In [ ]:
```
# Library

import pandas as pd
import numpy as np

from mpl_toolkits.basemap import Basemap
import matplotlib.pyplot as plt
from pylab import rcParams
%matplotlib inline

from sklearn.cluster import DBSCAN
import sklearn.utils
from sklearn.preprocessing import StandardScaler
```

In [ ]:
```
#Dataset
pdf = pd.read_csv('weather-stations.csv')
pdf.head(5)
```

Out[ ]:

	Stn_Name	Lat	Long	Prov	Tm	DwTm	D	Tx	DwTx	Tn	...	DwP	P%N	S_G
0	CHEMAINUS	48.935	-123.742	BC	8.2	0.0	NaN	13.5	0.0	1.0	...	0.0	NaN	0.0
1	COWICHAN LAKE FORESTRY	48.824	-124.133	BC	7.0	0.0	3.0	15.0	0.0	-3.0	...	0.0	104.0	0.0
2	LAKE COWICHAN	48.829	-124.052	BC	6.8	13.0	2.8	16.0	9.0	-2.5	...	9.0	NaN	NaN
3	DISCOVERY ISLAND	48.425	-123.226	BC	NaN	NaN	NaN	12.5	0.0	NaN	...	NaN	NaN	NaN
4	DUNCAN KELVIN CREEK	48.735	-123.728	BC	7.7	2.0	3.4	14.5	2.0	-1.0	...	2.0	NaN	NaN

5 rows × 25 columns

In [ ]:
```
#Cleaning Data
pdf = pdf[pd.notnull(pdf["Tm"])]
pdf = pdf.reset_index(drop=True)
pdf.head(5)
```

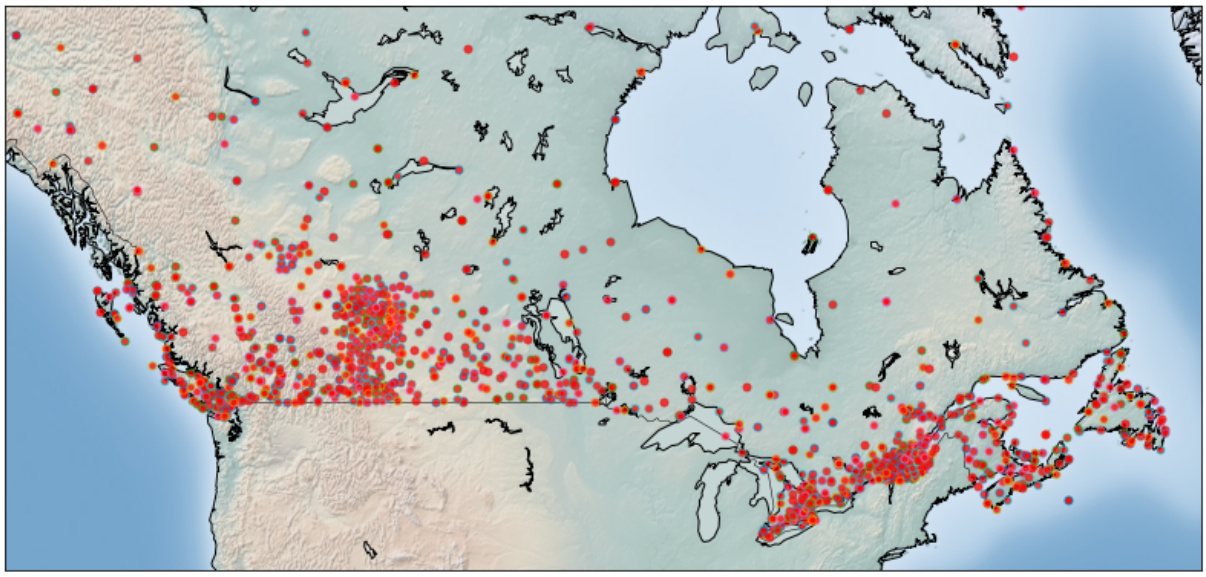
Out[ ]:

	Stn_Name	Lat	Long	Prov	Tm	DwTm	D	Tx	DwTx	Tn	...	DwP	P%N	S_G
0	CHEMAINUS	48.935	-123.742	BC	8.2	0.0	NaN	13.5	0.0	1.0	...	0.0	NaN	0.0
1	COWICHAN LAKE FORESTRY	48.824	-124.133	BC	7.0	0.0	3.0	15.0	0.0	-3.0	...	0.0	104.0	0.0
2	LAKE COWICHAN	48.829	-124.052	BC	6.8	13.0	2.8	16.0	9.0	-2.5	...	9.0	NaN	NaN
3	DUNCAN KELVIN CREEK	48.735	-123.728	BC	7.7	2.0	3.4	14.5	2.0	-1.0	...	2.0	NaN	NaN

	Stn_Name	Lat	Long	Prov	Tm	DwTm	D	Tx	DwTx	Tn	...	DwP	P%N	S_G
4	ESQUIMALT HARBOUR	48.432	-123.439	BC	8.8	0.0	NaN	13.1	0.0	1.9	...	8.0	NaN	NaN

5 rows × 25 columns

In [ ]:
```
# Plotting and Visualize Data
rcParams['figure.figsize'] = (14,10)

llon=-140
ulon=-50
llat=40
ulat=65

pdf = pdf[(pdf['Long'] > llon) & (pdf['Long'] < ulon) & (pdf['Lat'] > llat) &(pdf['L

my_map = Basemap(projection='merc',
            resolution = 'l', area_thresh = 1000.0,
            llcrnrlon=llon, llcrnrlat=llat, #minimal dari bujur (llcrnrlon) dan lint
            urcrnrlon=ulon, urcrnrlat=ulat) #maksimal dari bujur (llcrnrlon) dan lin

my_map.drawcoastlines()
my_map.drawcountries()
my_map.fillcontinents(color = 'white', alpha = 0.3)
my_map.shadedrelief()

# To collect data based on stations

xs,ys = my_map(np.asarray(pdf.Long), np.asarray(pdf.Lat))
pdf['xm']= xs.tolist()
pdf['ym'] =ys.tolist()

#Visualization1
for index,row in pdf.iterrows():
   my_map.plot(row.xm, row.ym,markerfacecolor =([1,0,0]),  marker='o', markersize= 5

plt.show()
```



In [ ]:
```
# Clustering using DBSCAN
sklearn.utils.check_random_state(1000)
```

```
Clus_dataSet = pdf[['xm','ym']]
Clus_dataSet = np.nan_to_num(Clus_dataSet)
Clus_dataSet = StandardScaler().fit_transform(Clus_dataSet)

db = DBSCAN(eps=0.15, min_samples=10).fit(Clus_dataSet)
core_samples_mask = np.zeros_like(db.labels_, dtype=bool)
core_samples_mask[db.core_sample_indices_] = True
labels = db.labels_
pdf["Clus_Db"]=labels

realClusterNum=len(set(labels)) - (1 if -1 in labels else 0)
clusterNum = len(set(labels))

# Samples of clusters
pdf[["Stn_Name","Tx","Tm","Clus_Db"]].head(5)
```

Out[ ]:

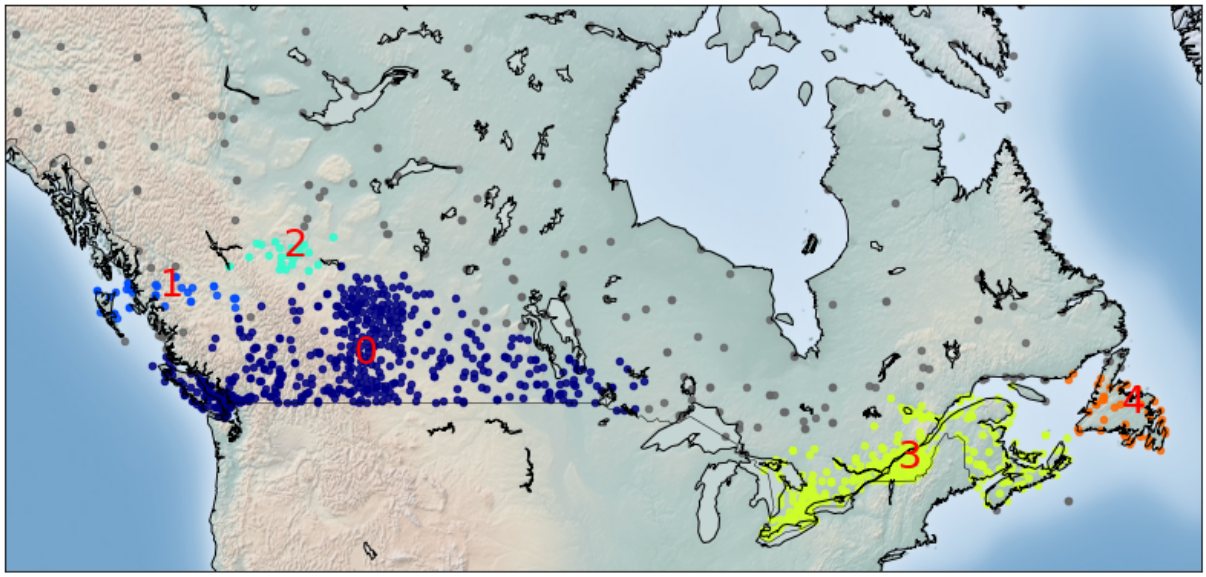
	Stn_Name	Tx	Tm	Clus_Db
0	CHEMAINUS	13.5	8.2	0
1	COWICHAN LAKE FORESTRY	15.0	7.0	0
2	LAKE COWICHAN	16.0	6.8	0
3	DUNCAN KELVIN CREEK	14.5	7.7	0
4	ESQUIMALT HARBOUR	13.1	8.8	0

In [ ]:

```
# Visualize the clusters
rcParams['figure.figsize'] = (14,10)

my_map = Basemap(projection='merc',
            resolution = 'l', area_thresh = 1000.0,
            llcrnrlon=llon, llcrnrlat=llat, #minimal dari bujur (llcrnrlon) dan lint
            urcrnrlon=ulon, urcrnrlat=ulat) #maksimal dari bujur (llcrnrlon) dan lin

my_map.drawcoastlines()
my_map.drawcountries()
my_map.fillcontinents(color = 'white', alpha = 0.3)
my_map.shadedrelief()

# To create a color map
colors = plt.get_cmap('jet')(np.linspace(0.0, 1.0, clusterNum))


#Visualization1
for clust_number in set(labels):
    c=(([0.4,0.4,0.4]) if clust_number == -1 else colors[np.int(clust_number)])
    clust_set = pdf[pdf.Clus_Db == clust_number]
    my_map.scatter(clust_set.xm, clust_set.ym, color =c,  marker='o', s= 20, alpha =
    if clust_number != -1:
        cenx=np.mean(clust_set.xm)
        ceny=np.mean(clust_set.ym)
        plt.text(cenx,ceny,str(clust_number), fontsize=25, color='red',)
        print ("Cluster "+str(clust_number)+', Avg Temp: '+ str(np.mean(clust_set.Tm
```

```
C:\Users\Christian\AppData\Local\Temp/ipykernel_20436/1736319119.py:21: DeprecationW
arning: `np.int` is a deprecated alias for the builtin `int`. To silence this warnin
g, use `int` by itself. Doing this will not modify any behavior and is safe. When re
placing `np.int`, you may wish to use e.g. `np.int64` or `np.int32` to specify the p
recision. If you wish to review your current use, check the release note link for ad
ditional information.
Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/devdocs/r
```

```
elease/1.20.0-notes.html#deprecations
  c=(([0.4,0.4,0.4]) if clust_number == -1 else colors[np.int(clust_number)])
Cluster 0, Avg Temp: -5.538747553816046
Cluster 1, Avg Temp: 1.9526315789473685
Cluster 2, Avg Temp: -9.195652173913045
Cluster 3, Avg Temp: -15.300833333333333
Cluster 4, Avg Temp: -7.769047619047619
```



In [ ]:

```
# Clustering of stations based on their location

sklearn.utils.check_random_state(1000)
Clus_dataSet = pdf[['xm','ym','Tx','Tm','Tn']]
Clus_dataSet = np.nan_to_num(Clus_dataSet)
Clus_dataSet = StandardScaler().fit_transform(Clus_dataSet)

db = DBSCAN(eps=0.3, min_samples=10).fit(Clus_dataSet)
core_samples_mask = np.zeros_like(db.labels_, dtype=bool)
core_samples_mask[db.core_sample_indices_] = True
labels = db.labels_
pdf["Clus_Db"]=labels

realClusterNum=len(set(labels)) - (1 if -1 in labels else 0)
clusterNum = len(set(labels))


# Samples of clusters
pdf[["Stn_Name","Tx","Tm","Clus_Db"]].head(5)
```

Out[ ]:

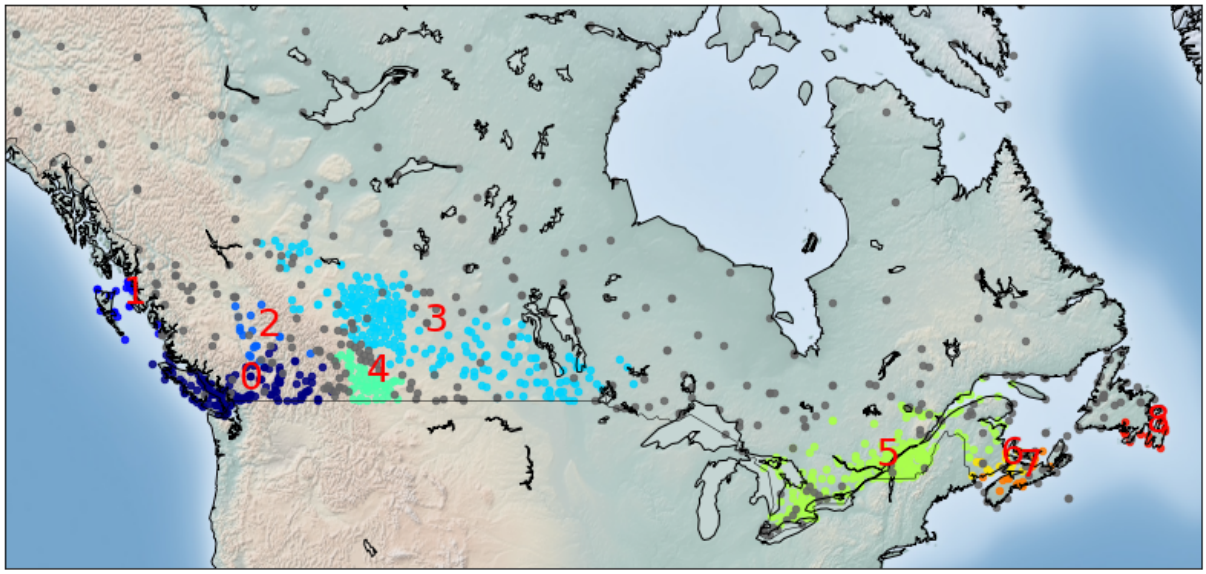
	Stn_Name	Tx	Tm	Clus_Db
0	CHEMAINUS	13.5	8.2	0
1	COWICHAN LAKE FORESTRY	15.0	7.0	0
2	LAKE COWICHAN	16.0	6.8	0
3	DUNCAN KELVIN CREEK	14.5	7.7	0
4	ESQUIMALT HARBOUR	13.1	8.8	0

In [ ]:

```
# Visualization of clusters based on location and Temperture
rcParams['figure.figsize'] = (14,10)

my_map = Basemap(projection='merc',
            resolution = 'l', area_thresh = 1000.0,
```

```
            llcrnrlon=llon, llcrnrlat=llat, #min longitude (llcrnrlon) and latitude
            urcrnrlon=ulon, urcrnrlat=ulat) #max longitude (urcrnrlon) and latitude

my_map.drawcoastlines()
my_map.drawcountries()
my_map.fillcontinents(color = 'white', alpha = 0.3)
my_map.shadedrelief()

# To create a color map
colors = plt.get_cmap('jet')(np.linspace(0.0, 1.0, clusterNum))


#Visualization1
for clust_number in set(labels):
    c=(([0.4,0.4,0.4]) if clust_number == -1 else colors[np.int(clust_number)])
    clust_set = pdf[pdf.Clus_Db == clust_number]
    my_map.scatter(clust_set.xm, clust_set.ym, color =c,  marker='o', s= 20, alpha =
    if clust_number != -1:
        cenx=np.mean(clust_set.xm)
        ceny=np.mean(clust_set.ym)
        plt.text(cenx,ceny,str(clust_number), fontsize=25, color='red',)
        print ("Cluster "+str(clust_number)+', Avg Temp: '+ str(np.mean(clust_set.Tm
```

```
C:\Users\Christian\AppData\Local\Temp/ipykernel_20436/1076788452.py:21: DeprecationW
arning: `np.int` is a deprecated alias for the builtin `int`. To silence this warnin
g, use `int` by itself. Doing this will not modify any behavior and is safe. When re
placing `np.int`, you may wish to use e.g. `np.int64` or `np.int32` to specify the p
recision. If you wish to review your current use, check the release note link for ad
ditional information.
Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/devdocs/r
elease/1.20.0-notes.html#deprecations
  c=(([0.4,0.4,0.4]) if clust_number == -1 else colors[np.int(clust_number)])
Cluster 0, Avg Temp: 6.221192052980132
Cluster 1, Avg Temp: 6.790000000000001
Cluster 2, Avg Temp: -0.49411764705882344
Cluster 3, Avg Temp: -13.87720930232558
Cluster 4, Avg Temp: -4.186274509803922
Cluster 5, Avg Temp: -16.301503759398496
Cluster 6, Avg Temp: -13.599999999999998
Cluster 7, Avg Temp: -9.753333333333334
Cluster 8, Avg Temp: -4.258333333333334
```



In [ ]:

```
# Lesson Learned
# 1. DBSCAN memerlukan waktu lama untuk tuning
# 2. DBSCAN tidak cocok untuk cluster yang bervariasi dan banyak kesalahan
```

```
# Insight
# Pembagian dari 5 menjadi 8 cluster menunjukkan bahwa ada 3 cluster yang memiliki t
# Cluster yang memiliki suhu terendah adalah cluster 3, sedangkan cluster yang memil

# Summary
# Dengan menggunakan DBSCAN, kita dapat membagi stasiun cuaca Kanada menjadi 9 clust


# References
# 1. https://en.wikipedia.org/wiki/DBSCAN
# 2. https://www.naftaliharris.com/blog/visualizing-dbscan-clustering/
```