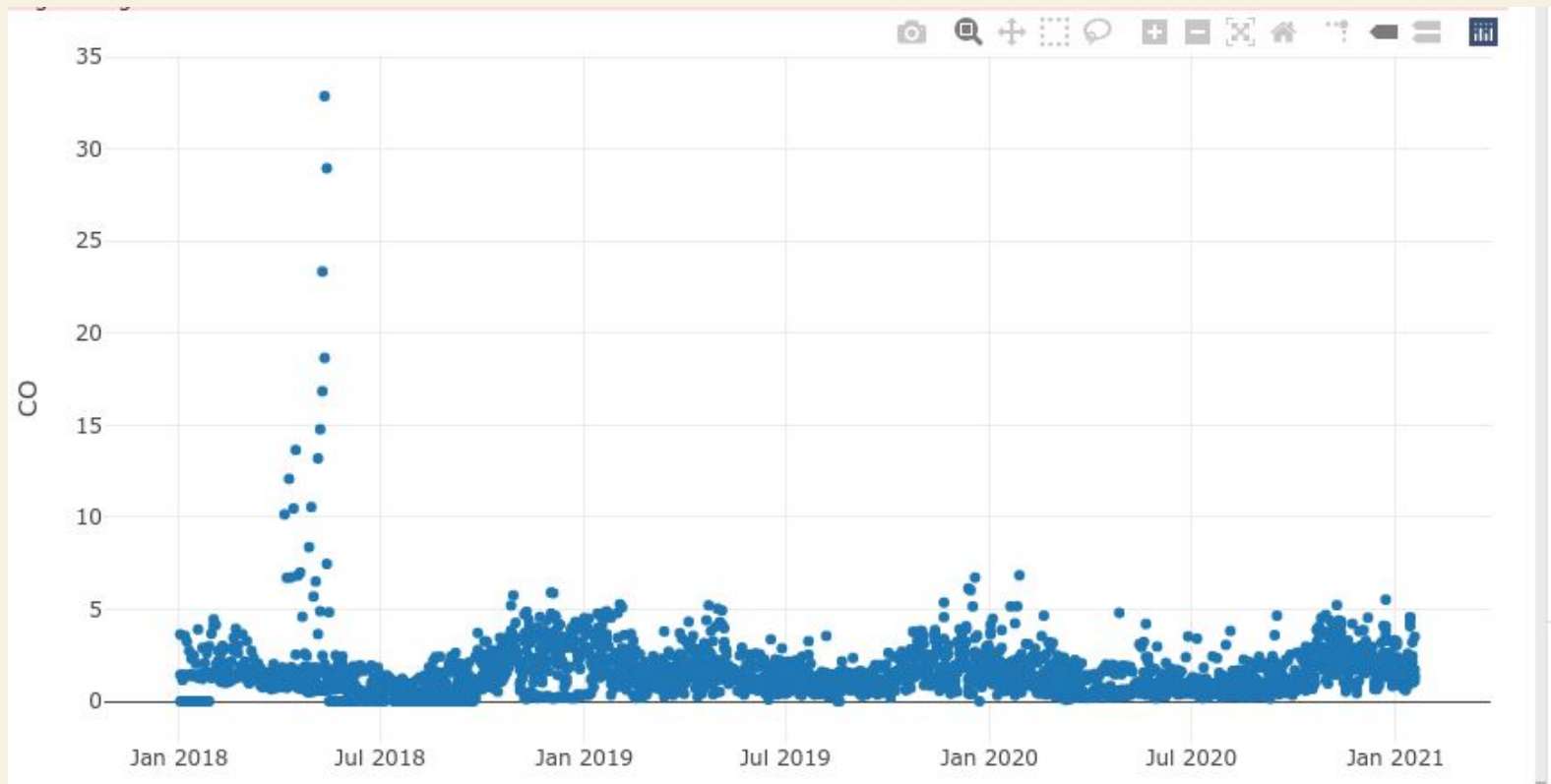
Particulate Matter 2.5

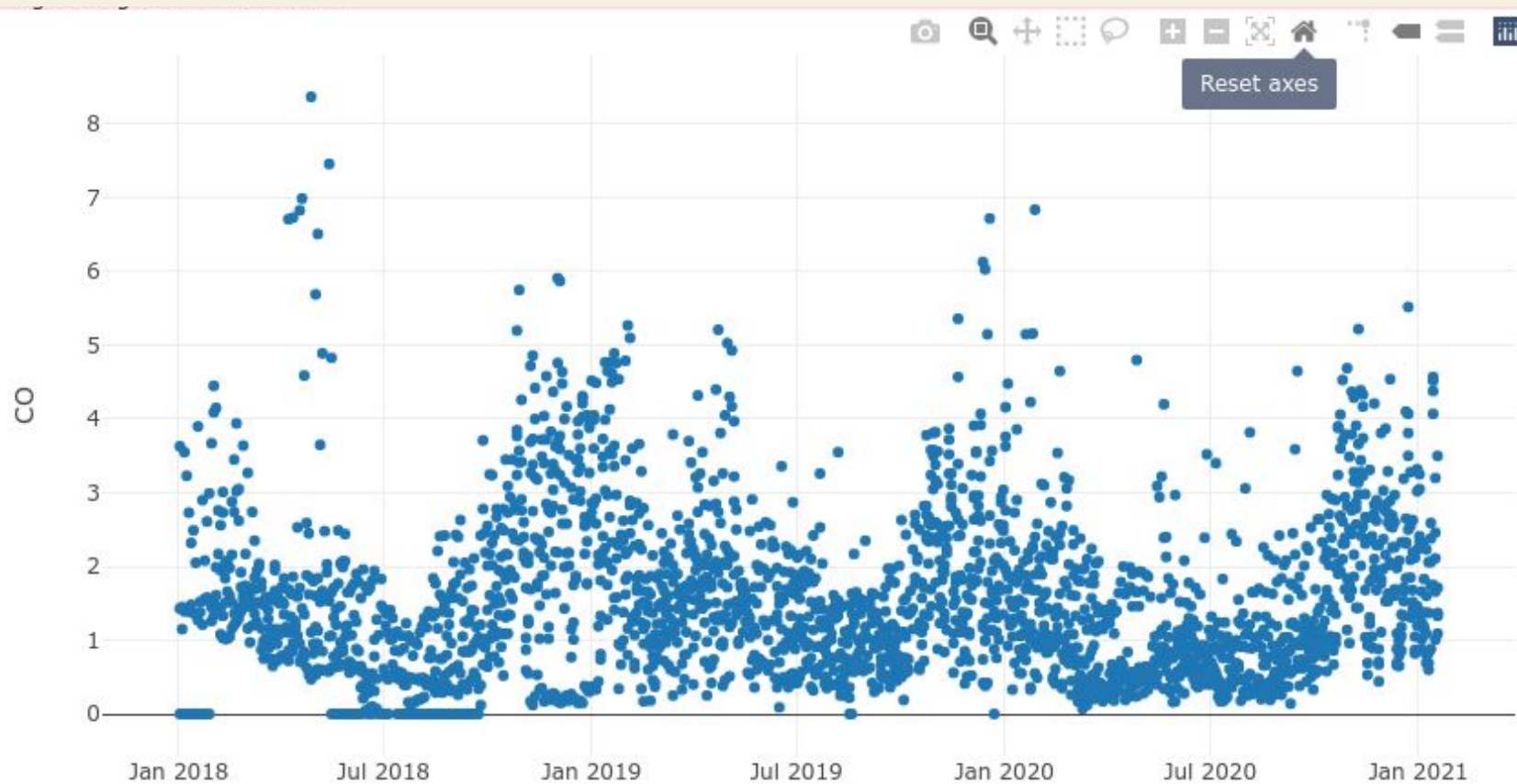


Particulate Matter 10

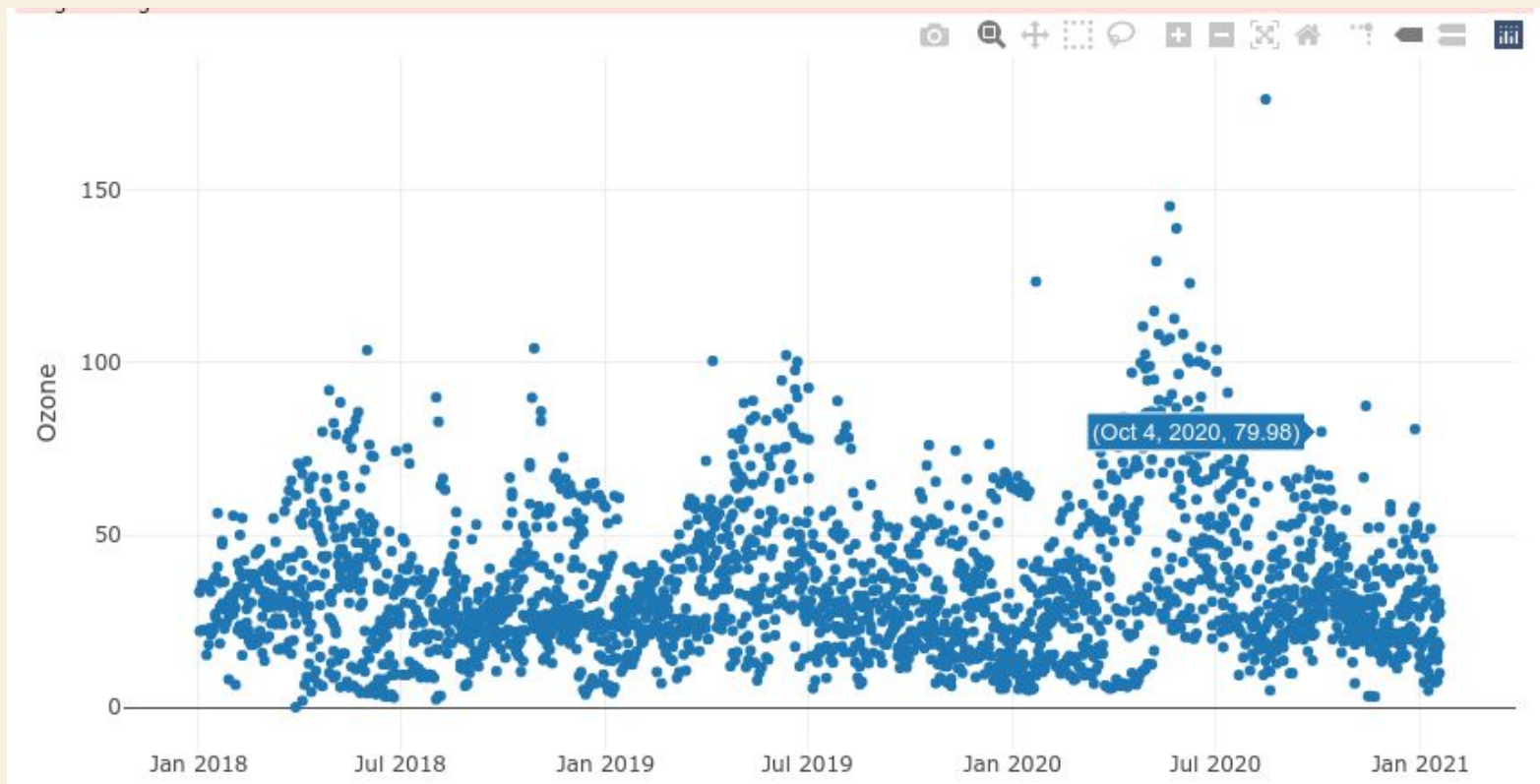


CO

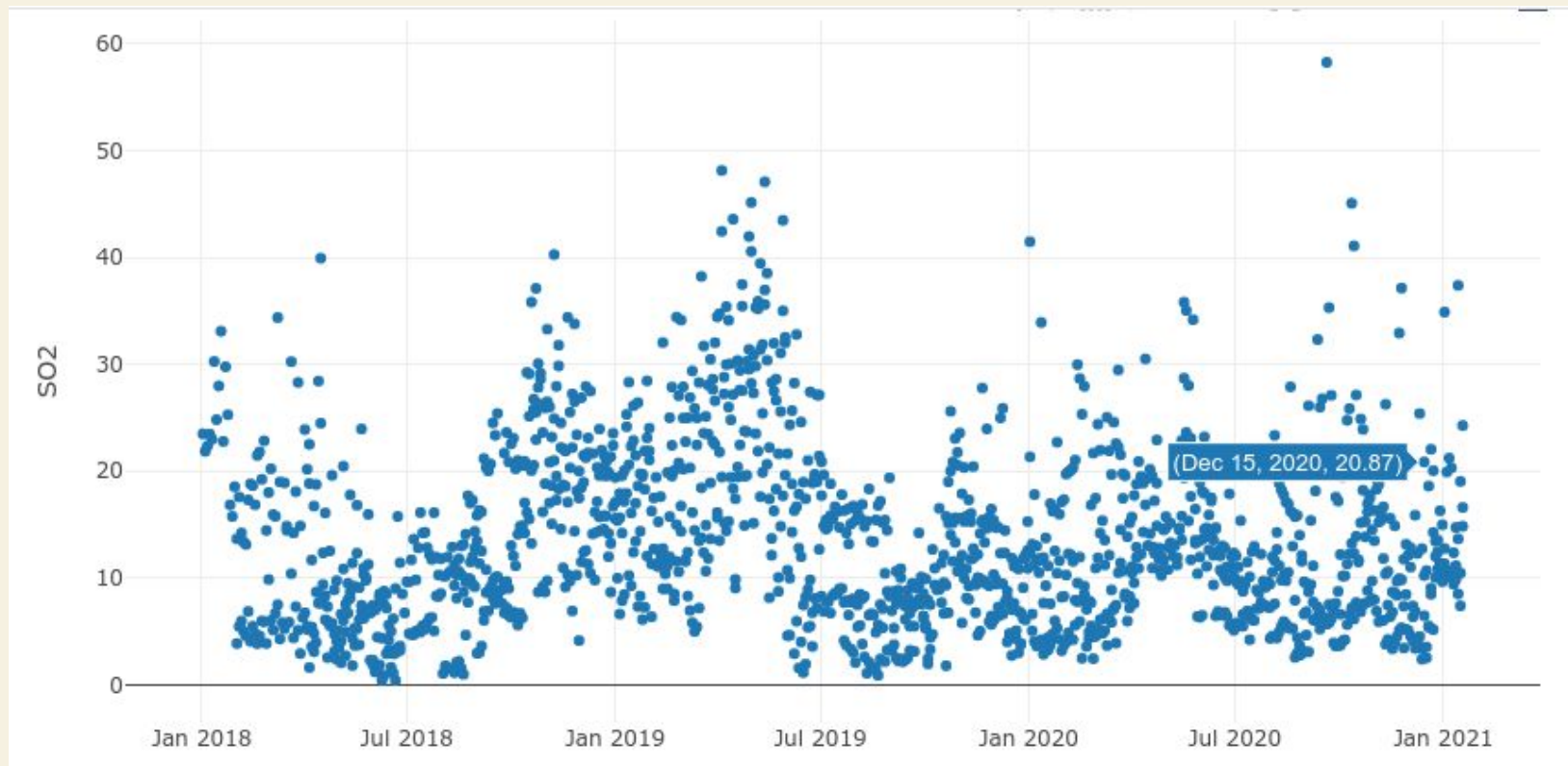




Ozone



SO₂






Phase of Lockdown	PM10 levels and AQI
First Three Phases (March-May 2020)	<p>The first three phases of the national lockdown, which started on March 25, led to large declines in air pollution in Delhi. In April 2020, the concentration of PM 10 fell to 71.7 $\mu\text{g}/\text{m}^3$, less than half the concentration observed during the same month over the previous three years.</p>
Fourth Phase (May-October 2020)	<p>The concentration of PM 10 rose to 96.4 $\mu\text{g}/\text{m}^3$ during the fourth phase of the lockdown, which expanded exemptions and permitted interstate movement starting May 18 But, shortly after lockdown restrictions were eased after May 18, a spike was recorded, and records indicated that Delhi's pollution patterns started climbing again. Delhi's air pollution levels increased by 43 percent in comparison to its best levels of air quality during the lockdown.</p>

Post-Lockdown (October 2020 onwards)	To make matters worse, air quality in the Indian capital plummeted to an eight-month low on October 17, 2020. The air quality index (AQI) crossed 350 at various places, hovering between “very poor” and “severe” since then.
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FURTHER SCOPE FOR THIS PROJECT



1. Calculate AQI from the given values.
 2. Try to predict future values (although this would require the inclusion of other factors such as season, temperature, rainfall, wind speed, humidity etc)
 3. Extract more data for turning this into a big data project.
- 
- 
- 

EVERYBODY SUFFERS; So IT IS EVERYBODY'S RESPONSIBILITY





THANKS!

Do you have any questions?

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