Importing required libraries

In [11]:

```
import pandas as pd
import numpy as np

from statsmodels.tsa.ar_model import AutoReg
from statsmodels.tsa.arima.model import ARIMA
from statsmodels.tsa.statespace.sarimax import SARIMAX
from statsmodels.tsa.stattools import adfuller

from sklearn.metrics import mean_absolute_error, mean_squared_error

import matplotlib.pyplot as plt


import warnings
warnings.filterwarnings("ignore")
```

Paths for data import and result storage ¶

In [12]:

```
dpath = r"/Users/bashirulazambiswas/Documents/Sadia/SUNY courses/2022_
path = r"/Users/bashirulazambiswas/Documents/Sadia/SUNY courses/2022_F
```

Specification Selection

In [13]:

```
station_name = 'QUEE'
target_variable = 'temperature'
window = 5
train_method = 'prediction with target only'
model = "AR"
```

Data preparation function

In [14]:

```
def data_prep(dpath, station_name,target_variable):
    data = classical_time_series_data(dpath,station_name,target_variab
    data.time = time_coversion(data.time)
    return data

def classical_time_series_data(path,station_name,dependent_variable_la
    data_preprocessed = preprocess(path,station_name,dependent_variabl
    if dependent_variable_label == 'temperature':
        dependent_variable = 'temp_2m_avg [degF]'
    elif dependent_variable_label == 'humidity':
        dependent_variable = 'relative_humidity_avg [percent]'
    elif dependent_variable_label == 'precipitation':
        dependent_variable = 'precip_total [inch]'
    data_classical = data_preprocessed[0][['station','time',dependent_
    return data_classical


def time_coversion(time_col): #Converts time from string to datetime
    time_list = [time_col[i].split()[0] for i in range(len(time_col))]
    return pd.to_datetime(time_list)
```

Preprocessing function

In [15]:
```
def preprocess(path,station_name,dependent_variable_label):
    data = pd.read_csv(path+"/"+station_name+".csv").drop("Unnamed: 0"
    correlation = data.corr().round(2)
    index = correlation.index
    for i in correlation.index:
        if i in index:
            temp = correlation.loc[i]
            temp = temp[temp==1]
            for j in temp.index:
                if j != i:
                    if j not in index:
                        continue
                    index = index.drop(j)

    preprocessed_data = pd.DataFrame()
    preprocessed_data['station'] = data['station']
    preprocessed_data['time'] = data['time']
    preprocessed_data[index] = data[index]


    if dependent_variable_label == 'temperature':
        dependent_variable = 'temp_2m_avg [degF]'
        independent_feature_label = preprocessed_data.columns.drop(['t
    elif dependent_variable_label == 'humidity':
        dependent_variable = 'relative_humidity_avg [percent]'
        independent_feature_label = preprocessed_data.columns.drop(['r
    elif dependent_variable_label == 'precipitation':
        dependent_variable = 'precip_total [inch]'
        independent_feature_label = preprocessed_data.columns.drop(['p
    x = preprocessed_data[independent_feature_label]
    y = preprocessed_data[dependent_variable]

    return preprocessed_data,x,y
```

Data generated after preprocessing

In [16]:

```
data = data_prep(dpath, station_name,target_variable)
data.head(5)
```

Out[16]:

	station	time	temp_2m_avg [degF]
0	QUEE	2018-09-10	59.7
1	QUEE	2018-09-11	67.9
2	QUEE	2018-09-12	72.6
3	QUEE	2018-09-13	70.8
4	QUEE	2018-09-14	70.7

Train-test split function

In [17]:

```
def TrainTestSplit(data,target_variable):
    train_year = [2018,2019,2020]
    test_year = [2021,2022]
    if target_variable == 'temperature':
        target = 'temp_2m_avg [degF]'
    elif target_variable == 'humidity':
        target = 'relative_humidity_avg [percent]'
    elif target_variable == 'precipitation':
        target = 'precip_total [inch]'
    train = pd.DataFrame()
    for year in train_year:
         train = train.append(data[(data['time'].dt.year == year)])
    train = train.drop(train[train[target].isna()].index)

    test = pd.DataFrame()
    for year in test_year:
         test = test.append(data[(data['time'].dt.year == year)])
    test = test.drop(test[test[target].isna()].index)
    return train,test
```

Train and test set after splitting

In [18]:

```
train,test =  TrainTestSplit(data,target_variable)

print("Train:",train.shape)
print("Test:",test.shape)
```

```
Train: (822, 3)
Test: (618, 3)
```

ARIMA function

In [19]:

```
def ARIMA_model(path,train,test,target_variable,p,d,q,station_name,moc
    if target_variable == 'temperature':
        target = 'temp_2m_avg [degF]'
    elif target_variable == 'humidity':
        target = 'relative_humidity_avg [percent]'
    elif target_variable == 'precipitation':
        target = 'precip_total [inch]'
    model = ARIMA(train[target], order=(p,d,q))
    model_fit = model.fit()
    y_pred = model_fit.predict(1, len(test))
    prediction = pd.DataFrame({"time":test['time'].reset_index(drop=Tr
    return prediction

def ARIMA_compute_d(data,target_variable):
    # Computes the d for ARIMA model
    if target_variable == 'temperature':
        target = 'temp_2m_avg [degF]'
    elif target_variable == 'humidity':
        target = 'relative_humidity_avg [percent]'
    elif target_variable == 'precipitation':
        target = 'precip_total [inch]'
    temp = data[target].dropna()
    score = adfuller(temp)[1]
    d = 0
    while score > 0.05:
        temp = temp.diff().dropna()
        score = adfuller(temp)[1]
        d = d+1

    return d
```

Prediction using AutoRegression

In [20]:

```
p = window
d = ARIMA_compute_d(train,target_variable)
q = window
prediction = ARIMA_model(path,train,test,target_variable,p,d,q,statior

prediction.head(10)
```

Out[20]:

	time	predicted	actual
0	2021-01-01	59.699943	36.0
1	2021-01-02	67.664962	42.1
2	2021-01-03	69.612503	35.7
3	2021-01-04	67.932879	37.3
4	2021-01-05	70.116839	37.7
5	2021-01-06	70.020964	36.4
6	2021-01-07	71.575969	34.5
7	2021-01-08	71.848404	31.2
8	2021-01-09	72.296489	30.7
9	2021-01-10	71.966349	33.6

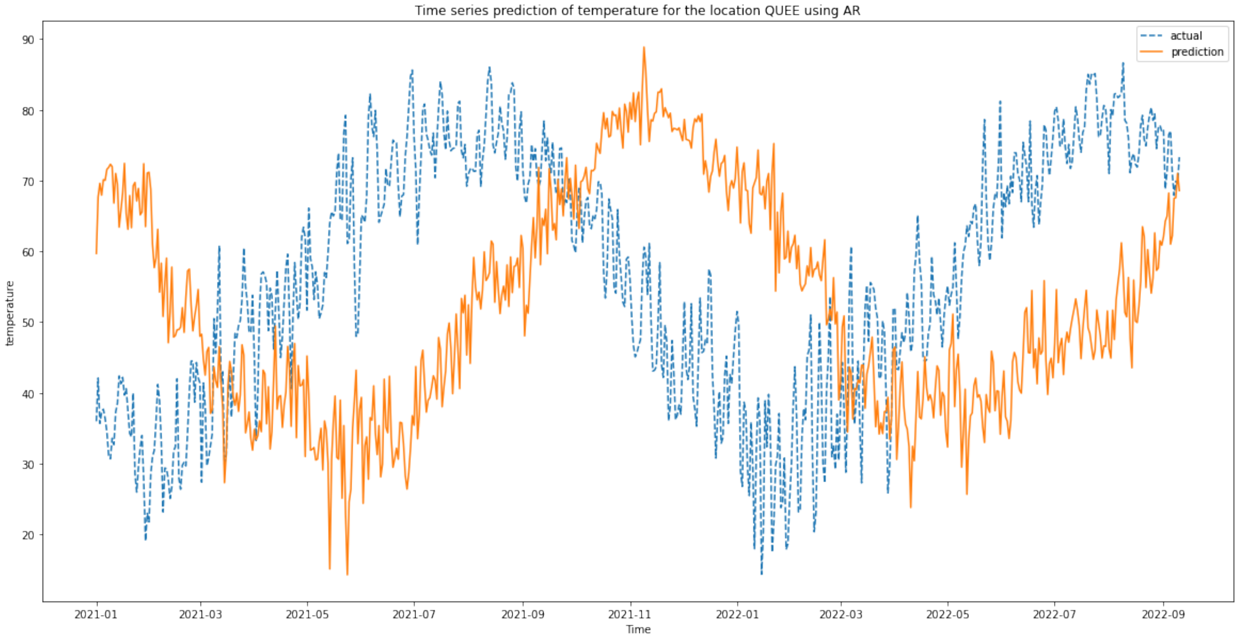
Plotting function

In [21]:

```
def PlotPrediction(prediction,target_variable,window,station_name,mode
    plt.figure(figsize=(20,10))
    plt.plot(prediction['time'],prediction['actual'],'--',label='actua
    plt.plot(prediction['time'],prediction['predicted'],'-',label='pre
    plt.legend()
    plt.xlabel("Time")
    plt.ylabel(target_variable)
    plt.title("Time series prediction of "+target_variable+" for the l
```

In [22]:

```
PlotPrediction(prediction,target_variable,window,station_name,model,tr
```



In [ ]:

```
```