Initial data exploration

Load

```
import pandas

data = pandas.read_csv('../data/weatherAUS.csv')
```

Data shape and head

Notes:

- NaN are missing values.
- Response variable to predict: RainTomorrow (Yes, No)

```
print('Dimensions of data: {0}'.format(data.shape))
print('Head:')
data.head(n=10)
```

```
Dimensions of data: (145460, 23)
Head:

         Date Location  MinTemp  MaxTemp  Rainfall  Evaporation
Sunshine  \
0  2008-12-01   Albury     13.4     22.9       0.6          NaN
NaN
1  2008-12-02   Albury      7.4     25.1       0.0          NaN
NaN
2  2008-12-03   Albury     12.9     25.7       0.0          NaN
NaN
3  2008-12-04   Albury      9.2     28.0       0.0          NaN
NaN
4  2008-12-05   Albury     17.5     32.3       1.0          NaN
NaN
5  2008-12-06   Albury     14.6     29.7       0.2          NaN
NaN
6  2008-12-07   Albury     14.3     25.0       0.0          NaN
NaN
7  2008-12-08   Albury      7.7     26.7       0.0          NaN
NaN
8  2008-12-09   Albury      9.7     31.9       0.0          NaN
NaN
9  2008-12-10   Albury     13.1     30.1       1.4          NaN
NaN

  WindGustDir  WindGustSpeed WindDir9am      ...      Humidity9am  \
0           W           44.0          W      ...             71.0
1         WNW           44.0        NNW      ...             44.0
2         WSW           46.0          W      ...             38.0
```

```
3           NE           24.0           SE      ...            45.0
4            W           41.0          ENE      ...            82.0
5          WNW           56.0            W      ...            55.0
6            W           50.0           SW      ...            49.0
7            W           35.0          SSE      ...            48.0
8          NNW           80.0           SE      ...            42.0
9            W           28.0            S      ...            58.0

   Humidity3pm  Pressure9am  Pressure3pm  Cloud9am  Cloud3pm  Temp9am
\
0         22.0       1007.7       1007.1       8.0       NaN     16.9

1         25.0       1010.6       1007.8       NaN       NaN     17.2

2         30.0       1007.6       1008.7       NaN       2.0     21.0

3         16.0       1017.6       1012.8       NaN       NaN     18.1

4         33.0       1010.8       1006.0       7.0       8.0     17.8

5         23.0       1009.2       1005.4       NaN       NaN     20.6

6         19.0       1009.6       1008.2       1.0       NaN     18.1

7         19.0       1013.4       1010.1       NaN       NaN     16.3

8          9.0       1008.9       1003.6       NaN       NaN     18.3

9         27.0       1007.0       1005.7       NaN       NaN     20.1


   Temp3pm  RainToday  RainTomorrow
0     21.8         No            No
1     24.3         No            No
2     23.2         No            No
3     26.5         No            No
4     29.7         No            No
5     28.9         No            No
6     24.6         No            No
7     25.5         No            No
8     30.2         No           Yes
9     28.2        Yes            No

[10 rows x 23 columns]
```

Data summaries

Numerical variables:

```
print('Total number of rows: {0}'.format(data.shape[0]))
data.describe()
```

```
Total number of rows: 145460

             MinTemp        MaxTemp       Rainfall   Evaporation  \
count  143975.000000  144199.000000  142199.000000  82670.000000
mean       12.194034      23.221348       2.360918      5.468232
std         6.398495       7.119049       8.478060      4.193704
min        -8.500000      -4.800000       0.000000      0.000000
25%         7.600000      17.900000       0.000000      2.600000
50%        12.000000      22.600000       0.000000      4.800000
75%        16.900000      28.200000       0.800000      7.400000
max        33.900000      48.100000     371.000000    145.000000

            Sunshine  WindGustSpeed   WindSpeed9am   WindSpeed3pm  \
count  75625.000000  135197.000000  143693.000000  142398.000000
mean       7.611178      40.035230      14.043426      18.662657
std        3.785483      13.607062       8.915375       8.809800
min        0.000000       6.000000       0.000000       0.000000
25%        4.800000      31.000000       7.000000      13.000000
50%        8.400000      39.000000      13.000000      19.000000
75%       10.600000      48.000000      19.000000      24.000000
max       14.500000     135.000000     130.000000      87.000000

          Humidity9am    Humidity3pm   Pressure9am    Pressure3pm  \
count  142806.000000  140953.000000  130395.00000  130432.000000
mean       68.880831      51.539116    1017.64994    1015.255889
std        19.029164      20.795902       7.10653       7.037414
min         0.000000       0.000000     980.50000     977.100000
25%        57.000000      37.000000    1012.90000    1010.400000
50%        70.000000      52.000000    1017.60000    1015.200000
75%        83.000000      66.000000    1022.40000    1020.000000
max       100.000000     100.000000    1041.00000    1039.600000

            Cloud9am      Cloud3pm        Temp9am       Temp3pm
count  89572.000000  86102.000000  143693.000000  141851.00000
mean       4.447461      4.509930      16.990631      21.68339
std        2.887159      2.720357       6.488753       6.93665
min        0.000000      0.000000      -7.200000      -5.40000
25%        1.000000      2.000000      12.300000      16.60000
50%        5.000000      5.000000      16.700000      21.10000
75%        7.000000      7.000000      21.600000      26.40000
max        9.000000      9.000000      40.200000      46.70000
```

Categorical variables:

```
data.describe(include=['O'])
```

```
              Date  Location WindGustDir WindDir9am WindDir3pm
RainToday  \
```

```
count       145460    145460      135134     134894     141232
142199
unique        3436        49          16         16         16
2
top     2015-10-19  Canberra           W          N         SE
No
freq            49      3436        9915      11758      10838
110319

       RainTomorrow
count        142193
unique            2
top              No
freq         110316
```

Some plots

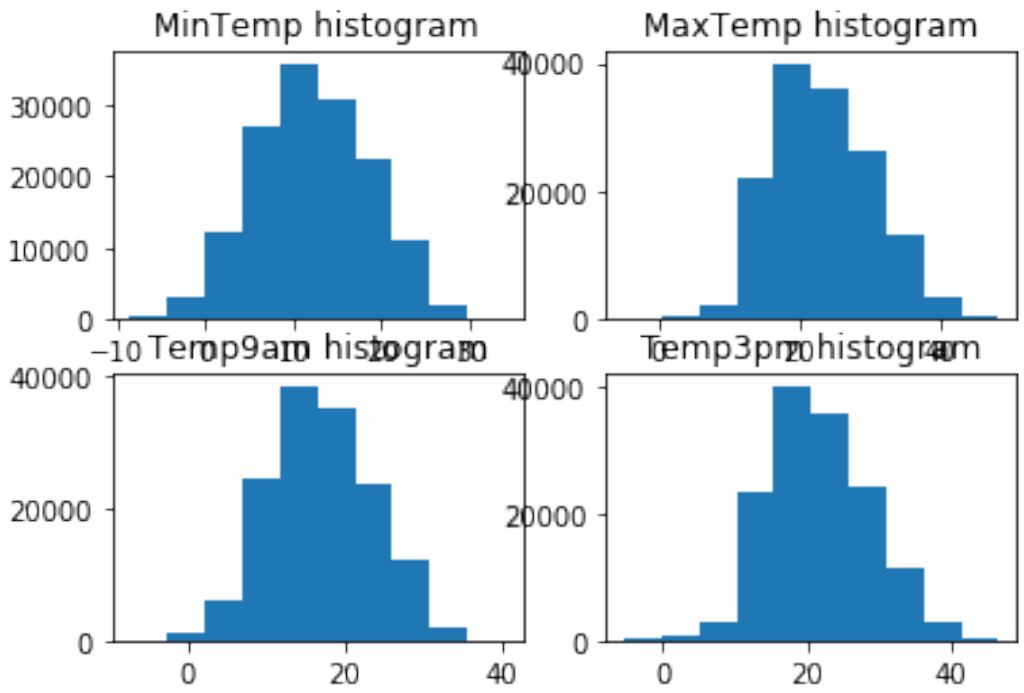
```
import matplotlib.pyplot as pyplot

%matplotlib inline
```

Temperature

```
fig, axs = pyplot.subplots(2,2)

axs[0,0].set_title('MinTemp histogram')
axs[0,0].hist(data['MinTemp'])

axs[0,1].set_title('MaxTemp histogram')
axs[0,1].hist(data['MaxTemp'])

axs[1,0].set_title('Temp9am histogram')
axs[1,0].hist(data['Temp9am'])

axs[1,1].set_title('Temp3pm histogram')
axs[1,1].hist(data['Temp3pm'])
```

```
/usr/lib/python3/dist-packages/numpy/lib/histograms.py:824:
RuntimeWarning: invalid value encountered in greater_equal
  keep = (tmp_a >= first_edge)
/usr/lib/python3/dist-packages/numpy/lib/histograms.py:825:
RuntimeWarning: invalid value encountered in less_equal
  keep &= (tmp_a <= last_edge)
```

```
(array([  172.,   634.,  3112., 23341., 40168., 35761., 24036.,
11314.,
         3030.,   283.]),
 array([-5.4 , -0.19,  5.02, 10.23, 15.44, 20.65, 25.86, 31.07, 36.28,
       41.49, 46.7 ]),
 <a list of 10 Patch objects>)
```

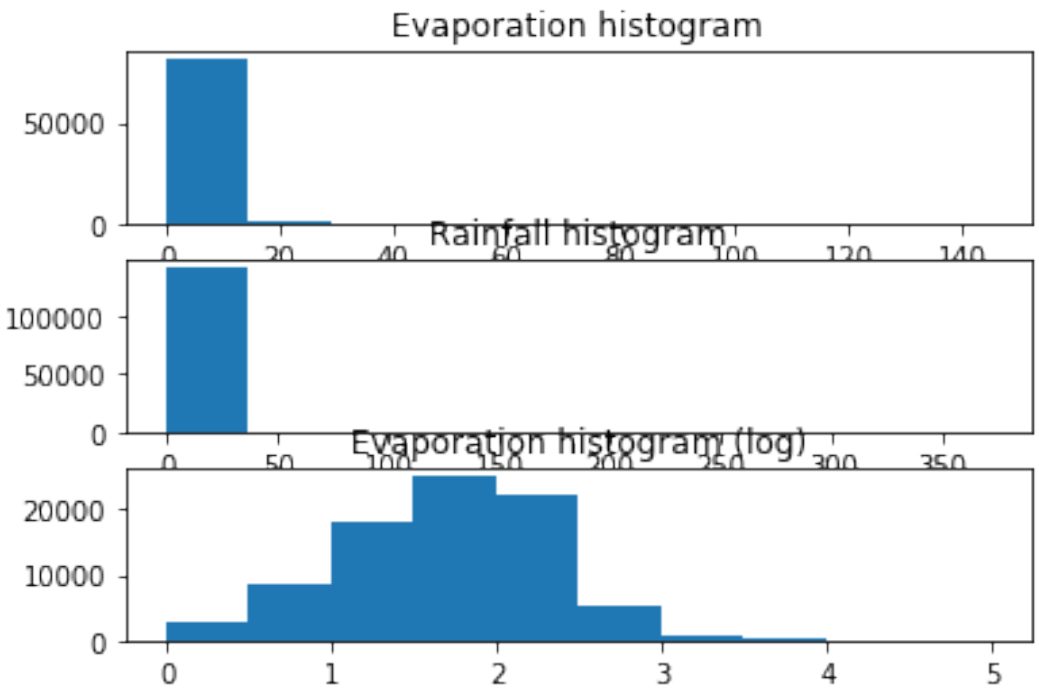


Rainfall, Evaporation

The data for these features are very skewed. Can apply a log transformation on Evaporation to make it less skewed. It may be more suitable to use RainToday in place of Rainfall.

```
import numpy as np

def log_transformation(data):
    return data.apply(np.log1p)

fig, axs = pyplot.subplots(3,1)

axs[0].set_title('Evaporation histogram')
axs[0].hist(data['Evaporation'])

axs[1].set_title('Rainfall histogram')
axs[1].hist(data['Rainfall'])

axs[2].set_title('Evaporation histogram (log)')
axs[2].hist(log_transformation(data['Evaporation']))
```

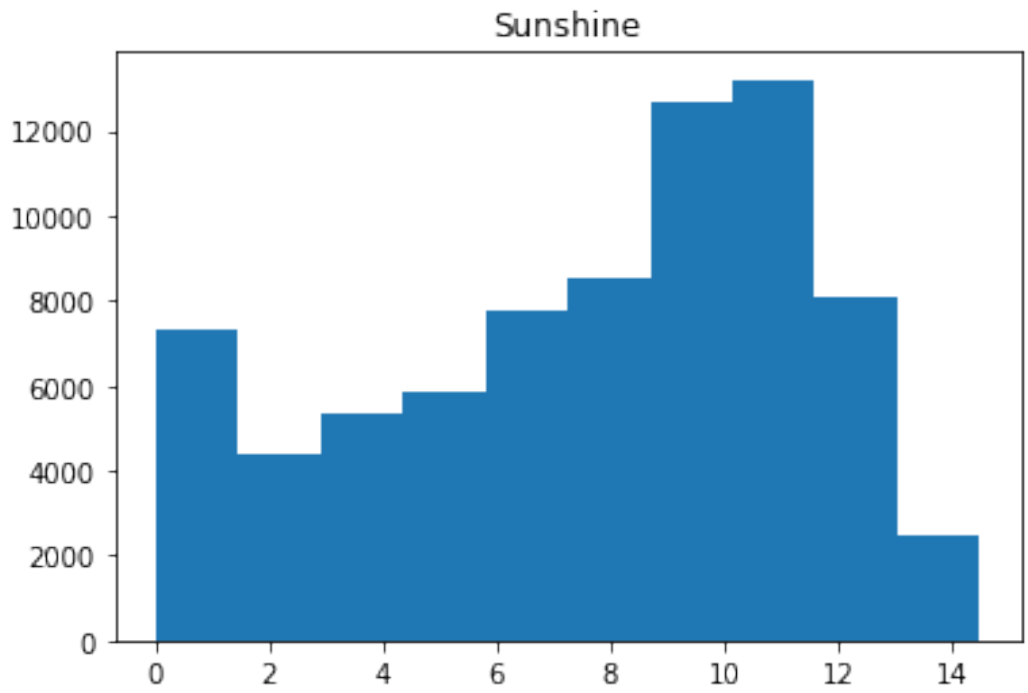
```
(array([2.6450e+03, 8.4680e+03, 1.8182e+04, 2.5154e+04, 2.2130e+04,
        5.3470e+03, 5.5600e+02, 1.4200e+02, 4.5000e+01, 1.0000e+00]),
 array([0.        , 0.49836066, 0.99672132, 1.49508199, 1.99344265,
        2.49180331, 2.99016397, 3.48852464, 3.9868853 , 4.48524596,
        4.98360662]),
 <a list of 10 Patch objects>)
```



Sunshine

```
fig, axs = pyplot.subplots(1,1)

axs.set_title('Sunshine')
axs.hist(data['Sunshine'])
```

```
(array([ 7297.,  4373.,  5314.,  5879.,  7737.,  8548., 12685.,
13206.,
         8093.,  2493.]),
 array([ 0.  ,  1.45,  2.9 ,  4.35,  5.8 ,  7.25,  8.7 , 10.15, 11.6 ,
       13.05, 14.5 ]),
 <a list of 10 Patch objects>)
```

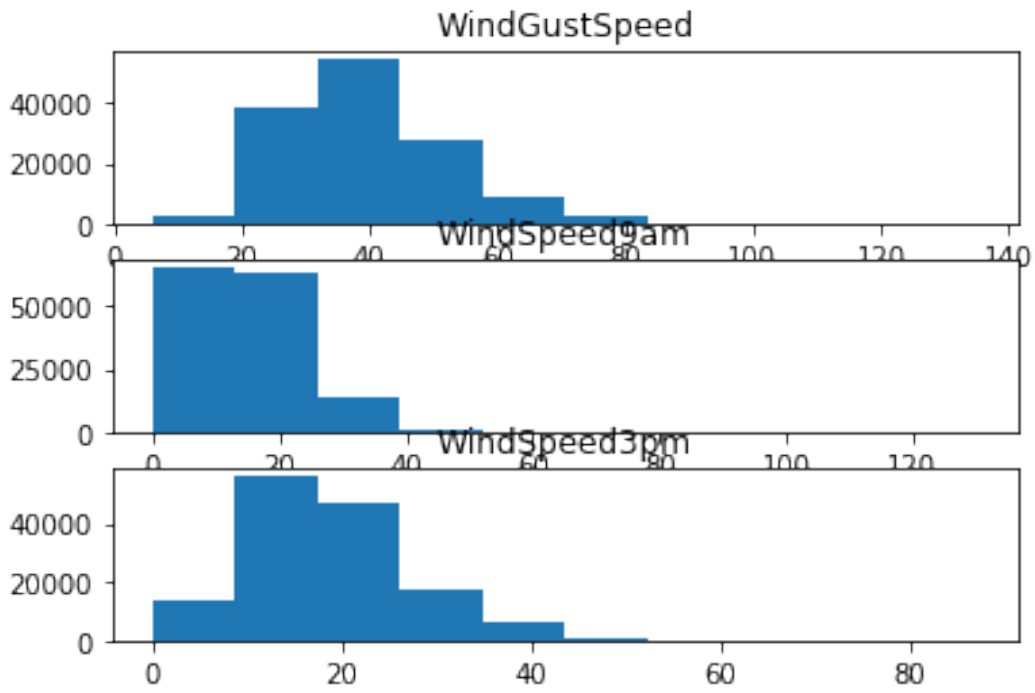


Wind

```
# WindGustSpeed  WindSpeed9am     WindSpeed3pm
```

```
fig, axs = pyplot.subplots(3,1)

axs[0].set_title('WindGustSpeed')
axs[0].hist(data['WindGustSpeed'])

axs[1].set_title('WindSpeed9am')
axs[1].hist(data['WindSpeed9am'])

axs[2].set_title('WindSpeed3pm')
axs[2].hist(data['WindSpeed3pm'])
```

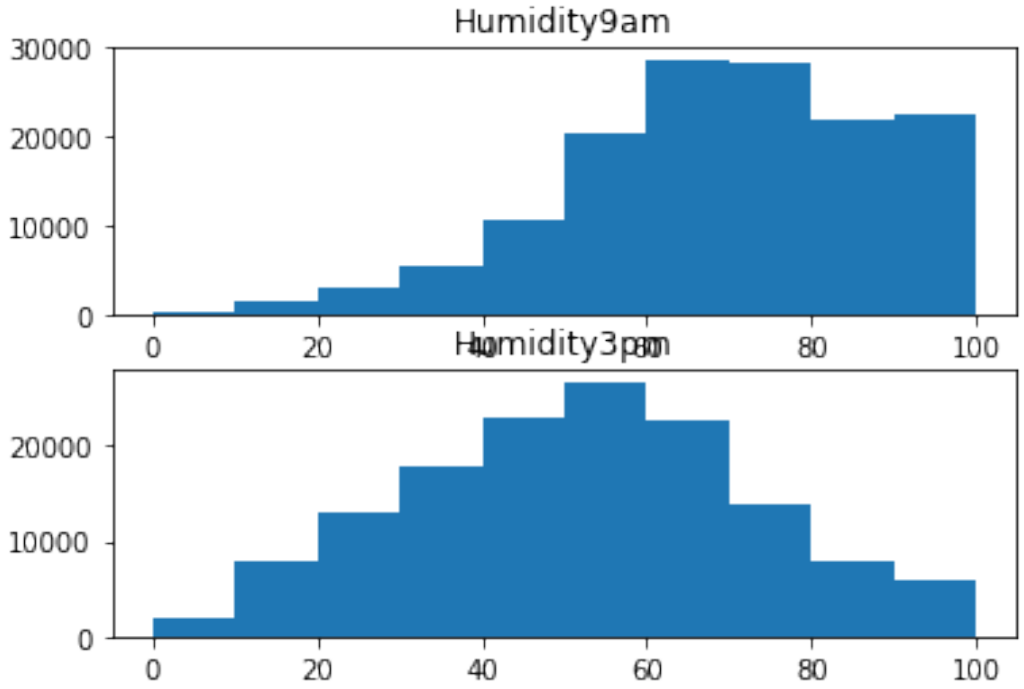
```
(array([1.4103e+04, 5.6370e+04, 4.7134e+04, 1.7637e+04, 5.8450e+03,
        1.0870e+03, 1.6000e+02, 5.3000e+01, 6.0000e+00, 3.0000e+00]),
 array([ 0. ,  8.7, 17.4, 26.1, 34.8, 43.5, 52.2, 60.9, 69.6, 78.3,
87. ]),
 <a list of 10 Patch objects>)
```



Humidity

```
# Humidity9am    Humidity3pm

fig, axs = pyplot.subplots(2,1)

axs[0].set_title('Humidity9am')
axs[0].hist(data['Humidity9am'])

axs[1].set_title('Humidity3pm')
axs[1].hist(data['Humidity3pm'])
```

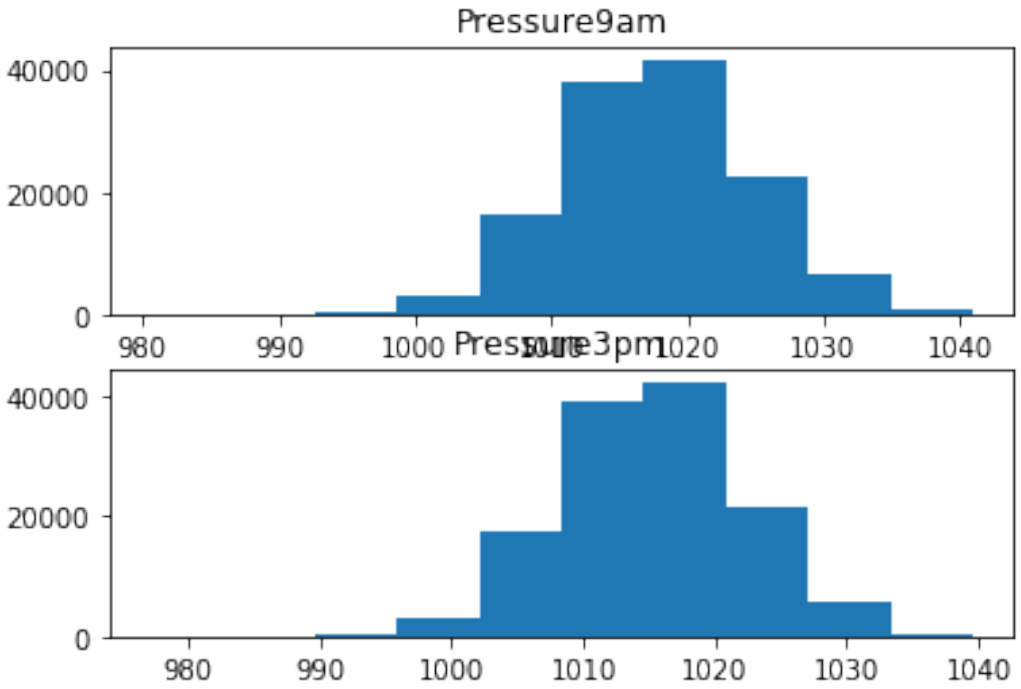
```
(array([ 1846.,  8040., 13030., 17975., 23028., 26748., 22752.,
13931.,
         7800.,  5803.]),
 array([  0.,  10.,  20.,  30.,  40.,  50.,  60.,  70.,  80.,  90.,
100.]),
 <a list of 10 Patch objects>)
```



Pressure

```
# Pressure9am    Pressure3pm

fig, axs = pyplot.subplots(2,1)

axs[0].set_title('Pressure9am')
axs[0].hist(data['Pressure9am'])

axs[1].set_title('Pressure3pm')
axs[1].hist(data['Pressure3pm'])
```

```
(array([1.3000e+01, 8.4000e+01, 5.1200e+02, 2.9200e+03, 1.7509e+04,
        3.9194e+04, 4.2330e+04, 2.1521e+04, 5.7970e+03, 5.5200e+02]),
 array([ 977.1 ,  983.35,  989.6 ,  995.85, 1002.1 , 1008.35, 1014.6 ,
        1020.85, 1027.1 , 1033.35, 1039.6 ]),
 <a list of 10 Patch objects>)
```

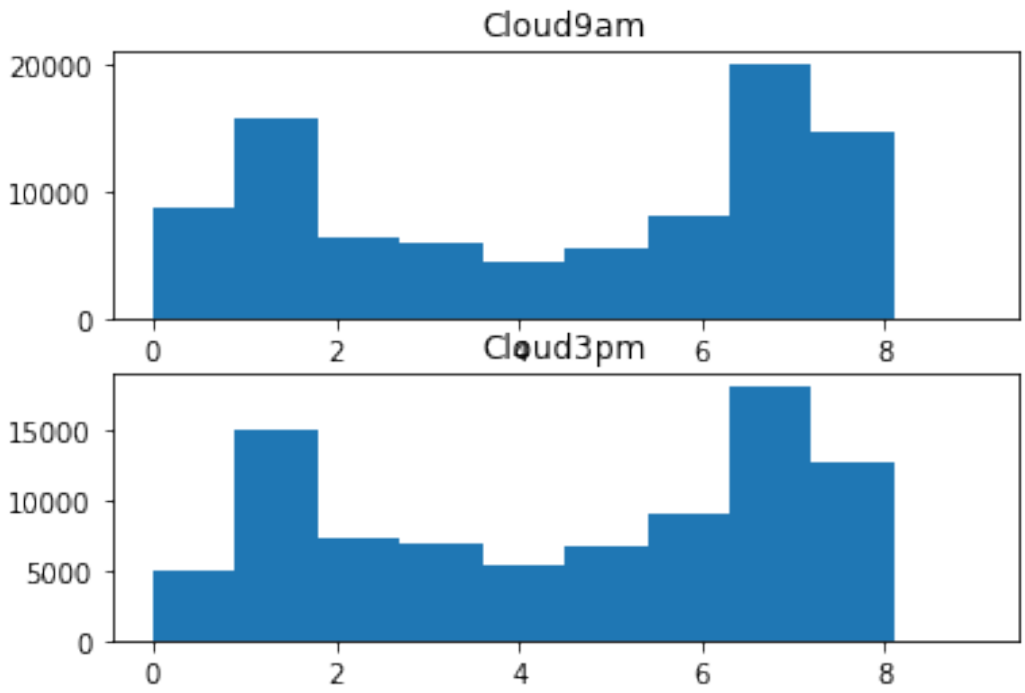


Clouds

Cloud9am and Cloud3pm appear to be bimodal.

```
# Cloud9am Cloud3pm

fig, axs = pyplot.subplots(2,1)

axs[0].set_title('Cloud9am')
axs[0].hist(data['Cloud9am'])

axs[1].set_title('Cloud3pm')
axs[1].hist(data['Cloud3pm'])
```

```
(array([4.9740e+03, 1.4976e+04, 7.2260e+03, 6.9210e+03, 5.3220e+03,
        6.8150e+03, 8.9780e+03, 1.8229e+04, 1.2660e+04, 1.0000e+00]),
 array([0. , 0.9, 1.8, 2.7, 3.6, 4.5, 5.4, 6.3, 7.2, 8.1, 9. ]),
 <a list of 10 Patch objects>)
```



Statistical analysis

Done in R Markdown file.