In [14]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings('ignore')
```

In [2]:
```
df=pd.read_csv('https://raw.githubusercontent.com/dsrscientist/dataset3/main/weatherAUS.csv')
```

In [3]:
```
df.head()
```

Out[3]:

| | Date | Location | MinTemp | MaxTemp | Rainfall | Evaporation | Sunshine | WindGustDir | WindGustSpeed | WindDir9am | ... | Humidity9am | Humidity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 2008-12-01 | Albury | 13.4 | 22.9 | 0.6 | NaN | NaN | W | 44.0 | W | ... | 71.0 | |
| 1 | 2008-12-02 | Albury | 7.4 | 25.1 | 0.0 | NaN | NaN | WNW | 44.0 | NNW | ... | 44.0 | |
| 2 | 2008-12-03 | Albury | 12.9 | 25.7 | 0.0 | NaN | NaN | WSW | 46.0 | W | ... | 38.0 | |
| 3 | 2008-12-04 | Albury | 9.2 | 28.0 | 0.0 | NaN | NaN | NE | 24.0 | SE | ... | 45.0 | |
| 4 | 2008-12-05 | Albury | 17.5 | 32.3 | 1.0 | NaN | NaN | W | 41.0 | ENE | ... | 82.0 | |

5 rows × 23 columns

In [4]:
```
df.shape
```

Out[4]:
```
(8425, 23)
```

In [5]:
```
df.dtypes
```

Out[5]:
```
Date             object
Location         object
MinTemp         float64
MaxTemp         float64
Rainfall        float64
Evaporation     float64
Sunshine        float64
WindGustDir      object
WindGustSpeed   float64
WindDir9am       object
WindDir3pm       object
WindSpeed9am    float64
WindSpeed3pm    float64
Humidity9am     float64
Humidity3pm     float64
Pressure9am     float64
Pressure3pm     float64
Cloud9am        float64
Cloud3pm        float64
Temp9am         float64
Temp3pm         float64
RainToday        object
RainTomorrow     object
dtype: object
```

In [6]:
```
df.isnull().sum()
```

Out[6]:
```
Date               0
Location           0
MinTemp           75
MaxTemp           60
Rainfall         240
Evaporation     3512
Sunshine        3994
WindGustDir      991
WindGustSpeed    991
WindDir9am       829
```

```
WindDir3pm        308
WindSpeed9am       76
WindSpeed3pm      107
Humidity9am        59
Humidity3pm       102
Pressure9am      1309
Pressure3pm      1312
Cloud9am         2421
Cloud3pm         2455
Temp9am            56
Temp3pm            96
RainToday         240
RainTomorrow      239
dtype: int64
```

In [7]:

```
## looks like there are lot of null values
```

In [8]:

```
# Checking number of unique values in each columns
count = 1
for x in df:
    print(f'{count}. {x}: {df[x].nunique()}')
    print(f'{df[x].value_counts()}', end = '\n----------\n\n' )
    count += 1
```

```
1. Date: 3004
2011-02-04    5
2011-02-14    5
2011-03-29    5
2011-05-25    5
2011-03-05    5
             ..
2013-05-07    1
2013-01-24    1
2013-04-12    1
2013-04-19    1
2013-01-05    1
Name: Date, Length: 3004, dtype: int64
----------

2. Location: 12
Melbourne       1622
Williamtown     1230
PerthAirport    1204
Albury           907
Newcastle        822
CoffsHarbour     611
Brisbane         579
Penrith          482
Wollongong       474
Darwin           250
Adelaide         205
Uluru             39
Name: Location, dtype: int64
----------

3. MinTemp: 285
 12.0    74
 13.2    71
 13.8    69
 12.7    68
 14.8    67
         ..
-1.5      1
 25.9     1
-0.8      1
-1.4      1
-1.1      1
Name: MinTemp, Length: 285, dtype: int64
----------

4. MaxTemp: 331
19.0    87
23.8    75
19.8    74
25.0    71
22.3    68
        ..
44.9     1
10.0     1
43.1     1
```

```
40.6     1
10.7     1
Name: MaxTemp, Length: 331, dtype: int64
----------

5. Rainfall: 250
0.0      5299
0.2       406
0.4       177
0.6       116
1.2        86
         ...
41.2        1
240.0       1
67.0        1
128.0       1
6.3         1
Name: Rainfall, Length: 250, dtype: int64
----------

6. Evaporation: 116
4.0     180
3.0     163
2.4     147
2.2     146
2.6     143
       ...
17.6      1
22.4      1
18.6      1
14.0      1
15.6      1
Name: Evaporation, Length: 116, dtype: int64
----------

7. Sunshine: 140
0.0     166
11.1     68
11.2     67
11.0     66
10.7     64
       ...
2.5       8
13.6      7
13.8      4
13.9      3
13.5      2
Name: Sunshine, Length: 140, dtype: int64
----------

8. WindGustDir: 16
N      713
SSE    578
S      577
SW     572
E      557
WNW    531
W      507
WSW    504
SE     484
ENE    415
SSW    396
NW     383
NE     353
NNE    343
ESE    302
NNW    219
Name: WindGustDir, dtype: int64
----------

9. WindGustSpeed: 52
39.0     441
35.0     435
37.0     422
33.0     408
31.0     396
41.0     371
30.0     367
28.0     332
43.0     302
48.0     292
26.0     275
50.0     259
```

```
46.0     258
24.0     255
52.0     249
44.0     241
22.0     223
54.0     210
20.0     186
56.0     153
57.0     148
19.0     137
61.0     114
59.0     113
63.0      95
17.0      92
65.0      74
67.0      64
72.0      62
15.0      58
13.0      57
74.0      54
70.0      53
69.0      49
76.0      44
78.0      23
80.0      22
11.0      18
85.0      14
81.0      13
91.0      12
89.0       7
93.0       7
9.0        6
83.0       6
98.0       4
87.0       3
94.0       3
7.0        2
102.0      2
100.0      2
107.0      1
Name: WindGustSpeed, dtype: int64
----------

10. WindDir9am: 16
N      906
SW     704
NW     625
WSW    543
SE     505
WNW    480
SSW    467
ENE    433
NNE    430
W      414
NE     409
S      402
E      380
SSE    365
NNW    280
ESE    253
Name: WindDir9am, dtype: int64
----------

11. WindDir3pm: 16
SE     813
S      742
SSE    623
WSW    580
NE     544
N      524
SW     494
WNW    487
NW     468
ESE    462
W      462
E      460
ENE    417
SSW    370
NNE    365
NNW    306
Name: WindDir3pm, dtype: int64
----------
```

```
12. WindSpeed9am: 34
9.0     803
0.0     752
13.0    708
4.0     610
11.0    607
7.0     572
6.0     515
17.0    481
15.0    467
19.0    430
20.0    427
24.0    312
22.0    279
2.0     258
28.0    229
26.0    208
31.0    153
30.0    114
35.0     77
33.0     70
37.0     58
41.0     49
39.0     35
44.0     29
43.0     28
46.0     26
52.0     16
50.0     10
56.0      8
54.0      6
48.0      6
61.0      2
57.0      2
63.0      2
Name: WindSpeed9am, dtype: int64
----------

13. WindSpeed3pm: 35
9.0     724
19.0    639
13.0    599
20.0    594
17.0    555
11.0    534
15.0    524
24.0    511
28.0    458
22.0    457
26.0    378
7.0     331
4.0     287
30.0    279
31.0    266
6.0     240
0.0     199
33.0    170
35.0    137
37.0    125
39.0     80
2.0      58
41.0     45
43.0     34
46.0     29
44.0     18
50.0     12
48.0     11
52.0      9
56.0      7
54.0      2
61.0      2
57.0      2
83.0      1
65.0      1
Name: WindSpeed3pm, dtype: int64
----------

14. Humidity9am: 90
73.0    205
62.0    202
68.0    199
74.0    195
70.0    188
```

```
       ...
11.0      2
16.0      2
14.0      2
10.0      1
15.0      1
Name: Humidity9am, Length: 90, dtype: int64
----------

15. Humidity3pm: 94
55.0    195
51.0    194
48.0    194
46.0    193
54.0    193
       ...
8.0      11
7.0       9
98.0      7
6.0       3
99.0      3
Name: Humidity3pm, Length: 94, dtype: int64
----------

16. Pressure9am: 384
1014.8    58
1019.2    55
1016.1    54
1019.6    53
1017.1    49
          ..
1033.6     1
1036.3     1
1033.2     1
998.5      1
1037.3     1
Name: Pressure9am, Length: 384, dtype: int64
----------

17. Pressure3pm: 374
1017.8    60
1018.0    57
1019.8    53
1017.9    53
1015.5    52
          ..
1035.2     1
1027.9     1
1034.2     1
1032.2     1
996.2      1
Name: Pressure3pm, Length: 374, dtype: int64
----------

18. Cloud9am: 9
7.0    1418
1.0    1038
8.0    1015
0.0     554
6.0     551
5.0     414
3.0     384
2.0     357
4.0     273
Name: Cloud9am, dtype: int64
----------

19. Cloud3pm: 9
7.0    1294
1.0    1077
8.0     863
6.0     597
5.0     522
2.0     508
3.0     411
4.0     351
0.0     347
Name: Cloud3pm, dtype: int64
----------

20. Temp9am: 304
14.8    77
18.0    73
```

```
18.3    71
17.5    69
20.6    68
        ..
5.2      1
34.5     1
36.8     1
30.2     1
3.5      1
Name: Temp9am, Length: 304, dtype: int64
----------

21. Temp3pm: 328
19.2    78
22.5    77
19.0    75
21.7    72
18.5    72
        ..
9.6      1
39.5     1
43.4     1
40.5     1
42.4     1
Name: Temp3pm, Length: 328, dtype: int64
----------

22. RainToday: 2
No     6195
Yes    1990
Name: RainToday, dtype: int64
----------

23. RainTomorrow: 2
No     6195
Yes    1991
Name: RainTomorrow, dtype: int64
----------
```

In [9]:
```
df.describe()
```

Out[9]:

| | MinTemp | MaxTemp | Rainfall | Evaporation | Sunshine | WindGustSpeed | WindSpeed9am | WindSpeed3pm | Humidity9am | Humid |
|---|---|---|---|---|---|---|---|---|---|---|
| **count** | 8350.000000 | 8365.000000 | 8185.000000 | 4913.000000 | 4431.000000 | 7434.000000 | 8349.000000 | 8318.000000 | 8366.000000 | 8323. |
| **mean** | 13.193305 | 23.859976 | 2.805913 | 5.389395 | 7.632205 | 40.174469 | 13.847646 | 18.533662 | 67.822496 | 51. |
| **std** | 5.403596 | 6.136408 | 10.459379 | 5.044484 | 3.896235 | 14.665721 | 10.174579 | 9.766986 | 16.833283 | 18. |
| **min** | -2.000000 | 8.200000 | 0.000000 | 0.000000 | 0.000000 | 7.000000 | 0.000000 | 0.000000 | 10.000000 | 6. |
| **25%** | 9.200000 | 19.300000 | 0.000000 | 2.600000 | 4.750000 | 30.000000 | 6.000000 | 11.000000 | 56.000000 | 39. |
| **50%** | 13.300000 | 23.300000 | 0.000000 | 4.600000 | 8.700000 | 39.000000 | 13.000000 | 19.000000 | 68.000000 | 51. |
| **75%** | 17.400000 | 28.000000 | 1.000000 | 7.000000 | 10.700000 | 50.000000 | 20.000000 | 24.000000 | 80.000000 | 63. |
| **max** | 28.500000 | 45.500000 | 371.000000 | 145.000000 | 13.900000 | 107.000000 | 63.000000 | 83.000000 | 100.000000 | 99. |

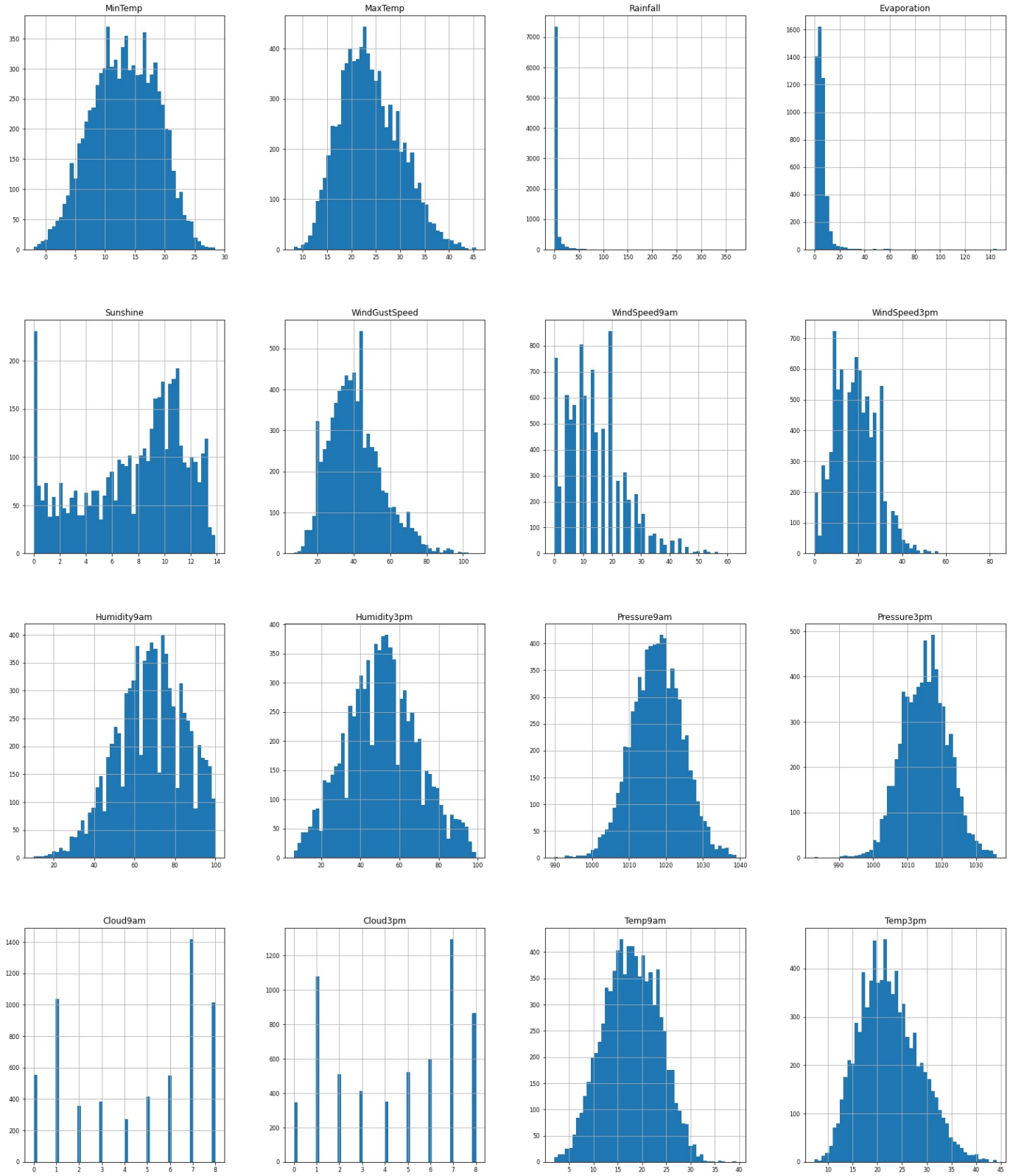
In [10]:
```
cont_data = df.select_dtypes(exclude = ['object'] )
cont_data
```

Out[10]:

| | MinTemp | MaxTemp | Rainfall | Evaporation | Sunshine | WindGustSpeed | WindSpeed9am | WindSpeed3pm | Humidity9am | Humidity3pm | Press |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 13.4 | 22.9 | 0.6 | NaN | NaN | 44.0 | 20.0 | 24.0 | 71.0 | 22.0 | |
| **1** | 7.4 | 25.1 | 0.0 | NaN | NaN | 44.0 | 4.0 | 22.0 | 44.0 | 25.0 | |
| **2** | 12.9 | 25.7 | 0.0 | NaN | NaN | 46.0 | 19.0 | 26.0 | 38.0 | 30.0 | |
| **3** | 9.2 | 28.0 | 0.0 | NaN | NaN | 24.0 | 11.0 | 9.0 | 45.0 | 16.0 | |
| **4** | 17.5 | 32.3 | 1.0 | NaN | NaN | 41.0 | 7.0 | 20.0 | 82.0 | 33.0 | |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| **8420** | 2.8 | 23.4 | 0.0 | NaN | NaN | 31.0 | 13.0 | 11.0 | 51.0 | 24.0 | |
| **8421** | 3.6 | 25.3 | 0.0 | NaN | NaN | 22.0 | 13.0 | 9.0 | 56.0 | 21.0 | |
| **8422** | 5.4 | 26.9 | 0.0 | NaN | NaN | 37.0 | 9.0 | 9.0 | 53.0 | 24.0 | |
| **8423** | 7.8 | 27.0 | 0.0 | NaN | NaN | 28.0 | 13.0 | 7.0 | 51.0 | 24.0 | |
| **8424** | 14.9 | NaN | 0.0 | NaN | NaN | NaN | 17.0 | 17.0 | 62.0 | 36.0 | |

8425 rows × 16 columns

In [11]:
```
cont_data.hist(figsize = (25, 30), bins = 50, xlabelsize = 8, ylabelsize = 8)
plt.show()
```




In [12]:
```
cont_data.isnull().sum()
```

Out[12]:
```
MinTemp           75
MaxTemp           60
Rainfall         240
Evaporation     3512
Sunshine        3994
WindGustSpeed    991
WindSpeed9am      76
WindSpeed3pm     107
```

```
Humidity9am        59
Humidity3pm       102
Pressure9am      1309
Pressure3pm      1312
Cloud9am         2421
Cloud3pm         2455
Temp9am            56
Temp3pm            96
dtype: int64
```

In [ ]:
```
## filling the null values using mean
```

In [15]:
```
cont_data['MinTemp'].fillna(cont_data['MinTemp'].mean(),inplace=True)
cont_data
```

Out[15]:

| | MinTemp | MaxTemp | Rainfall | Evaporation | Sunshine | WindGustSpeed | WindSpeed9am | WindSpeed3pm | Humidity9am | Humidity3pm | Press |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 13.4 | 22.9 | 0.6 | NaN | NaN | 44.0 | 20.0 | 24.0 | 71.0 | 22.0 | |
| **1** | 7.4 | 25.1 | 0.0 | NaN | NaN | 44.0 | 4.0 | 22.0 | 44.0 | 25.0 | |
| **2** | 12.9 | 25.7 | 0.0 | NaN | NaN | 46.0 | 19.0 | 26.0 | 38.0 | 30.0 | |
| **3** | 9.2 | 28.0 | 0.0 | NaN | NaN | 24.0 | 11.0 | 9.0 | 45.0 | 16.0 | |
| **4** | 17.5 | 32.3 | 1.0 | NaN | NaN | 41.0 | 7.0 | 20.0 | 82.0 | 33.0 | |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| **8420** | 2.8 | 23.4 | 0.0 | NaN | NaN | 31.0 | 13.0 | 11.0 | 51.0 | 24.0 | |
| **8421** | 3.6 | 25.3 | 0.0 | NaN | NaN | 22.0 | 13.0 | 9.0 | 56.0 | 21.0 | |
| **8422** | 5.4 | 26.9 | 0.0 | NaN | NaN | 37.0 | 9.0 | 9.0 | 53.0 | 24.0 | |
| **8423** | 7.8 | 27.0 | 0.0 | NaN | NaN | 28.0 | 13.0 | 7.0 | 51.0 | 24.0 | |
| **8424** | 14.9 | NaN | 0.0 | NaN | NaN | NaN | 17.0 | 17.0 | 62.0 | 36.0 | |

8425 rows × 16 columns

In [16]:
```
cont_data['MaxTemp'].fillna(cont_data['MaxTemp'].mean(),inplace=True)
cont_data
```

Out[16]:

| | MinTemp | MaxTemp | Rainfall | Evaporation | Sunshine | WindGustSpeed | WindSpeed9am | WindSpeed3pm | Humidity9am | Humidity3pm | Press |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 13.4 | 22.900000 | 0.6 | NaN | NaN | 44.0 | 20.0 | 24.0 | 71.0 | 22.0 | |
| **1** | 7.4 | 25.100000 | 0.0 | NaN | NaN | 44.0 | 4.0 | 22.0 | 44.0 | 25.0 | |
| **2** | 12.9 | 25.700000 | 0.0 | NaN | NaN | 46.0 | 19.0 | 26.0 | 38.0 | 30.0 | |
| **3** | 9.2 | 28.000000 | 0.0 | NaN | NaN | 24.0 | 11.0 | 9.0 | 45.0 | 16.0 | |
| **4** | 17.5 | 32.300000 | 1.0 | NaN | NaN | 41.0 | 7.0 | 20.0 | 82.0 | 33.0 | |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| **8420** | 2.8 | 23.400000 | 0.0 | NaN | NaN | 31.0 | 13.0 | 11.0 | 51.0 | 24.0 | |
| **8421** | 3.6 | 25.300000 | 0.0 | NaN | NaN | 22.0 | 13.0 | 9.0 | 56.0 | 21.0 | |
| **8422** | 5.4 | 26.900000 | 0.0 | NaN | NaN | 37.0 | 9.0 | 9.0 | 53.0 | 24.0 | |
| **8423** | 7.8 | 27.000000 | 0.0 | NaN | NaN | 28.0 | 13.0 | 7.0 | 51.0 | 24.0 | |
| **8424** | 14.9 | 23.859976 | 0.0 | NaN | NaN | NaN | 17.0 | 17.0 | 62.0 | 36.0 | |

8425 rows × 16 columns

In [17]:
```
cont_data['Rainfall'].fillna(cont_data['Rainfall'].mean(),inplace=True)
cont_data
```

Out[17]:

| | MinTemp | MaxTemp | Rainfall | Evaporation | Sunshine | WindGustSpeed | WindSpeed9am | WindSpeed3pm | Humidity9am | Humidity3pm | Press |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 13.4 | 22.900000 | 0.6 | NaN | NaN | 44.0 | 20.0 | 24.0 | 71.0 | 22.0 | |
| **1** | 7.4 | 25.100000 | 0.0 | NaN | NaN | 44.0 | 4.0 | 22.0 | 44.0 | 25.0 | |
| **2** | 12.9 | 25.700000 | 0.0 | NaN | NaN | 46.0 | 19.0 | 26.0 | 38.0 | 30.0 | |
| **3** | 9.2 | 28.000000 | 0.0 | NaN | NaN | 24.0 | 11.0 | 9.0 | 45.0 | 16.0 | |
| **4** | 17.5 | 32.300000 | 1.0 | NaN | NaN | 41.0 | 7.0 | 20.0 | 82.0 | 33.0 | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| **8420** | 2.8 | 23.400000 | 0.0 | NaN | NaN | 31.0 | 13.0 | 11.0 | 51.0 | 24.0 |
| **8421** | 3.6 | 25.300000 | 0.0 | NaN | NaN | 22.0 | 13.0 | 9.0 | 56.0 | 21.0 |
| **8422** | 5.4 | 26.900000 | 0.0 | NaN | NaN | 37.0 | 9.0 | 9.0 | 53.0 | 24.0 |
| **8423** | 7.8 | 27.000000 | 0.0 | NaN | NaN | 28.0 | 13.0 | 7.0 | 51.0 | 24.0 |
| **8424** | 14.9 | 23.859976 | 0.0 | NaN | NaN | NaN | 17.0 | 17.0 | 62.0 | 36.0 |

8425 rows × 16 columns

In [18]:
```
cont_data['Evaporation'].fillna(cont_data['Evaporation'].mean(),inplace=True)
cont_data
```

Out[18]:

| | MinTemp | MaxTemp | Rainfall | Evaporation | Sunshine | WindGustSpeed | WindSpeed9am | WindSpeed3pm | Humidity9am | Humidity3pm | Press |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 13.4 | 22.900000 | 0.6 | 5.389395 | NaN | 44.0 | 20.0 | 24.0 | 71.0 | 22.0 | |
| **1** | 7.4 | 25.100000 | 0.0 | 5.389395 | NaN | 44.0 | 4.0 | 22.0 | 44.0 | 25.0 | |
| **2** | 12.9 | 25.700000 | 0.0 | 5.389395 | NaN | 46.0 | 19.0 | 26.0 | 38.0 | 30.0 | |
| **3** | 9.2 | 28.000000 | 0.0 | 5.389395 | NaN | 24.0 | 11.0 | 9.0 | 45.0 | 16.0 | |
| **4** | 17.5 | 32.300000 | 1.0 | 5.389395 | NaN | 41.0 | 7.0 | 20.0 | 82.0 | 33.0 | |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| **8420** | 2.8 | 23.400000 | 0.0 | 5.389395 | NaN | 31.0 | 13.0 | 11.0 | 51.0 | 24.0 | |
| **8421** | 3.6 | 25.300000 | 0.0 | 5.389395 | NaN | 22.0 | 13.0 | 9.0 | 56.0 | 21.0 | |
| **8422** | 5.4 | 26.900000 | 0.0 | 5.389395 | NaN | 37.0 | 9.0 | 9.0 | 53.0 | 24.0 | |
| **8423** | 7.8 | 27.000000 | 0.0 | 5.389395 | NaN | 28.0 | 13.0 | 7.0 | 51.0 | 24.0 | |
| **8424** | 14.9 | 23.859976 | 0.0 | 5.389395 | NaN | NaN | 17.0 | 17.0 | 62.0 | 36.0 | |

8425 rows × 16 columns

In [19]:
```
cont_data['Sunshine'].fillna(cont_data['Sunshine'].mean(),inplace=True)
cont_data
```

Out[19]:

| | MinTemp | MaxTemp | Rainfall | Evaporation | Sunshine | WindGustSpeed | WindSpeed9am | WindSpeed3pm | Humidity9am | Humidity3pm | Press |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 13.4 | 22.900000 | 0.6 | 5.389395 | 7.632205 | 44.0 | 20.0 | 24.0 | 71.0 | 22.0 | |
| **1** | 7.4 | 25.100000 | 0.0 | 5.389395 | 7.632205 | 44.0 | 4.0 | 22.0 | 44.0 | 25.0 | |
| **2** | 12.9 | 25.700000 | 0.0 | 5.389395 | 7.632205 | 46.0 | 19.0 | 26.0 | 38.0 | 30.0 | |
| **3** | 9.2 | 28.000000 | 0.0 | 5.389395 | 7.632205 | 24.0 | 11.0 | 9.0 | 45.0 | 16.0 | |
| **4** | 17.5 | 32.300000 | 1.0 | 5.389395 | 7.632205 | 41.0 | 7.0 | 20.0 | 82.0 | 33.0 | |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| **8420** | 2.8 | 23.400000 | 0.0 | 5.389395 | 7.632205 | 31.0 | 13.0 | 11.0 | 51.0 | 24.0 | |
| **8421** | 3.6 | 25.300000 | 0.0 | 5.389395 | 7.632205 | 22.0 | 13.0 | 9.0 | 56.0 | 21.0 | |
| **8422** | 5.4 | 26.900000 | 0.0 | 5.389395 | 7.632205 | 37.0 | 9.0 | 9.0 | 53.0 | 24.0 | |
| **8423** | 7.8 | 27.000000 | 0.0 | 5.389395 | 7.632205 | 28.0 | 13.0 | 7.0 | 51.0 | 24.0 | |
| **8424** | 14.9 | 23.859976 | 0.0 | 5.389395 | 7.632205 | NaN | 17.0 | 17.0 | 62.0 | 36.0 | |

8425 rows × 16 columns

In [20]:
```
cont_data['WindGustSpeed'].fillna(cont_data['WindGustSpeed'].mean(),inplace=True)
cont_data
```

Out[20]:

| | MinTemp | MaxTemp | Rainfall | Evaporation | Sunshine | WindGustSpeed | WindSpeed9am | WindSpeed3pm | Humidity9am | Humidity3pm | Press |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 13.4 | 22.900000 | 0.6 | 5.389395 | 7.632205 | 44.000000 | 20.0 | 24.0 | 71.0 | 22.0 | |
| **1** | 7.4 | 25.100000 | 0.0 | 5.389395 | 7.632205 | 44.000000 | 4.0 | 22.0 | 44.0 | 25.0 | |
| **2** | 12.9 | 25.700000 | 0.0 | 5.389395 | 7.632205 | 46.000000 | 19.0 | 26.0 | 38.0 | 30.0 | |
| **3** | 9.2 | 28.000000 | 0.0 | 5.389395 | 7.632205 | 24.000000 | 11.0 | 9.0 | 45.0 | 16.0 | |
| **4** | 17.5 | 32.300000 | 1.0 | 5.389395 | 7.632205 | 41.000000 | 7.0 | 20.0 | 82.0 | 33.0 | |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **8420** | 2.8 | 23.400000 | 0.0 | 5.389395 | 7.632205 | 31.000000 | 13.0 | 11.0 | 51.0 | 24.0 |
| **8421** | 3.6 | 25.300000 | 0.0 | 5.389395 | 7.632205 | 22.000000 | 13.0 | 9.0 | 56.0 | 21.0 |
| **8422** | 5.4 | 26.900000 | 0.0 | 5.389395 | 7.632205 | 37.000000 | 9.0 | 9.0 | 53.0 | 24.0 |
| **8423** | 7.8 | 27.000000 | 0.0 | 5.389395 | 7.632205 | 28.000000 | 13.0 | 7.0 | 51.0 | 24.0 |
| **8424** | 14.9 | 23.859976 | 0.0 | 5.389395 | 7.632205 | 40.174469 | 17.0 | 17.0 | 62.0 | 36.0 |

8425 rows × 16 columns

In [21]:
```
cont_data['WindSpeed3pm'].fillna(cont_data['WindSpeed3pm'].mean(),inplace=True)
cont_data
```

Out[21]:

| | MinTemp | MaxTemp | Rainfall | Evaporation | Sunshine | WindGustSpeed | WindSpeed9am | WindSpeed3pm | Humidity9am | Humidity3pm | Press |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 13.4 | 22.900000 | 0.6 | 5.389395 | 7.632205 | 44.000000 | 20.0 | 24.0 | 71.0 | 22.0 | |
| **1** | 7.4 | 25.100000 | 0.0 | 5.389395 | 7.632205 | 44.000000 | 4.0 | 22.0 | 44.0 | 25.0 | |
| **2** | 12.9 | 25.700000 | 0.0 | 5.389395 | 7.632205 | 46.000000 | 19.0 | 26.0 | 38.0 | 30.0 | |
| **3** | 9.2 | 28.000000 | 0.0 | 5.389395 | 7.632205 | 24.000000 | 11.0 | 9.0 | 45.0 | 16.0 | |
| **4** | 17.5 | 32.300000 | 1.0 | 5.389395 | 7.632205 | 41.000000 | 7.0 | 20.0 | 82.0 | 33.0 | |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| **8420** | 2.8 | 23.400000 | 0.0 | 5.389395 | 7.632205 | 31.000000 | 13.0 | 11.0 | 51.0 | 24.0 | |
| **8421** | 3.6 | 25.300000 | 0.0 | 5.389395 | 7.632205 | 22.000000 | 13.0 | 9.0 | 56.0 | 21.0 | |
| **8422** | 5.4 | 26.900000 | 0.0 | 5.389395 | 7.632205 | 37.000000 | 9.0 | 9.0 | 53.0 | 24.0 | |
| **8423** | 7.8 | 27.000000 | 0.0 | 5.389395 | 7.632205 | 28.000000 | 13.0 | 7.0 | 51.0 | 24.0 | |
| **8424** | 14.9 | 23.859976 | 0.0 | 5.389395 | 7.632205 | 40.174469 | 17.0 | 17.0 | 62.0 | 36.0 | |

8425 rows × 16 columns

In [22]:
```
cont_data['WindSpeed9am'].fillna(cont_data['WindSpeed9am'].mean(),inplace=True)
cont_data
```

Out[22]:

| | MinTemp | MaxTemp | Rainfall | Evaporation | Sunshine | WindGustSpeed | WindSpeed9am | WindSpeed3pm | Humidity9am | Humidity3pm | Press |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 13.4 | 22.900000 | 0.6 | 5.389395 | 7.632205 | 44.000000 | 20.0 | 24.0 | 71.0 | 22.0 | |
| **1** | 7.4 | 25.100000 | 0.0 | 5.389395 | 7.632205 | 44.000000 | 4.0 | 22.0 | 44.0 | 25.0 | |
| **2** | 12.9 | 25.700000 | 0.0 | 5.389395 | 7.632205 | 46.000000 | 19.0 | 26.0 | 38.0 | 30.0 | |
| **3** | 9.2 | 28.000000 | 0.0 | 5.389395 | 7.632205 | 24.000000 | 11.0 | 9.0 | 45.0 | 16.0 | |
| **4** | 17.5 | 32.300000 | 1.0 | 5.389395 | 7.632205 | 41.000000 | 7.0 | 20.0 | 82.0 | 33.0 | |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| **8420** | 2.8 | 23.400000 | 0.0 | 5.389395 | 7.632205 | 31.000000 | 13.0 | 11.0 | 51.0 | 24.0 | |
| **8421** | 3.6 | 25.300000 | 0.0 | 5.389395 | 7.632205 | 22.000000 | 13.0 | 9.0 | 56.0 | 21.0 | |
| **8422** | 5.4 | 26.900000 | 0.0 | 5.389395 | 7.632205 | 37.000000 | 9.0 | 9.0 | 53.0 | 24.0 | |
| **8423** | 7.8 | 27.000000 | 0.0 | 5.389395 | 7.632205 | 28.000000 | 13.0 | 7.0 | 51.0 | 24.0 | |
| **8424** | 14.9 | 23.859976 | 0.0 | 5.389395 | 7.632205 | 40.174469 | 17.0 | 17.0 | 62.0 | 36.0 | |

8425 rows × 16 columns

In [23]:
```
cont_data['Humidity9am'].fillna(cont_data['Humidity9am'].mean(),inplace=True)
cont_data
```

Out[23]:

| | MinTemp | MaxTemp | Rainfall | Evaporation | Sunshine | WindGustSpeed | WindSpeed9am | WindSpeed3pm | Humidity9am | Humidity3pm | Press |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 13.4 | 22.900000 | 0.6 | 5.389395 | 7.632205 | 44.000000 | 20.0 | 24.0 | 71.0 | 22.0 | |
| **1** | 7.4 | 25.100000 | 0.0 | 5.389395 | 7.632205 | 44.000000 | 4.0 | 22.0 | 44.0 | 25.0 | |
| **2** | 12.9 | 25.700000 | 0.0 | 5.389395 | 7.632205 | 46.000000 | 19.0 | 26.0 | 38.0 | 30.0 | |
| **3** | 9.2 | 28.000000 | 0.0 | 5.389395 | 7.632205 | 24.000000 | 11.0 | 9.0 | 45.0 | 16.0 | |
| **4** | 17.5 | 32.300000 | 1.0 | 5.389395 | 7.632205 | 41.000000 | 7.0 | 20.0 | 82.0 | 33.0 | |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| **8420** | 2.8 | 23.400000 | 0.0 | 5.389395 | 7.632205 | 31.000000 | 13.0 | 11.0 | 51.0 | 24.0 | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **8421** | 3.6 | 25.300000 | 0.0 | 5.389395 | 7.632205 | 22.000000 | 13.0 | 9.0 | 56.0 | 21.0 |
| **8422** | 5.4 | 26.900000 | 0.0 | 5.389395 | 7.632205 | 37.000000 | 9.0 | 9.0 | 53.0 | 24.0 |
| **8423** | 7.8 | 27.000000 | 0.0 | 5.389395 | 7.632205 | 28.000000 | 13.0 | 7.0 | 51.0 | 24.0 |
| **8424** | 14.9 | 23.859976 | 0.0 | 5.389395 | 7.632205 | 40.174469 | 17.0 | 17.0 | 62.0 | 36.0 |

8425 rows × 16 columns

In [24]:
```
cont_data['Humidity3pm'].fillna(cont_data['Humidity3pm'].mean(),inplace=True)
cont_data
```

Out[24]:

| | MinTemp | MaxTemp | Rainfall | Evaporation | Sunshine | WindGustSpeed | WindSpeed9am | WindSpeed3pm | Humidity9am | Humidity3pm | Pres |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 13.4 | 22.900000 | 0.6 | 5.389395 | 7.632205 | 44.000000 | 20.0 | 24.0 | 71.0 | 22.0 | |
| **1** | 7.4 | 25.100000 | 0.0 | 5.389395 | 7.632205 | 44.000000 | 4.0 | 22.0 | 44.0 | 25.0 | |
| **2** | 12.9 | 25.700000 | 0.0 | 5.389395 | 7.632205 | 46.000000 | 19.0 | 26.0 | 38.0 | 30.0 | |
| **3** | 9.2 | 28.000000 | 0.0 | 5.389395 | 7.632205 | 24.000000 | 11.0 | 9.0 | 45.0 | 16.0 | |
| **4** | 17.5 | 32.300000 | 1.0 | 5.389395 | 7.632205 | 41.000000 | 7.0 | 20.0 | 82.0 | 33.0 | |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| **8420** | 2.8 | 23.400000 | 0.0 | 5.389395 | 7.632205 | 31.000000 | 13.0 | 11.0 | 51.0 | 24.0 | |
| **8421** | 3.6 | 25.300000 | 0.0 | 5.389395 | 7.632205 | 22.000000 | 13.0 | 9.0 | 56.0 | 21.0 | |
| **8422** | 5.4 | 26.900000 | 0.0 | 5.389395 | 7.632205 | 37.000000 | 9.0 | 9.0 | 53.0 | 24.0 | |
| **8423** | 7.8 | 27.000000 | 0.0 | 5.389395 | 7.632205 | 28.000000 | 13.0 | 7.0 | 51.0 | 24.0 | |
| **8424** | 14.9 | 23.859976 | 0.0 | 5.389395 | 7.632205 | 40.174469 | 17.0 | 17.0 | 62.0 | 36.0 | |

8425 rows × 16 columns

In [25]:
```
cont_data['Pressure9am'].fillna(cont_data['Pressure9am'].mean(),inplace=True)
cont_data
```

Out[25]:

| | MinTemp | MaxTemp | Rainfall | Evaporation | Sunshine | WindGustSpeed | WindSpeed9am | WindSpeed3pm | Humidity9am | Humidity3pm | Pres |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 13.4 | 22.900000 | 0.6 | 5.389395 | 7.632205 | 44.000000 | 20.0 | 24.0 | 71.0 | 22.0 | |
| **1** | 7.4 | 25.100000 | 0.0 | 5.389395 | 7.632205 | 44.000000 | 4.0 | 22.0 | 44.0 | 25.0 | |
| **2** | 12.9 | 25.700000 | 0.0 | 5.389395 | 7.632205 | 46.000000 | 19.0 | 26.0 | 38.0 | 30.0 | |
| **3** | 9.2 | 28.000000 | 0.0 | 5.389395 | 7.632205 | 24.000000 | 11.0 | 9.0 | 45.0 | 16.0 | |
| **4** | 17.5 | 32.300000 | 1.0 | 5.389395 | 7.632205 | 41.000000 | 7.0 | 20.0 | 82.0 | 33.0 | |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| **8420** | 2.8 | 23.400000 | 0.0 | 5.389395 | 7.632205 | 31.000000 | 13.0 | 11.0 | 51.0 | 24.0 | |
| **8421** | 3.6 | 25.300000 | 0.0 | 5.389395 | 7.632205 | 22.000000 | 13.0 | 9.0 | 56.0 | 21.0 | |
| **8422** | 5.4 | 26.900000 | 0.0 | 5.389395 | 7.632205 | 37.000000 | 9.0 | 9.0 | 53.0 | 24.0 | |
| **8423** | 7.8 | 27.000000 | 0.0 | 5.389395 | 7.632205 | 28.000000 | 13.0 | 7.0 | 51.0 | 24.0 | |
| **8424** | 14.9 | 23.859976 | 0.0 | 5.389395 | 7.632205 | 40.174469 | 17.0 | 17.0 | 62.0 | 36.0 | |

8425 rows × 16 columns

In [26]:
```
cont_data['Pressure3pm'].fillna(cont_data['Pressure3pm'].mean(),inplace=True)
cont_data
```

Out[26]:

| | MinTemp | MaxTemp | Rainfall | Evaporation | Sunshine | WindGustSpeed | WindSpeed9am | WindSpeed3pm | Humidity9am | Humidity3pm | Pres |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 13.4 | 22.900000 | 0.6 | 5.389395 | 7.632205 | 44.000000 | 20.0 | 24.0 | 71.0 | 22.0 | |
| **1** | 7.4 | 25.100000 | 0.0 | 5.389395 | 7.632205 | 44.000000 | 4.0 | 22.0 | 44.0 | 25.0 | |
| **2** | 12.9 | 25.700000 | 0.0 | 5.389395 | 7.632205 | 46.000000 | 19.0 | 26.0 | 38.0 | 30.0 | |
| **3** | 9.2 | 28.000000 | 0.0 | 5.389395 | 7.632205 | 24.000000 | 11.0 | 9.0 | 45.0 | 16.0 | |
| **4** | 17.5 | 32.300000 | 1.0 | 5.389395 | 7.632205 | 41.000000 | 7.0 | 20.0 | 82.0 | 33.0 | |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| **8420** | 2.8 | 23.400000 | 0.0 | 5.389395 | 7.632205 | 31.000000 | 13.0 | 11.0 | 51.0 | 24.0 | |
| **8421** | 3.6 | 25.300000 | 0.0 | 5.389395 | 7.632205 | 22.000000 | 13.0 | 9.0 | 56.0 | 21.0 | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **8422** | 5.4 | 26.900000 | 0.0 | 5.389395 | 7.632205 | 37.000000 | 9.0 | 9.0 | 53.0 | 24.0 |
| **8423** | 7.8 | 27.000000 | 0.0 | 5.389395 | 7.632205 | 28.000000 | 13.0 | 7.0 | 51.0 | 24.0 |
| **8424** | 14.9 | 23.859976 | 0.0 | 5.389395 | 7.632205 | 40.174469 | 17.0 | 17.0 | 62.0 | 36.0 |

8425 rows × 16 columns

In [27]:
```
cont_data['Cloud9am'].fillna(cont_data['Cloud9am'].mean(),inplace=True)
cont_data
```

Out[27]:

| | MinTemp | MaxTemp | Rainfall | Evaporation | Sunshine | WindGustSpeed | WindSpeed9am | WindSpeed3pm | Humidity9am | Humidity3pm | Pres |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 13.4 | 22.900000 | 0.6 | 5.389395 | 7.632205 | 44.000000 | 20.0 | 24.0 | 71.0 | 22.0 | |
| **1** | 7.4 | 25.100000 | 0.0 | 5.389395 | 7.632205 | 44.000000 | 4.0 | 22.0 | 44.0 | 25.0 | |
| **2** | 12.9 | 25.700000 | 0.0 | 5.389395 | 7.632205 | 46.000000 | 19.0 | 26.0 | 38.0 | 30.0 | |
| **3** | 9.2 | 28.000000 | 0.0 | 5.389395 | 7.632205 | 24.000000 | 11.0 | 9.0 | 45.0 | 16.0 | |
| **4** | 17.5 | 32.300000 | 1.0 | 5.389395 | 7.632205 | 41.000000 | 7.0 | 20.0 | 82.0 | 33.0 | |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| **8420** | 2.8 | 23.400000 | 0.0 | 5.389395 | 7.632205 | 31.000000 | 13.0 | 11.0 | 51.0 | 24.0 | |
| **8421** | 3.6 | 25.300000 | 0.0 | 5.389395 | 7.632205 | 22.000000 | 13.0 | 9.0 | 56.0 | 21.0 | |
| **8422** | 5.4 | 26.900000 | 0.0 | 5.389395 | 7.632205 | 37.000000 | 9.0 | 9.0 | 53.0 | 24.0 | |
| **8423** | 7.8 | 27.000000 | 0.0 | 5.389395 | 7.632205 | 28.000000 | 13.0 | 7.0 | 51.0 | 24.0 | |
| **8424** | 14.9 | 23.859976 | 0.0 | 5.389395 | 7.632205 | 40.174469 | 17.0 | 17.0 | 62.0 | 36.0 | |

8425 rows × 16 columns

In [28]:
```
cont_data['Cloud3pm'].fillna(cont_data['Cloud3pm'].mean(),inplace=True)
cont_data
```

Out[28]:

| | MinTemp | MaxTemp | Rainfall | Evaporation | Sunshine | WindGustSpeed | WindSpeed9am | WindSpeed3pm | Humidity9am | Humidity3pm | Pres |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 13.4 | 22.900000 | 0.6 | 5.389395 | 7.632205 | 44.000000 | 20.0 | 24.0 | 71.0 | 22.0 | |
| **1** | 7.4 | 25.100000 | 0.0 | 5.389395 | 7.632205 | 44.000000 | 4.0 | 22.0 | 44.0 | 25.0 | |
| **2** | 12.9 | 25.700000 | 0.0 | 5.389395 | 7.632205 | 46.000000 | 19.0 | 26.0 | 38.0 | 30.0 | |
| **3** | 9.2 | 28.000000 | 0.0 | 5.389395 | 7.632205 | 24.000000 | 11.0 | 9.0 | 45.0 | 16.0 | |
| **4** | 17.5 | 32.300000 | 1.0 | 5.389395 | 7.632205 | 41.000000 | 7.0 | 20.0 | 82.0 | 33.0 | |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| **8420** | 2.8 | 23.400000 | 0.0 | 5.389395 | 7.632205 | 31.000000 | 13.0 | 11.0 | 51.0 | 24.0 | |
| **8421** | 3.6 | 25.300000 | 0.0 | 5.389395 | 7.632205 | 22.000000 | 13.0 | 9.0 | 56.0 | 21.0 | |
| **8422** | 5.4 | 26.900000 | 0.0 | 5.389395 | 7.632205 | 37.000000 | 9.0 | 9.0 | 53.0 | 24.0 | |
| **8423** | 7.8 | 27.000000 | 0.0 | 5.389395 | 7.632205 | 28.000000 | 13.0 | 7.0 | 51.0 | 24.0 | |
| **8424** | 14.9 | 23.859976 | 0.0 | 5.389395 | 7.632205 | 40.174469 | 17.0 | 17.0 | 62.0 | 36.0 | |

8425 rows × 16 columns

In [29]:
```
cont_data['Temp9am'].fillna(cont_data['Temp9am'].mean(),inplace=True)
cont_data
```

Out[29]:

| | MinTemp | MaxTemp | Rainfall | Evaporation | Sunshine | WindGustSpeed | WindSpeed9am | WindSpeed3pm | Humidity9am | Humidity3pm | Pres |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 13.4 | 22.900000 | 0.6 | 5.389395 | 7.632205 | 44.000000 | 20.0 | 24.0 | 71.0 | 22.0 | |
| **1** | 7.4 | 25.100000 | 0.0 | 5.389395 | 7.632205 | 44.000000 | 4.0 | 22.0 | 44.0 | 25.0 | |
| **2** | 12.9 | 25.700000 | 0.0 | 5.389395 | 7.632205 | 46.000000 | 19.0 | 26.0 | 38.0 | 30.0 | |
| **3** | 9.2 | 28.000000 | 0.0 | 5.389395 | 7.632205 | 24.000000 | 11.0 | 9.0 | 45.0 | 16.0 | |
| **4** | 17.5 | 32.300000 | 1.0 | 5.389395 | 7.632205 | 41.000000 | 7.0 | 20.0 | 82.0 | 33.0 | |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| **8420** | 2.8 | 23.400000 | 0.0 | 5.389395 | 7.632205 | 31.000000 | 13.0 | 11.0 | 51.0 | 24.0 | |
| **8421** | 3.6 | 25.300000 | 0.0 | 5.389395 | 7.632205 | 22.000000 | 13.0 | 9.0 | 56.0 | 21.0 | |
| **8422** | 5.4 | 26.900000 | 0.0 | 5.389395 | 7.632205 | 37.000000 | 9.0 | 9.0 | 53.0 | 24.0 | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **8423** | 7.8 | 27.000000 | 0.0 | 5.389395 | 7.632205 | 28.000000 | 13.0 | 7.0 | 51.0 | 24.0 | |
| **8424** | 14.9 | 23.859976 | 0.0 | 5.389395 | 7.632205 | 40.174469 | 17.0 | 17.0 | 62.0 | 36.0 | |

8425 rows × 16 columns

In [30]:
```
cont_data['Temp3pm'].fillna(cont_data['Temp3pm'].mean(),inplace=True)
cont_data
```

Out[30]:

| | MinTemp | MaxTemp | Rainfall | Evaporation | Sunshine | WindGustSpeed | WindSpeed9am | WindSpeed3pm | Humidity9am | Humidity3pm | Pres |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 13.4 | 22.900000 | 0.6 | 5.389395 | 7.632205 | 44.000000 | 20.0 | 24.0 | 71.0 | 22.0 | |
| **1** | 7.4 | 25.100000 | 0.0 | 5.389395 | 7.632205 | 44.000000 | 4.0 | 22.0 | 44.0 | 25.0 | |
| **2** | 12.9 | 25.700000 | 0.0 | 5.389395 | 7.632205 | 46.000000 | 19.0 | 26.0 | 38.0 | 30.0 | |
| **3** | 9.2 | 28.000000 | 0.0 | 5.389395 | 7.632205 | 24.000000 | 11.0 | 9.0 | 45.0 | 16.0 | |
| **4** | 17.5 | 32.300000 | 1.0 | 5.389395 | 7.632205 | 41.000000 | 7.0 | 20.0 | 82.0 | 33.0 | |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| **8420** | 2.8 | 23.400000 | 0.0 | 5.389395 | 7.632205 | 31.000000 | 13.0 | 11.0 | 51.0 | 24.0 | |
| **8421** | 3.6 | 25.300000 | 0.0 | 5.389395 | 7.632205 | 22.000000 | 13.0 | 9.0 | 56.0 | 21.0 | |
| **8422** | 5.4 | 26.900000 | 0.0 | 5.389395 | 7.632205 | 37.000000 | 9.0 | 9.0 | 53.0 | 24.0 | |
| **8423** | 7.8 | 27.000000 | 0.0 | 5.389395 | 7.632205 | 28.000000 | 13.0 | 7.0 | 51.0 | 24.0 | |
| **8424** | 14.9 | 23.859976 | 0.0 | 5.389395 | 7.632205 | 40.174469 | 17.0 | 17.0 | 62.0 | 36.0 | |

8425 rows × 16 columns

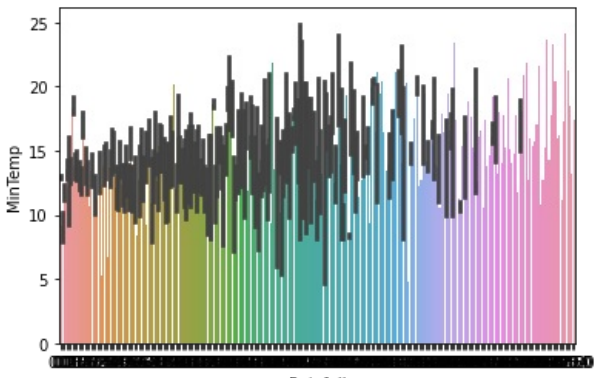
In [31]:
```
cont_data.isnull().sum()
```

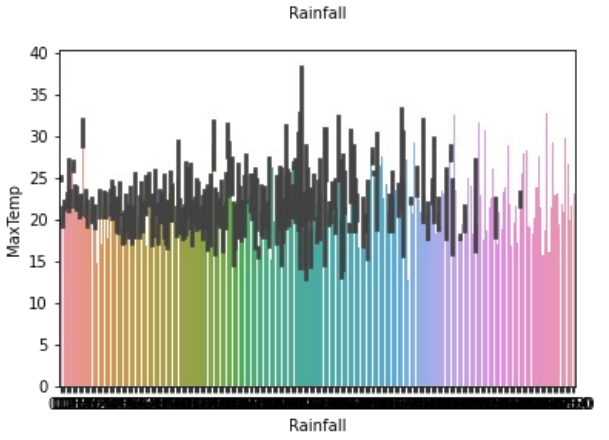
Out[31]:
```
MinTemp          0
MaxTemp          0
Rainfall         0
Evaporation      0
Sunshine         0
WindGustSpeed    0
WindSpeed9am     0
WindSpeed3pm     0
Humidity9am      0
Humidity3pm      0
Pressure9am      0
Pressure3pm      0
Cloud9am         0
Cloud3pm         0
Temp9am          0
Temp3pm          0
dtype: int64
```

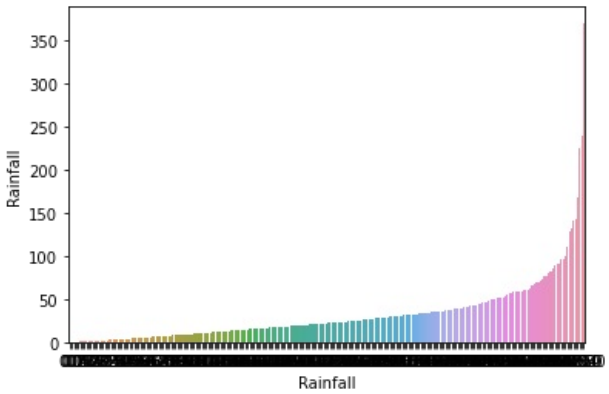
In [32]:
```
## all the null values has been removed
```

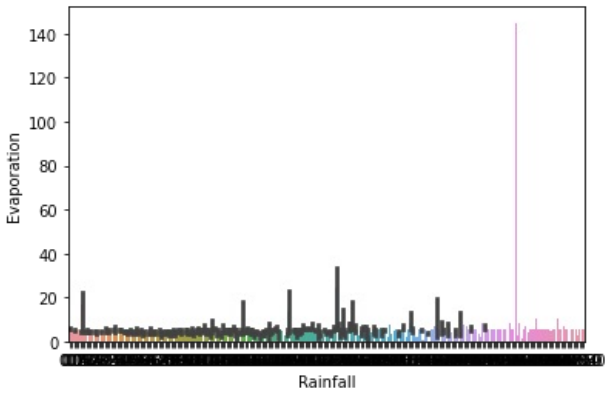
In [34]:
```
##cont_data.hist(figsize = (25, 30), bins = 50, xlabelsize = 8, ylabelsize = 8)
```

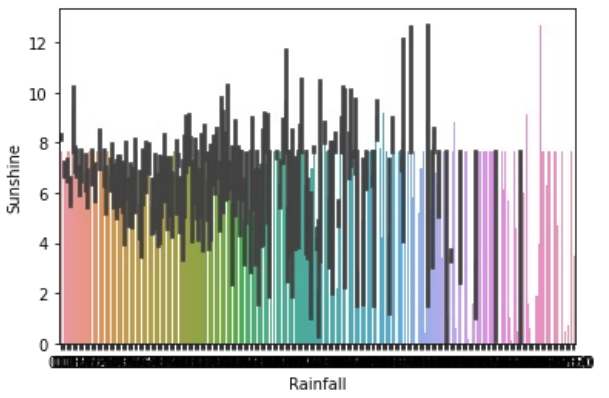
In [35]:
```
for i in cont_data:
    sns.barplot(y = cont_data[i], x = df['Rainfall'])
    plt.show()
```

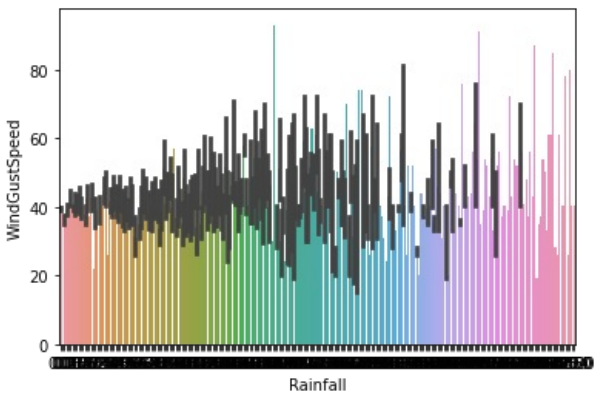


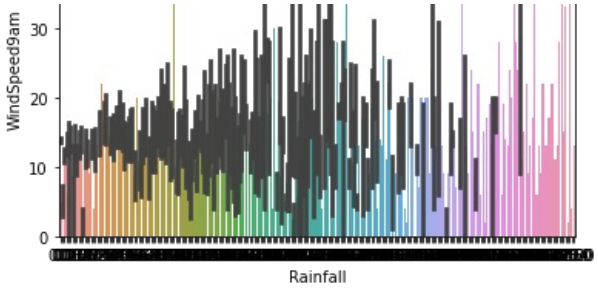

Rainfall
MaxTemp
Rainfall

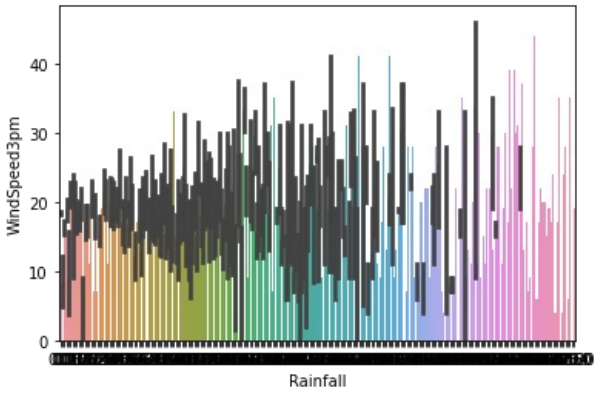

Rainfall
Rainfall

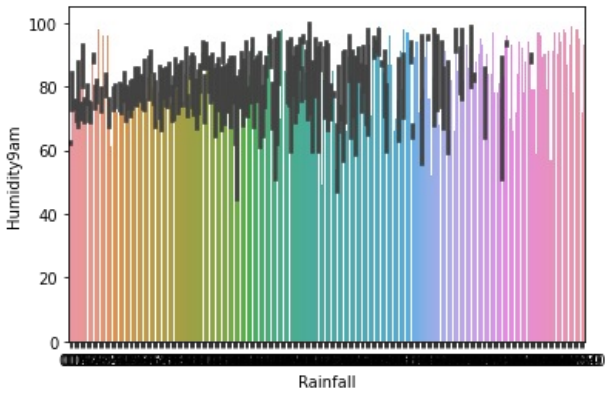

Evaporation
Rainfall

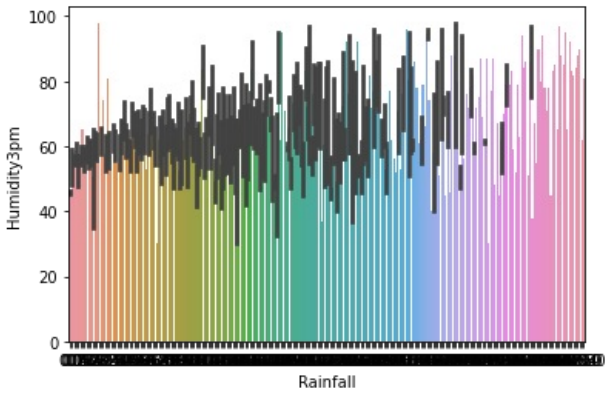

Sunshine
Rainfall

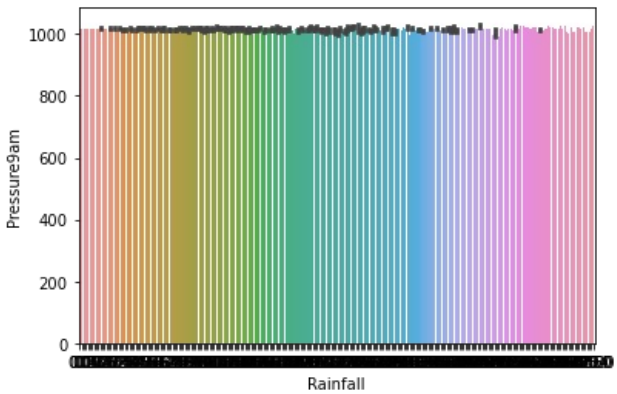

WindGustSpeed
Rainfall

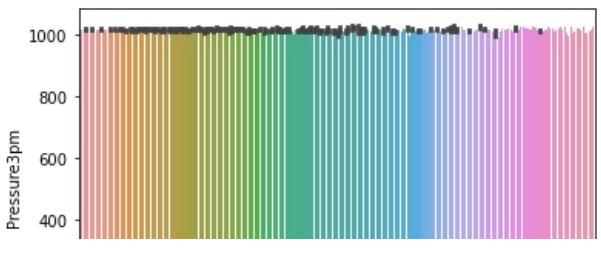

WindSpeed9am
0
10
20
30
Rainfall

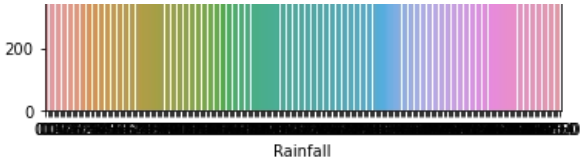

WindSpeed3pm
0
10
20
30
40
Rainfall

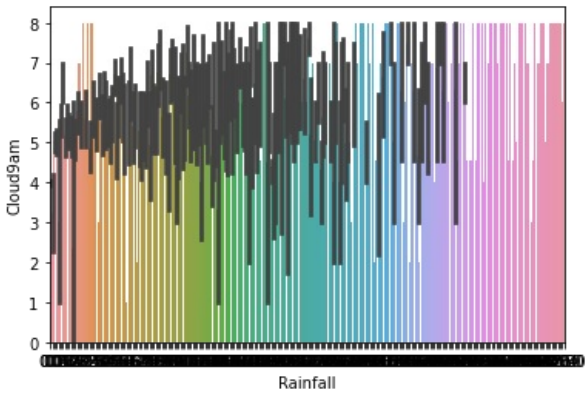

Humidity9am
0
20
40
60
80
100
Rainfall

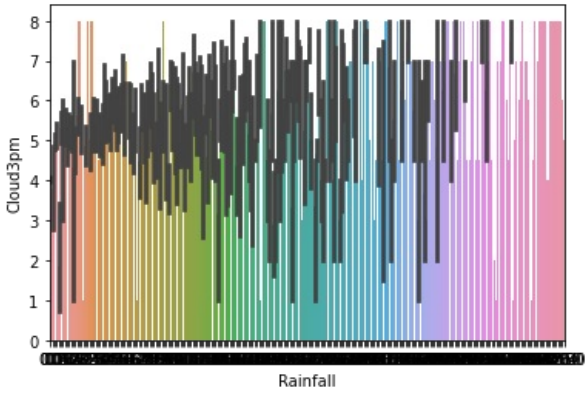

Humidity3pm
0
20
40
60
80
100
Rainfall

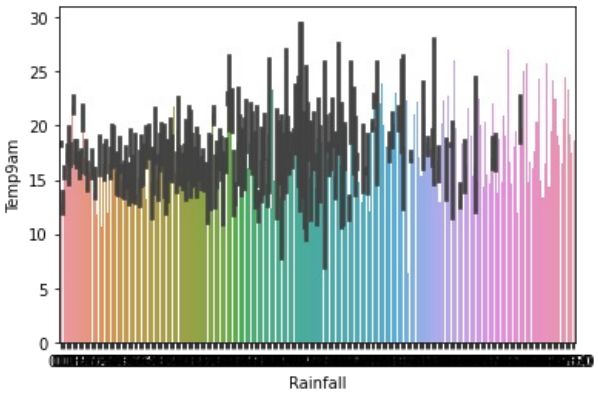

Pressure9am
0
200
400
600
800
1000
Rainfall

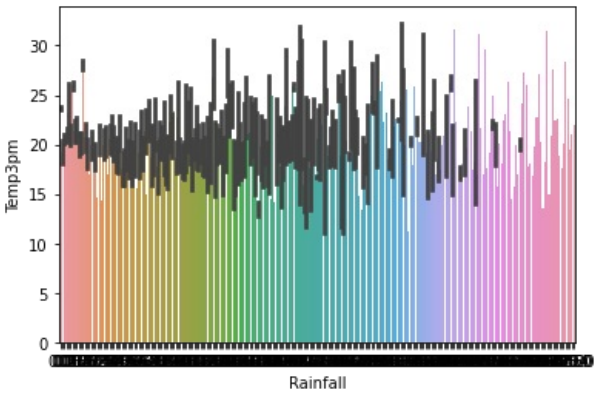

Pressure3pm
400
600
800
1000


200
0
Rainfall


Cloud9am
Rainfall


Cloud3pm
Rainfall


Temp9am
Rainfall

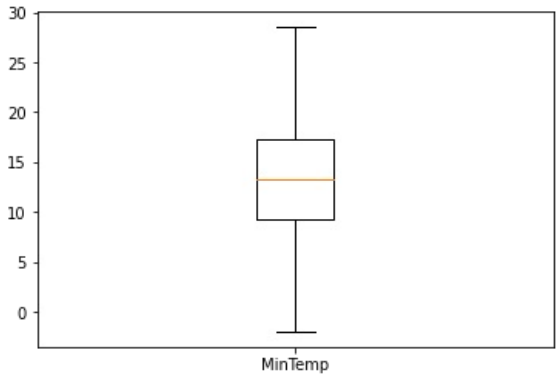

Temp3pm
Rainfall

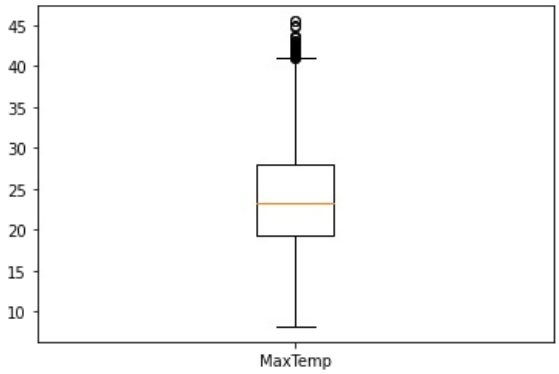
In [ ]:

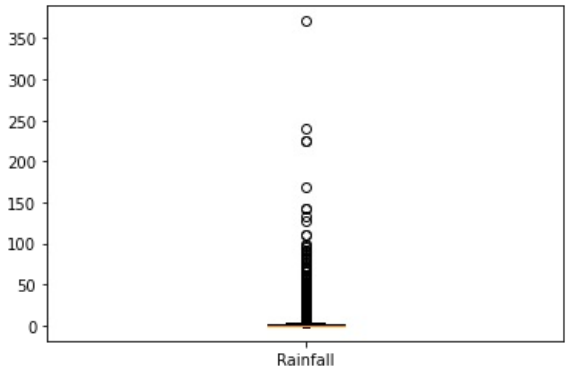
```
## box plot after removing the outliers
```

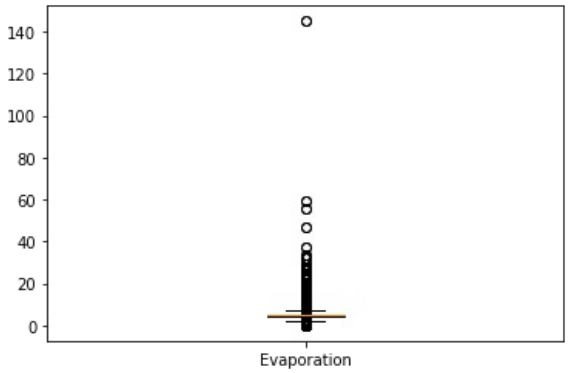
In [36]:

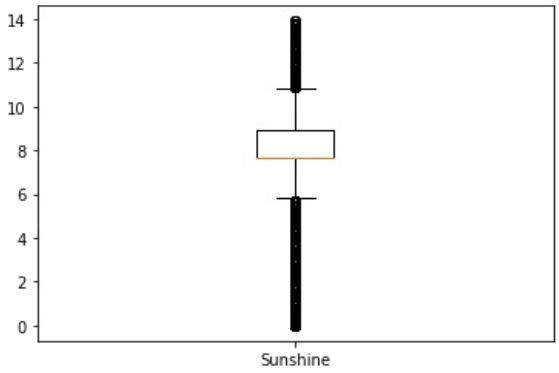
```
for i in cont_data:
    plt.boxplot(cont_data[i], labels = [i])
    plt.show()
```

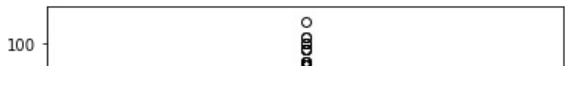


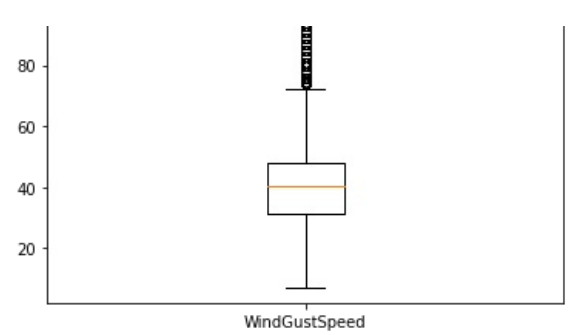



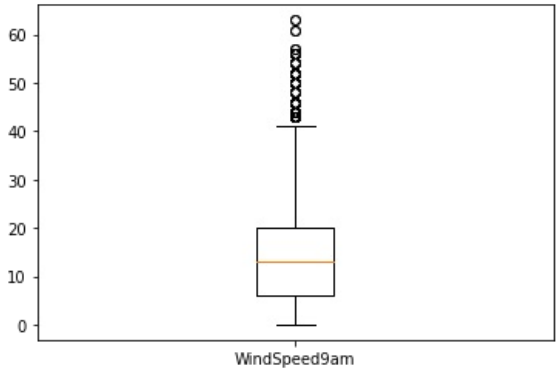



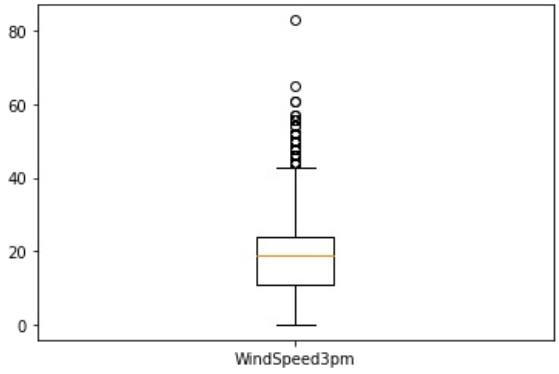



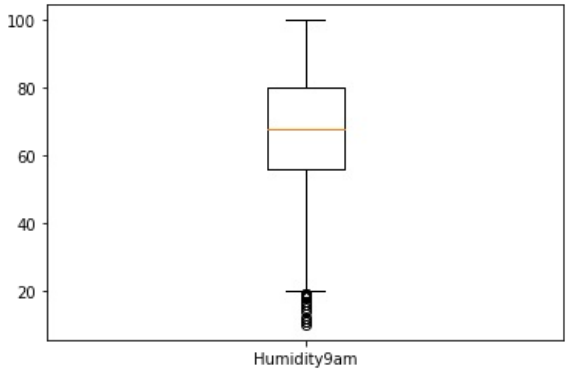



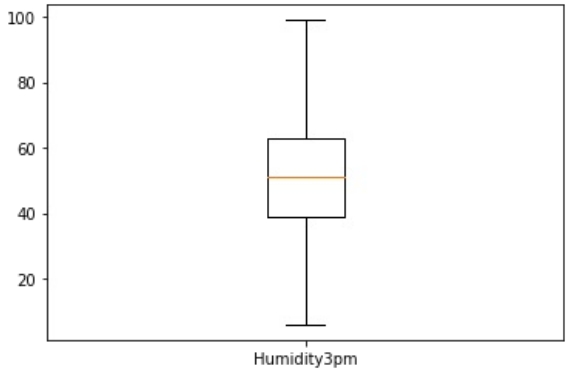



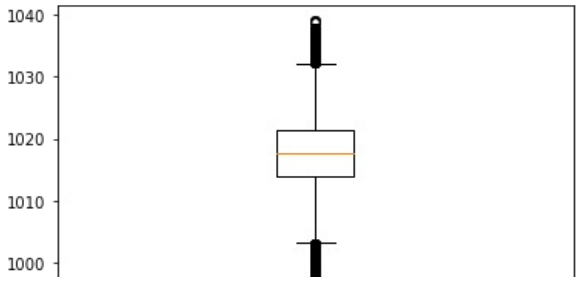

80
60
40
20
WindGustSpeed

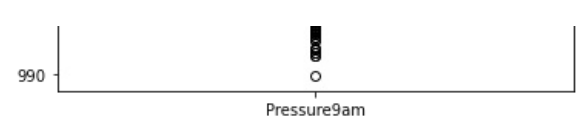

60
50
40
30
20
10
0
WindSpeed9am

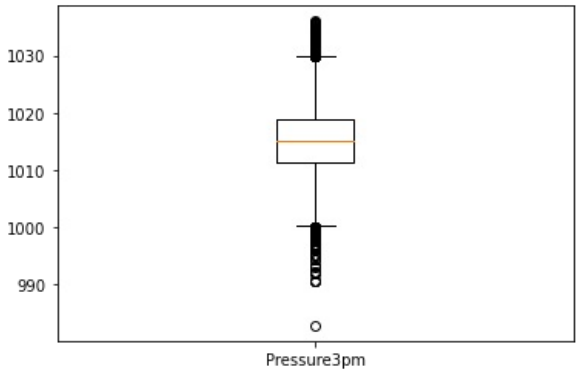

80
60
40
20
0
WindSpeed3pm

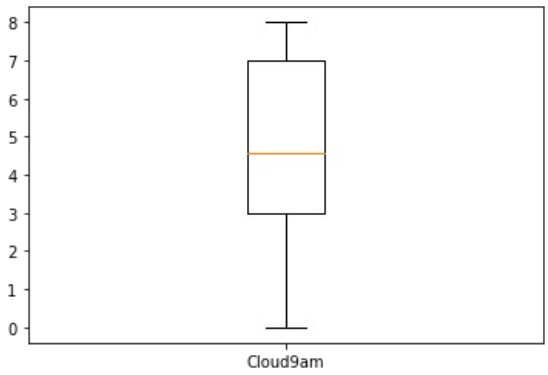

100
80
60
40
20
Humidity9am

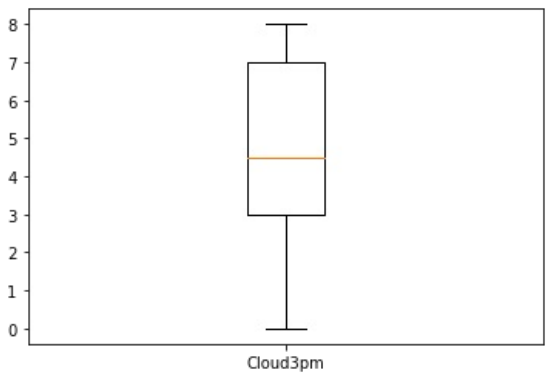

100
80
60
40
20
Humidity3pm

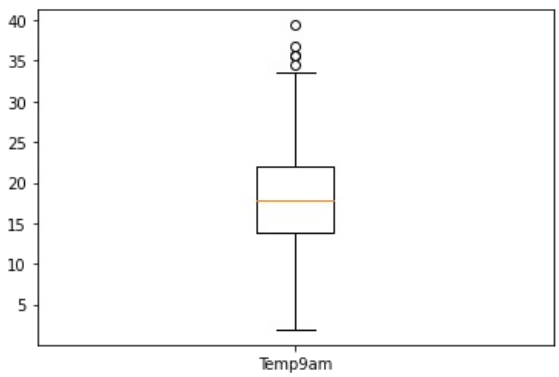

1040
1030
1020
1010
1000

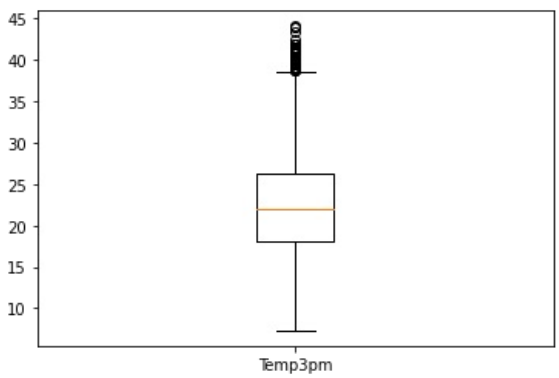

990
Pressure9am


1030
1020
1010
1000
990
Pressure3pm


8
7
6
5
4
3
2
1
0
Cloud9am


8
7
6
5
4
3
2
1
0
Cloud3pm

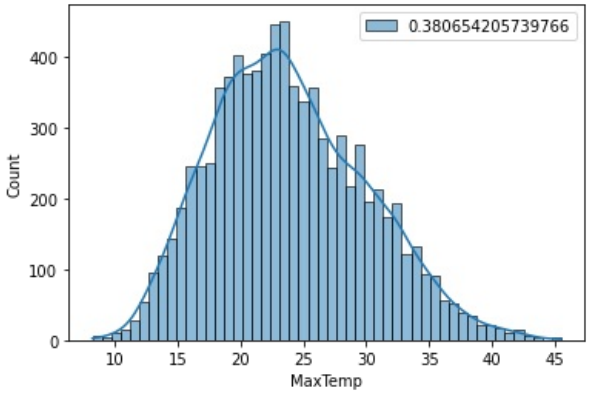

40
35
30
25
20
15
10
5
Temp9am

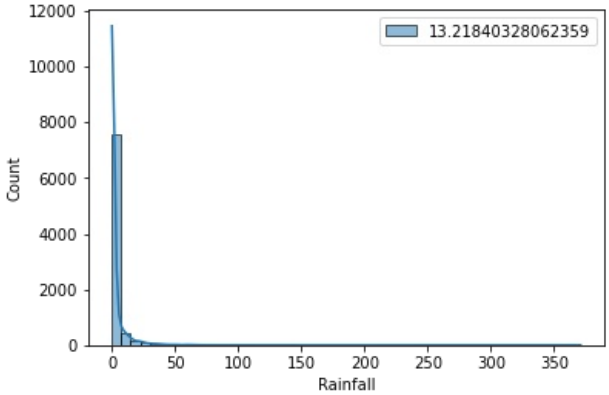

45
40
35
30
25
20
15
10
Temp3pm

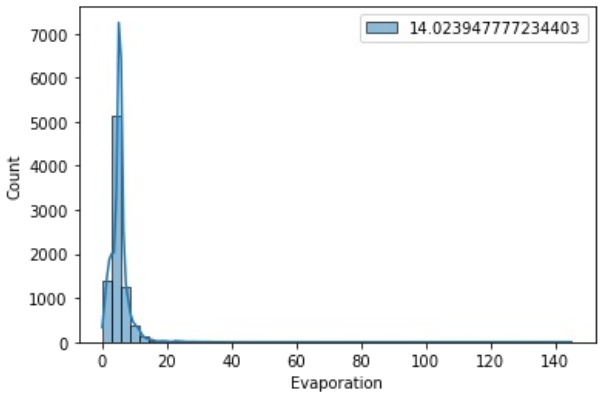
In [37]:
```
a=['MaxTemp','Rainfall','Evaporation','Sunshine','WindGustSpeed','WindSpeed9am','WindSpeed3pm','Humidity9am','Pre
```

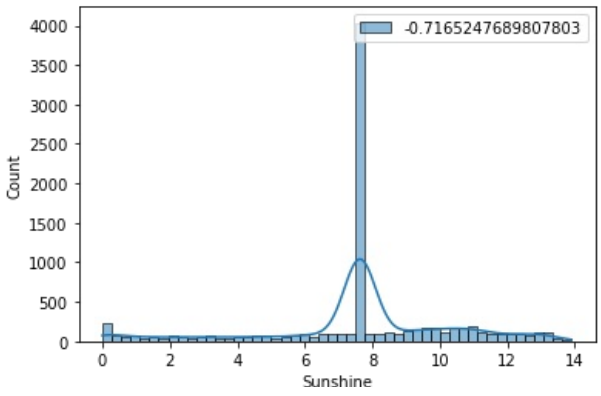
In [ ]:
```
## histplot
```

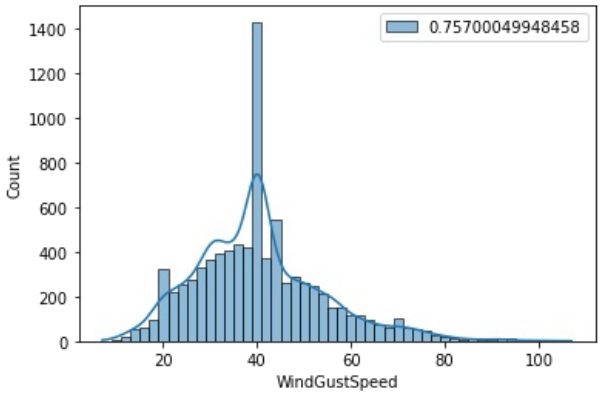
In [38]:
```
for i in a:
    sns.histplot(cont_data[i], kde = True, bins = 50, label = cont_data[i].skew())
    plt.legend(loc = 'upper right')
    plt.show()
```

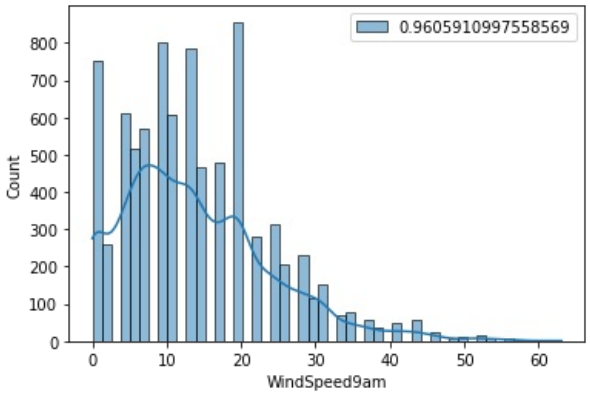


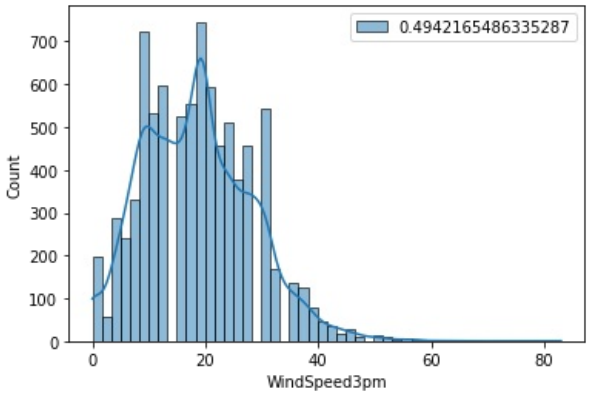



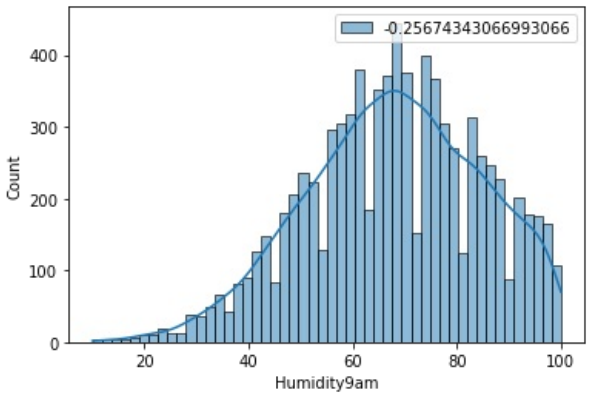



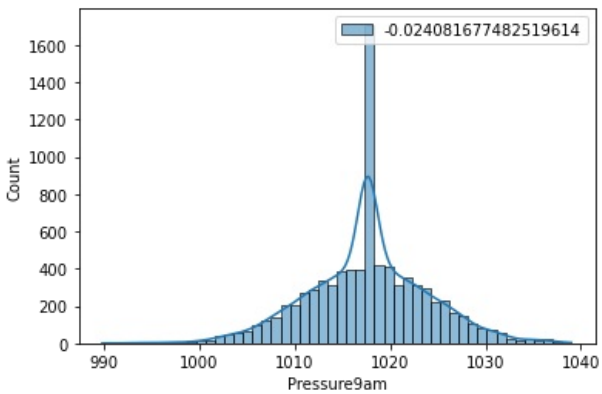




0.75700049948458
Count
WindGustSpeed

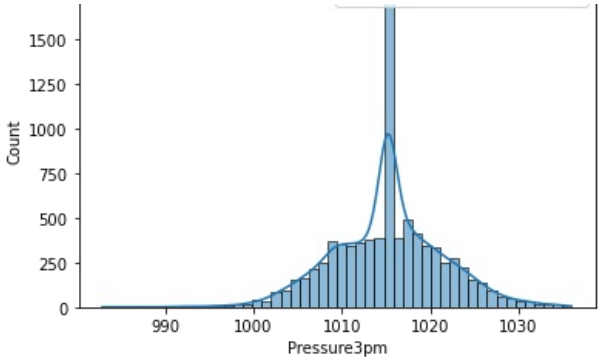

0.9605910997558569
Count
WindSpeed9am

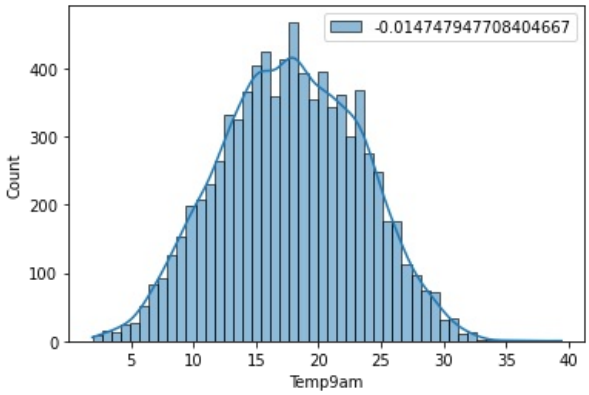

0.4942165486335287
Count
WindSpeed3pm

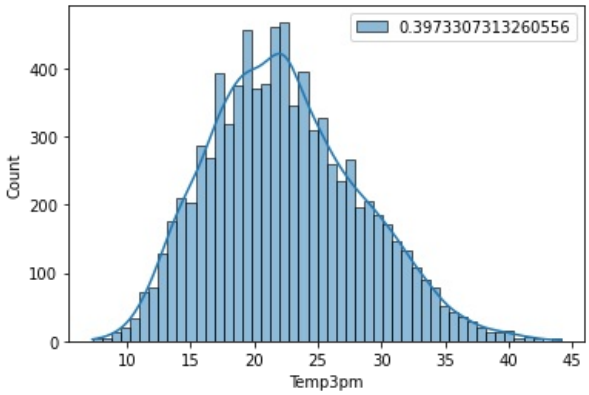

-0.25674343066993066
Count
Humidity9am


-0.024081677482519614
Count
Pressure9am


-0.010213864895896525




In [ ]:
```
## iqr method to remove ouliers
```

In [39]:
```
out_vars=['MaxTemp','Rainfall','Evaporation','Sunshine','WindGustSpeed','WindSpeed9am','WindSpeed3pm','Humidity9a
```

In [40]:
```
def outlierTreat(x):
    upper = x.quantile(.75) + 1.5 * (x.quantile(.75) - x.quantile(.25))
    lower = x.quantile(.25) - 1.5 * (x.quantile(.75) - x.quantile(.25))
    return x.clip(lower, upper)
```

In [42]:
```
cont_data.loc[:, out_vars] = cont_data.loc[:, out_vars].apply(outlierTreat)
cont_data.loc[:, out_vars]
```

Out[42]:

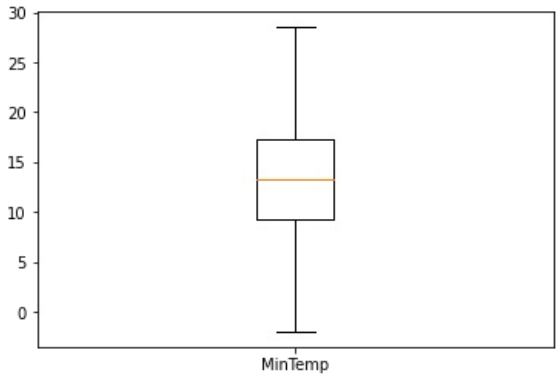
| | MaxTemp | Rainfall | Evaporation | Sunshine | WindGustSpeed | WindSpeed9am | WindSpeed3pm | Humidity9am | Pressure9am | Pressure3pm | T |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 22.900000 | 0.6 | 5.389395 | 7.632205 | 44.000000 | 20.0 | 24.0 | 71.0 | 1007.7 | 1007.1 | |
| **1** | 25.100000 | 0.0 | 5.389395 | 7.632205 | 44.000000 | 4.0 | 22.0 | 44.0 | 1010.6 | 1007.8 | |
| **2** | 25.700000 | 0.0 | 5.389395 | 7.632205 | 46.000000 | 19.0 | 26.0 | 38.0 | 1007.6 | 1008.7 | |
| **3** | 28.000000 | 0.0 | 5.389395 | 7.632205 | 24.000000 | 11.0 | 9.0 | 45.0 | 1017.6 | 1012.8 | |
| **4** | 32.300000 | 1.0 | 5.389395 | 7.632205 | 41.000000 | 7.0 | 20.0 | 82.0 | 1010.8 | 1006.0 | |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| **8420** | 23.400000 | 0.0 | 5.389395 | 7.632205 | 31.000000 | 13.0 | 11.0 | 51.0 | 1024.6 | 1020.3 | |
| **8421** | 25.300000 | 0.0 | 5.389395 | 7.632205 | 22.000000 | 13.0 | 9.0 | 56.0 | 1023.5 | 1019.1 | |
| **8422** | 26.900000 | 0.0 | 5.389395 | 7.632205 | 37.000000 | 9.0 | 9.0 | 53.0 | 1021.0 | 1016.8 | |
| **8423** | 27.000000 | 0.0 | 5.389395 | 7.632205 | 28.000000 | 13.0 | 7.0 | 51.0 | 1019.4 | 1016.5 | |

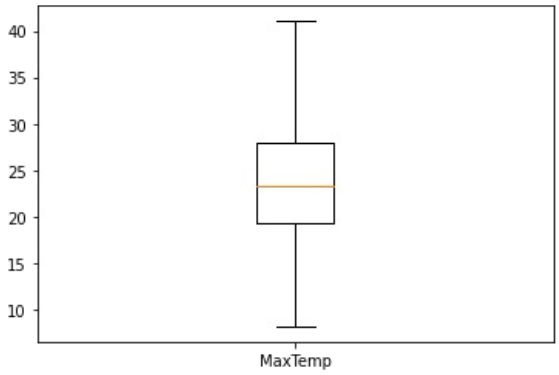
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **8424** | 23.859976 | 0.0 | 5.389395 | 7.632205 | 40.174469 | 17.0 | 17.0 | 62.0 | 1020.2 | 1017.9 |

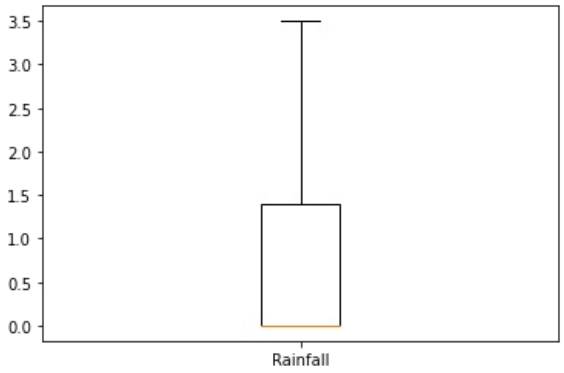
8425 rows × 12 columns

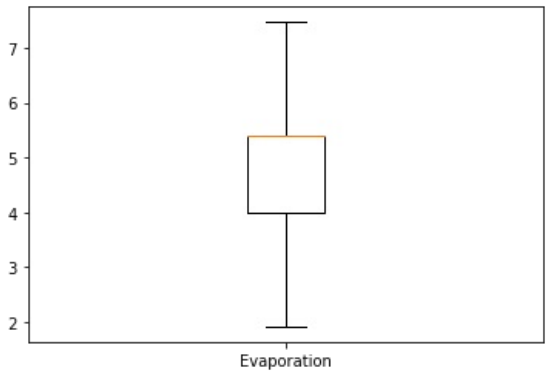
In [ ]:
```
##checking for ouliers
```

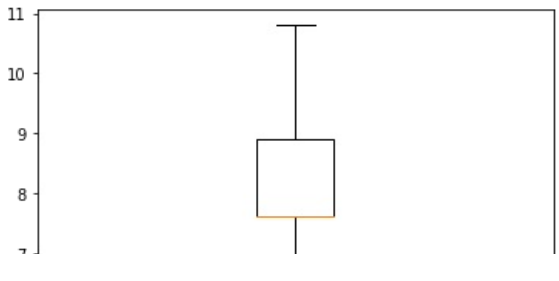
In [43]:
```
for i in cont_data:
    plt.boxplot(cont_data[i], labels = [i])
    plt.show()
```

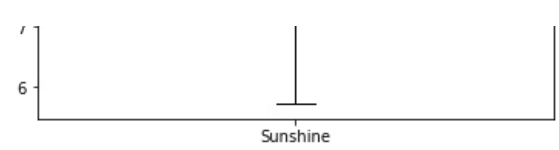


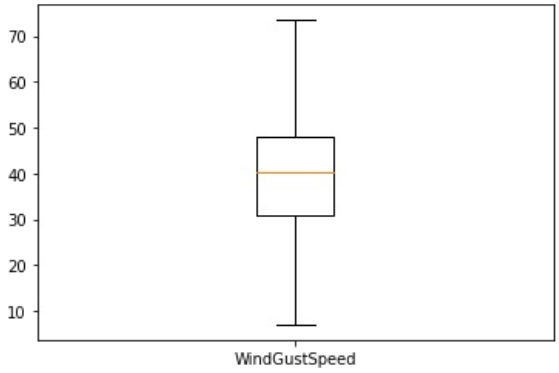



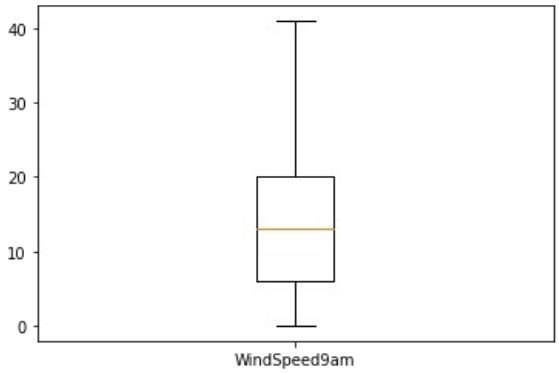



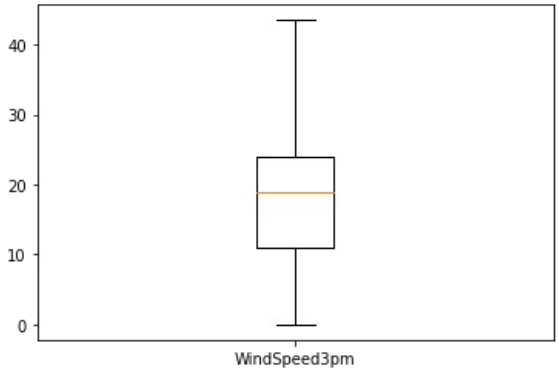



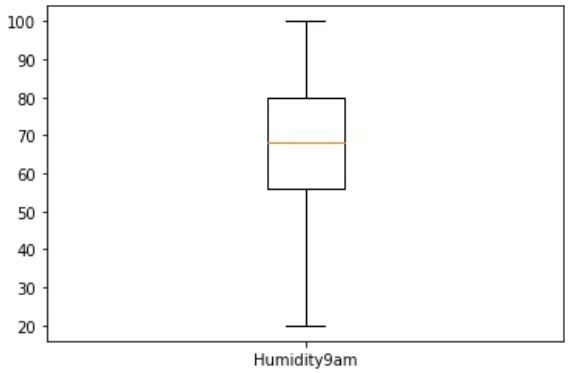



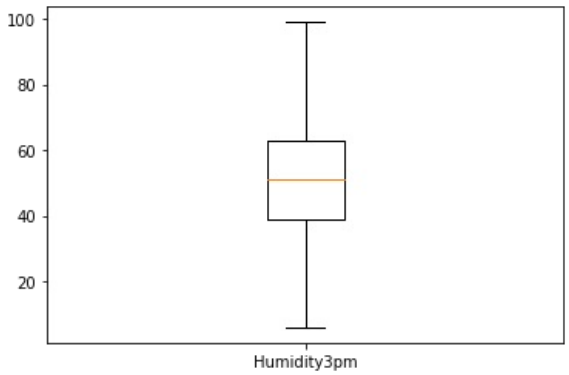

7
6
Sunshine

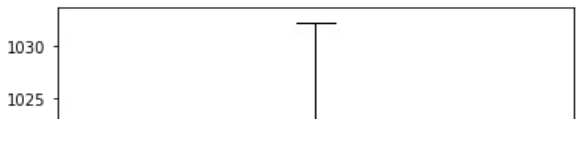

70
60
50
40
30
20
10
WindGustSpeed

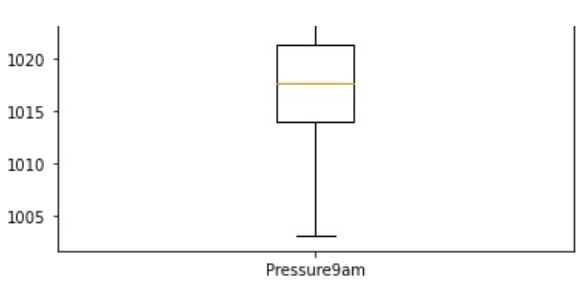

40
30
20
10
0
WindSpeed9am

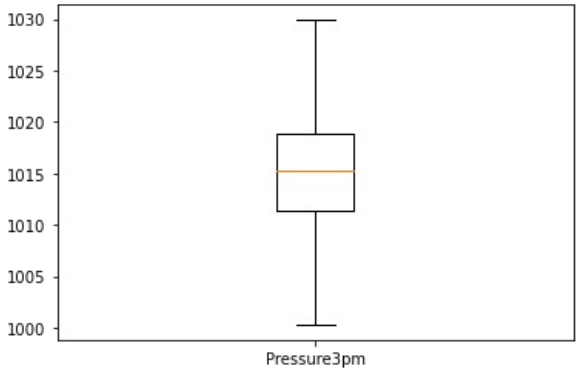

40
30
20
10
0
WindSpeed3pm

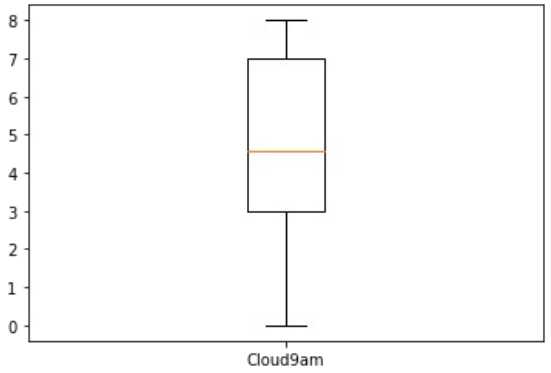

100
90
80
70
60
50
40
30
20
Humidity9am

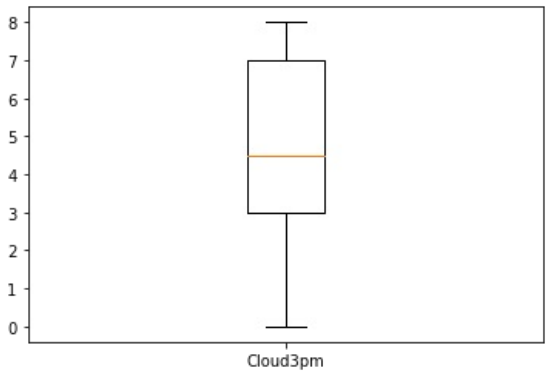

100
80
60
40
20
Humidity3pm

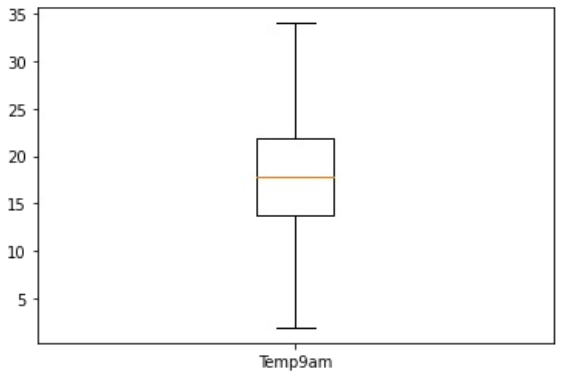

1030
1025

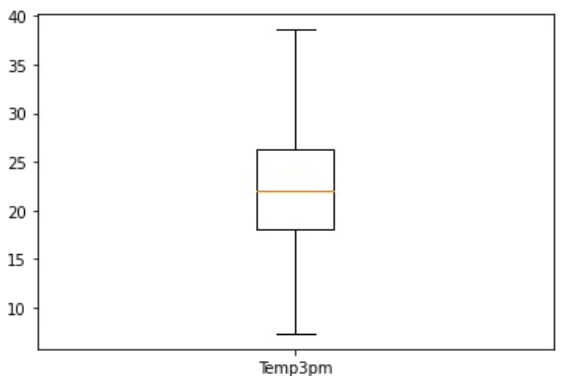

1020
1015
1010
1005
Pressure9am


1030
1025
1020
1015
1010
1005
1000
Pressure3pm


8
7
6
5
4
3
2
1
0
Cloud9am


8
7
6
5
4
3
2
1
0
Cloud3pm


35
30
25
20
15
10
5
Temp9am


40
35
30
25
20
15
10
Temp3pm

In [44]:
```
## outliers are removed
```

In [112…
```
corr=cont_data.corr()
```

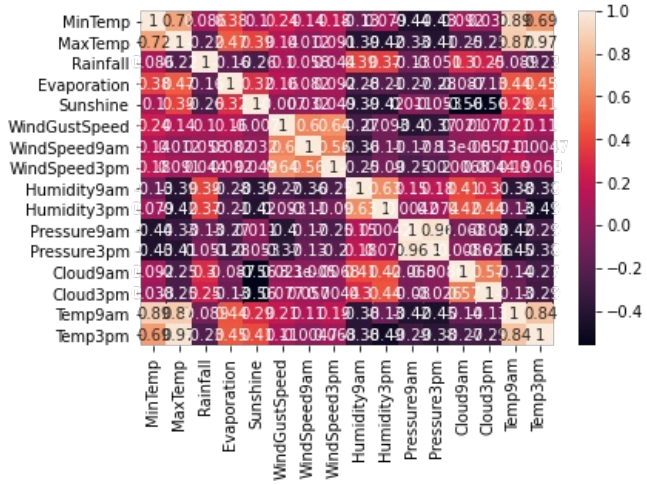
In [113…
```
plt.figure(figsize=(16,16))
```

Out[113…
```
<Figure size 1152x1152 with 0 Axes>
```

```
<Figure size 1152x1152 with 0 Axes>
```


In [114…
```
sns.heatmap(corr,annot=True)
```

Out[114…
```
<AxesSubplot:>
```




In [115…
```
cont_data=cont_data.drop(['Temp9am','MaxTemp','MinTemp','Pressure3pm','Temp9am','Temp3pm'],axis=1)
cont_data
```

Out[115…

| | Rainfall | Evaporation | Sunshine | WindGustSpeed | WindSpeed9am | WindSpeed3pm | Humidity9am | Humidity3pm | Pressure9am | Cloud9am | C |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 0.6 | 5.389395 | 7.632205 | 44.000000 | 20.0 | 24.0 | 71.0 | 22.0 | 1007.7 | 8.000000 | |
| **1** | 0.0 | 5.389395 | 7.632205 | 44.000000 | 4.0 | 22.0 | 44.0 | 25.0 | 1010.6 | 4.566622 | |
| **2** | 0.0 | 5.389395 | 7.632205 | 46.000000 | 19.0 | 26.0 | 38.0 | 30.0 | 1007.6 | 4.566622 | |
| **3** | 0.0 | 5.389395 | 7.632205 | 24.000000 | 11.0 | 9.0 | 45.0 | 16.0 | 1017.6 | 4.566622 | |
| **4** | 1.0 | 5.389395 | 7.632205 | 41.000000 | 7.0 | 20.0 | 82.0 | 33.0 | 1010.8 | 7.000000 | |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| **8420** | 0.0 | 5.389395 | 7.632205 | 31.000000 | 13.0 | 11.0 | 51.0 | 24.0 | 1024.6 | 4.566622 | |
| **8421** | 0.0 | 5.389395 | 7.632205 | 22.000000 | 13.0 | 9.0 | 56.0 | 21.0 | 1023.5 | 4.566622 | |
| **8422** | 0.0 | 5.389395 | 7.632205 | 37.000000 | 9.0 | 9.0 | 53.0 | 24.0 | 1021.0 | 4.566622 | |
| **8423** | 0.0 | 5.389395 | 7.632205 | 28.000000 | 13.0 | 7.0 | 51.0 | 24.0 | 1019.4 | 3.000000 | |
| **8424** | 0.0 | 5.389395 | 7.632205 | 40.174469 | 17.0 | 17.0 | 62.0 | 36.0 | 1020.2 | 8.000000 | |

8425 rows × 11 columns

In [116…]
```
cat_vars = df.select_dtypes(include = ['object'])
cat_vars
```

Out[116…]

| | Date | Location | WindGustDir | WindDir9am | WindDir3pm | RainToday | RainTomorrow |
|---|---|---|---|---|---|---|---|
| **0** | 2008-12-01 | Albury | W | W | WNW | No | No |
| **1** | 2008-12-02 | Albury | WNW | NNW | WSW | No | No |
| **2** | 2008-12-03 | Albury | WSW | W | WSW | No | No |
| **3** | 2008-12-04 | Albury | NE | SE | E | No | No |
| **4** | 2008-12-05 | Albury | W | ENE | NW | No | No |
| **...** | ... | ... | ... | ... | ... | ... | ... |
| **8420** | 2017-06-21 | Uluru | E | SE | ENE | No | No |
| **8421** | 2017-06-22 | Uluru | NNW | SE | N | No | No |
| **8422** | 2017-06-23 | Uluru | N | SE | WNW | No | No |
| **8423** | 2017-06-24 | Uluru | SE | SSE | N | No | No |
| **8424** | 2017-06-25 | Uluru | NaN | ESE | ESE | No | NaN |

8425 rows × 7 columns

In [117…]
```
cat_vars.isnull().sum()
```

Out[117…]
```
Date              0
Location          0
WindGustDir     991
WindDir9am      829
WindDir3pm      308
RainToday       240
RainTomorrow    239
dtype: int64
```

In [118…]
```
cat_vars=cat_vars.drop(['Date'],axis=1)
cat_vars
```

Out[118…]

| | Location | WindGustDir | WindDir9am | WindDir3pm | RainToday | RainTomorrow |
|---|---|---|---|---|---|---|
| **0** | Albury | W | W | WNW | No | No |
| **1** | Albury | WNW | NNW | WSW | No | No |
| **2** | Albury | WSW | W | WSW | No | No |
| **3** | Albury | NE | SE | E | No | No |
| **4** | Albury | W | ENE | NW | No | No |
| **...** | ... | ... | ... | ... | ... | ... |
| **8420** | Uluru | E | SE | ENE | No | No |
| **8421** | Uluru | NNW | SE | N | No | No |
| **8422** | Uluru | N | SE | WNW | No | No |
| **8423** | Uluru | SE | SSE | N | No | No |
| **8424** | Uluru | NaN | ESE | ESE | No | NaN |

8425 rows × 6 columns

In [119…]
```
## removing the null values
```

In [120…]
```
cat_vars=cat_vars.fillna(cat_vars.mode().iloc[0])
cat_vars
```

Out[120…]

| | Location | WindGustDir | WindDir9am | WindDir3pm | RainToday | RainTomorrow |
|---|---|---|---|---|---|---|
| **0** | Albury | W | W | WNW | No | No |
| **1** | Albury | WNW | NNW | WSW | No | No |
| **2** | Albury | WSW | W | WSW | No | No |

| | | | | | | |
|---|---|---|---|---|---|---|
| **3** | Albury | NE | SE | E | No | No |
| **4** | Albury | W | ENE | NW | No | No |
| **...** | ... | ... | ... | ... | ... | ... |
| **8420** | Uluru | E | SE | ENE | No | No |
| **8421** | Uluru | NNW | SE | N | No | No |
| **8422** | Uluru | N | SE | WNW | No | No |
| **8423** | Uluru | SE | SSE | N | No | No |
| **8424** | Uluru | N | ESE | ESE | No | No |

8425 rows × 6 columns

In [121…
```
cat_vars.isnull().sum()
```

Out[121…
```
Location        0
WindGustDir     0
WindDir9am      0
WindDir3pm      0
RainToday       0
RainTomorrow    0
dtype: int64
```

In [127…
```
cat_data = cat_vars.copy()
cat_data = pd.get_dummies(cat_vars, drop_first = True) ## numerical features to continuos features
cat_data
```

Out[127…

| | Location_Albury | Location_Brisbane | Location_CoffsHarbour | Location_Darwin | Location_Melbourne | Location_Newcastle | Location_Penrith |
|---|---|---|---|---|---|---|---|
| **0** | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| **1** | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| **2** | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| **3** | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| **4** | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| **...** | ... | ... | ... | ... | ... | ... | ... |
| **8420** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **8421** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **8422** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **8423** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **8424** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

8425 rows × 58 columns

In [128…
```
# Combining Numerical and Categorical data.
final_data = pd.concat([cont_data, cat_data], axis = 1)
final_data
```

Out[128…

| | Rainfall | Evaporation | Sunshine | WindGustSpeed | WindSpeed9am | WindSpeed3pm | Humidity9am | Humidity3pm | Pressure9am | Cloud9am | . |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 0.6 | 5.389395 | 7.632205 | 44.000000 | 20.0 | 24.0 | 71.0 | 22.0 | 1007.7 | 8.000000 | . |
| **1** | 0.0 | 5.389395 | 7.632205 | 44.000000 | 4.0 | 22.0 | 44.0 | 25.0 | 1010.6 | 4.566622 | . |
| **2** | 0.0 | 5.389395 | 7.632205 | 46.000000 | 19.0 | 26.0 | 38.0 | 30.0 | 1007.6 | 4.566622 | . |
| **3** | 0.0 | 5.389395 | 7.632205 | 24.000000 | 11.0 | 9.0 | 45.0 | 16.0 | 1017.6 | 4.566622 | . |
| **4** | 1.0 | 5.389395 | 7.632205 | 41.000000 | 7.0 | 20.0 | 82.0 | 33.0 | 1010.8 | 7.000000 | . |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | . |
| **8420** | 0.0 | 5.389395 | 7.632205 | 31.000000 | 13.0 | 11.0 | 51.0 | 24.0 | 1024.6 | 4.566622 | . |
| **8421** | 0.0 | 5.389395 | 7.632205 | 22.000000 | 13.0 | 9.0 | 56.0 | 21.0 | 1023.5 | 4.566622 | . |
| **8422** | 0.0 | 5.389395 | 7.632205 | 37.000000 | 9.0 | 9.0 | 53.0 | 24.0 | 1021.0 | 4.566622 | . |
| **8423** | 0.0 | 5.389395 | 7.632205 | 28.000000 | 13.0 | 7.0 | 51.0 | 24.0 | 1019.4 | 3.000000 | . |
| **8424** | 0.0 | 5.389395 | 7.632205 | 40.174469 | 17.0 | 17.0 | 62.0 | 36.0 | 1020.2 | 8.000000 | . |

8425 rows × 69 columns

In [129…
```
## correlation
```

In [130…
```
corr=final_data.corr()
```

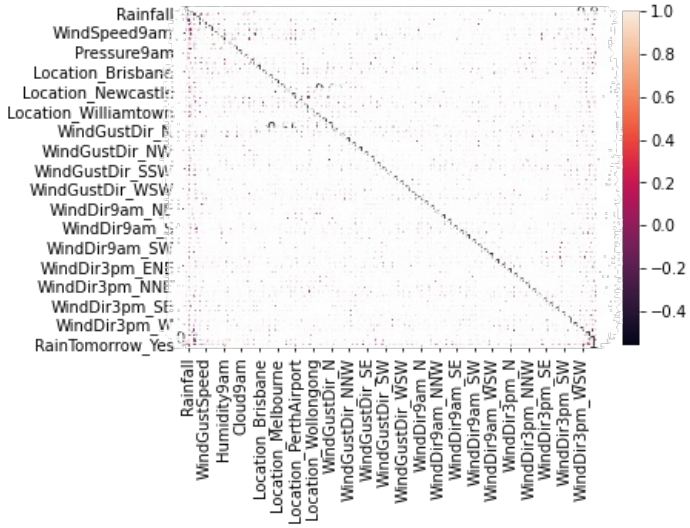
In [154…
```
plt.figure(figsize=(20,20))
```

Out[154… <Figure size 1440x1440 with 0 Axes>

<Figure size 1440x1440 with 0 Axes>

In [155…
```
sns.heatmap(corr,annot=True)
```

Out[155… <AxesSubplot:>




In [133…
```
## splitting the dependent and independent variables
```

In [135…
```
x=final_data.drop(['Rainfall'],axis=1)
x
```

Out[135…

| | Evaporation | Sunshine | WindGustSpeed | WindSpeed9am | WindSpeed3pm | Humidity9am | Humidity3pm | Pressure9am | Cloud9am | Cloud3pm |
|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 5.389395 | 7.632205 | 44.000000 | 20.0 | 24.0 | 71.0 | 22.0 | 1007.7 | 8.000000 | 4.503183 |
| **1** | 5.389395 | 7.632205 | 44.000000 | 4.0 | 22.0 | 44.0 | 25.0 | 1010.6 | 4.566622 | 4.503183 |
| **2** | 5.389395 | 7.632205 | 46.000000 | 19.0 | 26.0 | 38.0 | 30.0 | 1007.6 | 4.566622 | 2.000000 |
| **3** | 5.389395 | 7.632205 | 24.000000 | 11.0 | 9.0 | 45.0 | 16.0 | 1017.6 | 4.566622 | 4.503183 |
| **4** | 5.389395 | 7.632205 | 41.000000 | 7.0 | 20.0 | 82.0 | 33.0 | 1010.8 | 7.000000 | 8.000000 |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| **8420** | 5.389395 | 7.632205 | 31.000000 | 13.0 | 11.0 | 51.0 | 24.0 | 1024.6 | 4.566622 | 4.503183 |
| **8421** | 5.389395 | 7.632205 | 22.000000 | 13.0 | 9.0 | 56.0 | 21.0 | 1023.5 | 4.566622 | 4.503183 |
| **8422** | 5.389395 | 7.632205 | 37.000000 | 9.0 | 9.0 | 53.0 | 24.0 | 1021.0 | 4.566622 | 4.503183 |
| **8423** | 5.389395 | 7.632205 | 28.000000 | 13.0 | 7.0 | 51.0 | 24.0 | 1019.4 | 3.000000 | 2.000000 |
| **8424** | 5.389395 | 7.632205 | 40.174469 | 17.0 | 17.0 | 62.0 | 36.0 | 1020.2 | 8.000000 | 8.000000 |

8425 rows × 68 columns

In [158…
```
y=final_data['Rainfall']
y
```

Out[158…
```
0       0.6
1       0.0
2       0.0
3       0.0
4       1.0
       ...
8420    0.0
8421    0.0
8422    0.0
8423    0.0
8424    0.0
Name: Rainfall, Length: 8425, dtype: float64
```

In [159…
```
from sklearn.preprocessing import StandardScaler
```

In [160…
```
st=StandardScaler()
```

In [161…
```
st.fit_transform(x)
```

Out[161…
```
array([[ 0.24373602, -0.22498136,  0.30230391, ..., -0.27190521,
        -0.55609919, -0.55628212],
       [ 0.24373602, -0.22498136,  0.30230391, ...,  3.67775231,
        -0.55609919, -0.55628212],
       [ 0.24373602, -0.22498136,  0.45333217, ...,  3.67775231,
        -0.55609919, -0.55628212],
       ...,
       [ 0.24373602, -0.22498136, -0.22629499, ..., -0.27190521,
        -0.55609919, -0.55628212],
       [ 0.24373602, -0.22498136, -0.90592215, ..., -0.27190521,
        -0.55609919, -0.55628212],
       [ 0.24373602, -0.22498136,  0.01342224, ..., -0.27190521,
        -0.55609919, -0.55628212]])
```

In [162…
```
# feature selection
```

In [166…
```
from sklearn.ensemble import ExtraTreesRegressor
model=ExtraTreesRegressor()
```

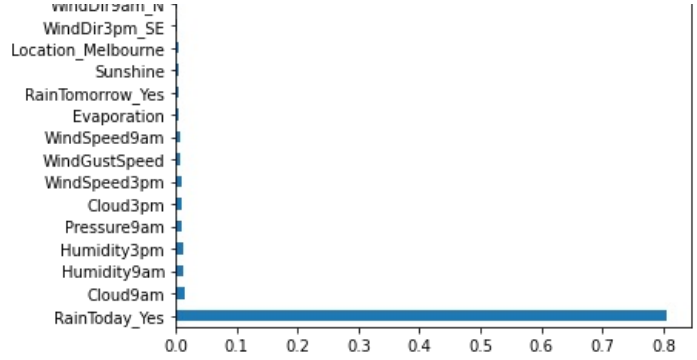
In [167…
```
model.fit(x,y)
```

Out[167…
```
ExtraTreesRegressor()
```

In [168…
```
print(model.feature_importances_)
```

```
[6.06199710e-03 4.10326128e-03 8.17671419e-03 8.16451742e-03
 9.07377978e-03 1.28720454e-02 1.27432034e-02 1.02163905e-02
 1.45827244e-02 9.97257322e-03 1.49911578e-03 6.28423322e-04
 1.22042778e-03 2.38703594e-04 4.08472104e-03 6.22888524e-04
 1.02226280e-03 1.05187212e-03 4.21546559e-06 2.67659617e-03
 1.38305482e-03 9.90980108e-04 6.30660797e-04 1.78995468e-03
 1.03468730e-03 8.70547463e-04 8.10296911e-04 1.17820208e-03
 2.12751874e-03 1.66933475e-03 3.12800121e-03 1.65635614e-03
 2.14924698e-03 2.46474698e-03 1.91076197e-03 2.68417709e-03
 6.39273838e-04 9.16950965e-04 3.13756906e-03 1.03100740e-03
 1.34731194e-03 1.62999250e-03 1.86475484e-03 1.57768886e-03
 1.37332603e-03 2.11623022e-03 1.35780354e-03 2.18228117e-03
 1.43658741e-03 1.62541877e-03 2.72848333e-03 2.31985070e-03
 1.43972907e-03 2.09904001e-03 8.98285531e-04 2.06373870e-03
 1.63514677e-03 1.20627122e-03 2.89127240e-03 3.41043148e-03
 2.50879869e-03 1.97274776e-03 1.80243302e-03 1.02757231e-03
 1.50453543e-03 1.96349734e-03 8.05113082e-01 5.68392603e-03]
```

In [172…
```
feat_importances=pd.Series(model.feature_importances_,index=x.columns)
feat_importances.nlargest(15).plot(kind='barh')
plt.show()
```




In [182…

```
x_new1=pd.DataFrame(x['RainToday_Yes'])
x_new1
```

Out[182…

| | RainToday_Yes |
|---|---|
| **0** | 0 |
| **1** | 0 |
| **2** | 0 |
| **3** | 0 |
| **4** | 0 |
| **...** | ... |
| **8420** | 0 |
| **8421** | 0 |
| **8422** | 0 |
| **8423** | 0 |
| **8424** | 0 |

8425 rows × 1 columns

In [183…

```
x_new2=pd.DataFrame(x['Cloud9am'])
x_new2
```

Out[183…

| | Cloud9am |
|---|---|
| **0** | 8.000000 |
| **1** | 4.566622 |
| **2** | 4.566622 |
| **3** | 4.566622 |
| **4** | 7.000000 |
| **...** | ... |
| **8420** | 4.566622 |
| **8421** | 4.566622 |
| **8422** | 4.566622 |
| **8423** | 3.000000 |
| **8424** | 8.000000 |

8425 rows × 1 columns

In [185…

```
x_new3=pd.DataFrame(x['Humidity9am'])
x_new3
```

Out[185…

| | Humidity9am |
|---|---|
| **0** | 71.0 |
| **1** | 44.0 |
| **2** | 38.0 |
| **3** | 45.0 |
| **4** | 82.0 |

| | |
|---|---|
| ... | ... |
| **8420** | 51.0 |
| **8421** | 56.0 |
| **8422** | 53.0 |
| **8423** | 51.0 |
| **8424** | 62.0 |

8425 rows × 1 columns

In [186...]
```
x_new4=pd.DataFrame(x['Humidity3pm'])
x_new4
```

Out[186...]

| | Humidity3pm |
|---|---|
| **0** | 22.0 |
| **1** | 25.0 |
| **2** | 30.0 |
| **3** | 16.0 |
| **4** | 33.0 |
| **...** | ... |
| **8420** | 24.0 |
| **8421** | 21.0 |
| **8422** | 24.0 |
| **8423** | 24.0 |
| **8424** | 36.0 |

8425 rows × 1 columns

In [187...]
```
x_new5=pd.DataFrame(x['Cloud3pm'])
x_new5
```

Out[187...]

| | Cloud3pm |
|---|---|
| **0** | 4.503183 |
| **1** | 4.503183 |
| **2** | 2.000000 |
| **3** | 4.503183 |
| **4** | 8.000000 |
| **...** | ... |
| **8420** | 4.503183 |
| **8421** | 4.503183 |
| **8422** | 4.503183 |
| **8423** | 2.000000 |
| **8424** | 8.000000 |

8425 rows × 1 columns

In [188...]
```
x_new6=pd.DataFrame(x['Pressure9am'])
x_new6
```

Out[188...]

| | Pressure9am |
|---|---|
| **0** | 1007.7 |
| **1** | 1010.6 |
| **2** | 1007.6 |
| **3** | 1017.6 |
| **4** | 1010.8 |
| **...** | ... |

| | |
|---|---|
| **8420** | 1024.6 |
| **8421** | 1023.5 |
| **8422** | 1021.0 |
| **8423** | 1019.4 |
| **8424** | 1020.2 |

8425 rows × 1 columns

In [189…
```
x_new7=pd.DataFrame(x['WindSpeed9am'])
x_new7
```

Out[189…

| | WindSpeed9am |
|---|---|
| **0** | 20.0 |
| **1** | 4.0 |
| **2** | 19.0 |
| **3** | 11.0 |
| **4** | 7.0 |
| **...** | ... |
| **8420** | 13.0 |
| **8421** | 13.0 |
| **8422** | 9.0 |
| **8423** | 13.0 |
| **8424** | 17.0 |

8425 rows × 1 columns

In [190…
```
x_new8=pd.DataFrame(x['WindSpeed3pm'])
x_new8
```

Out[190…

| | WindSpeed3pm |
|---|---|
| **0** | 24.0 |
| **1** | 22.0 |
| **2** | 26.0 |
| **3** | 9.0 |
| **4** | 20.0 |
| **...** | ... |
| **8420** | 11.0 |
| **8421** | 9.0 |
| **8422** | 9.0 |
| **8423** | 7.0 |
| **8424** | 17.0 |

8425 rows × 1 columns

In [191…
```
x_new9=pd.DataFrame(x['WindGustSpeed'])
x_new9
```

Out[191…

| | WindGustSpeed |
|---|---|
| **0** | 44.000000 |
| **1** | 44.000000 |
| **2** | 46.000000 |
| **3** | 24.000000 |
| **4** | 41.000000 |
| **...** | ... |
| **8420** | 31.000000 |

| | |
|---|---|
| **8421** | 22.000000 |
| **8422** | 37.000000 |
| **8423** | 28.000000 |
| **8424** | 40.174469 |

8425 rows × 1 columns

In [192…
```
x_new_10=pd.DataFrame(x['Evaporation'])
x_new_10
```

Out[192…

| | Evaporation |
|---|---|
| **0** | 5.389395 |
| **1** | 5.389395 |
| **2** | 5.389395 |
| **3** | 5.389395 |
| **4** | 5.389395 |
| **...** | ... |
| **8420** | 5.389395 |
| **8421** | 5.389395 |
| **8422** | 5.389395 |
| **8423** | 5.389395 |
| **8424** | 5.389395 |

8425 rows × 1 columns

In [194…
```
# Combining Numerical and Categorical data.
x_new = pd.concat([x_new1,x_new2,x_new3,x_new4,x_new5,x_new6,x_new7,x_new8,x_new9,x_new_10], axis = 1)
x_new
```

Out[194…

| | RainToday_Yes | Humidity9am | Humidity9am | Humidity3pm | Cloud3pm | Pressure9am | WindSpeed9am | WindSpeed3pm | WindGustSpeed | Eva |
|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 0 | 71.0 | 71.0 | 22.0 | 4.503183 | 1007.7 | 20.0 | 24.0 | 44.000000 | |
| **1** | 0 | 44.0 | 44.0 | 25.0 | 4.503183 | 1010.6 | 4.0 | 22.0 | 44.000000 | |
| **2** | 0 | 38.0 | 38.0 | 30.0 | 2.000000 | 1007.6 | 19.0 | 26.0 | 46.000000 | |
| **3** | 0 | 45.0 | 45.0 | 16.0 | 4.503183 | 1017.6 | 11.0 | 9.0 | 24.000000 | |
| **4** | 0 | 82.0 | 82.0 | 33.0 | 8.000000 | 1010.8 | 7.0 | 20.0 | 41.000000 | |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| **8420** | 0 | 51.0 | 51.0 | 24.0 | 4.503183 | 1024.6 | 13.0 | 11.0 | 31.000000 | |
| **8421** | 0 | 56.0 | 56.0 | 21.0 | 4.503183 | 1023.5 | 13.0 | 9.0 | 22.000000 | |
| **8422** | 0 | 53.0 | 53.0 | 24.0 | 4.503183 | 1021.0 | 9.0 | 9.0 | 37.000000 | |
| **8423** | 0 | 51.0 | 51.0 | 24.0 | 2.000000 | 1019.4 | 13.0 | 7.0 | 28.000000 | |
| **8424** | 0 | 62.0 | 62.0 | 36.0 | 8.000000 | 1020.2 | 17.0 | 17.0 | 40.174469 | |

8425 rows × 10 columns

In [196…
```
y
```

Out[196…
```
0       0.6
1       0.0
2       0.0
3       0.0
4       1.0
       ...
8420    0.0
8421    0.0
8422    0.0
8423    0.0
8424    0.0
Name: Rainfall, Length: 8425, dtype: float64
```

In [ ]:
```
##Training the models
```

In [207…
```
#importing models
from sklearn.neighbors import KNeighborsRegressor
from sklearn.linear_model import LinearRegression,Lasso,Ridge,ElasticNet
from sklearn.svm import SVR
from sklearn.tree import DecisionTreeRegressor
from sklearn.ensemble import RandomForestRegressor,AdaBoostRegressor,GradientBoostingRegressor
```

In [208…
```
from sklearn.metrics import r2_score,mean_absolute_error,mean_squared_error
```

In [209…
```
x_train,x_test,y_train,y_test=train_test_split(x_new,y,random_state=41,test_size=0.25)
```

In [210…
```
## knearestNeighbors
```

In [211…
```
kn=KNeighborsRegressor()
```

In [212…
```
kn.fit(x_train,y_train)
```

Out[212…
```
KNeighborsRegressor()
```

In [213…
```
y_pred=kn.predict(x_test)
```

In [214…
```
mean_absolute_error(y_test,y_pred)
```

Out[214…
```
0.7920012942285359
```

In [215…
```
mean_squared_error(y_test,y_pred)
```

Out[215…
```
1.3930879665000782
```

In [216…
```
r2_score(y_test,y_pred)
```

Out[216…
```
0.24702277069009237
```

In [217…
```
## svr
```

In [218…
```
sv=SVR()
```

In [219…
```
sv.fit(x_train,y_train)
```

Out[219…
```
SVR()
```

In [220…
```
y_pred=sv.predict(x_test)
```

In [221…
```
mean_absolute_error(y_test,y_pred)
```

Out[221…
```
0.8307197300718129
```

In [222…
```
r2_score(y_test,y_pred)
```

Out[222… -0.1333155254272731

In [ ]:
```
## decisiontreeRegressor
```

In [223…
```
dt=DecisionTreeRegressor()
```

In [224…
```
dt.fit(x_train,y_train)
```

Out[224… DecisionTreeRegressor()

In [225…
```
y_pred=dt.predict(x_test)
```

In [226…
```
mean_absolute_error(y_test,y_pred)
```

Out[226… 0.25056081970004646

In [227…
```
r2_score(y_test,y_pred)
```

Out[227… 0.7606819139564659

In [228…
```
mean_squared_error(y_test,y_pred)
```

Out[228… 0.44276391483793703

In [229…
```
rf=RandomForestRegressor()
```

In [230…
```
rf.fit(x_train,y_train)
```

Out[230… RandomForestRegressor()

In [231…
```
y_pred=rf.predict(x_test)
```

In [232…
```
mean_absolute_error(y_test,y_pred)
```

Out[232… 0.2800035593821739

In [233…
```
r2_score(y_test,y_pred)
```

Out[233… 0.8606769348483123

In [234…
```
mean_squared_error(y_test,y_pred)
```

Out[234… 0.25776248997144646

In [235…
```
##GradientBoostingRegressor
```

In [236…
```
gb=GradientBoostingRegressor()
```

In [237…
```
gb.fit(x_train,y_train)
```

Out[237…
```
GradientBoostingRegressor()
```

In [238…
```
y_pred=gb.predict(x_test)
```

In [239…
```
mean_absolute_error(y_test,y_pred)
```

Out[239…
```
0.3386004789382708
```

In [240…
```
mean_squared_error(y_test,y_pred)
```

Out[240…
```
0.35320615858548715
```

In [241…
```
r2_score(y_test,y_pred)
```

Out[241…
```
0.8090887287361541
```

In [242…
```
## randomforestregressor working is fine
```

In [243…
```
from sklearn.model_selection import RandomizedSearchCV
```

In [244…
```
params={'n_estimators':[100,200,300,400,500,600,700],'min_samples_split':[1,2,3,4],'min_samples_leaf':[1,2,3,4],'
```

In [245…
```
g=RandomizedSearchCV(RandomForestRegressor(),params,cv=10)
```

In [246…
```
g.fit(x_train,y_train)
```

Out[246…
```
RandomizedSearchCV(cv=10, estimator=RandomForestRegressor(),
                   param_distributions={'max_depth': [None, 1, 2, 3, 4, 5, 6, 7,
                                                      8],
                                        'min_samples_leaf': [1, 2, 3, 4],
                                        'min_samples_split': [1, 2, 3, 4],
                                        'n_estimators': [100, 200, 300, 400,
                                                         500, 600, 700]})
```

In [247…
```
g.best_params_
```

Out[247…
```
{'n_estimators': 300,
 'min_samples_split': 4,
 'min_samples_leaf': 1,
 'max_depth': None}
```

In [248…
```
m=RandomForestRegressor(n_estimators=300 ,
 min_samples_split=4 ,
 min_samples_leaf=1,
 max_depth=None)
```

In [249…
```
m.fit(x_train,y_train)
```

Out[249…
```
RandomForestRegressor(min_samples_split=4, n_estimators=300)
```

In [250…
```
y_test=m.predict(x_test)
```

In [251…
```
mean_absolute_error(y_test,y_pred)
```
Out[251…
```
0.14525713881890298
```

In [252…
```
mean_squared_error(y_test,y_pred)
```
Out[252…
```
0.061485532522505854
```

In [253…
```
r2_score(y_test,y_pred)
```
Out[253…
```
0.9602430200640046
```

In [254…
```
## evaluating the model
```

In [255…
```
import numpy as np
```

In [260…
```
a=np.array(y_test)
a
```
Out[260…
```
array([2.35436984, 0.33636027, 0.18776245, ..., 3.09962222, 0.08180406,
       3.16904603])
```

In [261…
```
predicted=np.array(m.predict(x_test))
predicted
```
Out[261…
```
array([2.35436984, 0.33636027, 0.18776245, ..., 3.09962222, 0.08180406,
       3.16904603])
```

In [258…
```
df_com=pd.DataFrame({'actual':a,'pred':predicted},index=range(len(a)))
```

In [259…
```
df_com
```
Out[259…

| | actual | pred |
|---|---|---|
| **0** | 2.354370 | 2.354370 |
| **1** | 0.336360 | 0.336360 |
| **2** | 0.187762 | 0.187762 |
| **3** | 0.071039 | 0.071039 |
| **4** | 0.029098 | 0.029098 |
| **...** | ... | ... |
| **2102** | 0.047858 | 0.047858 |
| **2103** | 0.030150 | 0.030150 |
| **2104** | 3.099622 | 3.099622 |
| **2105** | 0.081804 | 0.081804 |
| **2106** | 3.169046 | 3.169046 |

2107 rows × 2 columns

In [262…
```
## classifier
```

In [263…
```
x_new
```
Out[263…

| | RainToday_Yes | Humidity9am | Humidity9am | Humidity3pm | Cloud3pm | Pressure9am | WindSpeed9am | WindSpeed3pm | WindGustSpeed | Eva |
|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 0 | 71.0 | 71.0 | 22.0 | 4.503183 | 1007.7 | 20.0 | 24.0 | 44.000000 | |
| **1** | 0 | 44.0 | 44.0 | 25.0 | 4.503183 | 1010.6 | 4.0 | 22.0 | 44.000000 | |
| **2** | 0 | 38.0 | 38.0 | 30.0 | 2.000000 | 1007.6 | 19.0 | 26.0 | 46.000000 | |
| **3** | 0 | 45.0 | 45.0 | 16.0 | 4.503183 | 1017.6 | 11.0 | 9.0 | 24.000000 | |
| **4** | 0 | 82.0 | 82.0 | 33.0 | 8.000000 | 1010.8 | 7.0 | 20.0 | 41.000000 | |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | ... | |
| **8420** | 0 | 51.0 | 51.0 | 24.0 | 4.503183 | 1024.6 | 13.0 | 11.0 | 31.000000 | |
| **8421** | 0 | 56.0 | 56.0 | 21.0 | 4.503183 | 1023.5 | 13.0 | 9.0 | 22.000000 | |
| **8422** | 0 | 53.0 | 53.0 | 24.0 | 4.503183 | 1021.0 | 9.0 | 9.0 | 37.000000 | |
| **8423** | 0 | 51.0 | 51.0 | 24.0 | 2.000000 | 1019.4 | 13.0 | 7.0 | 28.000000 | |
| **8424** | 0 | 62.0 | 62.0 | 36.0 | 8.000000 | 1020.2 | 17.0 | 17.0 | 40.174469 | |

8425 rows × 10 columns

In [264…
```
from sklearn.preprocessing import LabelEncoder
```

In [265…
```
lb=LabelEncoder()
```

In [269…
```
e=lb.fit_transform(cat_vars['RainTomorrow'])
```

In [271…
```
y=pd.Series(e)
```

In [272…
```
y
```

Out[272…
```
0       0
1       0
2       0
3       0
4       0
       ..
8420    0
8421    0
8422    0
8423    0
8424    0
Length: 8425, dtype: int32
```

In [273…
```
from sklearn.model_selection import train_test_split,cross_val_score
#importing models
from sklearn.neighbors import KNeighborsClassifier
from sklearn.svm import SVC
from sklearn.tree import DecisionTreeClassifier
from sklearn.ensemble import RandomForestClassifier,AdaBoostClassifier,GradientBoostingClassifier
```

In [274…
```
x_train,x_test,y_train,y_test=train_test_split(x_new,y,test_size=0.30,random_state=41)
```

In [275…
```
kn=KNeighborsClassifier()
```

In [276…
```
kn.fit(x_train,y_train)
```

Out[276…
```
KNeighborsClassifier()
```

In [277…
```
y_pred=kn.predict(x_test)
```

In [285…
```
from sklearn.metrics import accuracy_score,confusion_matrix,classification_report,roc_auc_score
```

In [286…
```
accuracy_score(y_test,y_pred)
```

Out[286… 0.8263449367088608

In [287…
```
confusion_matrix(y_test,y_pred)
```

Out[287…
```
array([[1810,  123],
       [ 316,  279]], dtype=int64)
```

In [288…
```
classification_report(y_test,y_pred)
```

Out[288…
```
'              precision    recall  f1-score   support\n\n           0       0.85      0.94      0.89      1933\n
1       0.69      0.47      0.56       595\n\n    accuracy                           0.83      2528\n   macro avg
0.77      0.70      0.73      2528\nweighted avg       0.81      0.83      0.81      2528\n'
```

In [289…
```
roc_auc_score(y_test,y_pred)
```

Out[289… 0.7026379511970334

In [290…
```
cross_val_score(kn,x,y,cv=10).mean()
```

Out[290… 0.8262392822827647

In [291…
```
## SVM
```

In [292…
```
sv=SVC()
```

In [293…
```
sv.fit(x_train,y_train)
```

Out[293… SVC()

In [294…
```
y_pred=sv.predict(x_test)
```

In [295…
```
accuracy_score(y_test,y_pred)
```

Out[295… 0.7646360759493671

In [296…
```
confusion_matrix(y_test,y_pred)
```

Out[296…
```
array([[1933,    0],
       [ 595,    0]], dtype=int64)
```

In [297…
```
roc_auc_score(y_test,y_pred)
```

Out[297… 0.5

In [299…
```
cross_val_score(sv,x,y,cv=10).mean()
```

Out[299… 0.763679512430157

In [300…
```
classification_report(y_test,y_pred)
```

Out[300…
```
'              precision    recall  f1-score   support\n\n           0       0.76      1.00      0.87      1933\n
1       0.00      0.00      0.00       595\n\n    accuracy                           0.76      2528\n   macro avg
0.38      0.50      0.43      2528\nweighted avg       0.58      0.76      0.66      2528\n'
```

In [301…
```
## Decision tree classifier
```

In [302…
```
dt=DecisionTreeClassifier()
```

In [303…
```
dt.fit(x_train,y_train)
```

Out[303…
```
DecisionTreeClassifier()
```

In [304…
```
y_pred=dt.predict(x_test)
```

In [305…
```
accuracy_score(y_test,y_pred)
```

Out[305…
```
0.8326740506329114
```

In [306…
```
confusion_matrix(y_test,y_pred)
```

Out[306…
```
array([[1721,  212],
       [ 211,  384]], dtype=int64)
```

In [307…
```
roc_auc_score(y_test,y_pred)
```

Out[307…
```
0.7678520347611367
```

In [308…
```
cross_val_score(dt,x,y,cv=10).mean()
```

Out[308…
```
1.0
```

In [309…
```
classification_report(y_test,y_pred)
```

Out[309…
```
'              precision    recall  f1-score   support\n\n           0       0.89      0.89      0.89      1933\n
1       0.64      0.65      0.64       595\n\n    accuracy                           0.83      2528\n   macro avg
0.77      0.77      0.77      2528\nweighted avg       0.83      0.83      0.83      2528\n'
```

In [310…
```
## randomforestclassifier
```

In [311…
```
rf=RandomForestClassifier()
```

In [312…
```
rf.fit(x_train,y_train)
```

Out[312…
```
RandomForestClassifier()
```

In [313…
```
y_pred=rf.predict(x_test)
```

In [314…
```
accuracy_score(y_test,y_pred)
```

Out[314… 0.8833069620253164

In [315…
```
confusion_matrix(y_test,y_pred)
```

Out[315…
```
array([[1868,   65],
       [ 230,  365]], dtype=int64)
```

In [316…
```
roc_auc_score(y_test,y_pred)
```

Out[316… 0.7899094454129297

In [317…
```
cross_val_score(rf,x,y,cv=10).mean()
```

Out[317… 1.0

In [318…
```
classification_report(y_test,y_pred)
```

Out[318…
```
'              precision    recall  f1-score   support\n\n           0       0.89      0.97      0.93      1933\n
1       0.85      0.61      0.71       595\n\n    accuracy                           0.88      2528\n   macro avg
0.87      0.79      0.82      2528\nweighted avg       0.88      0.88      0.88      2528\n'
```

In [319…
```
## gradientBoostingClassifier
```

In [320…
```
gb=GradientBoostingClassifier()
```

In [321…
```
gb.fit(x_train,y_train)
```

Out[321… GradientBoostingClassifier()

In [322…
```
y_pred=gb.predict(x_test)
```

In [323…
```
accuracy_score(y_test,y_pred)
```

Out[323… 0.8409810126582279

In [324…
```
confusion_matrix(y_test,y_pred)
```

Out[324…
```
array([[1849,   84],
       [ 318,  277]], dtype=int64)
```

In [325…
```
roc_auc_score(y_test,y_pred)
```

Out[325… 0.7110452251257463

In [326…
```
cross_val_score(gb,x,y,cv=10).mean()
```

Out[326… 1.0

In [328…
```
## random forest classifier is working fine
```

In [329…
```
## hyperparamter tuning
```

In [330…
```
params={'n_estimators':[100,200,300,400,500,600,700],'min_samples_split':[1,2,3,4],'min_samples_leaf':[1,2,3,4],'
```

In [334…
```
g=RandomizedSearchCV(RandomForestClassifier(),params,cv=10)
```

In [335…
```
g.fit(x_train,y_train)
```

Out[335…
```
RandomizedSearchCV(cv=10, estimator=RandomForestClassifier(),
                   param_distributions={'max_depth': [None, 1, 2, 3, 4, 5, 6, 7,
                                                      8],
                                        'min_samples_leaf': [1, 2, 3, 4],
                                        'min_samples_split': [1, 2, 3, 4],
                                        'n_estimators': [100, 200, 300, 400,
                                                         500, 600, 700]})
```

In [336…
```
g.best_params_
```

Out[336…
```
{'n_estimators': 500,
 'min_samples_split': 2,
 'min_samples_leaf': 1,
 'max_depth': None}
```

In [337…
```
m=RandomForestClassifier(n_estimators=500 ,
 min_samples_split=2 ,
 min_samples_leaf=1,
 max_depth=None)
```

In [338…
```
m.fit(x_train,y_train)
```

Out[338…
```
RandomForestClassifier(n_estimators=500)
```

In [339…
```
y_test=m.predict(x_test)
```

In [340…
```
accuracy_score(y_test,y_pred)
```

Out[340…
```
0.9228639240506329
```

In [341…
```
confusion_matrix(y_test,y_pred)
```

Out[341…
```
array([[2037,   65],
       [ 130,  296]], dtype=int64)
```

In [342…
```
roc_auc_score(y_test,y_pred)
```

Out[342…
```
0.8319563751044166
```

In [343…
```
cross_val_score(m,x,y,cv=10).mean()
```

Out[343…
```
1.0
```

In [344…
```
classification_report(y_test,y_pred)
```

```
classification_report(y_test,y_pred)
```

Out[344…
```
'              precision    recall  f1-score   support\n\n           0       0.94      0.97      0.95      2102\n           1       0.82      0.69      0.75       426\n\n    accuracy                           0.92      2528\n   macro avg       0.88      0.83      0.85      2528\nweighted avg       0.92      0.92      0.92      2528\n'
```

In [345…
```
## evaluating the model
```

In [346…
```
b=np.array(y_test)
b
```

Out[346…
```
array([1, 0, 0, ..., 0, 0, 0])
```

In [347…
```
predicted=np.array(m.predict(x_test))
predicted
```

Out[347…
```
array([1, 0, 0, ..., 0, 0, 0])
```

In [350…
```
df_com_=pd.DataFrame({'actual':b,'pred':predicted},index=range(len(b)))
df_com_
```

Out[350…

| | actual | pred |
|---|---|---|
| **0** | 1 | 1 |
| **1** | 0 | 0 |
| **2** | 0 | 0 |
| **3** | 0 | 0 |
| **4** | 0 | 0 |
| **...** | ... | ... |
| **2523** | 0 | 0 |
| **2524** | 0 | 0 |
| **2525** | 0 | 0 |
| **2526** | 0 | 0 |
| **2527** | 0 | 0 |

2528 rows × 2 columns

In [351…
```
## saving the model
```

In [352…
```
import pickle
```

In [353…
```
filename='WEATHER_FORECASTING_PREDICTION'
```

In [355…
```
pickle.dump(m,open(filename,'wb'))
```

In [ ]:
```
```