Data Analytics in the Aviation Industry

Understand your flight data

```
display.Image('/Users/Yedou/Documents/Flight-analytics-from-ge-
digital-3200x1404.jpg', width = 1200, height = 300)
```


Data Engineering

Using data engineering to combine full-flight engine data, part manufacturing data, airport location data to create a data lake our analysts can use

Postgres/SQL | Data orchestration & transformation | Critical Thinking

```
import pandas as pd
import numpy as np
#import gspread as gs
import matplotlib.pyplot as plt
from IPython import display
import matplotlib.colors as mcolors
import folium
import json

df_engine_axm = pd.read_excel('/Users/Yedou/Documents/GE_Dataset_
Task1 (1) (2).xlsx',
sheet_name='av_engine_data_axm_psql')

df_engine_axm
```

```
          dataset       esn  unit  flight_cycle            datetime
operator  \
0       test_FD001  999126.0  26.0              1.0 2017-12-31 18:33:07
AXM
1       test_FD001  999126.0  26.0              2.0 2017-12-31 19:59:49
```

```
AXM
2        test_FD001  999126.0  26.0              3.0 2017-12-31 21:44:38
AXM
3        test_FD001  999126.0  26.0              4.0 2018-01-01 00:50:02
AXM
4        test_FD001  999126.0  26.0              5.0 2018-01-01 04:25:32
AXM
...             ...       ...   ...              ...                 ...
...
21183   train_FD001  999096.0  96.0            264.0 2018-02-13 22:32:30
AXM
21184   train_FD001  999096.0  96.0            265.0 2018-02-14 00:48:00
AXM
21185   train_FD001  999096.0  96.0            266.0 2018-02-14 02:06:00
AXM
21186   train_FD001  999096.0  96.0            267.0 2018-02-14 03:23:32
AXM
21187   train_FD001  999096.0  96.0            268.0 2018-02-14 17:04:38
AXM

       depart_icao destination_icao  hpc_eff_mod  hpc_flow_mod  ...
phi  \
0             VTBD             VTUV      -0.0027        0.0006  ...
522.55
1             VTUV             VTBD      -0.0029        0.0002  ...
521.85
2             VTBD             VMMC       0.0008        0.0001  ...
522.34
3             VMMC             VTBD      -0.0026        0.0005  ...
522.03
4             VTBD             VTSP       0.0020        0.0005  ...
522.04
...            ...              ...          ...           ...  ...
...
21183         WMKK             VDSV      -0.0034        0.0005  ...
519.47
21184         VDSV             WMKK       0.0015        0.0004  ...
519.49
21185         WMKK             WBKL      -0.0028       -0.0002  ...
519.48
21186         WMKK             WBKL       0.0001        0.0005  ...
519.61
21187         WMKK             VDSR      -0.0031       -0.0005  ...
519.18

           nrf      nrc     bpr  farb  htbleed  nf_dmd  pcnfr_dmd
w31  \
0      2387.98  8147.17  8.3468  0.03    392.0  2388.0      100.0
38.82
1      2388.01  8146.58  8.4159  0.03    390.0  2388.0      100.0
```

```
                                          39.00
2       2388.05   8144.60   8.4444   0.03   391.0   2388.0      100.0
39.20
3       2388.00   8147.98   8.3986   0.03   392.0   2388.0      100.0
38.97
4       2388.00   8142.07   8.4332   0.03   391.0   2388.0      100.0
39.11
...       ...       ...      ...     ...     ...     ...         ...    .
..
21183   2388.25   8142.08   8.5109   0.03   395.0   2388.0      100.0
38.53
21184   2388.20   8140.98   8.5158   0.03   396.0   2388.0      100.0
38.30
21185   2388.27   8145.65   8.5165   0.03   395.0   2388.0      100.0
38.63
21186   2388.25   8143.74   8.5615   0.03   396.0   2388.0      100.0
38.51
21187   2388.24   8144.03   8.5022   0.03   397.0   2388.0      100.0
38.36

            w32
0       23.3876
1       23.3793
2       23.3390
3       23.3931
4       23.3904
...         ...
21183   23.0965
21184   23.0309
21185   23.1059
21186   23.0118
21187   23.0258

[21188 rows x 32 columns]
```

```python
df_engine_fron = pd.read_excel('/Users/Yedou/Documents/GE_Dataset_
Task1 (1) (2).xlsx',
sheet_name='av_engine_data_fron_psql')

df_engine_fron
```

```
          dataset        esn   unit   flight_cycle          datetime
operator  \
0    train_FD001   999050.0   50.0            1.0  2018-01-06 06:01:09
FRON
1    train_FD001   999050.0   50.0            2.0  2018-01-06 07:41:00
FRON
2    train_FD001   999050.0   50.0            3.0  2018-01-06 08:41:18
FRON
3    train_FD001   999050.0   50.0            4.0  2018-01-06 10:14:00
FRON
```

```
4     train_FD001  999050.0  50.0           5.0 2018-01-06 11:12:52
FRON
...           ...       ...   ...           ...                 ...
...
7285  train_FD001  999086.0  86.0         271.0 2018-02-08 08:24:59
FRON
7286  train_FD001  999086.0  86.0         272.0 2018-02-08 13:16:00
FRON
7287  train_FD001  999086.0  86.0         273.0 2018-02-08 14:16:02
FRON
7288  train_FD001  999086.0  86.0         274.0 2018-02-08 18:21:45
FRON
7289  train_FD001  999086.0  86.0         275.0 2018-02-09 09:05:00
FRON

      depart_icao destination_icao  hpc_eff_mod  hpc_flow_mod  ...
phi  \
0            KMCO             KMSY      -0.0029       -0.0002  ...
521.68
1            KMSY             KSAT      -0.0002       -0.0005  ...
522.12
2            KMSY             KSAT      -0.0010       -0.0005  ...
521.96
3            KSAT             KSAN      -0.0061       -0.0002  ...
522.31
4            KSAT             KSAN      -0.0002        0.0001  ...
522.05
...           ...              ...          ...           ...  ...
...
7285         KMIA             KLAS      -0.0017        0.0000  ...
519.80
7286         KLAS             KIND       0.0002       -0.0004  ...
519.62
7287         KLAS             KIND       0.0017        0.0002  ...
519.51
7288         KIND             KMCO       0.0003        0.0003  ...
519.13
7289         KMCO             KBUF      -0.0002       -0.0005  ...
519.63

          nrf       nrc      bpr  farb  htbleed  nf_dmd  pcnfr_dmd
w31  \
0     2388.06   8151.49   8.4158  0.03    393.0  2388.0      100.0
38.80
1     2388.07   8142.72   8.4467  0.03    392.0  2388.0      100.0
38.99
2     2388.05   8139.14   8.4424  0.03    393.0  2388.0      100.0
38.91
3     2388.04   8145.16   8.4504  0.03    393.0  2388.0      100.0
38.95
```

```
4      2388.05  8145.35  8.3822  0.03    392.0  2388.0      100.0
38.83
...        ...      ...     ...    ...    ...    ...        ...   ..
.
7285  2388.22  8153.15  8.5043  0.03    396.0  2388.0      100.0
38.47
7286  2388.23  8153.33  8.4910  0.03    396.0  2388.0      100.0
38.52
7287  2388.21  8150.99  8.5339  0.03    396.0  2388.0      100.0
38.45
7288  2388.25  8157.08  8.5220  0.03    396.0  2388.0      100.0
38.49
7289  2388.22  8151.89  8.4919  0.03    398.0  2388.0      100.0
38.51

         w32
0      23.3016
1      23.3440
2      23.3190
3      23.3161
4      23.3256
...        ...
7285  23.0271
7286  23.0738
7287  23.1261
7288  23.0981
7289  22.9947

[7290 rows x 32 columns]

df_engine_aic = pd.read_excel('/Users/Yedou/Documents/GE_Dataset_
Task1 (1) (2).xlsx',
sheet_name='av_engine_data_aic_psql')

df_engine_aic

          dataset       esn  unit  flight_cycle           datetime
operator  \
0    train_FD001  999001.0   1.0           1.0 2018-01-11 17:10:56
AIC
1    train_FD001  999001.0   1.0           2.0 2018-01-12 01:07:00
AIC
2    train_FD001  999001.0   1.0           3.0 2018-01-12 02:06:59
AIC
3    train_FD001  999001.0   1.0           4.0 2018-01-12 07:42:00
AIC
4    train_FD001  999001.0   1.0           5.0 2018-01-12 08:42:17
AIC
...          ...       ...   ...           ...                ...
...
5815  train_FD001  999069.0  69.0         330.0 2018-02-17 19:08:17
```

```
AIC
5816   train_FD001   999069.0   69.0          331.0 2018-02-17 22:41:34
AIC
5817   train_FD001   999069.0   69.0          332.0 2018-02-18 04:41:00
AIC
5818   train_FD001   999069.0   69.0          333.0 2018-02-18 05:41:31
AIC
5819   train_FD001   999069.0   69.0          334.0 2018-02-18 08:05:00
AIC

     depart_icao destination_icao  hpc_eff_mod  hpc_flow_mod  ...
phi  \
0           VTBS             VICG      -0.0005        0.0002  ...
521.93
1           VICG             VTBS       0.0016       -0.0003  ...
521.72
2           VICG             VTBS      -0.0017        0.0001  ...
521.97
3           VTBS             VIDP      -0.0012       -0.0002  ...
522.04
4           VTBS             VIDP       0.0027        0.0001  ...
522.25
...          ...              ...          ...          ...  ...
...
5815        VIDP             VOMM       0.0040       -0.0002  ...
520.31
5816        VOMM             VIDP       0.0013        0.0003  ...
519.86
5817        VIDP             VECC       0.0004       -0.0001  ...
518.69
5818        VIDP             VECC       0.0016       -0.0002  ...
520.48
5819        VECC             VIDP       0.0007        0.0000  ...
519.12

          nrf      nrc     bpr  farb  htbleed  nf_dmd  pcnfr_dmd
w31  \
0     2388.12  8130.36  8.4279  0.03    392.0  2388.0      100.0
38.86
1     2388.09  8134.28  8.4230  0.03    391.0  2388.0      100.0
38.80
2     2388.09  8133.95  8.3951  0.03    391.0  2388.0      100.0
38.84
3     2388.10  8129.85  8.4040  0.03    391.0  2388.0      100.0
39.03
4     2387.97  8132.67  8.4135  0.03    392.0  2388.0      100.0
38.80
...       ...      ...     ...   ...      ...     ...        ...  ..
.
5815  2388.26  8129.59  8.5460  0.03    397.0  2388.0      100.0
```

```
          38.53
5816   2388.27   8131.20   8.5116   0.03   396.0   2388.0      100.0
          38.28
5817   2388.26   8126.63   8.5059   0.03   396.0   2388.0      100.0
          38.47
5818   2388.32   8132.97   8.5270   0.03   396.0   2388.0      100.0
          38.52
5819   2388.33   8124.27   8.5126   0.03   397.0   2388.0      100.0
          38.42

            w32
0        23.4513
1        23.3881
2        23.3085
3        23.3975
4        23.3820
...          ...
5815   23.0549
5816   23.0610
5817   23.0422
5818   23.1208
5819   22.9782

[5820 rows x 32 columns]

df_engine_pgt = pd.read_excel('/Users/Yedou/Documents/GE_Dataset_
Task1 (1) (2).xlsx',
sheet_name='av_engine_data_pgt_psql')

df_engine_pgt

            dataset        esn   unit   flight_cycle            datetime
operator  \
0      train_FD001   999056.0   56.0            1.0 2018-01-01 06:33:13
PGT
1      train_FD001   999056.0   56.0            2.0 2018-01-01 09:40:21
PGT
2      train_FD001   999056.0   56.0            3.0 2018-01-01 12:23:01
PGT
3      train_FD001   999056.0   56.0            4.0 2018-01-01 14:11:10
PGT
4      train_FD001   999056.0   56.0            5.0 2018-01-01 21:10:50
PGT
...          ...        ...    ...            ...                 ...
...
6295   train_FD001   999084.0   84.0          257.0 2018-06-06 08:22:54
PGT
6296   train_FD001   999084.0   84.0          258.0 2018-06-06 12:01:39
PGT
6297   train_FD001   999084.0   84.0          259.0 2018-06-06 14:01:52
PGT
```

```
6298  train_FD001  999084.0  84.0          260.0 2018-06-06 18:41:30
PGT
6299  train_FD001  999095.0  95.0          266.0 2018-02-08 01:30:23
PGT

     depart_icao destination_icao  hpc_eff_mod  hpc_flow_mod  ...
phi  \
0          LTBJ            LTCR       0.0012       -0.0004  ...
521.18
1          LTCR            LTBJ       0.0012       -0.0004  ...
520.82
2          LTBJ            LTFJ       0.0026        0.0005  ...
521.70
3          LTFJ            LTCG       0.0034       -0.0002  ...
522.06
4          LTCG            LTFJ       0.0024       -0.0001  ...
521.36
...         ...             ...          ...           ...  ...
...
6295       LFSB            LTFJ      -0.0027        0.0000  ...
519.66
6296       LTFJ            LTAJ       0.0026        0.0001  ...
520.00
6297       LTAJ            LTFJ      -0.0013        0.0000  ...
519.74
6298       OKBK            LTFJ      -0.0023        0.0001  ...
519.77
6299       LTFJ            EDDS       0.0019        0.0003  ...
519.27

         nrf      nrc     bpr  farb  htbleed  nf_dmd  pcnfr_dmd
w31  \
0     2388.13  8136.92  8.4412  0.03    395.0  2388.0      100.0
38.81
1     2388.08  8133.11  8.4461  0.03    394.0  2388.0      100.0
38.82
2     2388.12  8136.86  8.4357  0.03    394.0  2388.0      100.0
38.89
3     2388.18  8132.53  8.4411  0.03    394.0  2388.0      100.0
38.79
4     2388.16  8133.47  8.4824  0.03    394.0  2388.0      100.0
39.00
...       ...      ...     ...   ...      ...     ...        ...   ..
.
6295  2388.20  8148.87  8.5464  0.03    397.0  2388.0      100.0
38.49
6296  2388.18  8148.76  8.5113  0.03    396.0  2388.0      100.0
38.49
6297  2388.20  8146.22  8.5336  0.03    395.0  2388.0      100.0
38.36
```

```
6298   2388.23   8149.66   8.5367   0.03      396.0   2388.0        100.0
38.49
6299   2388.20   8183.58   8.5648   0.03      396.0   2388.0        100.0
38.37

           w32
0      23.2391
1      23.3340
2      23.2844
3      23.3204
4      23.3592
...        ...
6295   22.9996
6296   23.0383
6297   23.0022
6298   23.1018
6299   23.1041

[6300 rows x 32 columns]
```

```python
# provide list of dataframes
df_engine_concat =
pd.concat([df_engine_axm,df_engine_fron,df_engine_aic,df_engine_pgt])

df_engine_concat
```

```
           dataset        esn   unit   flight_cycle          datetime
operator  \
0      test_FD001   999126.0   26.0           1.0  2017-12-31 18:33:07
AXM
1      test_FD001   999126.0   26.0           2.0  2017-12-31 19:59:49
AXM
2      test_FD001   999126.0   26.0           3.0  2017-12-31 21:44:38
AXM
3      test_FD001   999126.0   26.0           4.0  2018-01-01 00:50:02
AXM
4      test_FD001   999126.0   26.0           5.0  2018-01-01 04:25:32
AXM
...           ...        ...    ...           ...                  ...
...
6295   train_FD001   999084.0   84.0         257.0  2018-06-06 08:22:54
PGT
6296   train_FD001   999084.0   84.0         258.0  2018-06-06 12:01:39
PGT
6297   train_FD001   999084.0   84.0         259.0  2018-06-06 14:01:52
PGT
6298   train_FD001   999084.0   84.0         260.0  2018-06-06 18:41:30
PGT
6299   train_FD001   999095.0   95.0         266.0  2018-02-08 01:30:23
PGT
```

```
     depart_icao destination_icao  hpc_eff_mod  hpc_flow_mod  ...
phi  \
0            VTBD             VTUV      -0.0027        0.0006  ...
522.55
1            VTUV             VTBD      -0.0029        0.0002  ...
521.85
2            VTBD             VMMC       0.0008        0.0001  ...
522.34
3            VMMC             VTBD      -0.0026        0.0005  ...
522.03
4            VTBD             VTSP       0.0020        0.0005  ...
522.04
...           ...              ...          ...           ...  ...
...
6295         LFSB             LTFJ      -0.0027        0.0000  ...
519.66
6296         LTFJ             LTAJ       0.0026        0.0001  ...
520.00
6297         LTAJ             LTFJ      -0.0013        0.0000  ...
519.74
6298         OKBK             LTFJ      -0.0023        0.0001  ...
519.77
6299         LTFJ             EDDS       0.0019        0.0003  ...
519.27

          nrf       nrc      bpr  farb  htbleed  nf_dmd  pcnfr_dmd
w31  \
0     2387.98   8147.17   8.3468  0.03    392.0  2388.0      100.0
38.82
1     2388.01   8146.58   8.4159  0.03    390.0  2388.0      100.0
39.00
2     2388.05   8144.60   8.4444  0.03    391.0  2388.0      100.0
39.20
3     2388.00   8147.98   8.3986  0.03    392.0  2388.0      100.0
38.97
4     2388.00   8142.07   8.4332  0.03    391.0  2388.0      100.0
39.11
...       ...       ...      ...   ...      ...     ...        ...  ..
.
6295  2388.20   8148.87   8.5464  0.03    397.0  2388.0      100.0
38.49
6296  2388.18   8148.76   8.5113  0.03    396.0  2388.0      100.0
38.49
6297  2388.20   8146.22   8.5336  0.03    395.0  2388.0      100.0
38.36
6298  2388.23   8149.66   8.5367  0.03    396.0  2388.0      100.0
38.49
6299  2388.20   8183.58   8.5648  0.03    396.0  2388.0      100.0
38.37
```

```
          w32
0      23.3876
1      23.3793
2      23.3390
3      23.3931
4      23.3904
...        ...
6295   22.9996
6296   23.0383
6297   23.0022
6298   23.1018
6299   23.1041

[40598 rows x 32 columns]
```

```python
df_manuf_psql = pd.read_excel('/Users/Yedou/Documents/GE_Dataset_
Task1 (1) (2).xlsx',
sheet_name='av_bom_manufacturing_psql')
df_manuf_psql
```

```
              esn        pn             sn   desc            vstream
0        999010.0  54321P01  8.221064e+08  shroud                cmc
1        999010.0  54321P01  6.644757e+08  shroud                cmc
2        999010.0  54321P01  2.430976e+09  shroud                cmc
3        999010.0  54321P01  1.277358e+09  shroud                cmc
4        999010.0  54321P01  8.668055e+09  shroud                cmc
...           ...       ...           ...    ...                ...
20195    999093.0  44321P02  1.003440e+09  blade  machined_airfoils
20196    999093.0  44321P02  3.829220e+09  blade  machined_airfoils
20197    999093.0  44321P02  4.571830e+09  blade  machined_airfoils
20198    999093.0  44321P02  8.136479e+09  blade  machined_airfoils
20199    999093.0  65421P11  4.508429e+09   disk      rotating_parts

[20200 rows x 5 columns]
```

```python
df_manuf_supply_chain =
pd.read_excel('/Users/Yedou/Documents/GE_Dataset_ Task1 (1) (2).xlsx',
sheet_name='av_manufacturing_supply_chain')
df_manuf_supply_chain
```

```
                 sn        pn    op part_desc   kc       msmts
max  \
0      7.837606e+09  54321P01  op116     shroud  1.0   31.983503
33.061659
1      5.039652e+09  54321P01  op116     shroud  1.0   34.456691
33.061659
2      7.837606e+09  54321P01  op220     shroud  2.0   27.895096
30.303501
```

```
3       5.039652e+09   54321P01   op220      shroud   2.0   32.920628
30.303501
4       9.856636e+09   44321P02   op420       blade   1.0   12.640872
16.346054
...              ...        ...     ...         ...   ...         ...
...
63995   6.299767e+09   54321P01   op116      shroud   1.0   20.554360
33.061659
63996   4.512062e+09   54321P01   op116      shroud   1.0   22.756896
33.061659
63997   6.299767e+09   54321P01   op220      shroud   2.0   29.583411
30.303501
63998   4.512062e+09   54321P01   op220      shroud   2.0   30.475523
30.303501
63999   4.567413e+09   44321P02   op016       blade   2.0   19.191280
27.987527

              min
0        21.160852
1        21.160852
2        17.044897
3        17.044897
4        10.600079
...            ...
63995    21.160852
63996    21.160852
63997    17.044897
63998    17.044897
63999    11.183152

[64000 rows x 8 columns]

df_manuf_supply_chain =
pd.read_excel('/Users/Yedou/Documents/GE_Dataset_ Task1 (1) (2).xlsx',
sheet_name='av_manufacturing_supply_chain')
df_manuf_supply_chain

                 sn        pn      op part_desc    kc      msmts
max   \
0       7.837606e+09   54321P01   op116      shroud   1.0   31.983503
33.061659
1       5.039652e+09   54321P01   op116      shroud   1.0   34.456691
33.061659
2       7.837606e+09   54321P01   op220      shroud   2.0   27.895096
30.303501
3       5.039652e+09   54321P01   op220      shroud   2.0   32.920628
30.303501
4       9.856636e+09   44321P02   op420       blade   1.0   12.640872
16.346054

...              ...        ...     ...         ...   ...         ...
```

```
...
63995  6.299767e+09  54321P01  op116      shroud  1.0  20.554360
33.061659
63996  4.512062e+09  54321P01  op116      shroud  1.0  22.756896
33.061659
63997  6.299767e+09  54321P01  op220      shroud  2.0  29.583411
30.303501
63998  4.512062e+09  54321P01  op220      shroud  2.0  30.475523
30.303501
63999  4.567413e+09  44321P02  op016       blade  2.0  19.191280
27.987527

             min
0       21.160852
1       21.160852
2       17.044897
3       17.044897
4       10.600079
...           ...
63995   21.160852
63996   21.160852
63997   17.044897
63998   17.044897
63999   11.183152

[64000 rows x 8 columns]


inner_join = pd.merge(df_manuf_supply_chain,
                      df_manuf_psql,
                      on ='sn',
                      how ='inner')
inner_join

                 sn       pn_x       op part_desc   kc       msmts
max  \
0      7.837606e+09  54321P01  op116      shroud  1.0  31.983503
33.061659
1      7.837606e+09  54321P01  op220      shroud  2.0  27.895096
30.303501
2      5.039652e+09  54321P01  op116      shroud  1.0  34.456691
33.061659
3      5.039652e+09  54321P01  op220      shroud  2.0  32.920628
30.303501
4      9.856636e+09  44321P02  op420       blade  1.0  12.640872
16.346054
...             ...       ...      ...       ...  ...        ...
...
63995  5.762950e+09  54321P01  op220      shroud  2.0  26.486150
```

```
       30.303501
63996  6.299767e+09  54321P01  op116    shroud  1.0  20.554360
       33.061659
63997  6.299767e+09  54321P01  op220    shroud  2.0  29.583411
       30.303501
63998  4.512062e+09  54321P01  op116    shroud  1.0  22.756896
       33.061659
63999  4.512062e+09  54321P01  op220    shroud  2.0  30.475523
       30.303501

             min       esn       pn_y   desc          vstream
0      21.160852  999001.0  54321P01  shroud               cmc
1      17.044897  999001.0  54321P01  shroud               cmc
2      21.160852  999001.0  54321P01  shroud               cmc
3      17.044897  999001.0  54321P01  shroud               cmc
4      10.600079  999001.0  44321P02   blade  machined_airfoils
...          ...       ...       ...     ...               ...
63995  17.044897  999199.0  54321P01  shroud               cmc
63996  21.160852  999200.0  54321P01  shroud               cmc
63997  17.044897  999200.0  54321P01  shroud               cmc
63998  21.160852  999200.0  54321P01  shroud               cmc
63999  17.044897  999200.0  54321P01  shroud               cmc

[64000 rows x 12 columns]
```

```python
inner_join.to_excel('/Users/Yedou/Documents/export_inner_join.xlsx',
index = False, header=True)
```

```python
# https://towardsdatascience.com/creating-a-simple-map-with-folium-
and-python-4c083abfff94
# https://campus.datacamp.com/courses/visualizing-geospatial-data-in-
python/geoseries-and-folium?ex=11
```

Data Visualization

Use data to create a run chart and KPI (key performance indicators) tables based off of
simulated Aviation data

Run Chart | Data storytelling through visualizations | Business Intelligence (BI)

```python
df_map = pd.read_excel('/Users/Yedou/Documents/GE_Dataset_ Task1 (1)
(2).xlsx',
sheet_name='av_lkp_airport_codes_t_psql')

df_map
```

```
    airport_icao  destination_latitude  destination_longitude
0           VISR                33.988                 74.775
```

```
1            VLVT                17.988                102.563
2            VTSG                 8.100                 98.985
3            KONT                34.056               -117.601
4            MMPR                20.680               -105.254
..           ...                   ...                   ...
314          LTCE                39.956                41.171
315          VLLB                19.906               102.169
316          VTSS                 6.933               100.395
317          WADD                -8.747               115.169
318          WBGB                 3.124               113.020

[319 rows x 3 columns]
```

```python
df_map.to_excel('/Users/Yedou/Documents/export_df_map.xlsx', index =
False, header=True)
```

Creating the map

For the map, the first step is to create a map of the location I want. Using the location
parameter, I pass in the mean of the latitude and longitude coordinates I have to centre the
map there.

```python
map = folium.Map(location=[df_map['destination_latitude'].mean(),
df_map['destination_longitude'].mean()], zoom_start=14,
control_scale=True)
```

```python
map
```

```
<folium.folium.Map at 0x1248a7df0>
```

Step 5 — Adding points to the map

Now I add the points for each airport locations to the map. Iterating through each row of
the dataframe, I pass the location latitude and longitudes to folium.Marker as a list and pass
the name to the popup parameter. And for each location I add to map:

```python
for index, location_info in df_map.iterrows():
    folium.Marker([location_info["destination_latitude"],
location_info["destination_longitude"]],
popup=location_info["airport_icao"]).add_to(map)
```

```python
map
```

```
<folium.folium.Map at 0x1248a7df0>
```