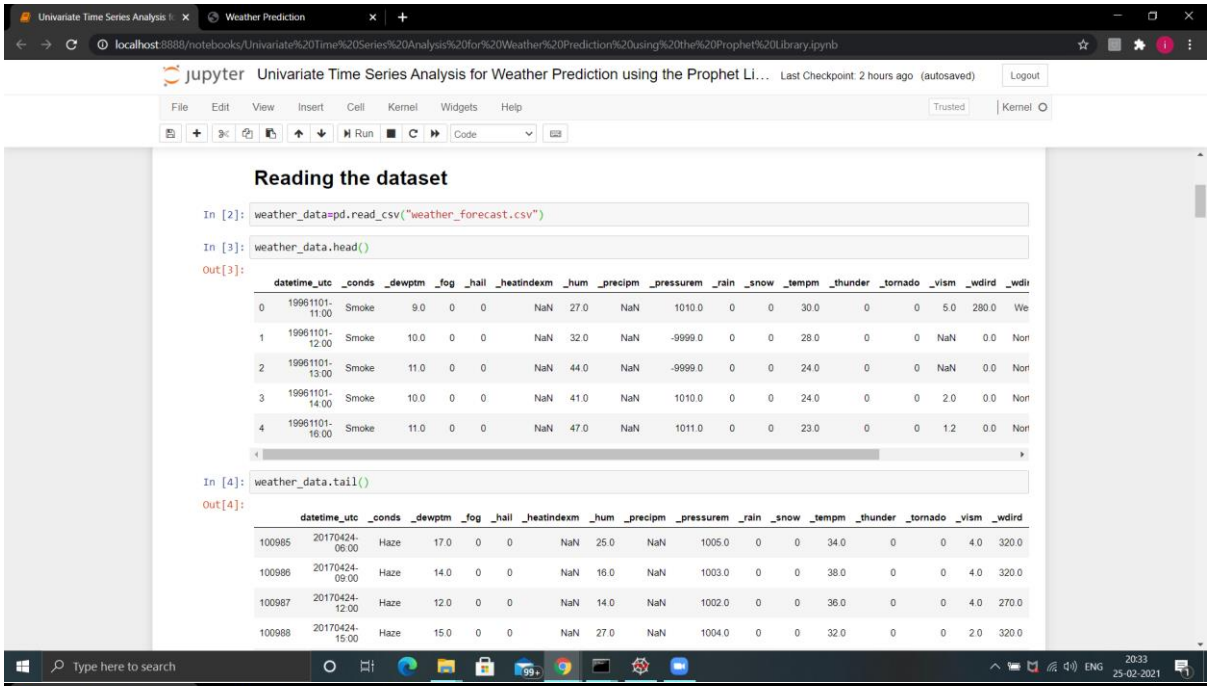
Univariate Time Series Analysis f
Weather Prediction
localhost:8888/notebooks/Univariate%20Time%20Series%20Analysis%20for%20Weather%20Prediction%20using%20the%20Prophet%20Library.ipynb
jupyter Univariate Time Series Analysis for Weather Prediction using the Prophet Li... Last Checkpoint: 2 hours ago (autosaved)
Logout
File Edit View Insert Cell Kernel Widgets Help
Trusted
Kernel
Run
Code
Reading the dataset
In [2]: weather_data=pd.read_csv("weather_forecast.csv")
In [3]: weather_data.head()
Out[3]:
datetime_utc _conds _dewptm _fog _hail _heatindexm _hum _precipm _pressurem _rain _snow _tempm _thunder _tornado _vism _wdird _wdi
0 19961101-11:00 Smoke 9.0 0 0 NaN 27.0 NaN 1010.0 0 0 30.0 0 0 5.0 280.0 We
1 19961101-12:00 Smoke 10.0 0 0 NaN 32.0 NaN -9999.0 0 0 28.0 0 0 NaN 0.0 Nor
2 19961101-13:00 Smoke 11.0 0 0 NaN 44.0 NaN -9999.0 0 0 24.0 0 0 NaN 0.0 Nor
3 19961101-14:00 Smoke 10.0 0 0 NaN 41.0 NaN 1010.0 0 0 24.0 0 0 2.0 0.0 Nor
4 19961101-16:00 Smoke 11.0 0 0 NaN 47.0 NaN 1011.0 0 0 23.0 0 0 1.2 0.0 Nor
In [4]: weather_data.tail()
Out[4]:
datetime_utc _conds _dewptm _fog _hail _heatindexm _hum _precipm _pressurem _rain _snow _tempm _thunder _tornado _vism _wdird
100985 20170424-06:00 Haze 17.0 0 0 NaN 25.0 NaN 1005.0 0 0 34.0 0 0 4.0 320.0
100986 20170424-09:00 Haze 14.0 0 0 NaN 16.0 NaN 1003.0 0 0 38.0 0 0 4.0 320.0
100987 20170424-12:00 Haze 12.0 0 0 NaN 14.0 NaN 1002.0 0 0 36.0 0 0 4.0 270.0
100988 20170424-15:00 Haze 15.0 0 0 NaN 27.0 NaN 1004.0 0 0 32.0 0 0 2.0 320.0
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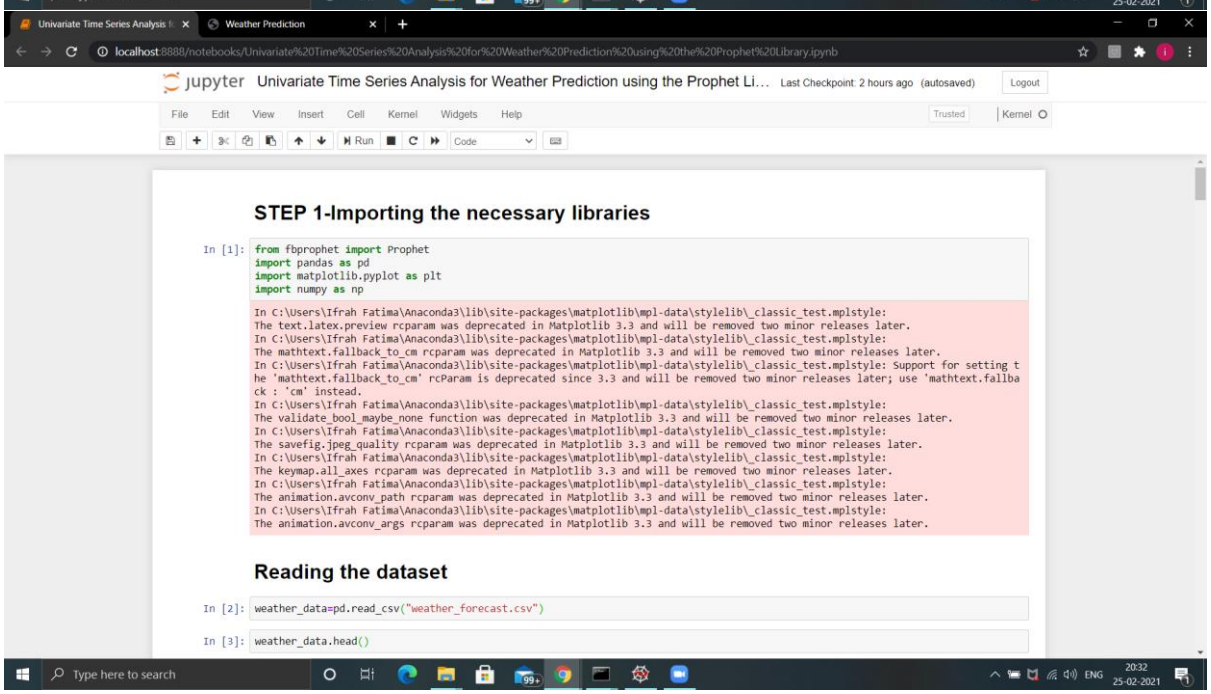
Univariate Time Series Analysis f
Weather Prediction
localhost:8888/notebooks/Univariate%20Time%20Series%20Analysis%20for%20Weather%20Prediction%20using%20the%20Prophet%20Library.ipynb
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File Edit View Insert Cell Kernel Widgets Help
Trusted
Kernel
Run
Code
STEP 1-Importing the necessary libraries
In [1]: from fbprophet import Prophet
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
In C:\Users\Ifrah Fatima\Anaconda3\lib\site-packages\matplotlib\mpl-data\stylelib_classic_test.mplstyle:
The text.latex.preview rcparam was deprecated in Matplotlib 3.3 and will be removed two minor releases later.
In C:\Users\Ifrah Fatima\Anaconda3\lib\site-packages\matplotlib\mpl-data\stylelib_classic_test.mplstyle:
The mathtext.fallback_to_cm rcparam was deprecated in Matplotlib 3.3 and will be removed two minor releases later.
In C:\Users\Ifrah Fatima\Anaconda3\lib\site-packages\matplotlib\mpl-data\stylelib_classic_test.mplstyle: Support for setting t
he 'mathtext.fallback_to_cm' rcParam is deprecated since 3.3 and will be removed two minor releases later; use 'mathtext.fallba
ck : 'cm' instead.
In C:\Users\Ifrah Fatima\Anaconda3\lib\site-packages\matplotlib\mpl-data\stylelib_classic_test.mplstyle:
The validate_bool_maybe_none function was deprecated in Matplotlib 3.3 and will be removed two minor releases later.
In C:\Users\Ifrah Fatima\Anaconda3\lib\site-packages\matplotlib\mpl-data\stylelib_classic_test.mplstyle:
The savefig.jpeg_quality rcparam was deprecated in Matplotlib 3.3 and will be removed two minor releases later.
In C:\Users\Ifrah Fatima\Anaconda3\lib\site-packages\matplotlib\mpl-data\stylelib_classic_test.mplstyle:
The keymap.all_axes rcparam was deprecated in Matplotlib 3.3 and will be removed two minor releases later.
In C:\Users\Ifrah Fatima\Anaconda3\lib\site-packages\matplotlib\mpl-data\stylelib_classic_test.mplstyle:
The animation.avconv_path rcparam was deprecated in Matplotlib 3.3 and will be removed two minor releases later.
In C:\Users\Ifrah Fatima\Anaconda3\lib\site-packages\matplotlib\mpl-data\stylelib_classic_test.mplstyle:
The animation.avconv_args rcparam was deprecated in Matplotlib 3.3 and will be removed two minor releases later.
Reading the dataset
In [2]: weather_data=pd.read_csv("weather_forecast.csv")
In [3]: weather_data.head()
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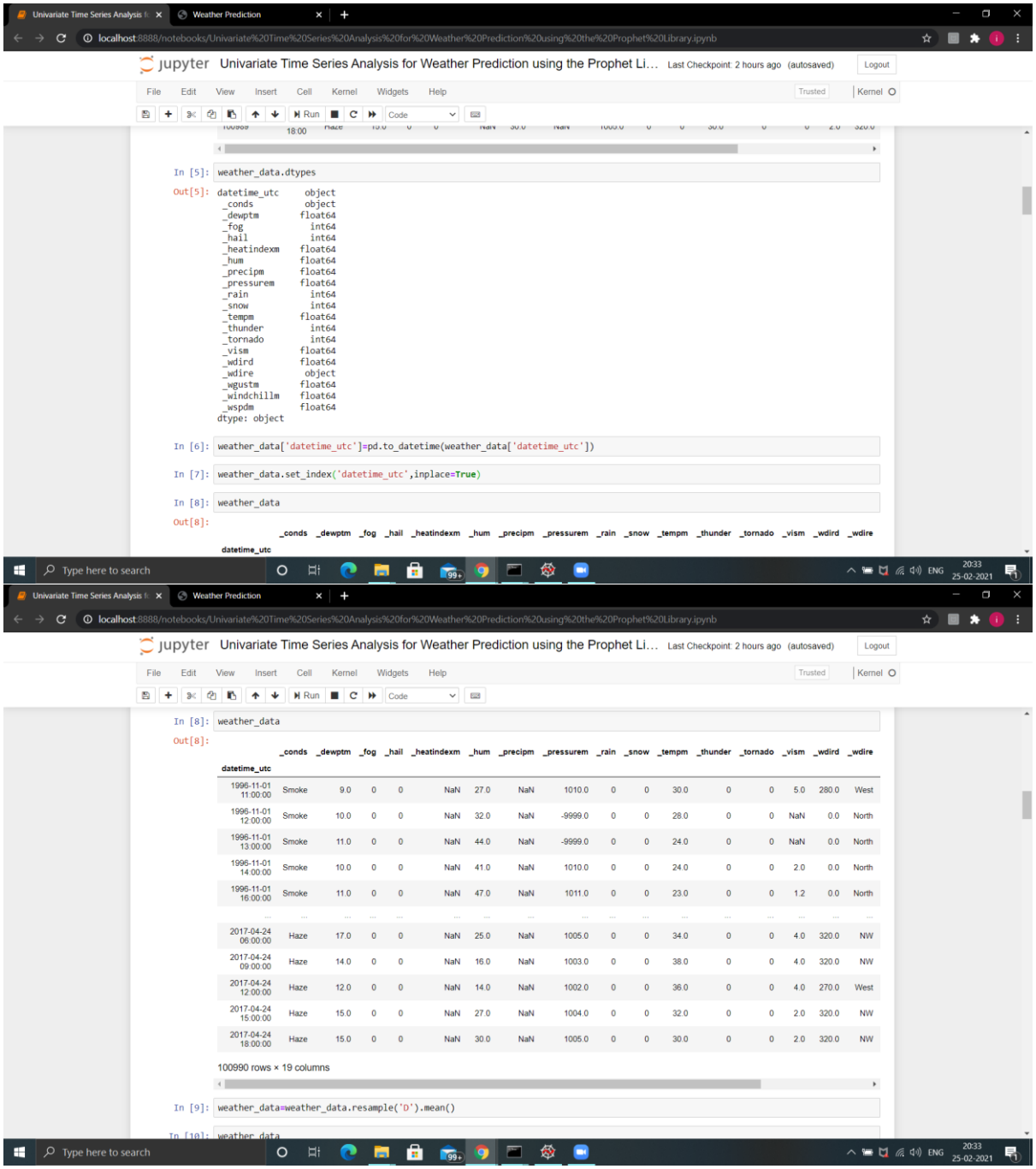
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Weather Prediction
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Run
Code
18:00
In [5]: weather_data.dtypes
Out[5]:
datetime_utc object
_conds object
_dewptm float64
_fog int64
_hail int64
_heatindexm float64
_hum float64
_precipm float64
_pressurem float64
_rain int64
_snow int64
_tempm float64
_thunder int64
_tornado int64
_vism float64
_wdird float64
_wdire object
_wgustm float64
_windchillm float64
_wspdm float64
dtype: object
In [6]: weather_data['datetime_utc']=pd.to_datetime(weather_data['datetime_utc'])
In [7]: weather_data.set_index('datetime_utc',inplace=True)
In [8]: weather_data
Out[8]:
_conds _dewptm _fog _hail _heatindexm _hum _precipm _pressurem _rain _snow _tempm _thunder _tornado _vism _wdird _wdire
datetime_utc
Type here to search
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Run
Code
In [8]: weather_data
Out[8]:
_conds _dewptm _fog _hail _heatindexm _hum _precipm _pressurem _rain _snow _tempm _thunder _tornado _vism _wdird _wdire
datetime_utc
1996-11-01 11:00:00 Smoke 9.0 0 0 NaN 27.0 NaN 1010.0 0 0 30.0 0 0 5.0 280.0 West
1996-11-01 12:00:00 Smoke 10.0 0 0 NaN 32.0 NaN -9999.0 0 0 28.0 0 0 NaN 0.0 North
1996-11-01 13:00:00 Smoke 11.0 0 0 NaN 44.0 NaN -9999.0 0 0 24.0 0 0 NaN 0.0 North
1996-11-01 14:00:00 Smoke 10.0 0 0 NaN 41.0 NaN 1010.0 0 0 24.0 0 0 2.0 0.0 North
1996-11-01 16:00:00 Smoke 11.0 0 0 NaN 47.0 NaN 1011.0 0 0 23.0 0 0 1.2 0.0 North
2017-04-24 06:00:00 Haze 17.0 0 0 NaN 25.0 NaN 1005.0 0 0 34.0 0 0 4.0 320.0 NW
2017-04-24 09:00:00 Haze 14.0 0 0 NaN 16.0 NaN 1003.0 0 0 38.0 0 0 4.0 320.0 NW
2017-04-24 12:00:00 Haze 12.0 0 0 NaN 14.0 NaN 1002.0 0 0 36.0 0 0 4.0 270.0 West
2017-04-24 15:00:00 Haze 15.0 0 0 NaN 27.0 NaN 1004.0 0 0 32.0 0 0 2.0 320.0 NW
2017-04-24 18:00:00 Haze 15.0 0 0 NaN 30.0 NaN 1005.0 0 0 30.0 0 0 2.0 320.0 NW
100990 rows × 19 columns
In [9]: weather_data=weather_data.resample('D').mean()
In [10]: weather_data
Type here to search
ENG
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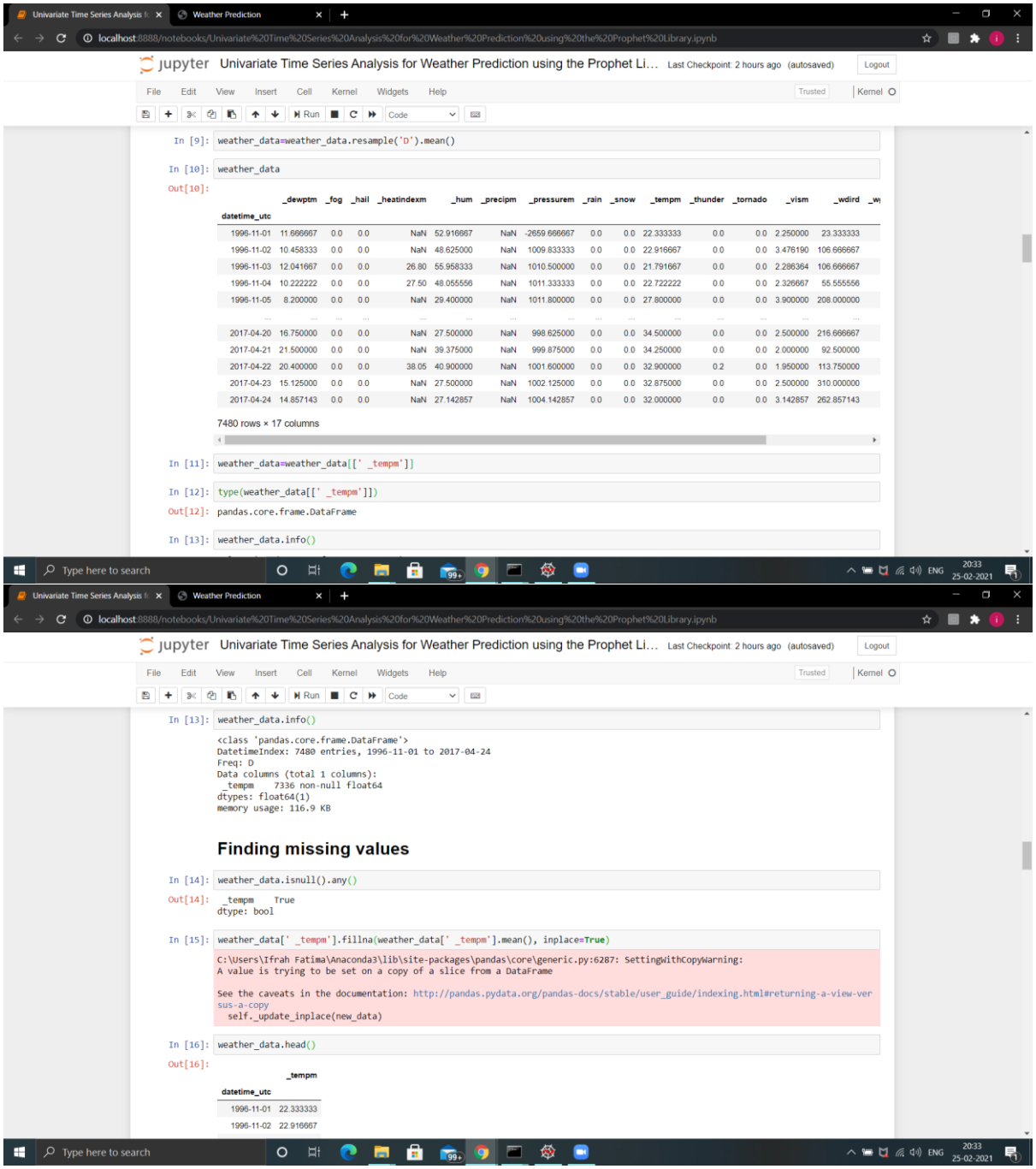
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Run Code
In [9]: weather_data=weather_data.resample('D').mean()
In [10]: weather_data
Out[10]:
_dewptm _fog _hail _heatindexm _hum _precipm _pressurem _rain _snow _tempm _thunder _tornado _vism _wdird _w
datetime_utc
1996-11-01 11.666667 0.0 0.0 NaN 52.916667 NaN -2659.666667 0.0 0.0 22.333333 0.0 0.0 2.250000 23.333333
1996-11-02 10.458333 0.0 0.0 NaN 48.625000 NaN 1009.833333 0.0 0.0 22.916667 0.0 0.0 3.476190 106.666667
1996-11-03 12.041667 0.0 0.0 26.80 55.958333 NaN 1010.500000 0.0 0.0 21.791667 0.0 0.0 2.286364 106.666667
1996-11-04 10.222222 0.0 0.0 27.50 48.055556 NaN 1011.333333 0.0 0.0 22.722222 0.0 0.0 2.326667 55.555556
1996-11-05 8.200000 0.0 0.0 NaN 29.400000 NaN 1011.800000 0.0 0.0 27.800000 0.0 0.0 3.900000 208.000000
2017-04-20 16.750000 0.0 0.0 NaN 27.500000 NaN 998.625000 0.0 0.0 34.500000 0.0 0.0 2.500000 216.666667
2017-04-21 21.500000 0.0 0.0 NaN 39.375000 NaN 999.875000 0.0 0.0 34.250000 0.0 0.0 2.000000 92.500000
2017-04-22 20.400000 0.0 0.0 38.05 40.900000 NaN 1001.600000 0.0 0.0 32.900000 0.2 0.0 1.950000 113.750000
2017-04-23 15.125000 0.0 0.0 NaN 27.500000 NaN 1002.125000 0.0 0.0 32.875000 0.0 0.0 2.500000 310.000000
2017-04-24 14.857143 0.0 0.0 NaN 27.142857 NaN 1004.142857 0.0 0.0 32.000000 0.0 0.0 3.142857 262.857143
7480 rows × 17 columns
In [11]: weather_data=weather_data[[' _tempm']]
In [12]: type(weather_data[[' _tempm']])
Out[12]: pandas.core.frame.DataFrame
In [13]: weather_data.info()
Type here to search
ENG 20:33 25-02-2021
Univariate Time Series Analysis f
Weather Prediction
localhost:8888/notebooks/Univariate%20Time%20Series%20Analysis%20for%20Weather%20Prediction%20using%20the%20Prophet%20Library.ipynb
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File Edit View Insert Cell Kernel Widgets Help Trusted Kernel
Run Code
In [13]: weather_data.info()
<class 'pandas.core.frame.DataFrame'>
DatetimeIndex: 7480 entries, 1996-11-01 to 2017-04-24
Freq: D
Data columns (total 1 columns):
_tempm 7336 non-null float64
dtypes: float64(1)
memory usage: 116.9 KB
Finding missing values
In [14]: weather_data.isnull().any()
Out[14]: _tempm True
dtype: bool
In [15]: weather_data[' _tempm'].fillna(weather_data[' _tempm'].mean(), inplace=True)
C:\Users\Ifrah Fatima\Anaconda3\lib\site-packages\pandas\core\generic.py:6287: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame
See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
self._update_inplace(new_data)
In [16]: weather_data.head()
Out[16]:
_tempm
datetime_utc
1996-11-01 22.333333
1996-11-02 22.916667
Type here to search
ENG 20:33 25-02-2021

Univariate Time Series Analysis f | Weather Prediction

localhost:8888/notebooks/Univariate%20Time%20Series%20Analysis%20for%20Weather%20Prediction%20using%20the%20Prophet%20Library.ipynb

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Run Code

Out[16]:

datetime_utc	_tempm
1996-11-01	22.333333
1996-11-02	22.916667
1996-11-03	21.791667
1996-11-04	22.722222
1996-11-05	27.800000

In [17]:
```
weather_data.reset_index(inplace=True)
```

In [18]:
```
weather_data.rename(columns={'datetime_utc':'ds',' _tempm':'y'}, inplace=True)
```

```
C:\Users\Ifrah Fatima\Anaconda3\lib\site-packages\pandas\core\frame.py:4223: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  return super().rename(**kwargs)
```

In [19]:
```
weather_data.head()
```

Out[19]:

	ds	y
0	1996-11-01	22.333333
1	1996-11-02	22.916667
2	1996-11-03	21.791667
3	1996-11-04	22.722222
4	1996-11-05	27.800000

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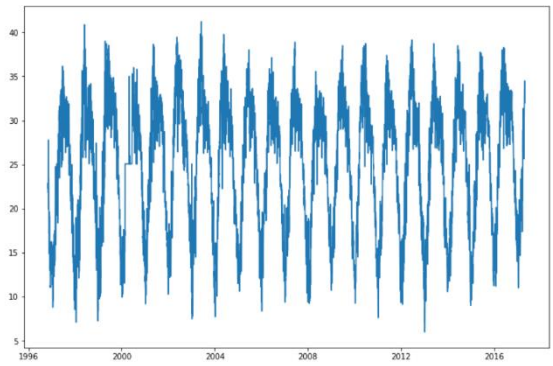
Run Code

Visualising the data

In [20]:
```
plt.figure(figsize=(12,8))
plt.plot(weather_data.set_index(["ds"]))
```

Out[20]:
```
[<matplotlib.lines.Line2D at 0x2370dbea9c8>]
```



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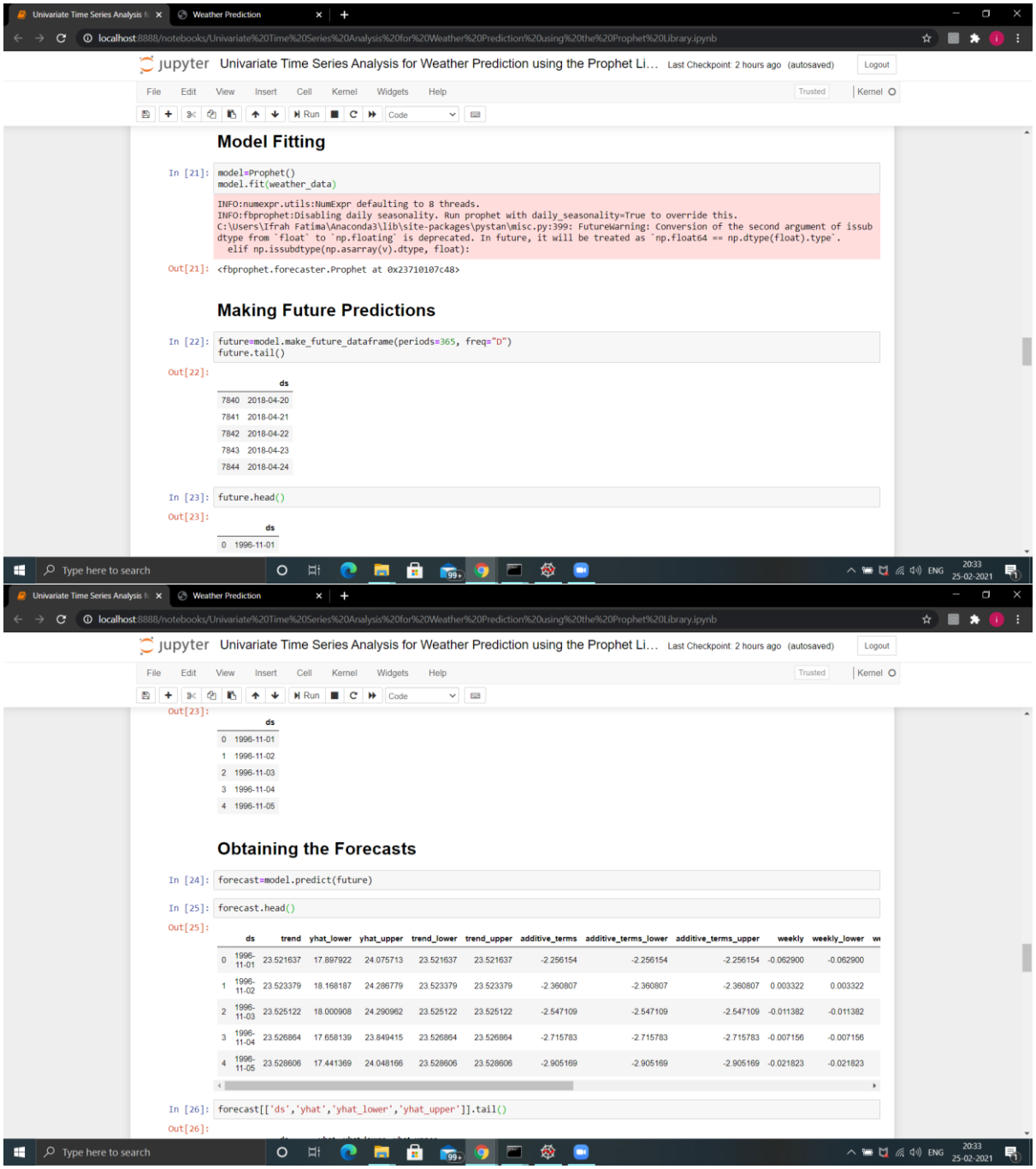
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Weather Prediction
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Kernel
Run
Code
Model Fitting
In [21]:
model=Prophet()
model.fit(weather_data)
INFO:numexpr.utils:NumExpr defaulting to 8 threads.
INFO:fbprophet:Disabling daily seasonality. Run prophet with daily_seasonality=True to override this.
C:\Users\Ifrah Fatima\Anaconda3\lib\site-packages\pystan\misc.py:399: FutureWarning: Conversion of the second argument of issubdtype from `float` to `np.floating` is deprecated. In future, it will be treated as `np.float64 == np.dtype(float).type`.
elif np.issubdtype(np.asarray(v).dtype, float):
Out[21]:
<fbprophet.forecaster.Prophet at 0x23710107c48>
Making Future Predictions
In [22]:
future=model.make_future_dataframe(periods=365, freq="D")
future.tail()
Out[22]:
ds
7840 2018-04-20
7841 2018-04-21
7842 2018-04-22
7843 2018-04-23
7844 2018-04-24
In [23]:
future.head()
Out[23]:
ds
0 1996-11-01
Type here to search
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Univariate Time Series Analysis f
Weather Prediction
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Run
Code
Out[23]:
ds
0 1996-11-01
1 1996-11-02
2 1996-11-03
3 1996-11-04
4 1996-11-05
Obtaining the Forecasts
In [24]:
forecast=model.predict(future)
In [25]:
forecast.head()
Out[25]:
ds trend yhat_lower yhat_upper trend_lower trend_upper additive_terms additive_terms_lower additive_terms_upper weekly weekly_lower w
0 1996-11-01 23.521637 17.897922 24.075713 23.521637 23.521637 -2.256154 -2.256154 -2.256154 -0.062900 -0.062900
1 1996-11-02 23.523379 18.168187 24.286779 23.523379 23.523379 -2.360807 -2.360807 -2.360807 0.003322 0.003322
2 1996-11-03 23.525122 18.000908 24.290962 23.525122 23.525122 -2.547109 -2.547109 -2.547109 -0.011382 -0.011382
3 1996-11-04 23.526864 17.658139 23.849415 23.526864 23.526864 -2.715783 -2.715783 -2.715783 -0.007156 -0.007156
4 1996-11-05 23.528606 17.441369 24.048166 23.528606 23.528606 -2.905169 -2.905169 -2.905169 -0.021823 -0.021823
In [26]:
forecast[['ds','yhat','yhat_lower','yhat_upper']].tail()
Out[26]:
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Univariate Time Series Analysis f | Weather Prediction

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In [26]:
```
forecast[['ds','yhat','yhat_lower','yhat_upper']].tail()
```

Out[26]:

	ds	yhat	yhat_lower	yhat_upper
7840	2018-04-20	32.513276	29.455970	35.369515
7841	2018-04-21	32.724116	29.682652	35.860843
7842	2018-04-22	32.853331	29.701953	35.737704
7843	2018-04-23	33.000876	29.807881	35.802719
7844	2018-04-24	33.128920	29.895047	36.416263

In [27]:
```
forecast[['ds','yhat','yhat_lower','yhat_upper']].head()
```

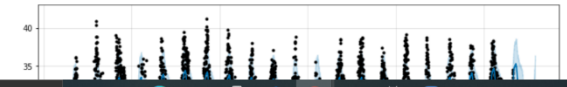
Out[27]:

	ds	yhat	yhat_lower	yhat_upper
0	1996-11-01	21.265483	17.897922	24.075713
1	1996-11-02	21.162573	18.168187	24.286779
2	1996-11-03	20.978013	18.000908	24.290962
3	1996-11-04	20.811080	17.658139	23.849415
4	1996-11-05	20.623437	17.441369	24.048166

Plotting the Forecasts

In [28]:
```
model.plot(forecast)
```

Out[28]:



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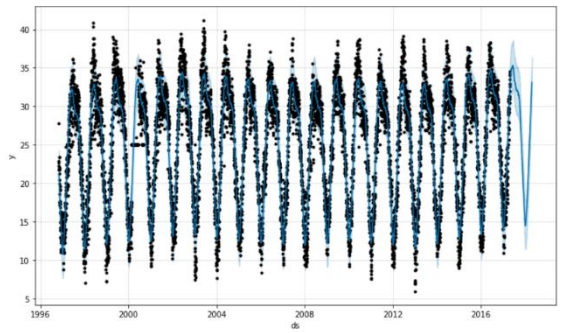
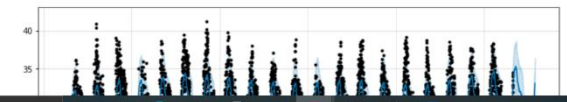
Run Code

Plotting the Forecasts

In [28]:
```
model.plot(forecast)
```

Out[28]:





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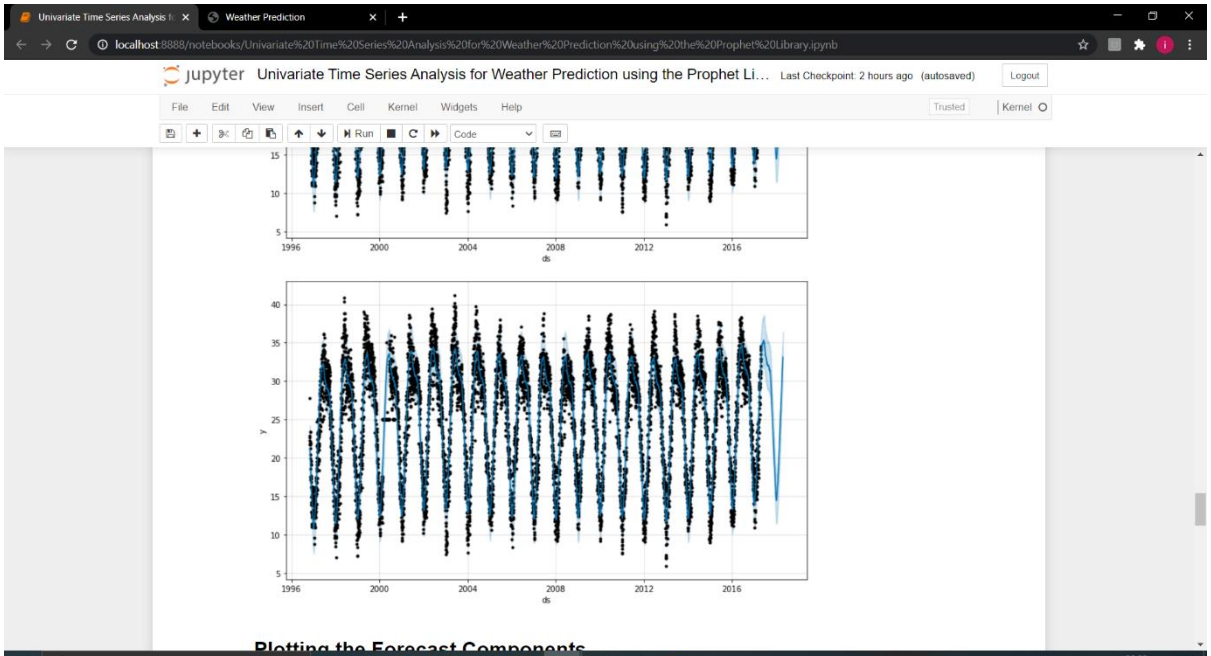
Univariate Time Series Analysis f
Weather Prediction
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Plotting the Forecast Components
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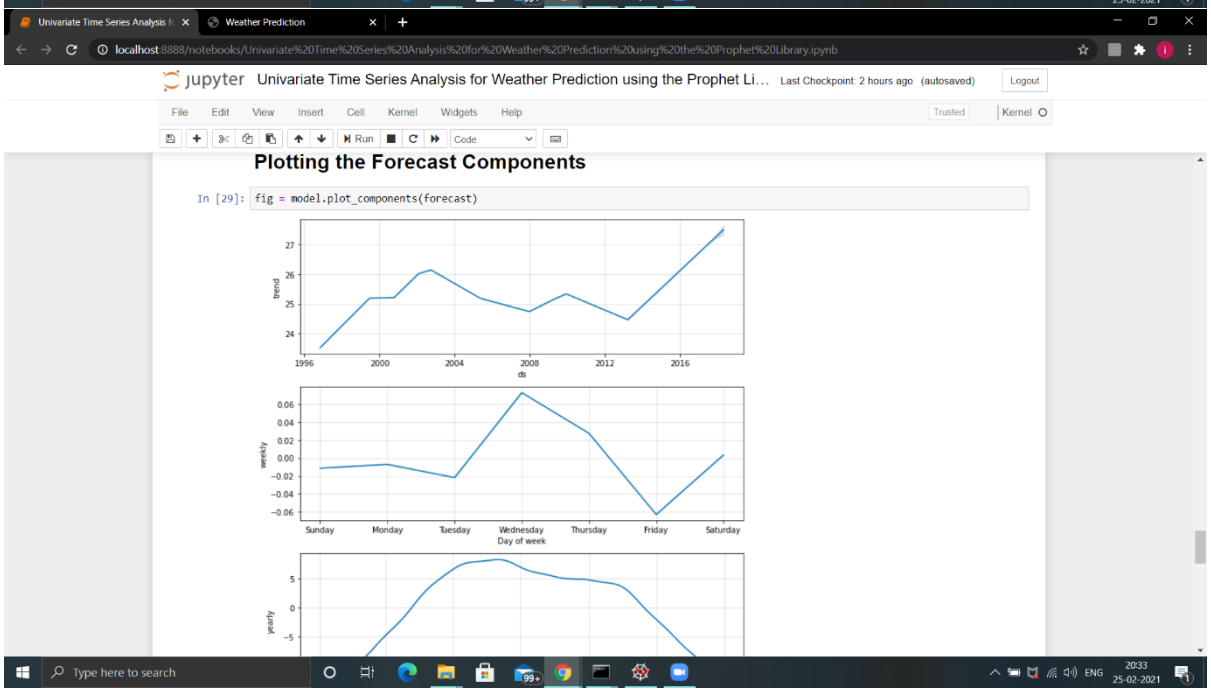
Univariate Time Series Analysis f
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Logout
File Edit View Insert Cell Kernel Widgets Help
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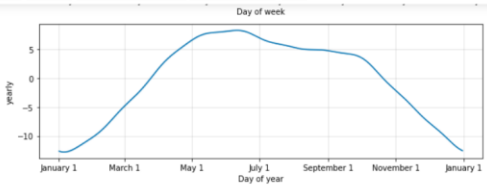
Kernel
Run
Code
Plotting the Forecast Components
In [29]: fig = model.plot_components(forecast)
trend
ds
weekly
Sunday
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Day of week
yearly
Type here to search
ENG
20:33
25-02-2021



Cross Validation

In [30]:
```
from fbprophet.diagnostics import cross_validation
df_cv = cross_validation(model, initial='730 days', period='180 days', horizon = '365 days')
df_cv.head()
```

```
INFO:fbprophet:Making 36 forecasts with cutoffs between 1999-01-24 00:00:00 and 2016-04-24 00:00:00
C:\Users\Ifrah Fatima\Anaconda3\lib\site-packages\pystan\misc.py:399: FutureWarning: Conversion of the second argument of issub
dtype from `float` to `np.floating` is deprecated. In future, it will be treated as `np.float64 == np.dtype(float).type`.
  elif np.issubdtype(np.asarray(v).dtype, float):
```

Out[30]:

	ds	yhat	yhat_lower	yhat_upper	y	cutoff
0	1999-01-25	13.719397	10.537031	16.759790	13.20	1999-01-24
1	1999-01-26	13.860526	10.804572	16.921983	10.00	1999-01-24
2	1999-01-27	14.041650	10.802333	17.079861	17.75	1999-01-24
3	1999-01-28	14.115146	10.866196	16.811213	11.75	1999-01-24
4	1999-01-29	13.887185	10.970404	17.121100	11.20	1999-01-24

Univariate Time Series Analysis f... | Weather Prediction
localhost:8888/notebooks/Univariate%20Time%20Series%20Analysis%20for%20Weather%20Prediction%20using%20the%20Prophet%20Library.ipynb
jupyter Univariate Time Series Analysis for Weather Prediction using the Prophet Li... Last Checkpoint: 2 hours ago (autosaved) Logout
File Edit View Insert Cell Kernel Widgets Help Trusted Kernel
Run Code

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Obtaining the Performance Metrics

In [31]:
```
from fbprophet.diagnostics import performance_metrics
df_p = performance_metrics(df_cv)
df_p.head()
```

Out[31]:

	horizon	mse	rmse	mae	mape	mdape	coverage
0	37 days	6.853411	2.617902	2.065823	0.100862	0.073711	0.796043
1	38 days	6.851475	2.617532	2.071824	0.101032	0.073711	0.793760
2	39 days	6.882861	2.623521	2.080719	0.101145	0.074131	0.790335
3	40 days	6.925709	2.631674	2.096371	0.101444	0.074186	0.788422

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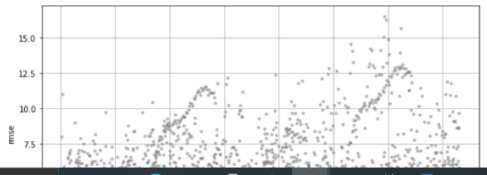
2	39 days	6.882861	2.623521	2.080719	0.101145	0.074131	0.790335
3	40 days	6.925709	2.631674	2.086371	0.101144	0.074186	0.788432
4	41 days	7.032192	2.651828	2.094893	0.100933	0.074186	0.784627

Visualizing Performance Metrics

In [32]:
```
from fbprophet.plot import plot_cross_validation_metric
fig = plot_cross_validation_metric(df_cv, metric='rmse')
```



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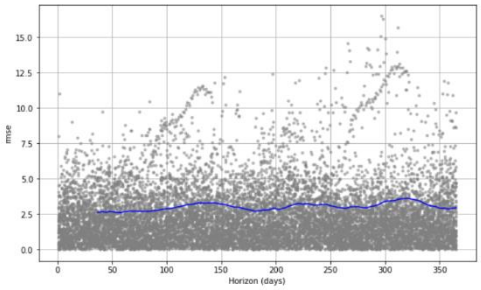

Saving the model file

In [33]:
```
import pickle
pickle.dump( model, open( "weather_prediction.pickle", "wb" ) )
```