Tuning a Weather Model

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Why might weather forecasting be important?

Secret Sauce

INGREDIENTS: COOKED RICE (WATER, LONG GRAIN BROWN RICE, RED RICE), BROCCOLI, SHRIMP (SHRIMP, SALT), WATER, RED BELL PEPPERS, BABY CORN, EDAMAME, SRIRACHA PASTE (CHILI PEPPER PUREE, DISTILLED WHITE VINEGAR, CANE SUGAR, SEA SALT, GARLIC PUREE, EXPELLER PRESSED CANOLA OIL, GARLIC POWDER, XANTHAN GUM), SOY SAUCE (WATER, SOYBEANS, RICE, SALT), DICED ONION, EXPELLER PRESSED CANOLA OIL, GARLIC PUREE (GARLIC, WATER), CORNSTARCH, PAPRIKA OLEORESIN (FOR COLOR), SHRIMP EXTRACT, SALT.

CONTAINS SOY, SHRIMP.

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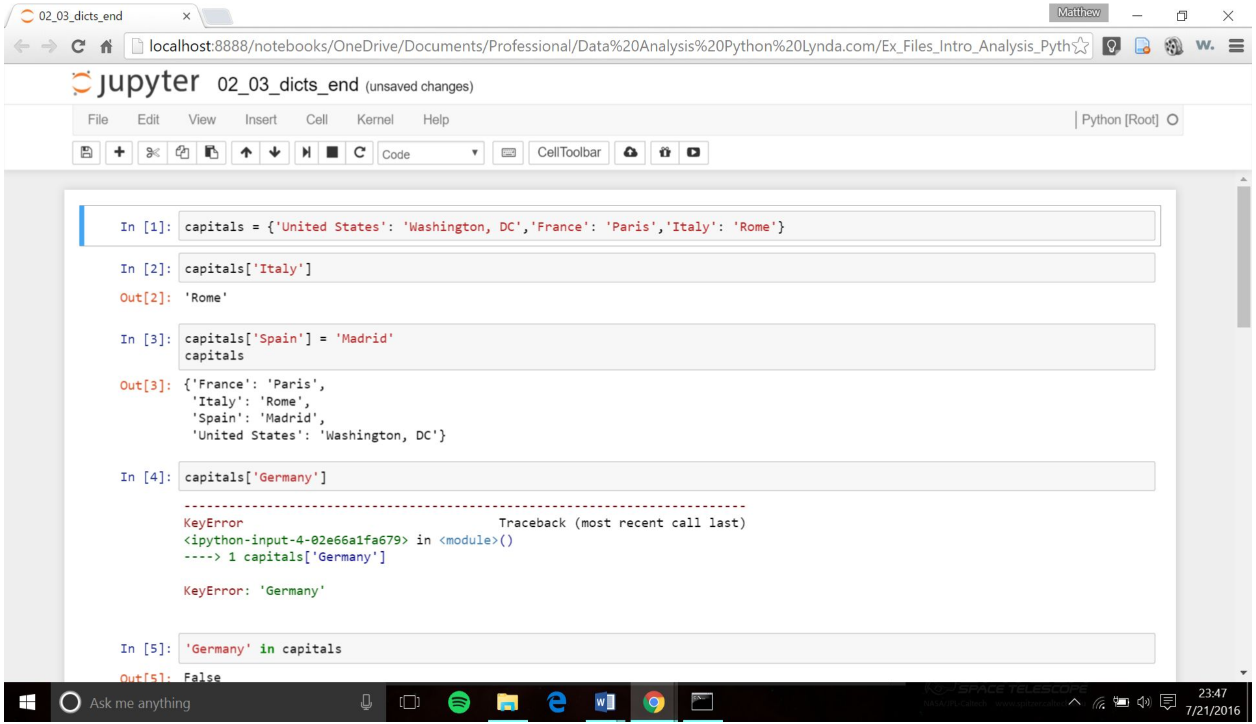
PRODUCT OF CANADA

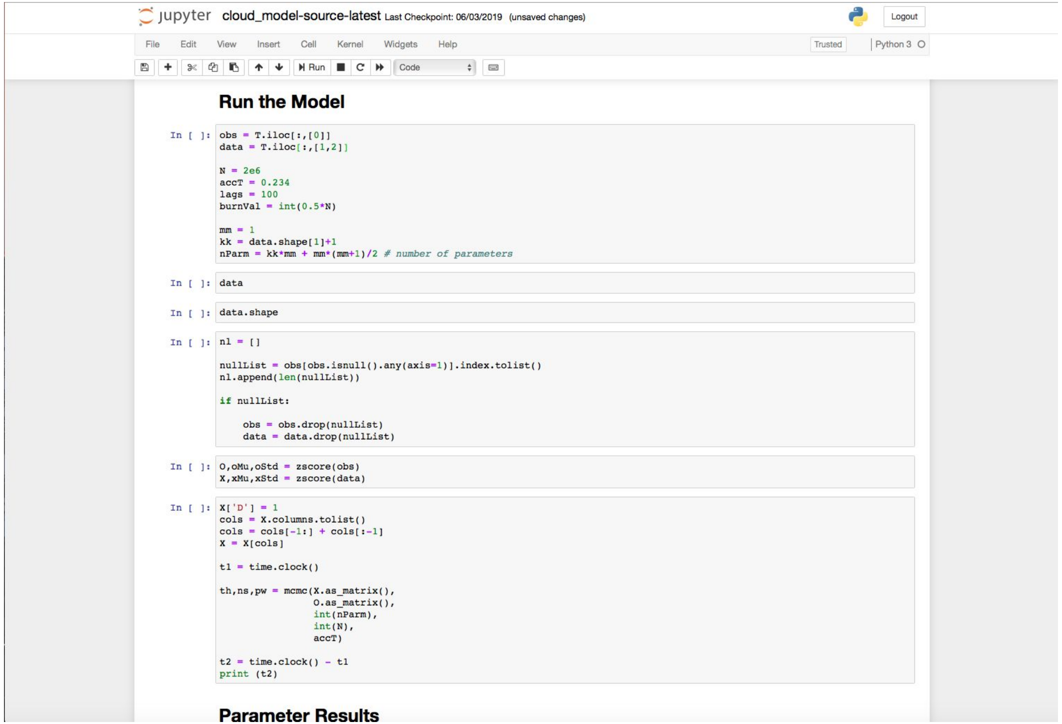
Project Overview

- Jupyter Notebook
- Python



Model Explanation

- Evaluating learning machine
- Using pre-existing data points to determine specific test dates
- The more training data used, the more accurate the test data will be (Hypothesis)



Breaking down the Data Sets

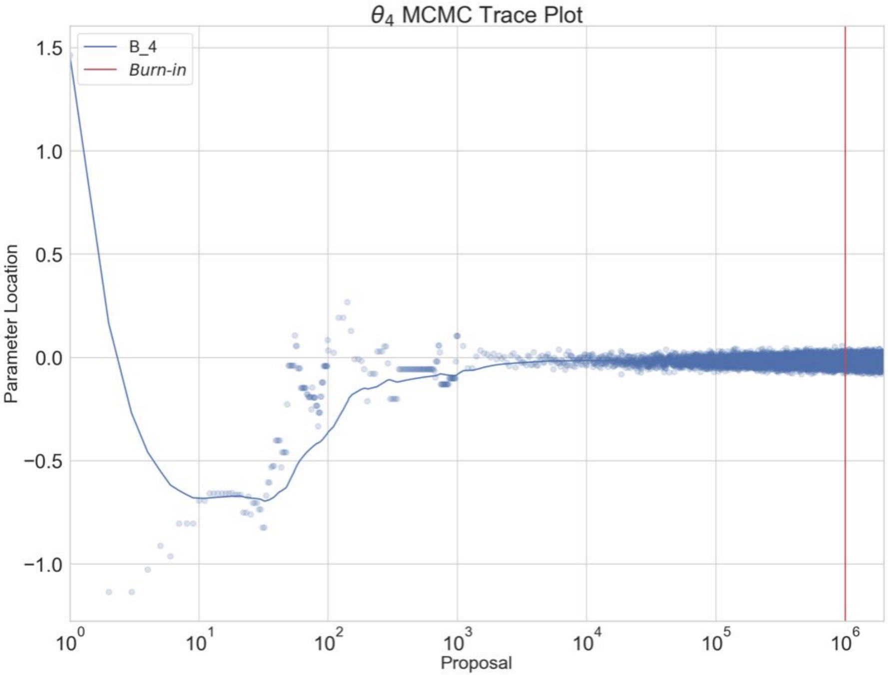
File Name Format: Year/Month/Day/Time - ex. 1606081500Z.pts

- Cloud data sets have a total of 15 columns
- Wind data sets have a total of 10 columns

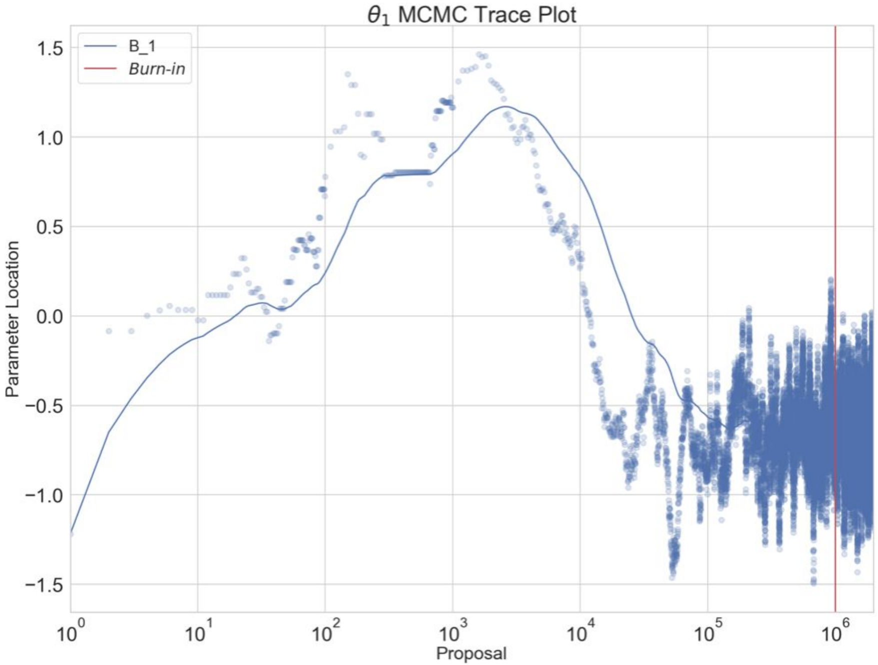
Predictors

Box Plot

Trace Plot

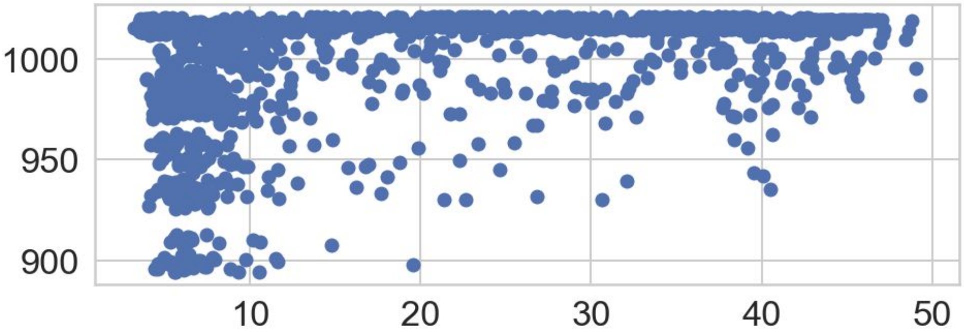


column 4: maximum vertical motion

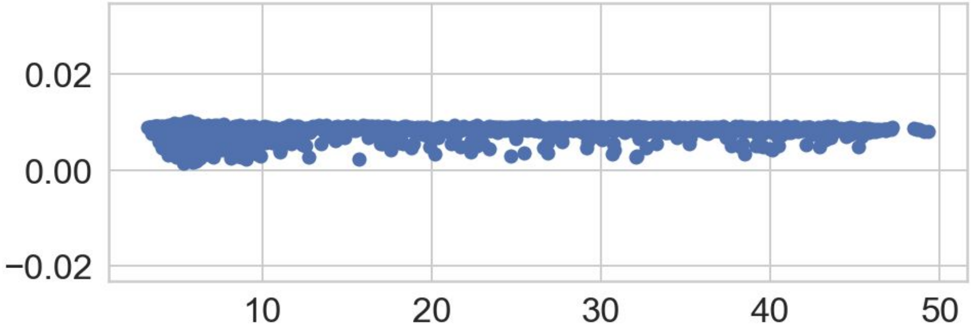


column 1: average cloud water

Scatter Plot



column 11: surface pressure



column 8: maximum specific humidity

Most effective/Promising

Cloud - maximum vertical motion, maximum relative humidity, average relative humidity, sea level pressure, surface pressure

Wind - N/A (all columns were needed to run the model)

Understanding the Results

tt: verification

bz: prediction

de: difference between tt and bz

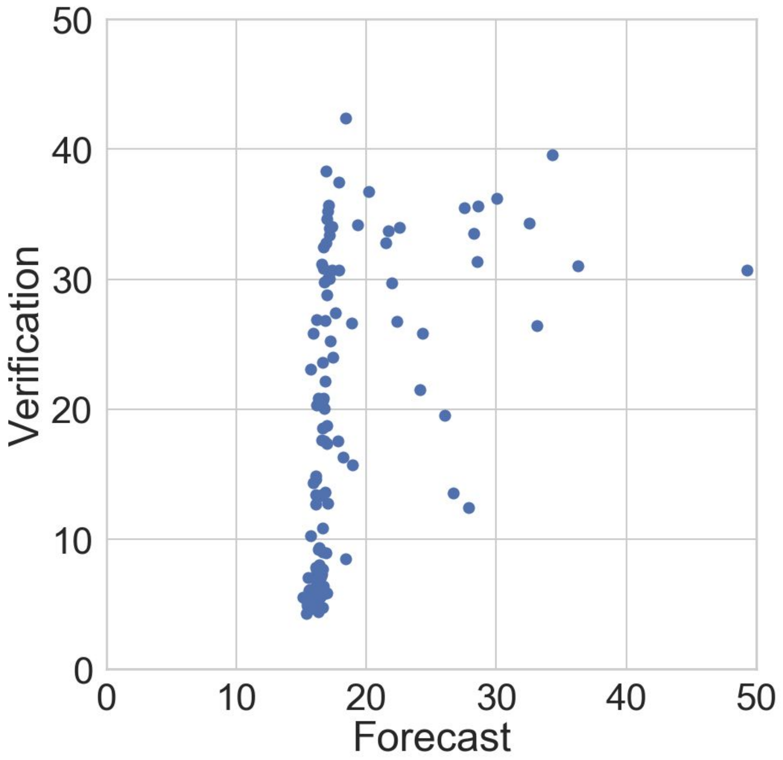
* these arrays were used to generate heat maps, scatterplots, stream plots, and vector plots *

```
de = []
bz = []
tt = []

for idx in range(t.shape[0]):

    pv = array(t.iloc[idx,[1,2,3,4,5]].tolist())
    truth = array(t.iloc[idx,[0]].tolist())
    fs = ppdNorm(bM,cM,pv,
                 xMu,
                 xStd,
                 oMu,
                 oStd,
                 mm,kk)
    fm = np.median(fs,axis=0)
    bz.append(fm)
    tt.append(truth)
    de.append((truth - fm).tolist())

    FS = pd.DataFrame(fs,columns=['I'])
#    FS['day'] = idx
#    FS = FS.set_index(['day'])

    if (idx == 0):

        dfFS = FS.copy()

    else:

        dfFS = pd.concat([dfFS,FS], ignore_index=False)

    #del FS
```

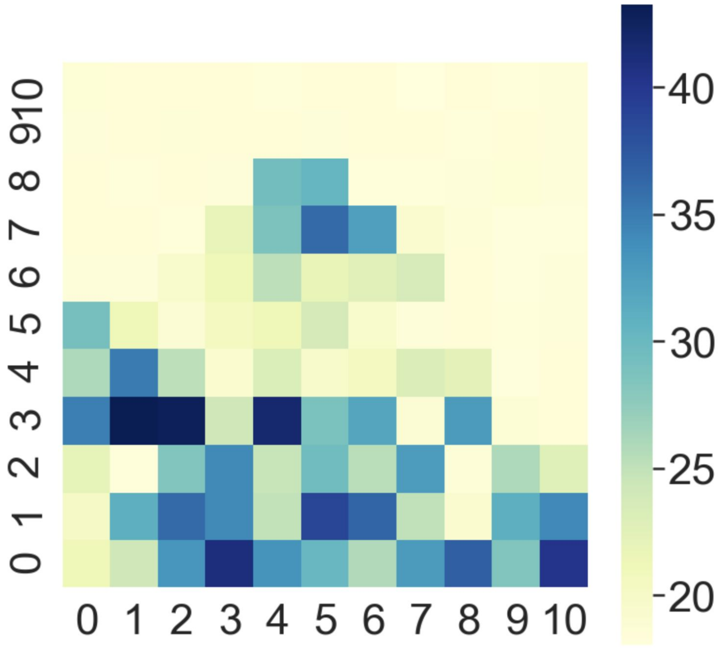
More Parameters
More Problems

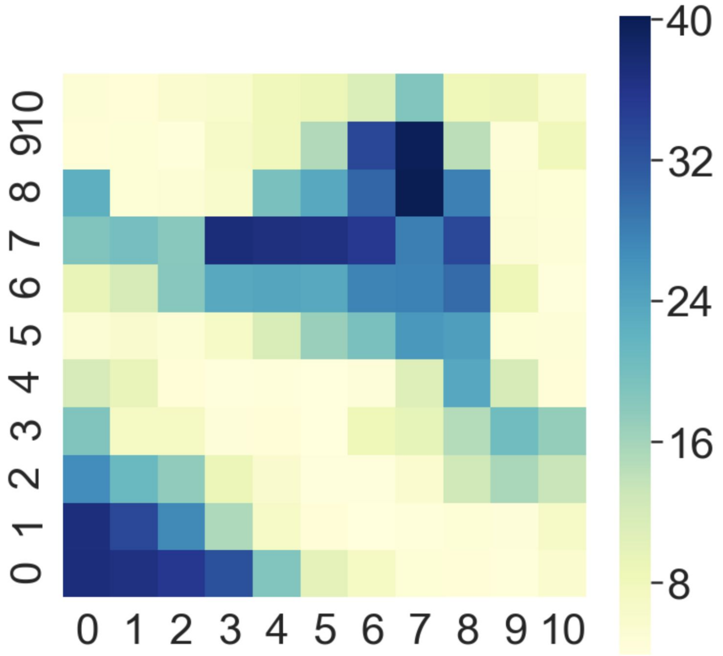
Cloud Model

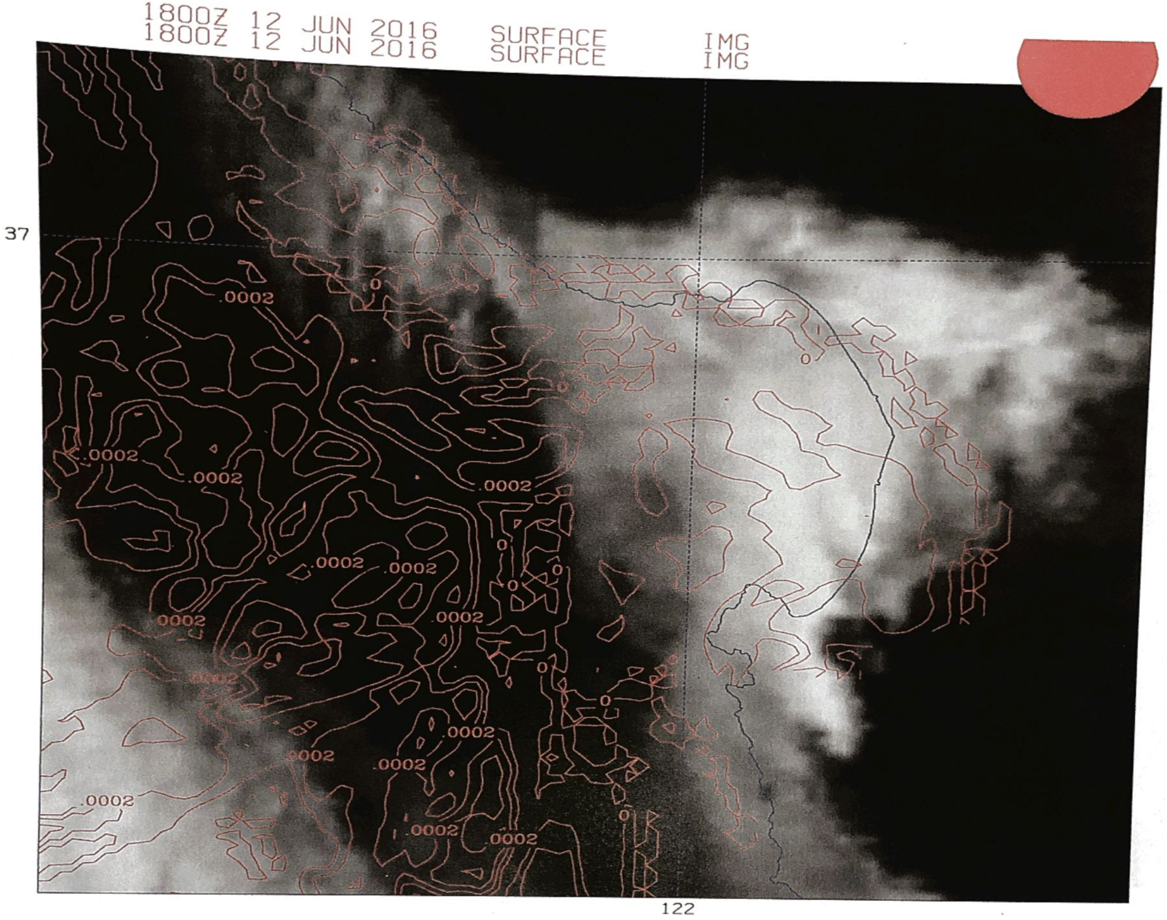
Scatter Plot: bz vs. tt



Predicted vs Truth Heat Map

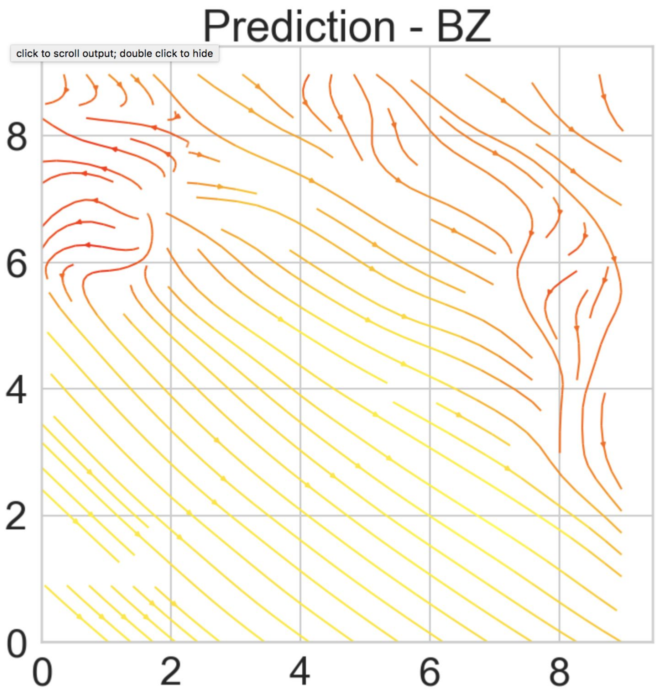




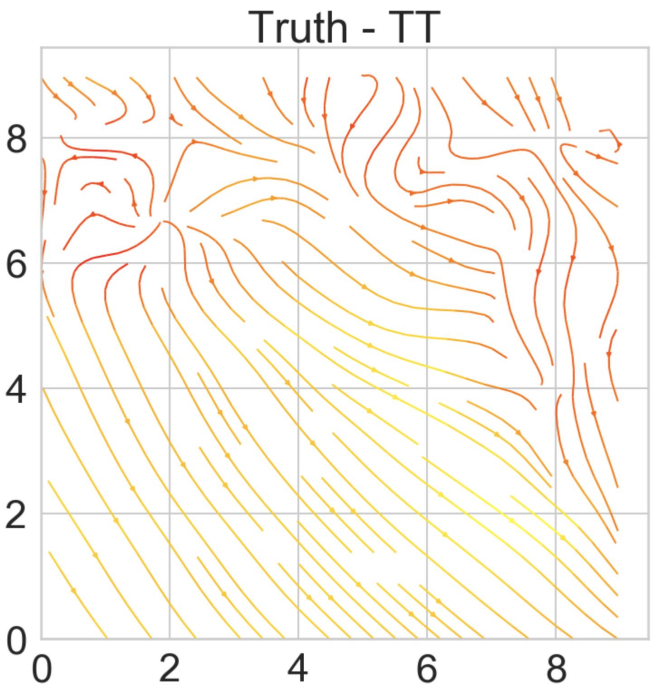

1800Z 12 JUN 2016 SURFACE IMG
1800Z 12 JUN 2016 SURFACE IMG
37
.0002
0
122

Wind Model

Stream Plot

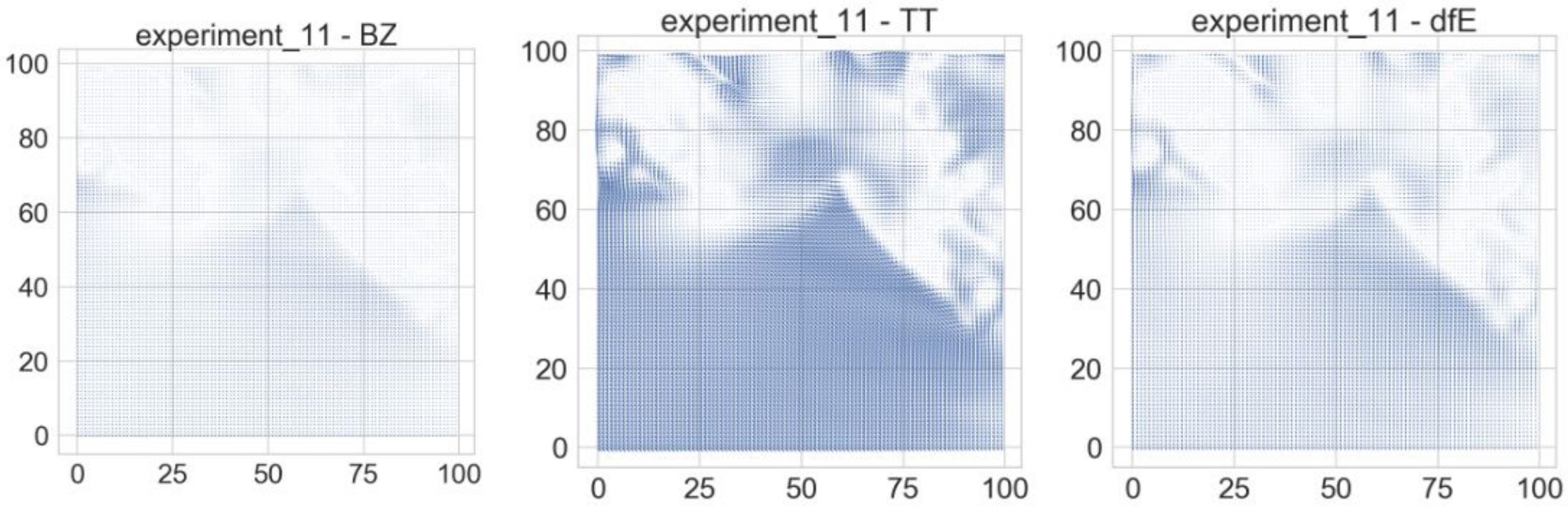


Prediction - BZ
click to scroll output; double click to hide
8
6
4
2
0
0
2
4
6
8



Truth - TT
8
6
4
2
0
0
2
4
6
8

Vector Plot


experiment_11 - BZ
experiment_11 - TT
experiment_11 - dfE
100
80
60
40
20
0
0
25
50
75
100

-Model Evaluation
(and where it breaks)

Integrated Cloud Water and Surface Pressure

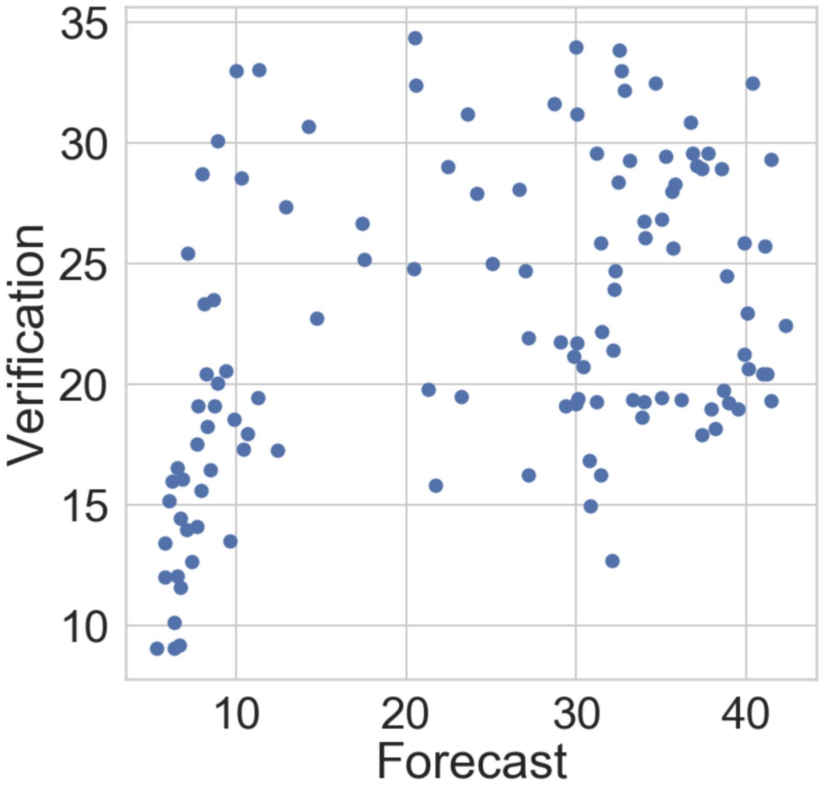
Training data:

160608-11 (4 days)

1500 hrs

Test:

16-06-**12**-1500



Integrated Cloud Water and Surface Pressure

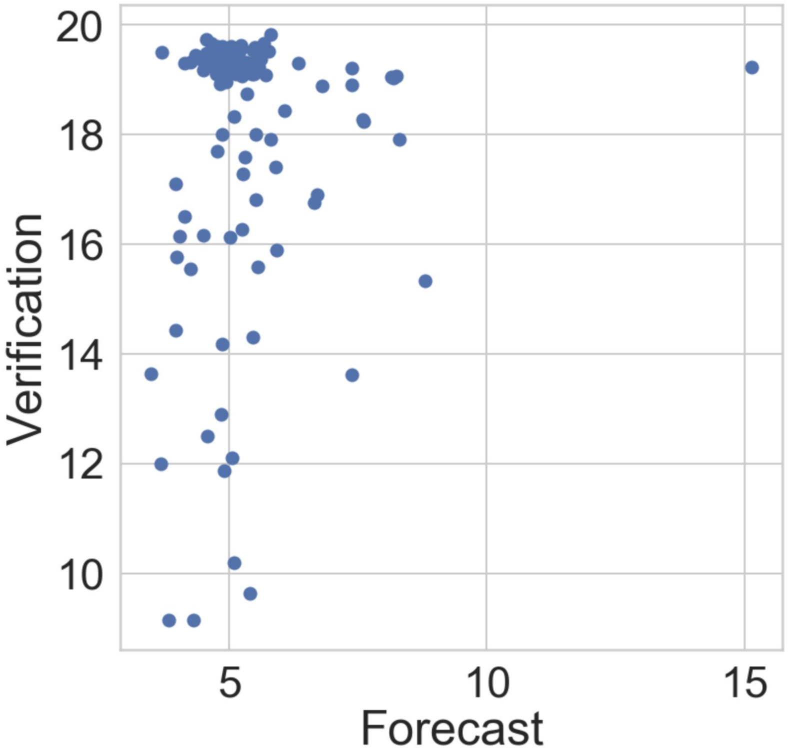
Training data:

160608-11 (4 days)

1500 hrs

Test:

16-06-**24**-1500



Integrated Cloud Water and Surface Pressure

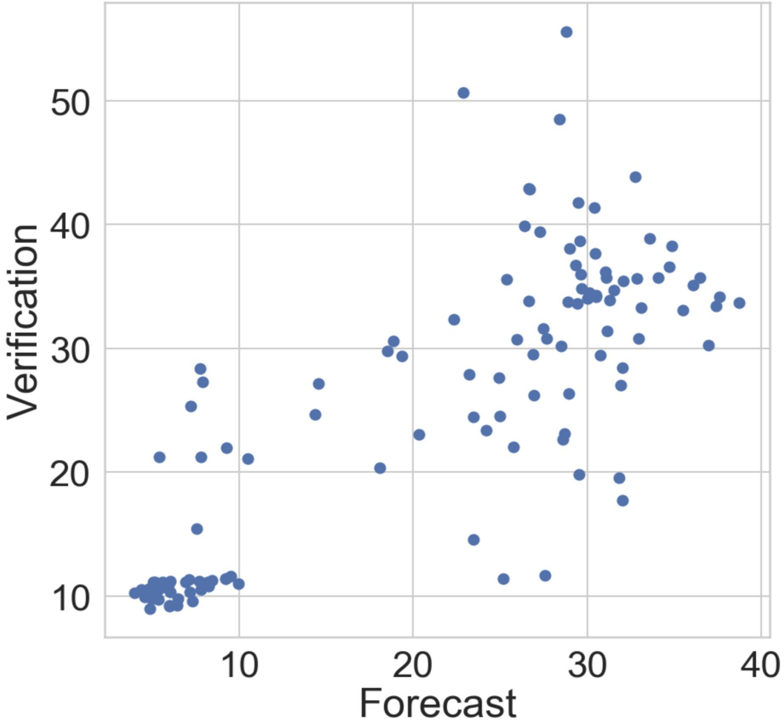
Training data:

160608-160623 (16 days)

1500 hrs

Test:

16-06-**24**-1500



8 June 2016 1500hrs

```
                                  OLS Regression Results
=========================================================================================
Dep. Variable:      Observed cloud reflectivity   R-squared:                       0.704
Model:                                      OLS   Adj. R-squared:                  0.704
Method:                           Least Squares   F-statistic:                     2375.
Date:                          Tue, 18 Jun 2019   Prob (F-statistic):               0.00
Time:                                  11:44:10   Log-Likelihood:                -32989.
No. Observations:                         10000   AIC:                         6.600e+04
Df Residuals:                              9989   BIC:                         6.608e+04
Df Model:                                    10
Covariance Type:                      nonrobust
===============================================================================================
                                coef    std err          t      P>|t|      [0.025      0.975]
-----------------------------------------------------------------------------------------------
const                     -7628.1427    342.949    -22.243      0.000   -8300.393   -6955.893
Average cloud water        7294.7560   3.08e+04      0.237      0.813   -5.31e+04    6.77e+04
Maximum cloud water       -1041.7062   1809.909     -0.576      0.565   -4589.492    2506.080
Integrated cloud water    -1091.6274   2764.131     -0.395      0.693   -6509.881    4326.627
Maximum Vertical Motion      -0.0161      0.778     -0.021      0.984      -1.541       1.509
Maximum Relative Humidity    -0.1906      0.020     -9.559      0.000      -0.230      -0.151
Average Relative Humidity     0.2363      0.016     15.200      0.000       0.206       0.267
Average Specific Humidity -5730.5433    211.593    -27.083      0.000   -6145.309   -5315.778
Max Specific Humidity      6051.7509    305.580     19.804      0.000    5452.753    6650.749
Sea Level Pressure            7.4645      0.341     21.884      0.000       6.796       8.133
Surface Pressure              0.0811      0.007     11.165      0.000       0.067       0.095
==============================================================================
Omnibus:                      159.815   Durbin-Watson:                   0.180
Prob(Omnibus):                  0.000   Jarque-Bera (JB):              237.960
Skew:                          -0.178   Prob(JB):                     2.13e-52
Kurtosis:                       3.666   Cond. No.                     6.74e+08
==============================================================================

Warnings:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 6.74e+08. This might indicate that there are
strong multicollinearity or other numerical problems.
```