paper01_eda

October 12, 2021

1 Exploratory Data Analysis.

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1.1 Reading Files

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/patsy/constraint.py:13: DeprecationWarning: Using or importing the ABCs
from 'collections' instead of from 'collections.abc' is deprecated since Python
3.3,and in 3.9 it will stop working
  from collections import Mapping
/home/jaa6766/.conda/envs/cuda/lib/python3.7/importlib/_bootstrap.py:219:
RuntimeWarning: numpy.ufunc size changed, may indicate binary incompatibility.
Expected 192 from C header, got 216 from PyObject
/home/jaa6766/.conda/envs/cuda/lib/python3.7/importlib/_bootstrap.py:219:
RuntimeWarning: numpy.ufunc size changed, may indicate binary incompatibility.
Expected 192 from C header, got 216 from PyObject
/home/jaa6766/.conda/envs/cuda/lib/python3.7/importlib/_bootstrap.py:219:
RuntimeWarning: numpy.ufunc size changed, may indicate binary incompatibility.
Expected 192 from C header, got 216 from PyObject
/home/jaa6766/.conda/envs/cuda/lib/python3.7/importlib/_bootstrap.py:219:
RuntimeWarning: numpy.ufunc size changed, may indicate binary incompatibility.
Expected 192 from C header, got 216 from PyObject
```

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```

Listing data files from: /home/jaa6766/Documents/jorge3a/itam/deeplearning/dlfinal/data/airdata

- Loading air-20210212-060408.json.gz
- Loading air-20210212-060529.json.gz
- Loading air-20210212-060534.json.gz
- Loading air-20210212-060545.json.gz
- Loading air-20210212-153737.json.gz
- Loading air-20210212-153808.json.gz
- Loading air-20210212-153921.json.gz
- Loading air-20210218-233000.json.gz
- Loading air-20210308-213952.json.gz
- Loading air-20210308-214511.json.gz
- Loading air-20210326-110304.json.gz
- Loading air-20210520-235254.json.gz
- Loading air-20210617-141714.json.gz

- Loading air-20210415-234052.json.gz
- Loading air-20210627-224727.json.gz
- Loading air-20210723-084450.json.gz
- Loading air-20210812-211858.json.gz
- Loading air-20210822-191723.json.gz
- Loading air-20210827-131714.json.gz
- Loading air-20210828-132805.json.gz
- Loading air-20210830-121252.json.gz

Done!

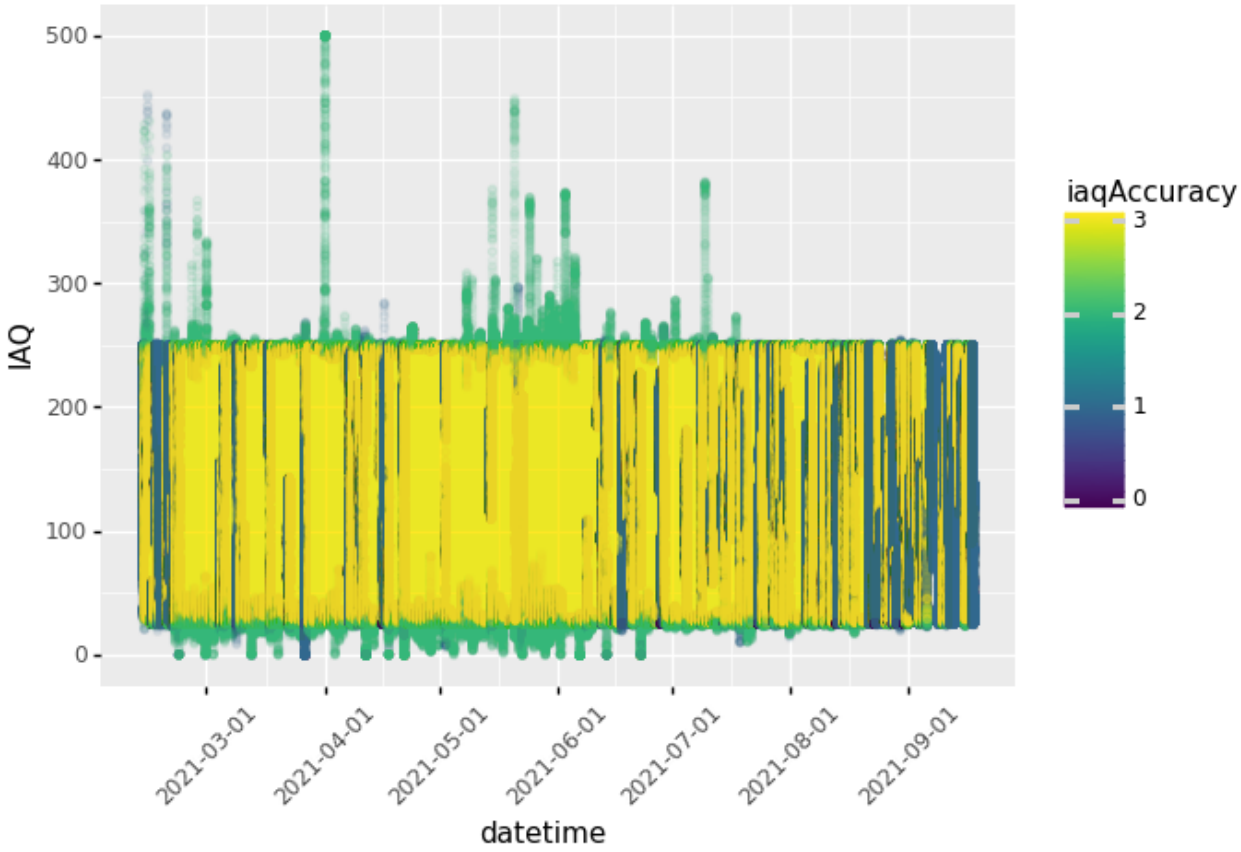
```
CPU times: user 2min 57s, sys: 4.93 s, total: 3min 2s
Wall time: 3min 2s
```

	temperature	pressure	humidity	gasResistance	IAQ	iaqAccuracy	\
0	21.54	777.41	43.93	151328	37.5	1	
1	21.56	777.41	43.89	152702	35.6	1	
2	21.53	777.41	43.97	151328	37.5	1	
3	21.51	777.41	44.03	151464	38.5	1	
4	21.51	777.41	44.05	152425	36.9	1	

	datetime	year	month	day	hour	minute
0	2021-02-12 06:04:09.089621067	2021	2	12	6	4
1	2021-02-12 06:04:12.087778807	2021	2	12	6	4
2	2021-02-12 06:04:15.072475433	2021	2	12	6	4
3	2021-02-12 06:04:18.070170164	2021	2	12	6	4
4	2021-02-12 06:04:21.061994791	2021	2	12	6	4

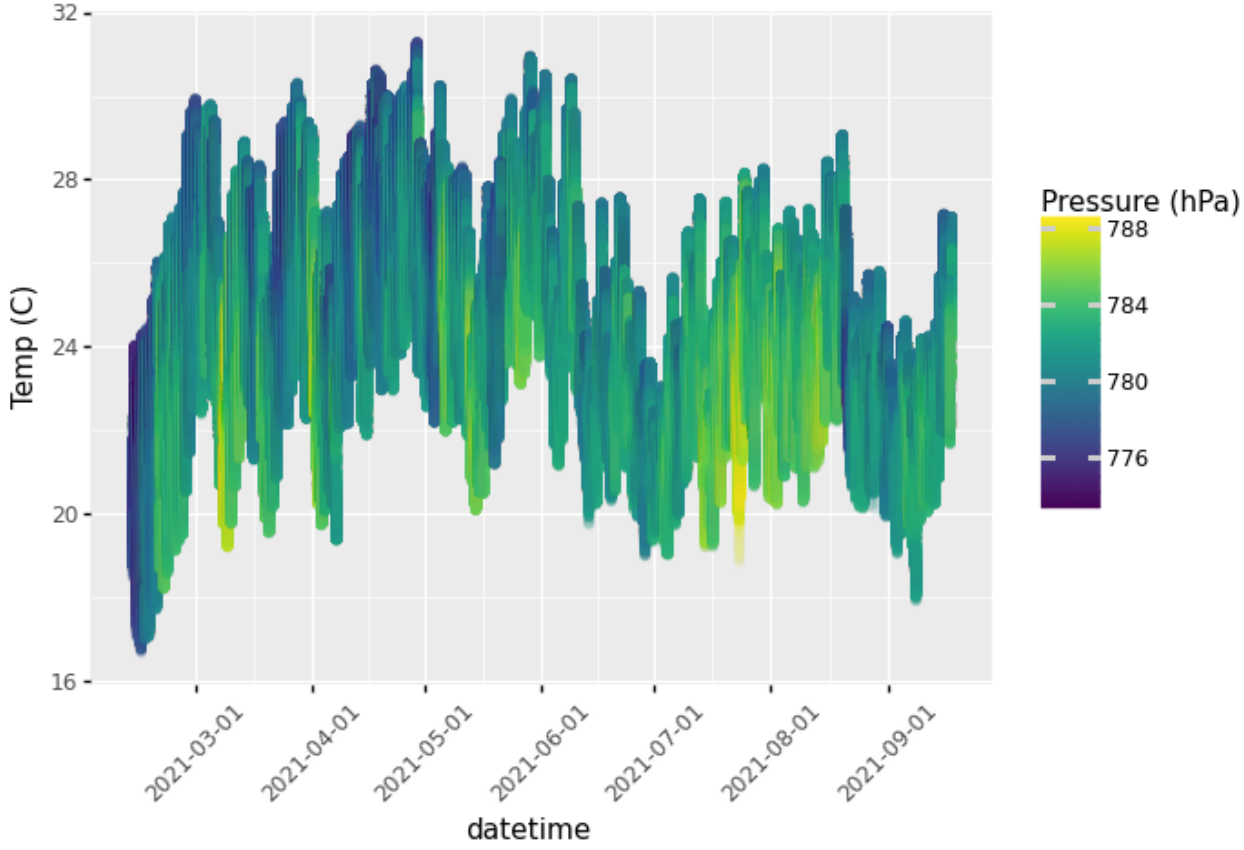
```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```

```
(6285103, 12)
```




```
<ggplot: (8757982147873)>
```

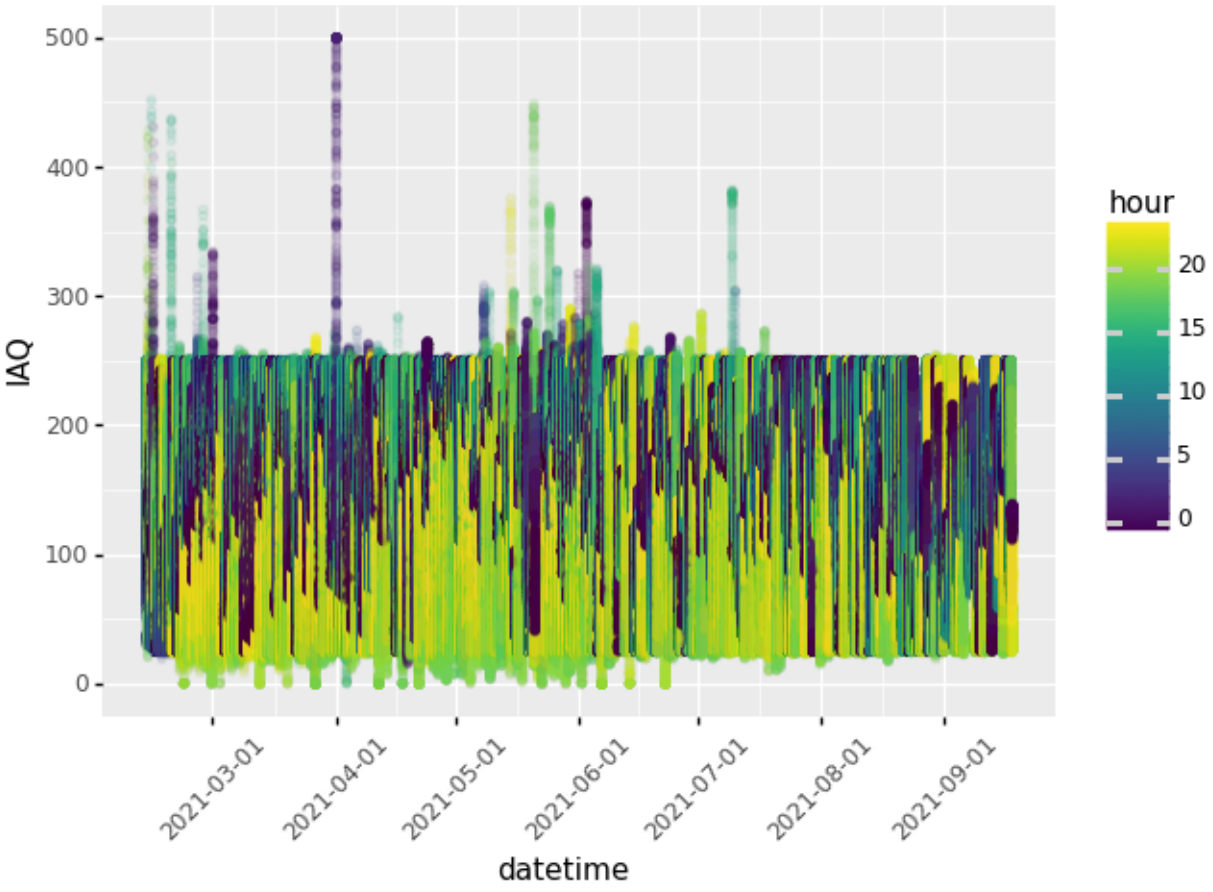
```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```




```
<ggplot: (8757872894413)>
```

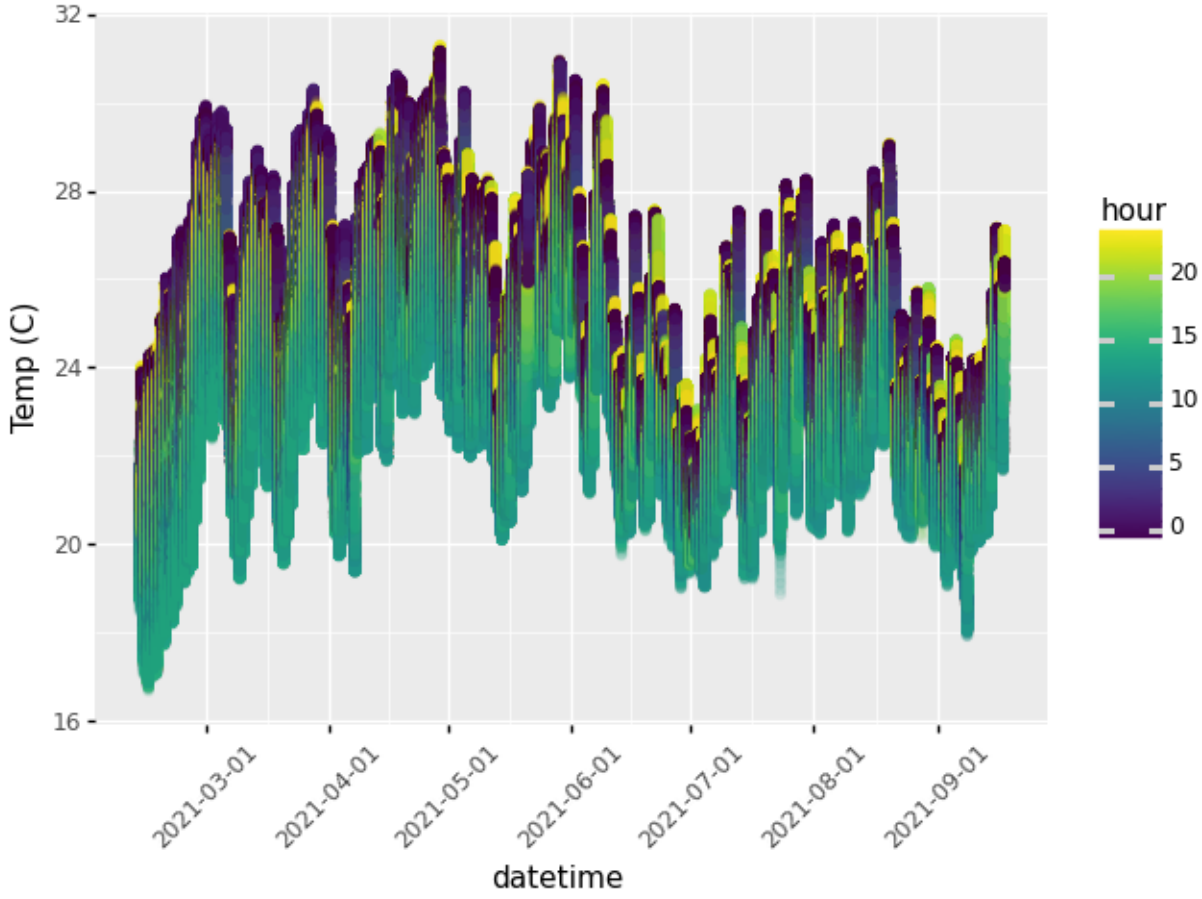
1.2 Hourly Plots

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```



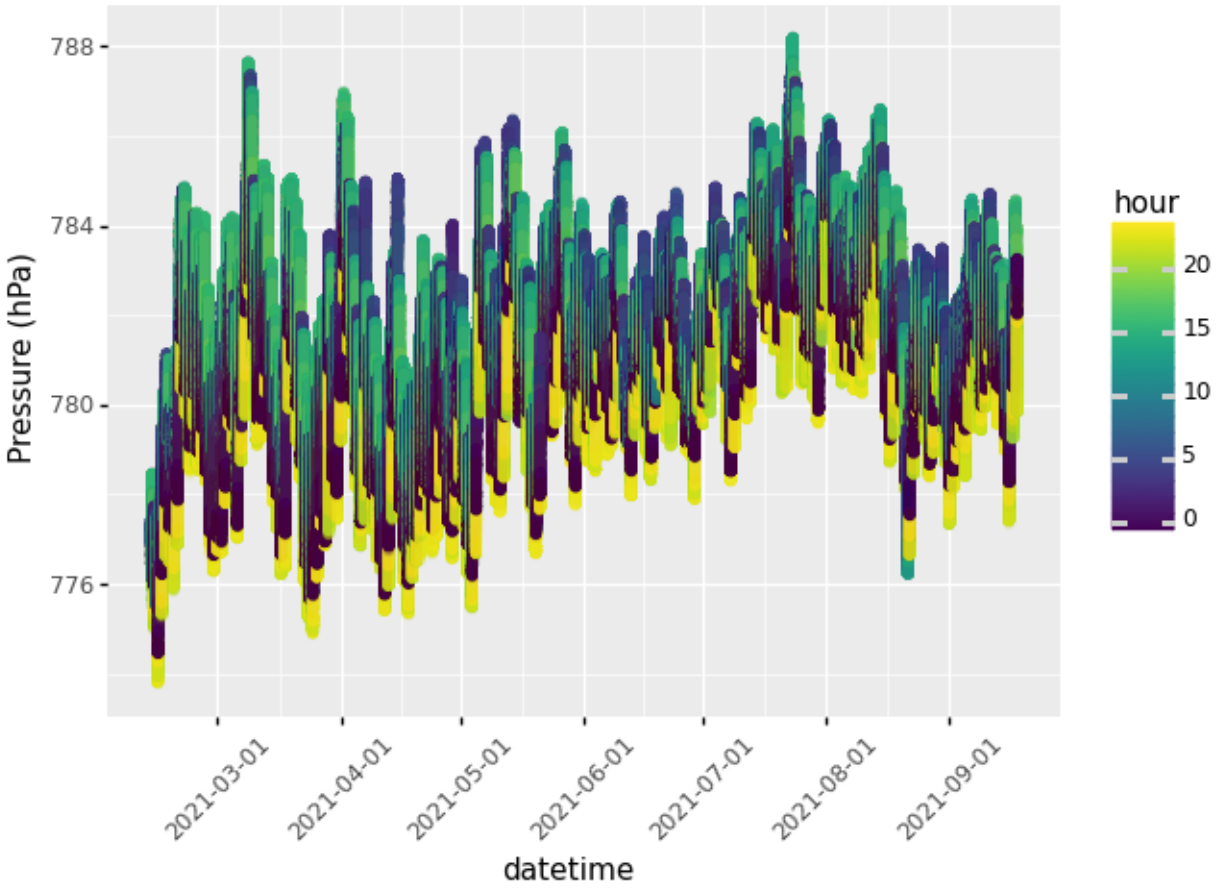

```
<ggplot: (8757896670165)>
```

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```



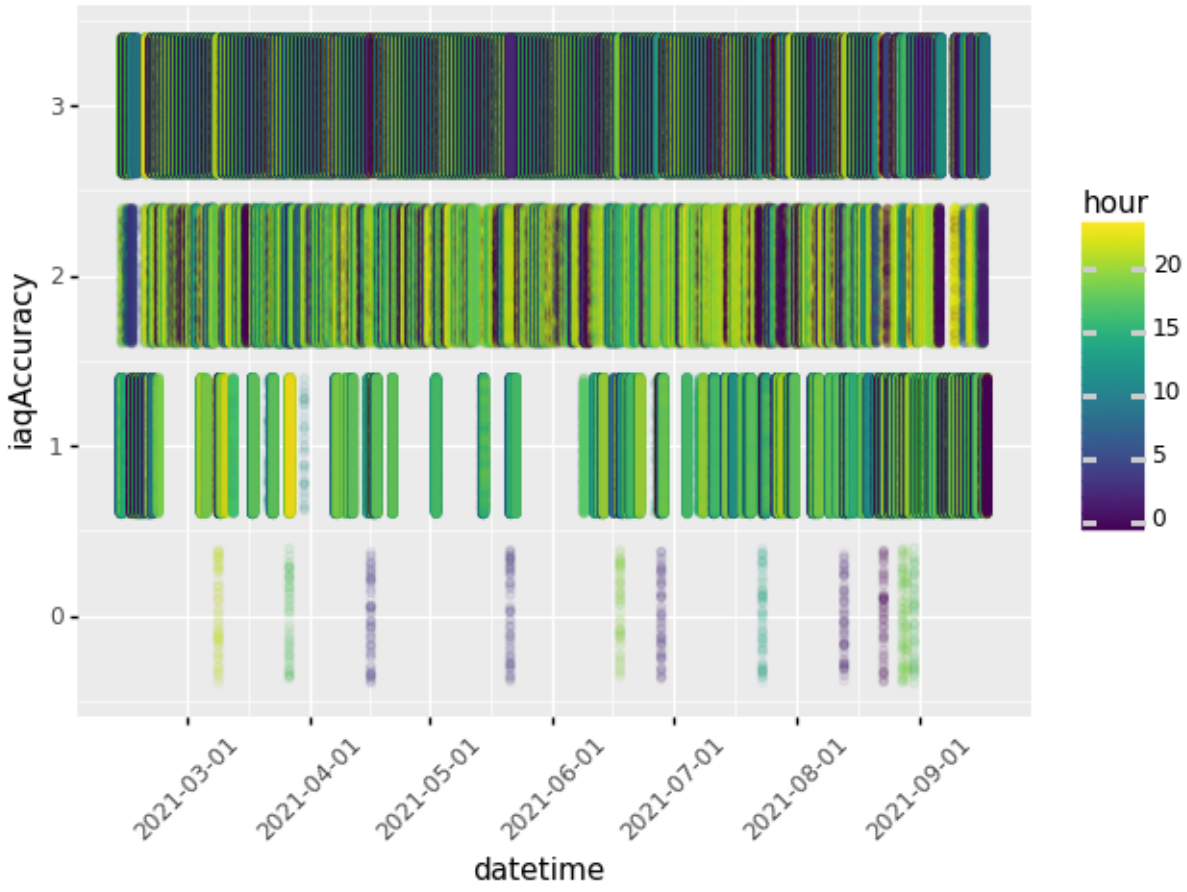

```
<ggplot: (8757896634977)>
```

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```




```
<ggplot: (8757982086333)>
```

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```




```
<ggplot: (8757896273573)>
```

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```

1.3 SINAICA

Listing data files from: /home/jaa6766/Documents/jorge3a/itam/deeplearning/dlfinal/data/sinaica/...

```
Loading pickle prev data...
```

	Parameter	Date	Value	Units	Monitoring Station
1	CO	2021-01-01	0.600	ppm	Camarones
1	NO	2021-01-01	0.006	ppm	Camarones
1	NO2	2021-01-01	0.029	ppm	Camarones
1	NOx	2021-01-01	0.034	ppm	Camarones
1	O3	2021-01-01	0.011	ppm	Camarones
34	SO2	2021-10-08	0.002	ppm	Merced
35	SO2	2021-10-08	0.001	ppm	Merced
36	SO2	2021-10-08	0.001	ppm	Merced
37	SO2	2021-10-08	0.000	ppm	Merced
38	SO2	2021-10-08	0.001	ppm	Merced

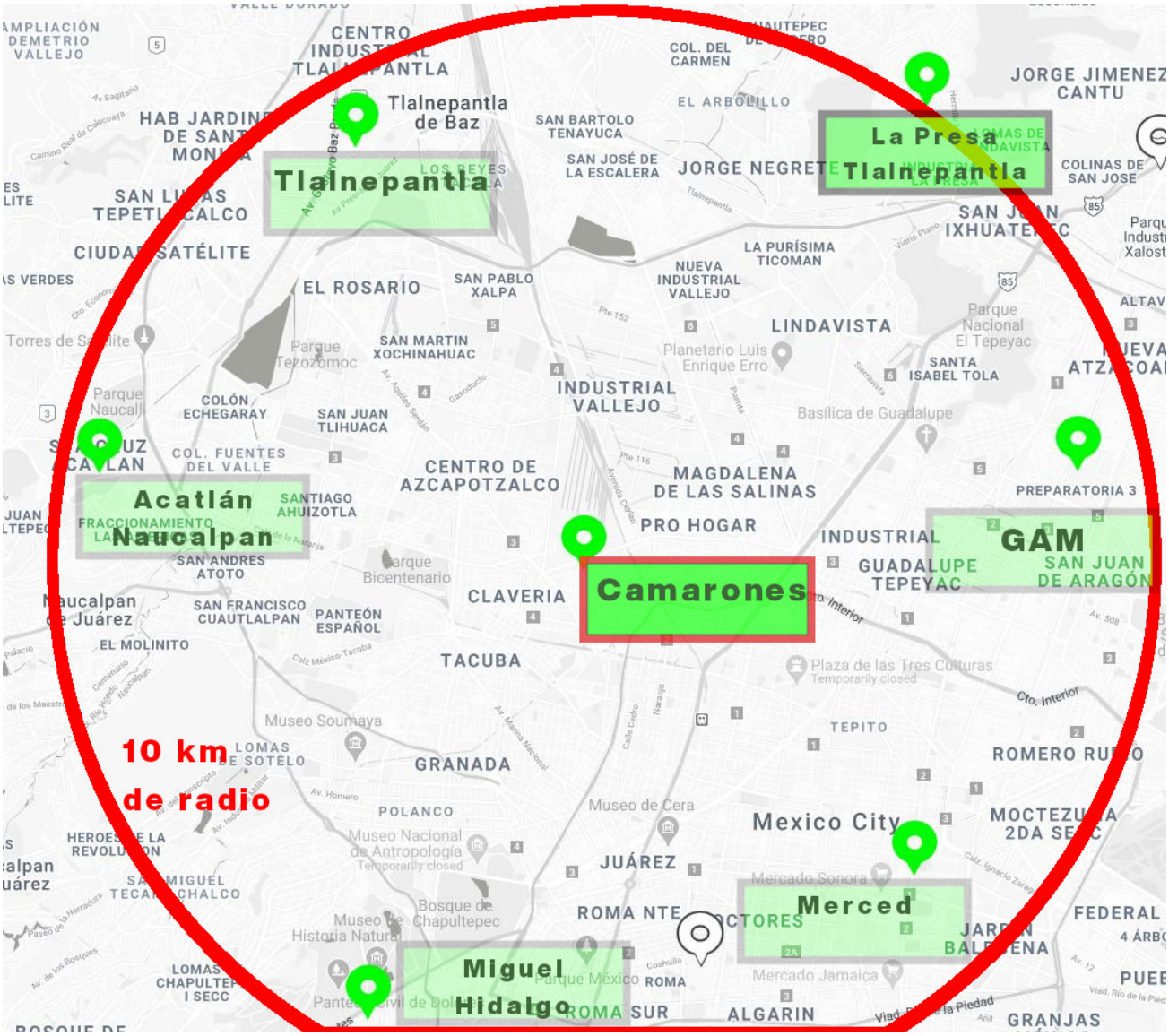
```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
```

`transformed_cell` argument and any exception that happen during thetransform in `preprocessing_exc_tuple` in IPython 7.17 and above.

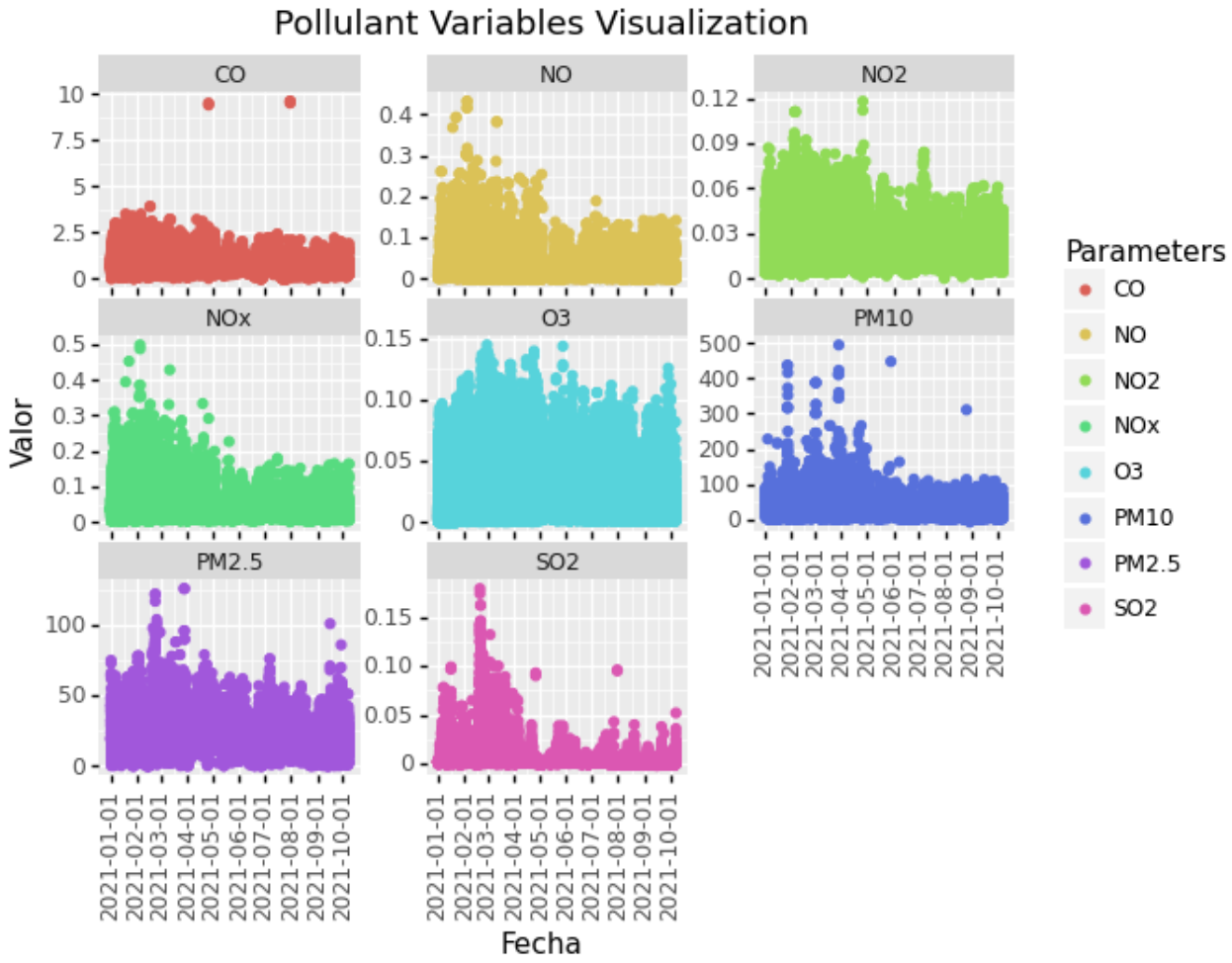
```
    Parameter       Date  Value Units Monitoring Station
1          CO 2021-01-01  0.600   ppm           Camarones
1          NO 2021-01-01  0.006   ppm           Camarones
1         NO2 2021-01-01  0.029   ppm           Camarones
1         NOx 2021-01-01  0.034   ppm           Camarones
1          O3 2021-01-01  0.011   ppm           Camarones
..        …          …    …   …                       …
34        SO2 2021-10-08  0.002   ppm              Merced
35        SO2 2021-10-08  0.001   ppm              Merced
36        SO2 2021-10-08  0.001   ppm              Merced
37        SO2 2021-10-08  0.000   ppm              Merced
38        SO2 2021-10-08  0.001   ppm              Merced

[196289 rows x 5 columns]
```

1.3.1 Nearby Air Quality Monitoring Stations

These are the air quality monitoring stations that are close to "Camarones", which is the one nearby to our sensor:



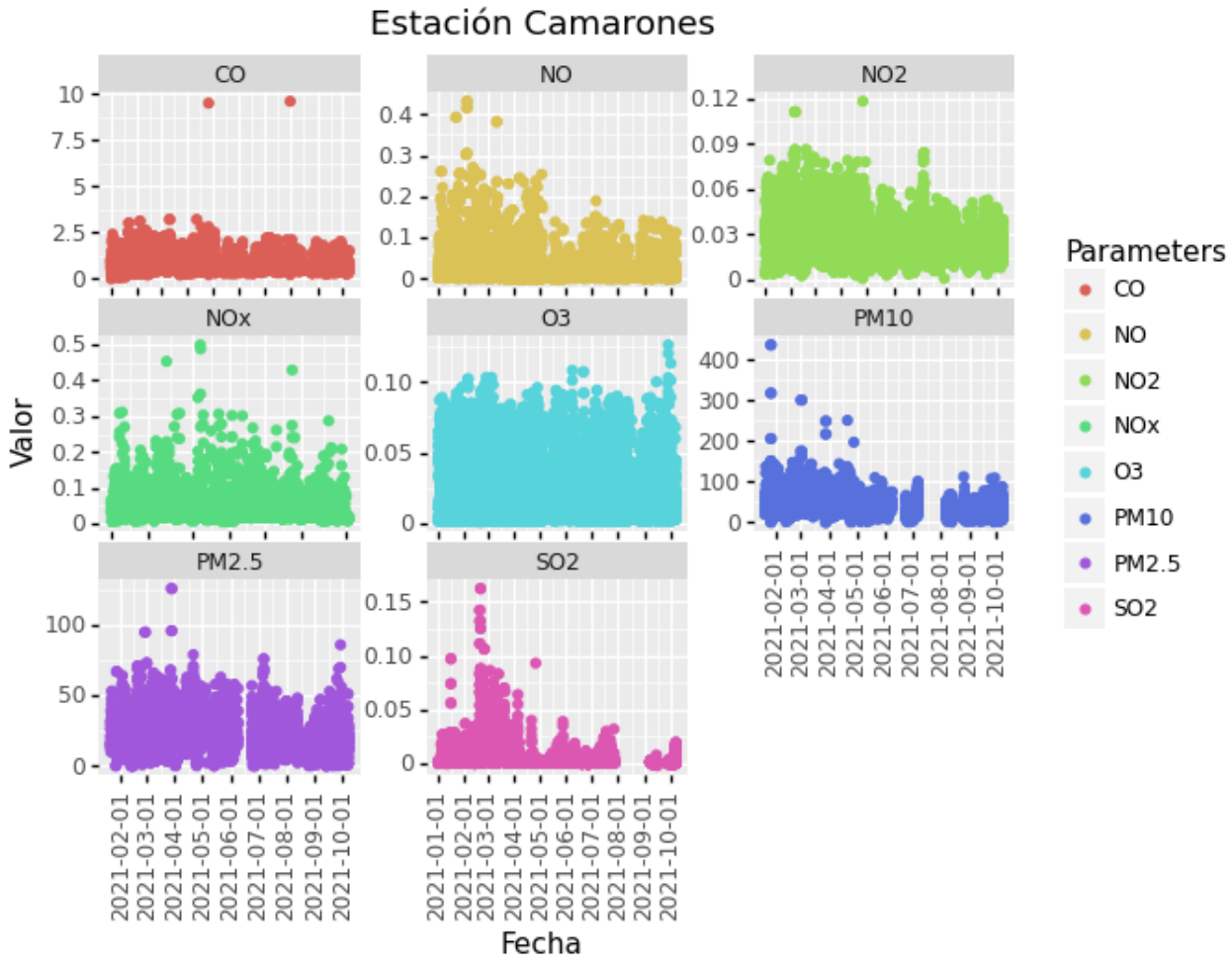
```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```




```
<ggplot: (8757896202205)>
```

1.3.2 Camarones Air Quality Monitoring Station

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```




```
<ggplot: (8757978345469)>
```

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```

1.4 Sensor Data

These are the hourly averages of the sensor in order to make them match the government air quality monitoring stations that report hourly vs every 3 seconds.

```
   temperature  pressure  humidity  gasResistance    IAQ  iaqAccuracy  \
0        21.54    777.41     43.93         151328  37.5            1
1        21.56    777.41     43.89         152702  35.6            1
2        21.53    777.41     43.97         151328  37.5            1
3        21.51    777.41     44.03         151464  38.5            1
4        21.51    777.41     44.05         152425  36.9            1

                       datetime  year  month  day  hour  minute
0 2021-02-12 06:04:09.089621067  2021      2   12     6       4
1 2021-02-12 06:04:12.087778807  2021      2   12     6       4
2 2021-02-12 06:04:15.072475433  2021      2   12     6       4
3 2021-02-12 06:04:18.070170164  2021      2   12     6       4
```

```
 4 2021-02-12 06:04:21.061994791  2021      2   12     6       4
```

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/dplython/dplython.py:196: DeprecationWarning: 'dfilter' is deprecated.
Please use 'sift' instead.
```

```
        temperature  pressure  humidity  gasResistance    IAQ  iaqAccuracy  \
490473        28.06     780.7     30.37         175863  198.1            3
490474        28.05     780.7     30.38         176417  197.7            3
490475        28.05     780.7     30.41         175313  198.0            3

                            datetime  year  month  day  hour  minute
490473 2021-03-01 06:00:01.807887316  2021      3    1     6       0
490474 2021-03-01 06:00:04.803511858  2021      3    1     6       0
490475 2021-03-01 06:00:07.798833609  2021      3    1     6       0
```

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```

```
CPU times: user 23.1 s, sys: 2.9 s, total: 26 s
Wall time: 26 s
```

```
      year  month  day  hour  temperature    pressure   humidity  \
0     2021      2   12     6    21.557391  777.271496  44.289745
1     2021      2   12     7    21.153699  777.077872  43.183375
2     2021      2   12     8    20.653242  776.620657  42.604564
3     2021      2   12     9    20.406470  776.213214  42.223995
4     2021      2   12    10    20.051380  776.202968  42.269584
…     …    …  …   …          …          …          …
5223  2021      9   17    21    26.476714  780.191339  50.048186
5224  2021      9   17    22    26.849135  780.496165  50.588394
5225  2021      9   17    23    26.281820  782.067298  54.032219
5226  2021      9   18     0    26.222995  782.853860  55.496814
5227  2021      9   18     1    25.928134  782.818660  56.467943

      gasResistance         IAQ  iaqAccuracy
0      1.439648e+05   90.755292            1
1      1.497397e+05   81.831588            1
2      1.537118e+05   86.220615            1
3      1.491061e+05  138.266030            1
4      1.428894e+05  198.164339            1
…             …         …          …
5223   1.043343e+06   37.047504            1
5224   1.050633e+06   38.850749            1
5225   9.918547e+05   81.164589            1
5226   9.266802e+05  128.776123            1
5227   9.204316e+05  134.620335            1

[5228 rows x 10 columns]
```

Estadísticas de los valores de las lecturas

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
```

```
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```

	year	month	day	hour	temperature	\
count	5228.0	5228.000000	5228.000000	5228.000000	5228.000000	
mean	2021.0	5.509946	15.633512	11.506121	24.349677	
std	0.0	2.093404	8.655932	6.921888	2.489229	
min	2021.0	2.000000	1.000000	0.000000	17.282542	
25%	2021.0	4.000000	8.000000	6.000000	22.518177	
50%	2021.0	6.000000	16.000000	12.000000	24.198175	
75%	2021.0	7.000000	23.000000	18.000000	26.116874	
max	2021.0	9.000000	31.000000	23.000000	31.066215	

	pressure	humidity	gasResistance	IAQ	iaqAccuracy
count	5228.000000	5228.000000	5.228000e+03	5228.000000	5228.000000
mean	781.624137	43.442600	6.950943e+05	157.429759	2.551071
std	2.187106	12.554327	3.111298e+05	69.918421	0.817749
min	774.004780	8.750125	9.540458e+04	22.751331	1.000000
25%	780.216749	32.662378	5.044701e+05	98.951158	3.000000
50%	781.726205	43.999339	6.915713e+05	171.485025	3.000000
75%	783.156527	54.322785	8.638399e+05	219.580799	3.000000
max	787.963968	70.166841	2.716493e+06	255.292928	3.000000

1.5 Air Quality Government Data

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```

	Parameter	Date	Value	Units	Monitoring Station
1	CO	2021-01-01	0.600	ppm	Camarones
1	NO	2021-01-01	0.006	ppm	Camarones
1	NO2	2021-01-01	0.029	ppm	Camarones
1	NOx	2021-01-01	0.034	ppm	Camarones
1	O3	2021-01-01	0.011	ppm	Camarones
..	…	…	…	…	…
34	SO2	2021-10-08	0.002	ppm	Merced
35	SO2	2021-10-08	0.001	ppm	Merced
36	SO2	2021-10-08	0.001	ppm	Merced
37	SO2	2021-10-08	0.000	ppm	Merced
38	SO2	2021-10-08	0.001	ppm	Merced

```
[196289 rows x 5 columns]

/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```

	Date	Camarones_CO	Camarones_NO	Camarones_NO2	\
0	2021-01-01 00:00:00	0.600000	0.006000	0.029000	
1	2021-01-01 01:00:00	1.000000	0.021000	0.038000	
2	2021-01-01 02:00:00	0.800000	0.013000	0.035000	
3	2021-01-01 03:00:00	1.000000	0.031000	0.034000	
4	2021-01-01 04:00:00	0.600000	0.005000	0.029000	
…	…	…	…	…	

```
2347 2021-10-04 00:00:00      0.441667      0.008292       0.015833
2348 2021-10-05 00:00:00      0.490000      0.010000       0.017000
2349 2021-10-06 00:00:00      0.542857      0.007571       0.022571
2350 2021-10-07 00:00:00      0.582609      0.011565       0.023130
2351 2021-10-08 00:00:00      0.738889      0.023778       0.026778

      Camarones_NOx  Camarones_O3  Camarones_PM10  Camarones_PM2.5  \
0             0.034      0.011000             NaN              NaN
1             0.059      0.002000             NaN              NaN
2             0.049      0.003000             NaN              NaN
3             0.065      0.002000             NaN              NaN
4             0.034      0.005000             NaN              NaN
…               …             …               …                …
2347            NaN      0.017167       22.173913        10.952381
2348            NaN      0.013947       22.142857         8.736842
2349            NaN      0.014333       25.150000        10.150000
2350            NaN      0.021304       33.500000        15.428571
2351            NaN      0.019667       41.266667        18.800000

      Camarones_SO2  FES Acatlán_CO  …  Miguel Hidalgo_O3  \
0          0.002000        0.400000  …              0.009
1          0.002000        0.600000  …              0.006
2          0.001000        0.900000  …              0.003
3          0.001000        0.800000  …              0.004
4          0.001000        1.000000  …              0.006
…             …             …  …                …
2347       0.000125        0.315000  …                NaN
2348       0.000000        0.466667  …                NaN
2349       0.000000        0.347619  …                NaN
2350       0.001783        0.447826  …                NaN
2351       0.010500        0.566667  …                NaN

      Miguel Hidalgo_SO2  Tlalnepantla_CO  Tlalnepantla_NO  Tlalnepantla_NO2  \
0                  0.003              0.6              NaN             0.030
1                  0.003              0.6              NaN             0.026
2                  0.002              0.7              NaN             0.032
3                  0.002              0.7              NaN             0.033
4                  0.002              0.7              NaN             0.032
…                    …                …                …                 …
2347                 NaN              NaN              NaN               NaN
2348                 NaN              NaN              NaN               NaN
2349                 NaN              NaN              NaN               NaN
2350                 NaN              NaN              NaN               NaN
2351                 NaN              NaN              NaN               NaN

      Tlalnepantla_NOx  Tlalnepantla_O3  Tlalnepantla_PM10  \
0                0.034            0.012               37.0
1                0.029            0.013               42.0
2                0.036            0.006               58.0
3                0.039            0.004               59.0
4                0.038            0.004               64.0
…                  …                …                  …
2347               NaN              NaN                NaN
2348               NaN              NaN                NaN
2349               NaN              NaN                NaN
2350               NaN              NaN                NaN
2351               NaN              NaN                NaN

      Tlalnepantla_PM2.5  Tlalnepantla_SO2
```

```
0                   19.0             0.002
1                   29.0             0.003
2                   43.0             0.002
3                   41.0             0.002
4                   46.0             0.002
…                    …                 …
2347                 NaN               NaN
2348                 NaN               NaN
2349                 NaN               NaN
2350                 NaN               NaN
2351                 NaN               NaN

[2352 rows x 45 columns]
```

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```

	Estacion	count	mean
Camarones_CO	Camarones_CO	2241.0	0.767037
Camarones_NO	Camarones_NO	2227.0	0.024599
Camarones_NO2	Camarones_NO2	2227.0	0.031139
Camarones_NOx	Camarones_NOx	2042.0	0.056961
Camarones_O3	Camarones_O3	2233.0	0.026094
Camarones_PM10	Camarones_PM10	1749.0	56.638261
Camarones_PM2.5	Camarones_PM2.5	1765.0	24.872841
Camarones_SO2	Camarones_SO2	2190.0	0.006284
FES Acatlán_CO	FES Acatlán_CO	2200.0	0.631953
FES Acatlán_NO	FES Acatlán_NO	1477.0	0.014508
FES Acatlán_NO2	FES Acatlán_NO2	2195.0	0.025301
FES Acatlán_NOx	FES Acatlán_NOx	2199.0	0.041105
FES Acatlán_O3	FES Acatlán_O3	2015.0	0.033841
FES Acatlán_PM10	FES Acatlán_PM10	2158.0	46.423940
FES Acatlán_SO2	FES Acatlán_SO2	2195.0	0.006255
Gustavo A. Madero_NO2	Gustavo A. Madero_NO2	2085.0	0.025859
Gustavo A. Madero_O3	Gustavo A. Madero_O3	2076.0	0.031555
Gustavo A. Madero_PM10	Gustavo A. Madero_PM10	2035.0	52.755283
Gustavo A. Madero_PM2.5	Gustavo A. Madero_PM2.5	2026.0	23.785291
La Presa_CO	La Presa_CO	2034.0	0.933628
La Presa_O3	La Presa_O3	1863.0	0.029086
La Presa_SO2	La Presa_SO2	2017.0	0.005163
Merced_CO	Merced_CO	2282.0	1.120228
Merced_NO	Merced_NO	1381.0	0.021361
Merced_NO2	Merced_NO2	2264.0	0.032059
Merced_NOx	Merced_NOx	2264.0	0.055272
Merced_O3	Merced_O3	2270.0	0.028855
Merced_PM10	Merced_PM10	2321.0	52.696149
Merced_PM2.5	Merced_PM2.5	2316.0	26.268777
Merced_SO2	Merced_SO2	2288.0	0.006037
Miguel Hidalgo_CO	Miguel Hidalgo_CO	2090.0	0.544785
Miguel Hidalgo_NO	Miguel Hidalgo_NO	2077.0	0.021710
Miguel Hidalgo_NO2	Miguel Hidalgo_NO2	2078.0	0.029400
Miguel Hidalgo_NOx	Miguel Hidalgo_NOx	2078.0	0.051113
Miguel Hidalgo_O3	Miguel Hidalgo_O3	2082.0	0.033624
Miguel Hidalgo_SO2	Miguel Hidalgo_SO2	2081.0	0.005228
Tlalnepantla_CO	Tlalnepantla_CO	2023.0	0.740287
Tlalnepantla_NO	Tlalnepantla_NO	1039.0	0.020687
Tlalnepantla_NO2	Tlalnepantla_NO2	1751.0	0.031346

```
Tlalnepantla_NOx               Tlalnepantla_NOx  1752.0   0.052864
Tlalnepantla_O3                 Tlalnepantla_O3  2077.0   0.027766
Tlalnepantla_PM10             Tlalnepantla_PM10  1989.0  48.649573
Tlalnepantla_PM2.5           Tlalnepantla_PM2.5  1973.0  22.273188
Tlalnepantla_SO2               Tlalnepantla_SO2  2066.0   0.008569
Fecha                                    Fecha     NaN        NaN

                               std       min        25%        50%      75%  \
Camarones_CO              0.412628  0.000000   0.500000   0.700000   0.9000
Camarones_NO              0.043639  0.000000   0.003000   0.007000   0.0260
Camarones_NO2             0.015144  0.003000   0.020000   0.029000   0.0400
Camarones_NOx             0.054418  0.004000   0.022000   0.039000   0.0710
Camarones_O3              0.022991  0.001000   0.005000   0.021000   0.0390
Camarones_PM10           26.729443  0.000000  40.000000  54.000000  70.0000
Camarones_PM2.5          12.620210  0.000000  16.000000  24.000000  32.0000
Camarones_SO2             0.012464 -0.000048   0.001217   0.003000   0.0050
FES Acatlán_CO            0.359163  0.100000   0.400000   0.547913   0.8000
FES Acatlán_NO            0.023519  0.000000   0.002000   0.005000   0.0160
FES Acatlán_NO2           0.013814  0.002000   0.015279   0.022280   0.0320
FES Acatlán_NOx           0.034157  0.002000   0.018000   0.029000   0.0510
FES Acatlán_O3            0.026037  0.003000   0.013000   0.027000   0.0480
FES Acatlán_PM10         31.656199  0.000000  26.729067  41.000000  60.0000
FES Acatlán_SO2           0.009587  0.000000   0.002000   0.003000   0.0060
Gustavo A. Madero_NO2     0.014361  0.003000   0.013000   0.026000   0.0360
Gustavo A. Madero_O3      0.029610  0.001000   0.004000   0.023000   0.0510
Gustavo A. Madero_PM10   27.911189  0.000000  34.500000  50.000000  67.0000
Gustavo A. Madero_PM2.5  13.182547  0.000000  14.000000  22.000000  31.0000
La Presa_CO               0.513861  0.100000   0.600000   0.800000   1.1000
La Presa_O3               0.025911  0.001000   0.006000   0.024000   0.0455
La Presa_SO2              0.009749  0.000000   0.001000   0.002000   0.0050
Merced_CO                 0.409799  0.117391   0.852444   1.000000   1.3000
Merced_NO                 0.034552  0.000000   0.003000   0.008000   0.0220
Merced_NO2                0.013544  0.005000   0.022000   0.031000   0.0400
Merced_NOx                0.042945  0.006000   0.027000   0.042000   0.0670
Merced_O3                 0.027825  0.000000   0.005000   0.022000   0.0440
Merced_PM10              24.127886  0.000000  37.000000  51.000000  66.0000
Merced_PM2.5             12.682280  0.000000  18.000000  25.000000  33.0000
Merced_SO2                0.009778  0.000000   0.002000   0.003000   0.0060
Miguel Hidalgo_CO         0.343697  0.000000   0.300000   0.500000   0.7000
Miguel Hidalgo_NO         0.038798  0.000000   0.002000   0.005000   0.0220
Miguel Hidalgo_NO2        0.013166  0.004000   0.019000   0.028000   0.0390
Miguel Hidalgo_NOx        0.046729  0.005000   0.022000   0.034000   0.0620
Miguel Hidalgo_O3         0.028588  0.002000   0.009000   0.027000   0.0500
Miguel Hidalgo_SO2        0.008925  0.000000   0.001000   0.002000   0.0050
Tlalnepantla_CO           0.360615  0.100000   0.500000   0.600000   0.9000
Tlalnepantla_NO           0.031055  0.000000   0.003000   0.007000   0.0220
Tlalnepantla_NO2          0.014525  0.004000   0.021000   0.030000   0.0390
Tlalnepantla_NOx          0.040767  0.005000   0.026000   0.039000   0.0660
Tlalnepantla_O3           0.025335  0.000000   0.007000   0.020000   0.0430
Tlalnepantla_PM10        27.959538  0.000000  33.000000  45.000000  59.0000
Tlalnepantla_PM2.5       12.075484  0.000000  14.000000  21.000000  29.0000
Tlalnepantla_SO2          0.014821  0.001000   0.002000   0.004000   0.0080
Fecha                          NaN       NaN        NaN        NaN      NaN

                             max    NAs
Camarones_CO               3.200  111.0
Camarones_NO               0.432  125.0
Camarones_NO2              0.111  125.0
Camarones_NOx              0.499  310.0
```

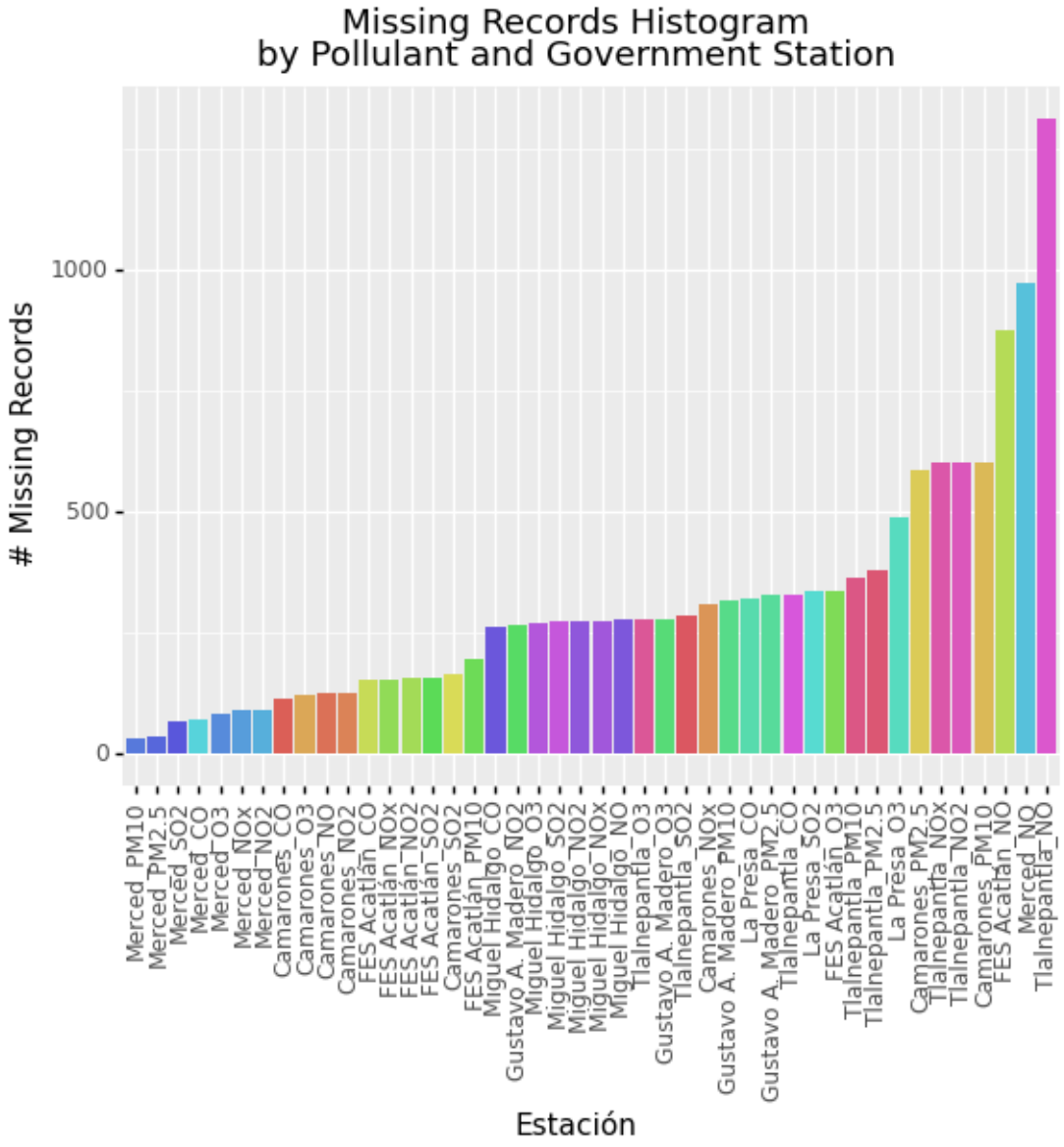
Camarones_O3	0.103	119.0
Camarones_PM10	437.000	603.0
Camarones_PM2.5	126.000	587.0
Camarones_SO2	0.162	162.0
FES Acatlán_CO	2.900	152.0
FES Acatlán_NO	0.215	875.0
FES Acatlán_NO2	0.092	157.0
FES Acatlán_NOx	0.260	153.0
FES Acatlán_O3	0.137	337.0
FES Acatlán_PM10	388.000	194.0
FES Acatlán_SO2	0.136	157.0
Gustavo A. Madero_NO2	0.081	267.0
Gustavo A. Madero_O3	0.128	276.0
Gustavo A. Madero_PM10	495.000	317.0
Gustavo A. Madero_PM2.5	117.000	326.0
La Presa_CO	3.500	318.0
La Presa_O3	0.118	489.0
La Presa_SO2	0.118	335.0
Merced_CO	3.900	70.0
Merced_NO	0.318	971.0
Merced_NO2	0.087	88.0
Merced_NOx	0.386	88.0
Merced_O3	0.140	82.0
Merced_PM10	411.000	31.0
Merced_PM2.5	122.000	36.0
Merced_SO2	0.146	64.0
Miguel Hidalgo_CO	2.600	262.0
Miguel Hidalgo_NO	0.368	275.0
Miguel Hidalgo_NO2	0.086	274.0
Miguel Hidalgo_NOx	0.395	274.0
Miguel Hidalgo_O3	0.145	270.0
Miguel Hidalgo_SO2	0.099	271.0
Tlalnepantla_CO	2.900	329.0
Tlalnepantla_NO	0.219	1313.0
Tlalnepantla_NO2	0.097	601.0
Tlalnepantla_NOx	0.274	600.0
Tlalnepantla_O3	0.125	275.0
Tlalnepantla_PM10	423.000	363.0
Tlalnepantla_PM2.5	90.000	379.0
Tlalnepantla_SO2	0.179	286.0
Fecha	NaN	0.0

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel_launcher.py:8: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
```

		Estacion	NAs
0	Camarones_CO	Camarones_CO	111.0
1	Camarones_NO	Camarones_NO	125.0
2	Camarones_NO2	Camarones_NO2	125.0
3	Camarones_NOx	Camarones_NOx	310.0
4	Camarones_O3	Camarones_O3	119.0

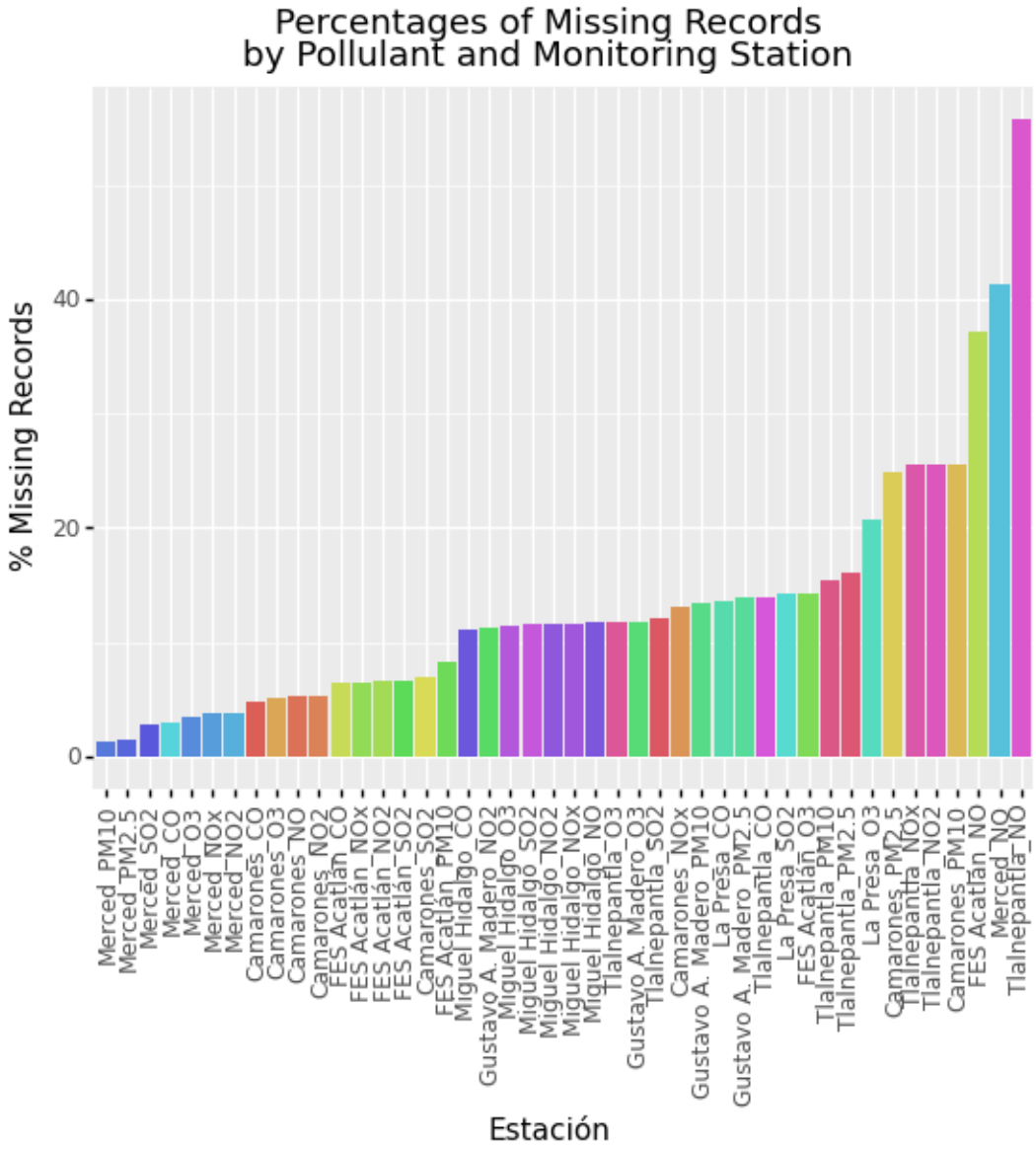
5	Camarones_PM10	Camarones_PM10	603.0
6	Camarones_PM2.5	Camarones_PM2.5	587.0
7	Camarones_SO2	Camarones_SO2	162.0
8	FES Acatlán_CO	FES Acatlán_CO	152.0
9	FES Acatlán_NO	FES Acatlán_NO	875.0
10	FES Acatlán_NO2	FES Acatlán_NO2	157.0
11	FES Acatlán_NOx	FES Acatlán_NOx	153.0
12	FES Acatlán_O3	FES Acatlán_O3	337.0
13	FES Acatlán_PM10	FES Acatlán_PM10	194.0
14	FES Acatlán_SO2	FES Acatlán_SO2	157.0
15	Gustavo A. Madero_NO2	Gustavo A. Madero_NO2	267.0
16	Gustavo A. Madero_O3	Gustavo A. Madero_O3	276.0
17	Gustavo A. Madero_PM10	Gustavo A. Madero_PM10	317.0
18	Gustavo A. Madero_PM2.5	Gustavo A. Madero_PM2.5	326.0
19	La Presa_CO	La Presa_CO	318.0
20	La Presa_O3	La Presa_O3	489.0
21	La Presa_SO2	La Presa_SO2	335.0
22	Merced_CO	Merced_CO	70.0
23	Merced_NO	Merced_NO	971.0
24	Merced_NO2	Merced_NO2	88.0
25	Merced_NOx	Merced_NOx	88.0
26	Merced_O3	Merced_O3	82.0
27	Merced_PM10	Merced_PM10	31.0
28	Merced_PM2.5	Merced_PM2.5	36.0
29	Merced_SO2	Merced_SO2	64.0
30	Miguel Hidalgo_CO	Miguel Hidalgo_CO	262.0
31	Miguel Hidalgo_NO	Miguel Hidalgo_NO	275.0
32	Miguel Hidalgo_NO2	Miguel Hidalgo_NO2	274.0
33	Miguel Hidalgo_NOx	Miguel Hidalgo_NOx	274.0
34	Miguel Hidalgo_O3	Miguel Hidalgo_O3	270.0
35	Miguel Hidalgo_SO2	Miguel Hidalgo_SO2	271.0
36	Tlalnepantla_CO	Tlalnepantla_CO	329.0
37	Tlalnepantla_NO	Tlalnepantla_NO	1313.0
38	Tlalnepantla_NO2	Tlalnepantla_NO2	601.0
39	Tlalnepantla_NOx	Tlalnepantla_NOx	600.0
40	Tlalnepantla_O3	Tlalnepantla_O3	275.0
41	Tlalnepantla_PM10	Tlalnepantla_PM10	363.0
42	Tlalnepantla_PM2.5	Tlalnepantla_PM2.5	379.0
43	Tlalnepantla_SO2	Tlalnepantla_SO2	286.0

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```



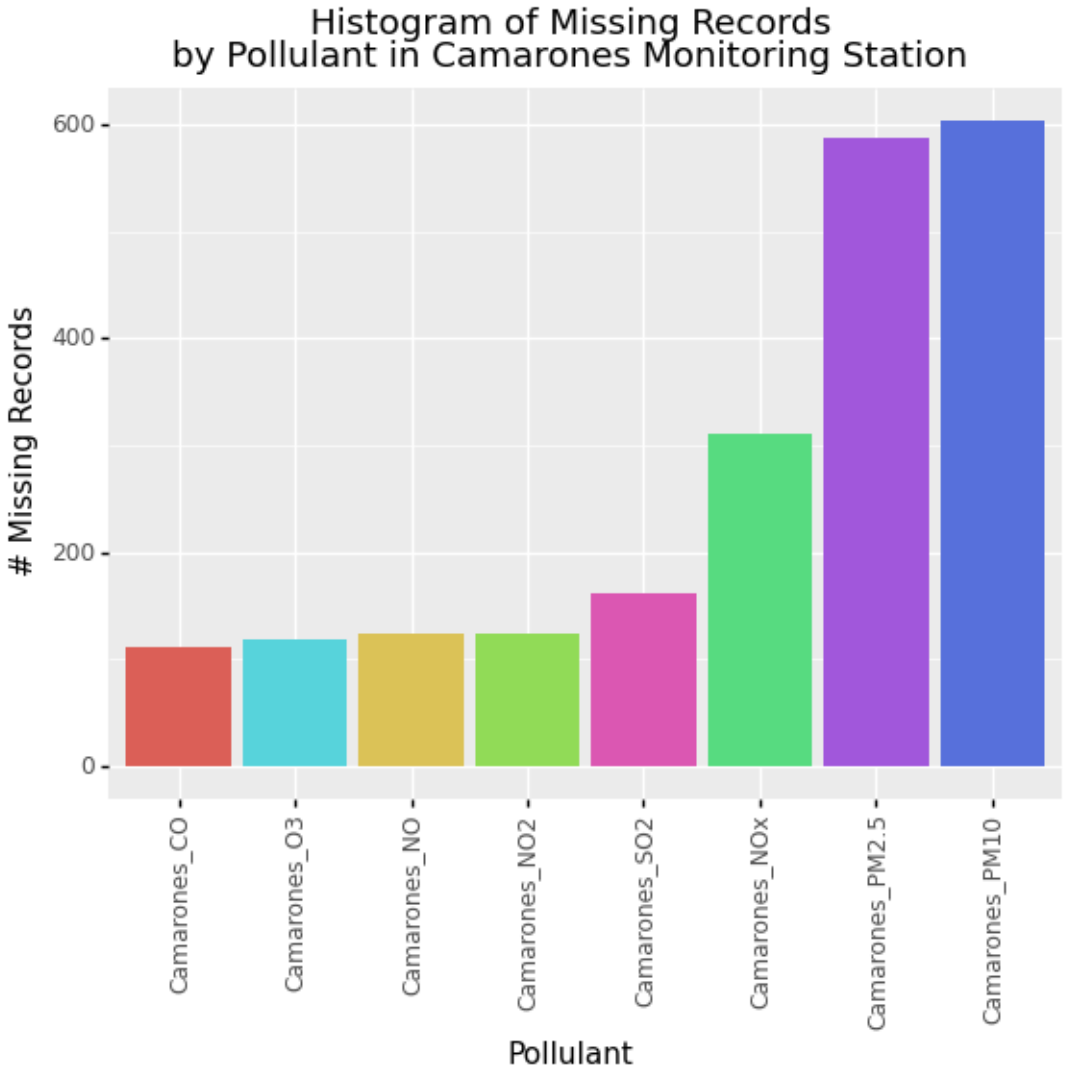

```
<ggplot: (8757977309781)>
```

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```



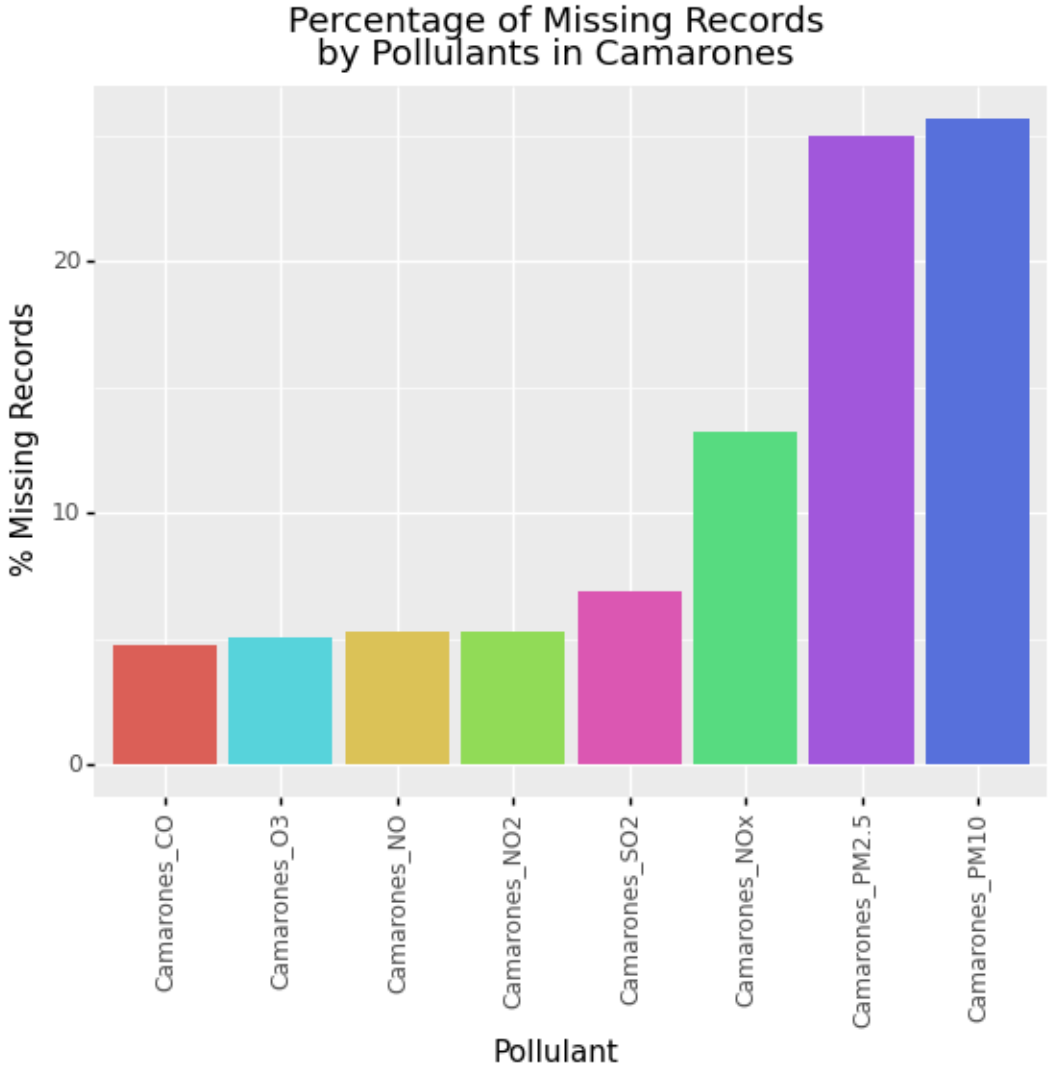

```
<ggplot: (8757789809049)>
```

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```




```
<ggplot: (8757977295893)>
```

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```




```
<ggplot: (8757895815993)>
```

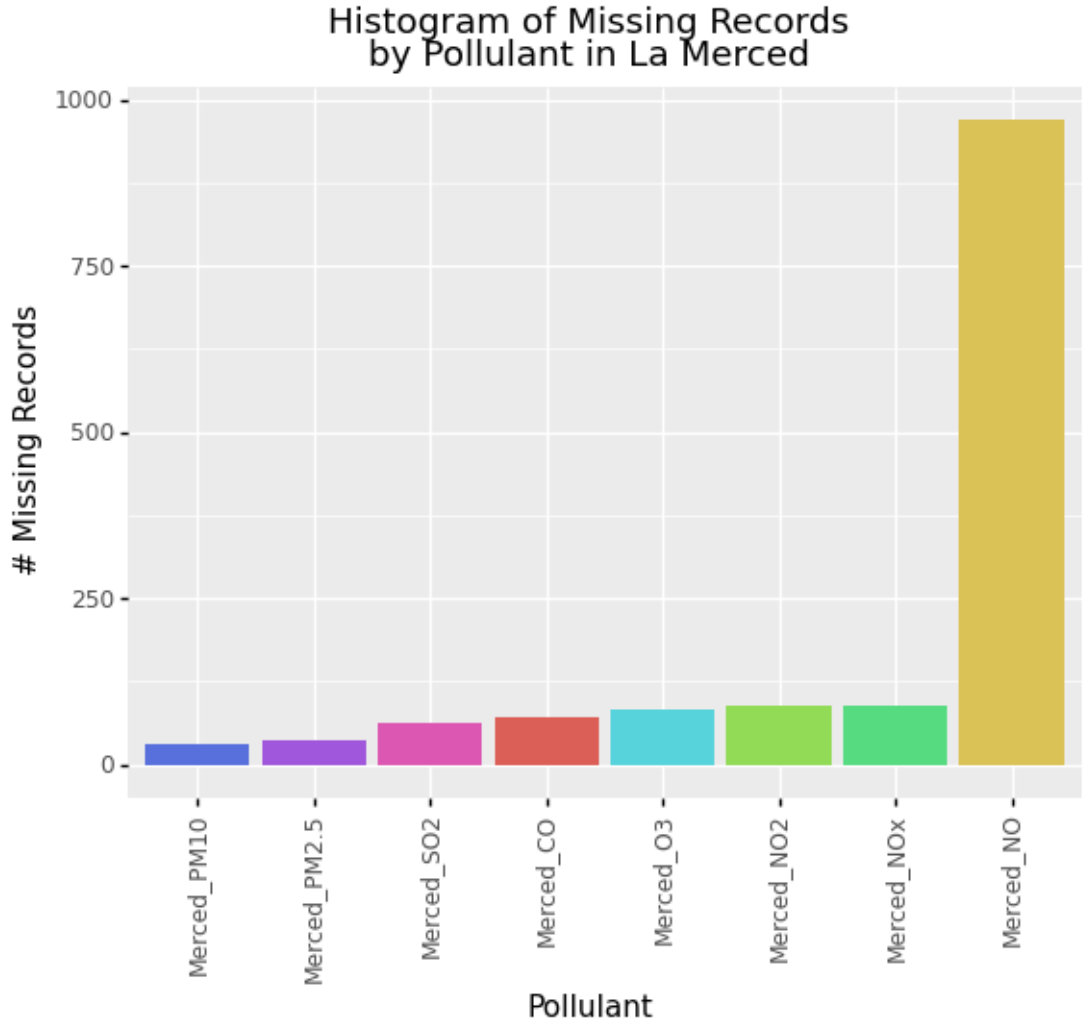
```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```

		Estacion	NAs
0	Camarones_CO	Camarones_CO	111.0
1	Camarones_NO	Camarones_NO	125.0
2	Camarones_NO2	Camarones_NO2	125.0
3	Camarones_NOx	Camarones_NOx	310.0
4	Camarones_O3	Camarones_O3	119.0
5	Camarones_PM10	Camarones_PM10	603.0
6	Camarones_PM2.5	Camarones_PM2.5	587.0
7	Camarones_SO2	Camarones_SO2	162.0

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```

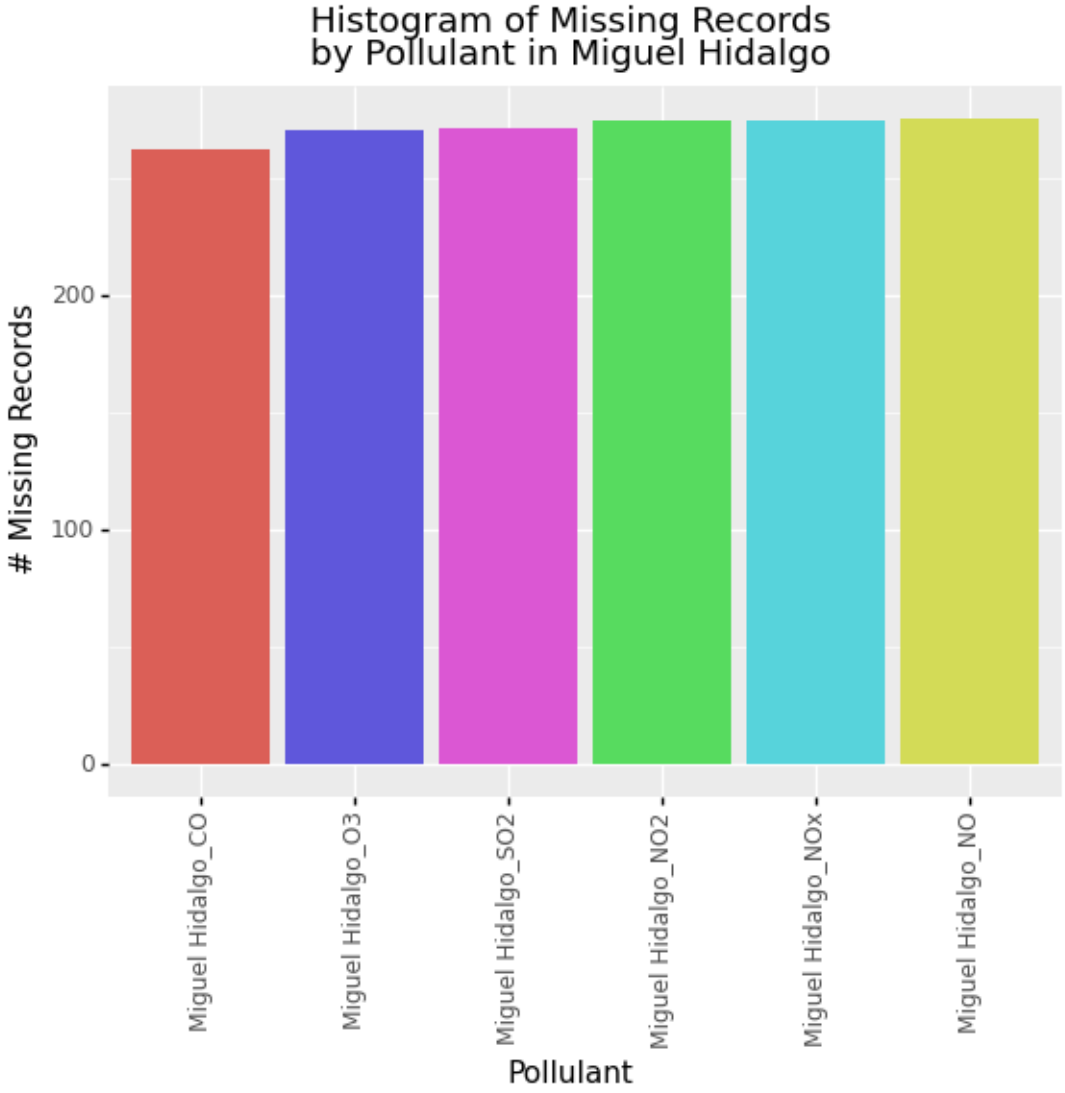
	Estacion	NAs
22	Merced_CO	70.0
23	Merced_NO	971.0
24	Merced_NO2	88.0
25	Merced_NOx	88.0
26	Merced_O3	82.0
27	Merced_PM10	31.0
28	Merced_PM2.5	36.0
29	Merced_SO2	64.0

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```




```
<ggplot: (8757896201989)>
```

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```




```
<ggplot: (8757977289453)>
```

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```

1.6 Weather Data

OpenWeatherMap Data

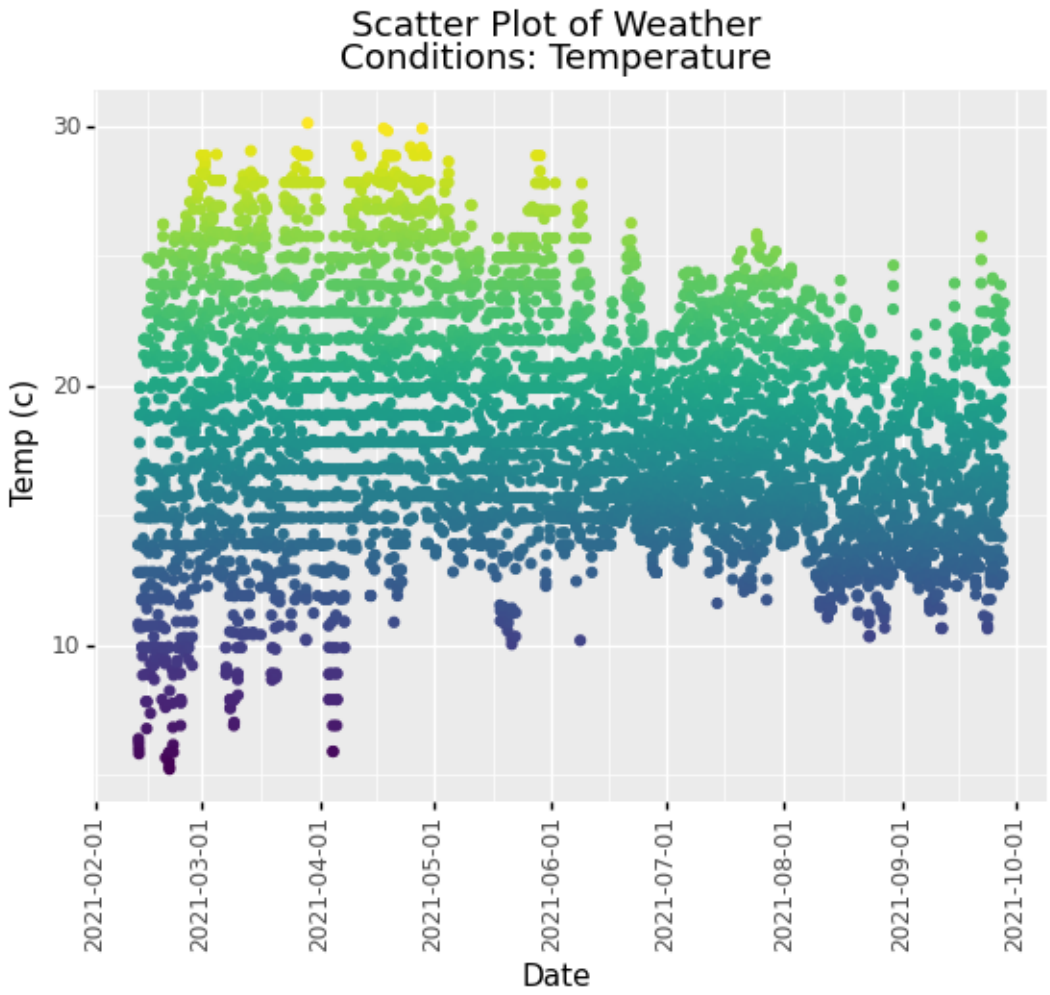
```
CPU times: user 1.01 s, sys: 88 ms, total: 1.1 s
Wall time: 1.1 s
```

	dt	temp	feels_like	temp_min	temp_max	pressure	\
0	2021-02-12 07:00:00	13.87	12.46	5.21	13.92	1020	
1	2021-02-12 08:00:00	12.81	11.37	4.21	12.92	1020	

	humidity	wind_speed	wind_deg	rain_1h	rain_3h	clouds_all	weather_id	\
0	44	0.0	0	0.0	0.0	1	800	
1	47	0.0	0	0.0	0.0	1	800	

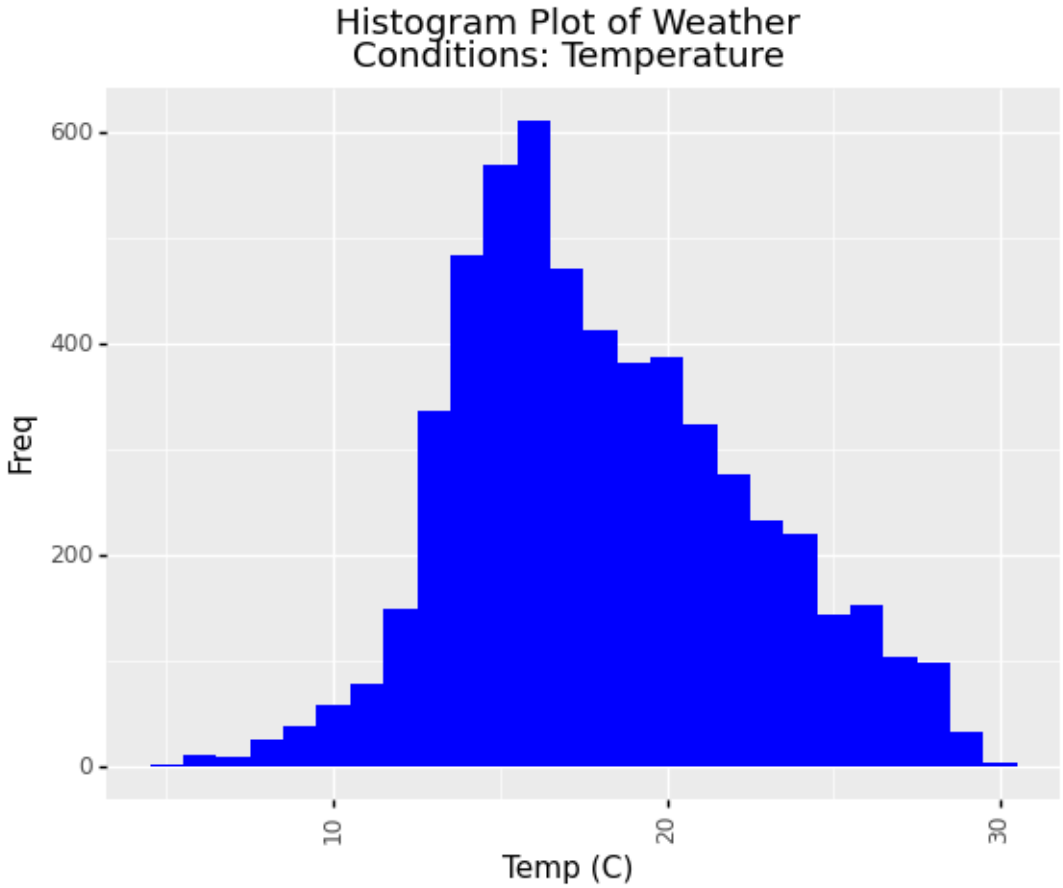
```
  weather_main
0        Clear
1        Clear
```

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```



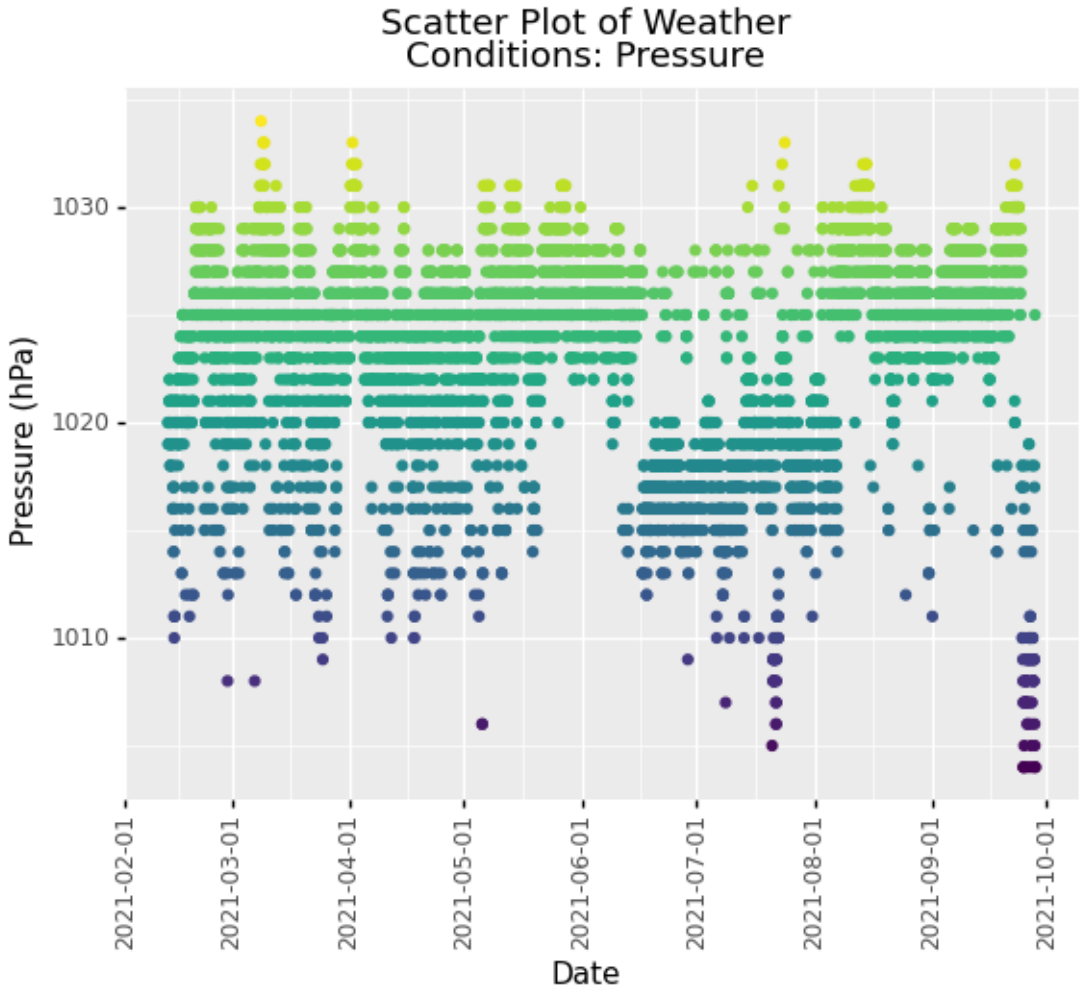

```
<ggplot: (8757896490037)>
```

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```



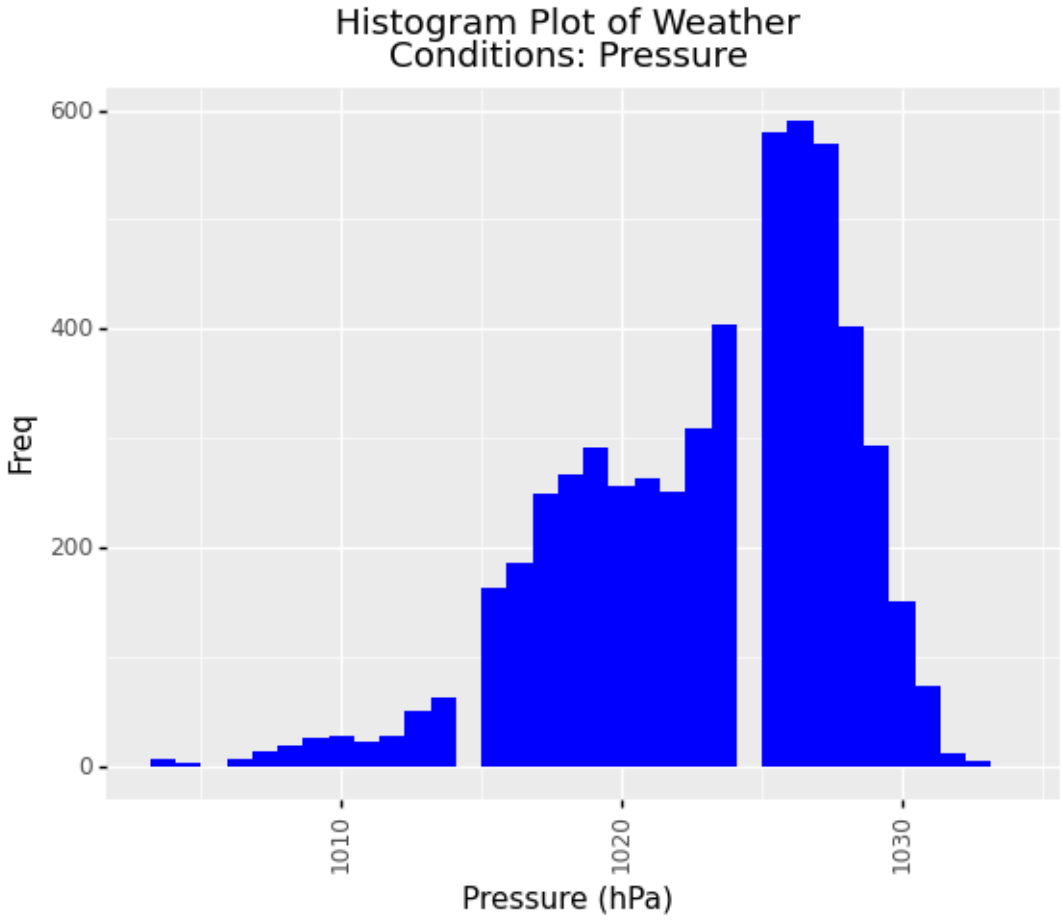

```
<ggplot: (8757896639785)>
```

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```



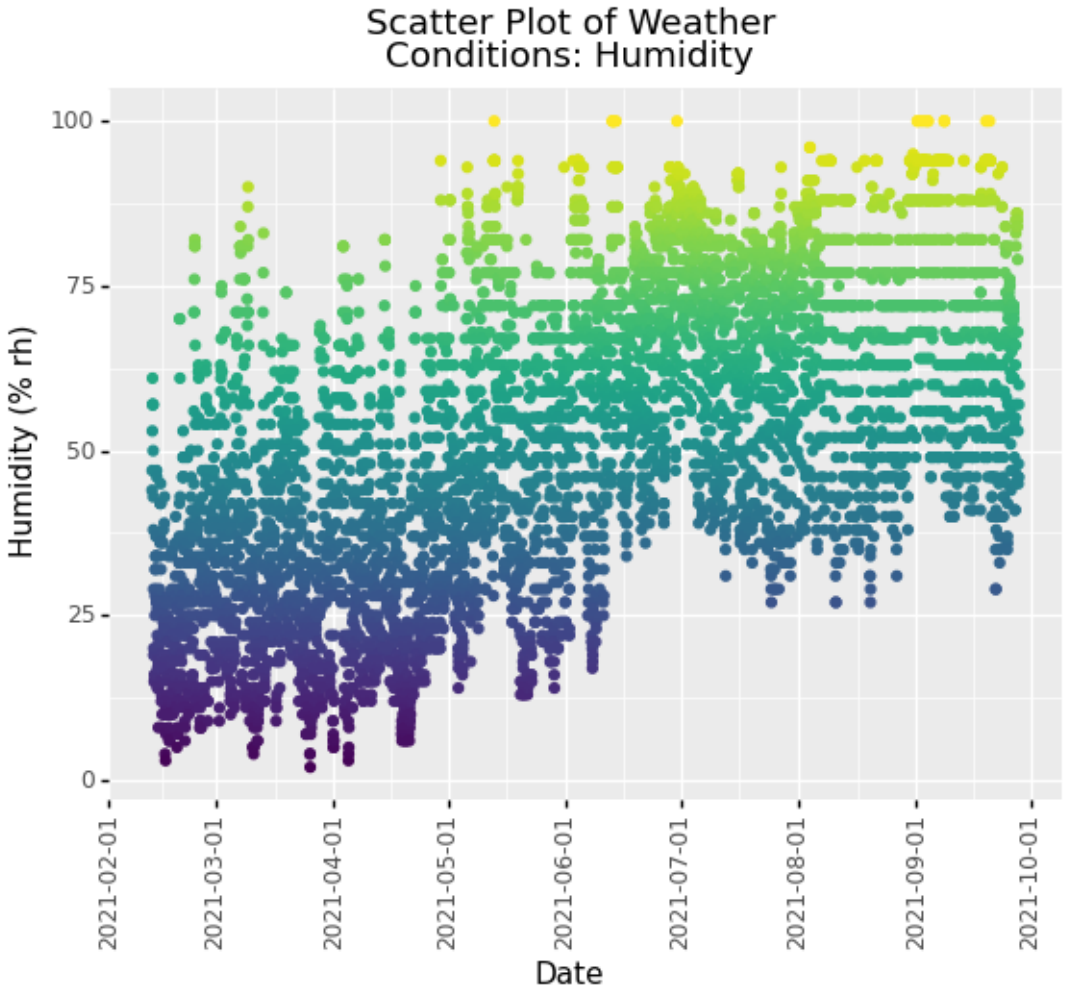

```
<ggplot: (8757896637977)>
```

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```



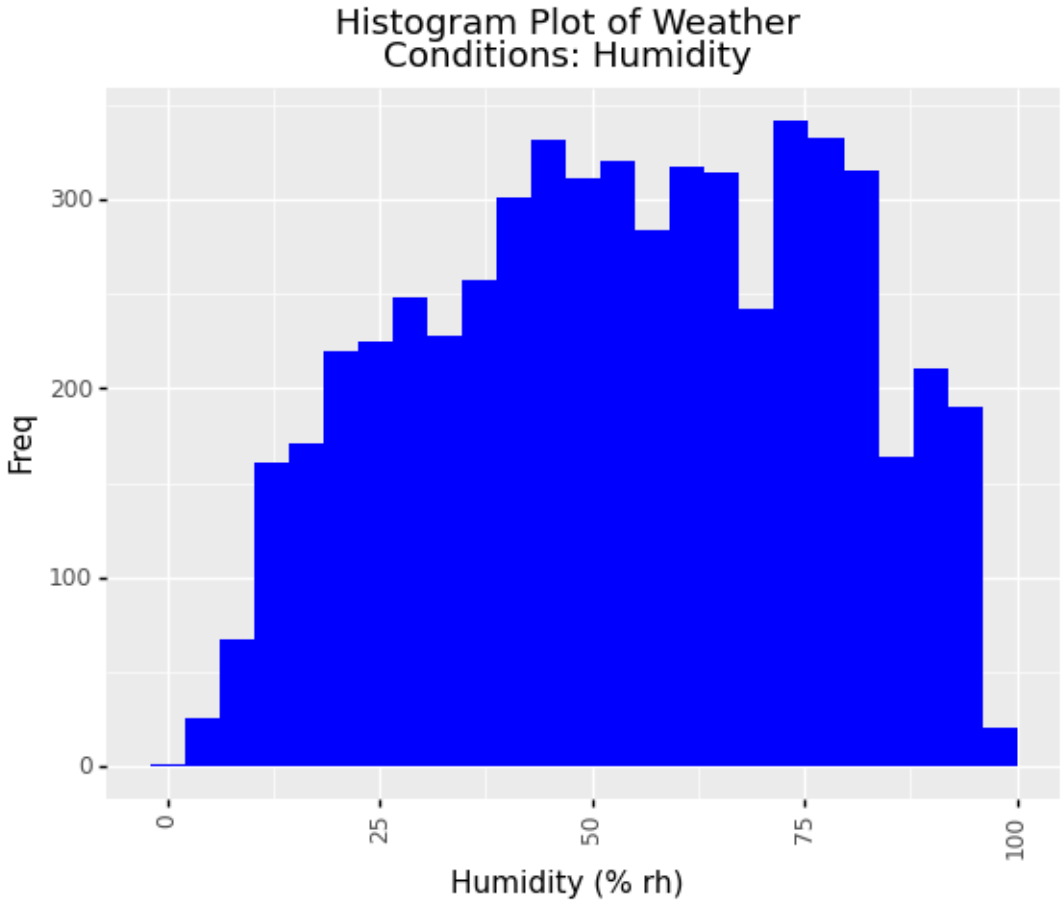

```
 <ggplot: (8757896489301)>
```

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```



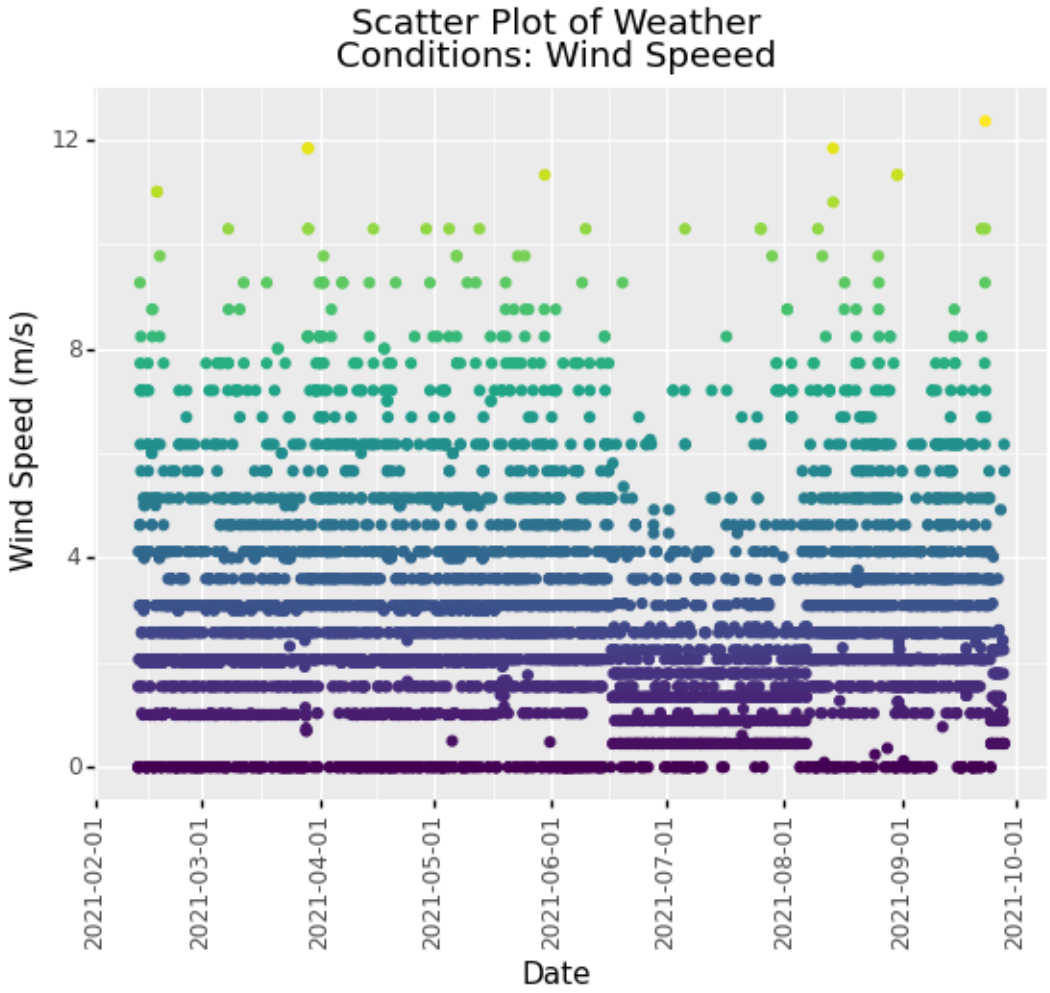

```
<ggplot: (8757896637225)>
```

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```



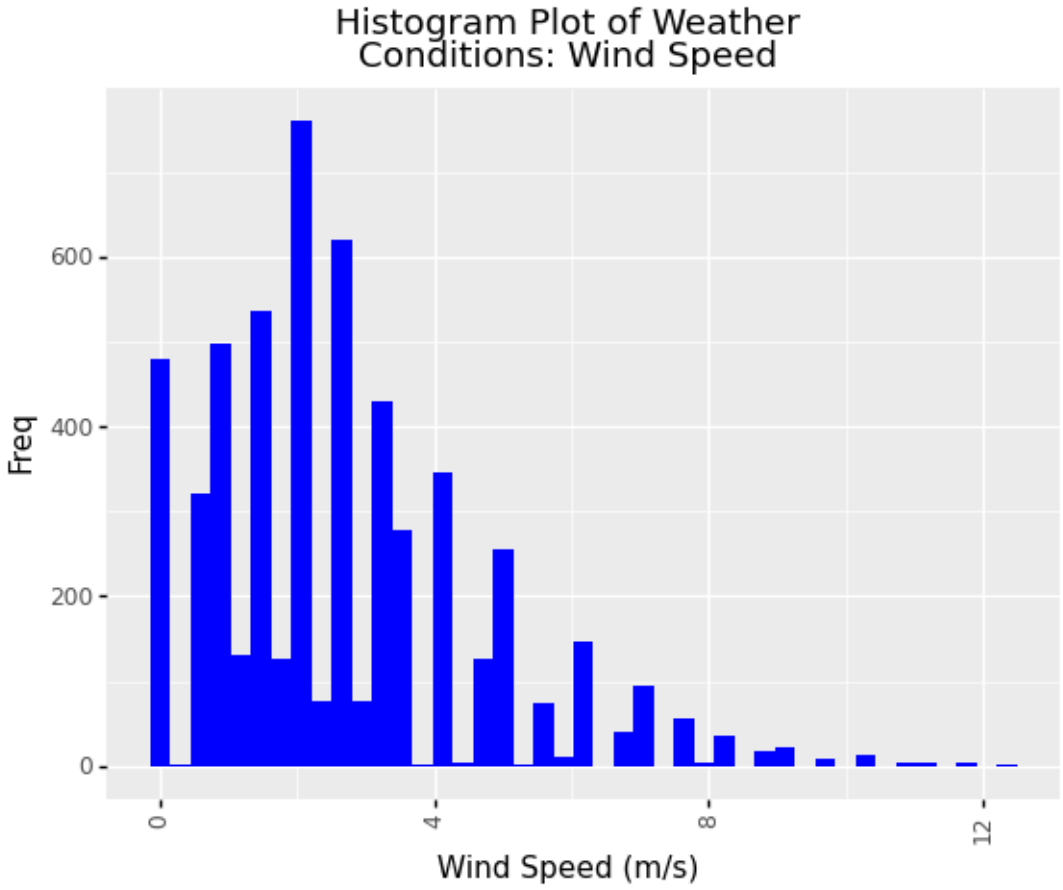

```
<ggplot: (8757973545229)>
```

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```



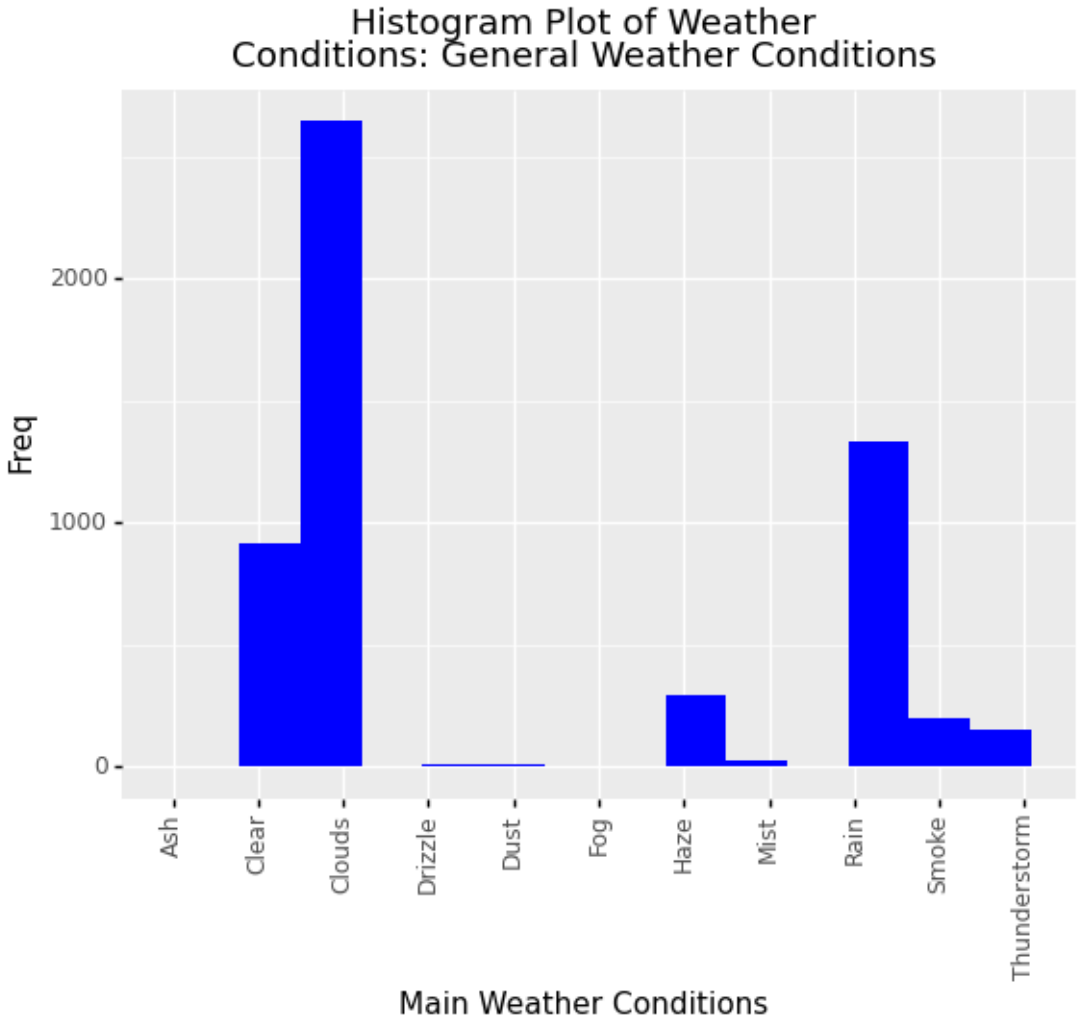

```
<ggplot: (8757896494013)>
```

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```




```
<ggplot: (8757982114029)>
```

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```




```
<ggplot: (8757549624317)>
```

```
/home/jaa6766/.conda/envs/cuda/lib/python3.7/site-
packages/ipykernel/ipkernel.py:287: DeprecationWarning: `should_run_async` will
not call `transform_cell` automatically in the future. Please pass the result to
`transformed_cell` argument and any exception that happen during thetransform in
`preprocessing_exc_tuple` in IPython 7.17 and above.
```

1.7 References

- Bosch BME680 Datasheet. 2021.
- Mancuso, Daniel. Indoor Air Quality Monitor | Hackster.io. 2019.
- OpenWeatherData: History Bulk weather data Documentation