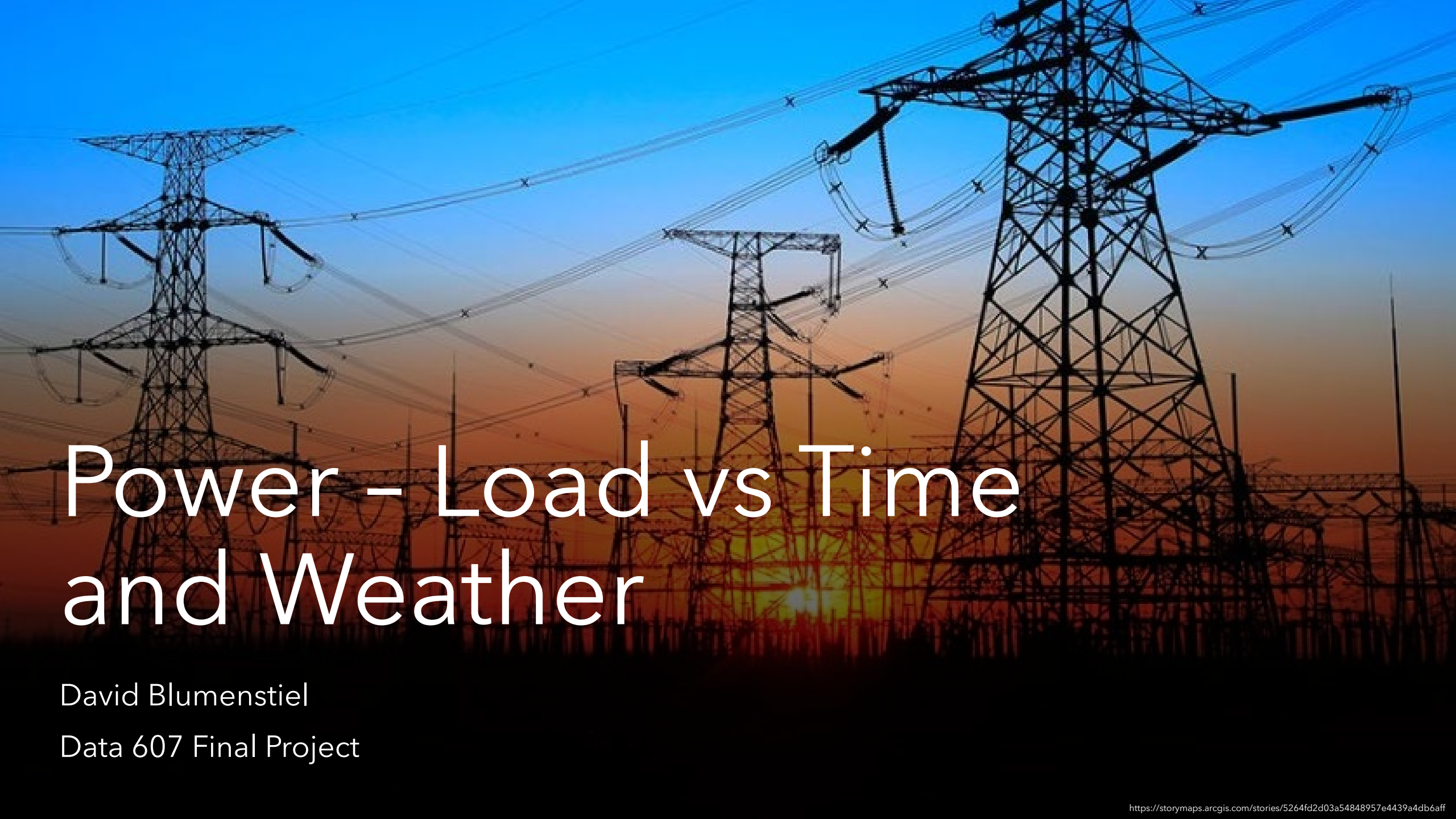


Power – Load vs Time and Weather

David Blumenstiel

Data 607 Final Project

https://storymaps.arcgis.com/stories/5264fd2d03a54848957e4439a4db6aff

Introduction

- How does power load on an electrical grid behave over time, and with precipitation.
- Focused on eastern Virginia.
- Constructed two models.

https://www.tdworld.com/grid-innovations/article/20972326/upgrading-our-floppydisk-power-grid

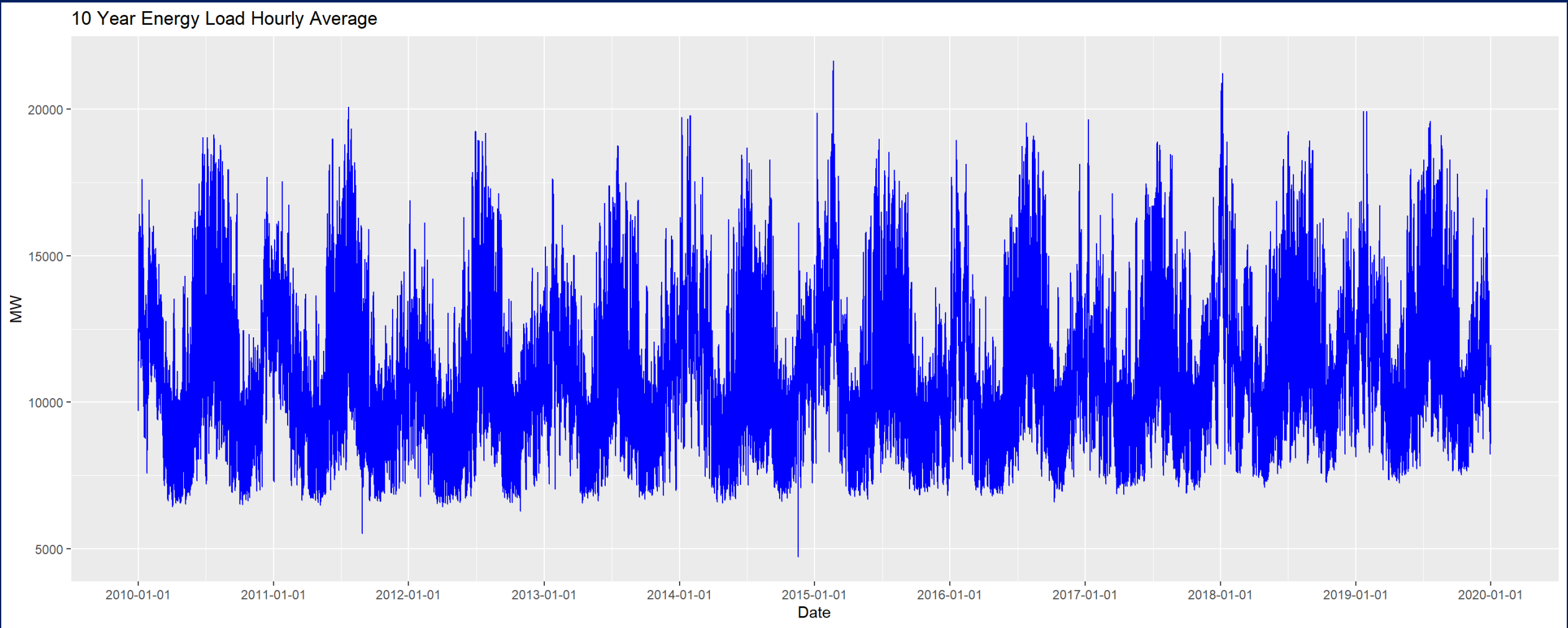
Data

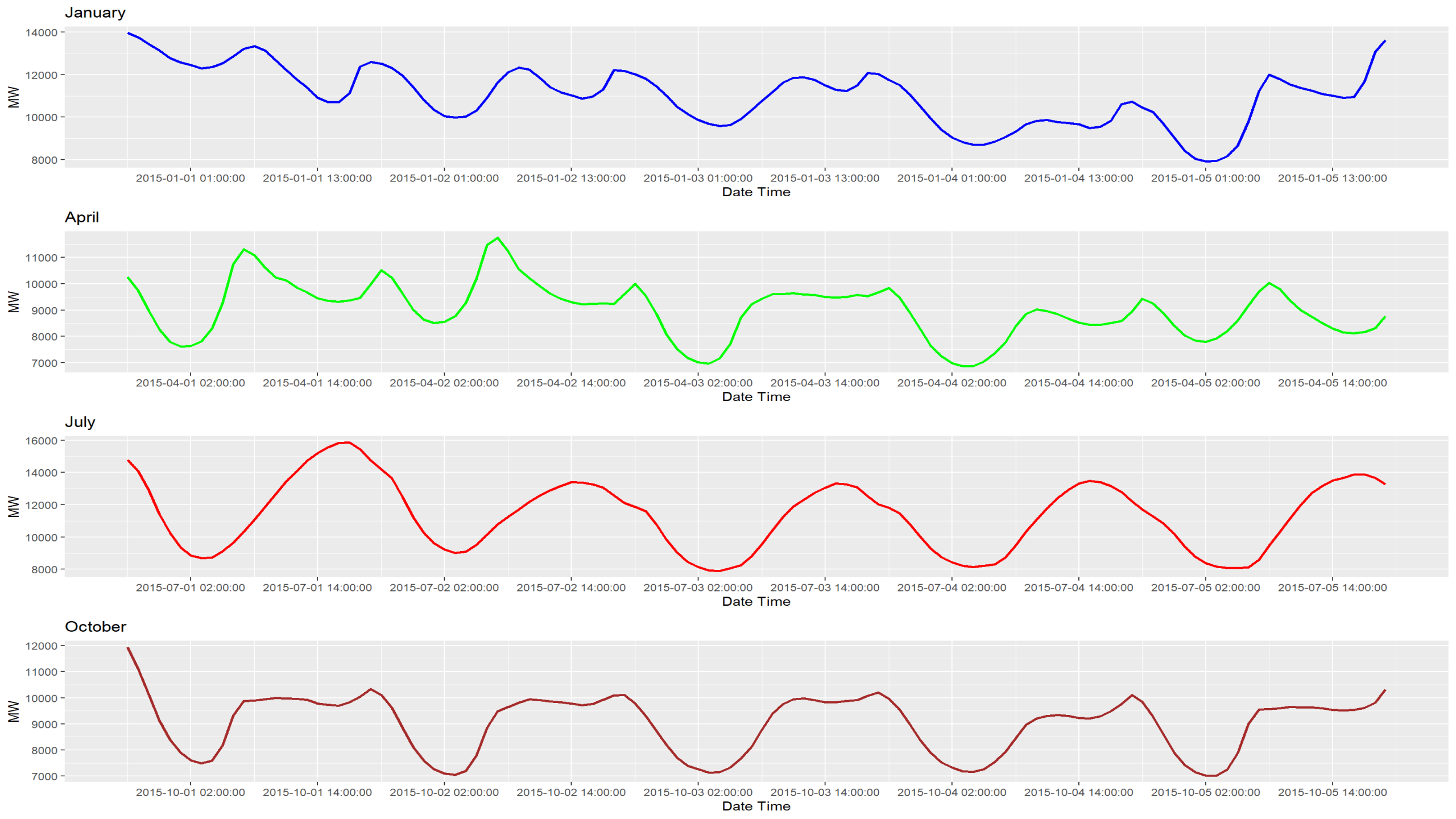
- Energy data comes from PJM, a regional transmission organization; coordinates electrical transmission between med-eastern states.
  - .csv format
- Weather data comes from NOAA.
  - .txt format

https://www.ocregister.com/2017/02/17/power-out-for-thousands-due-to-heavy-winds-rain-in-orange-county/

Data Investigation: Energy

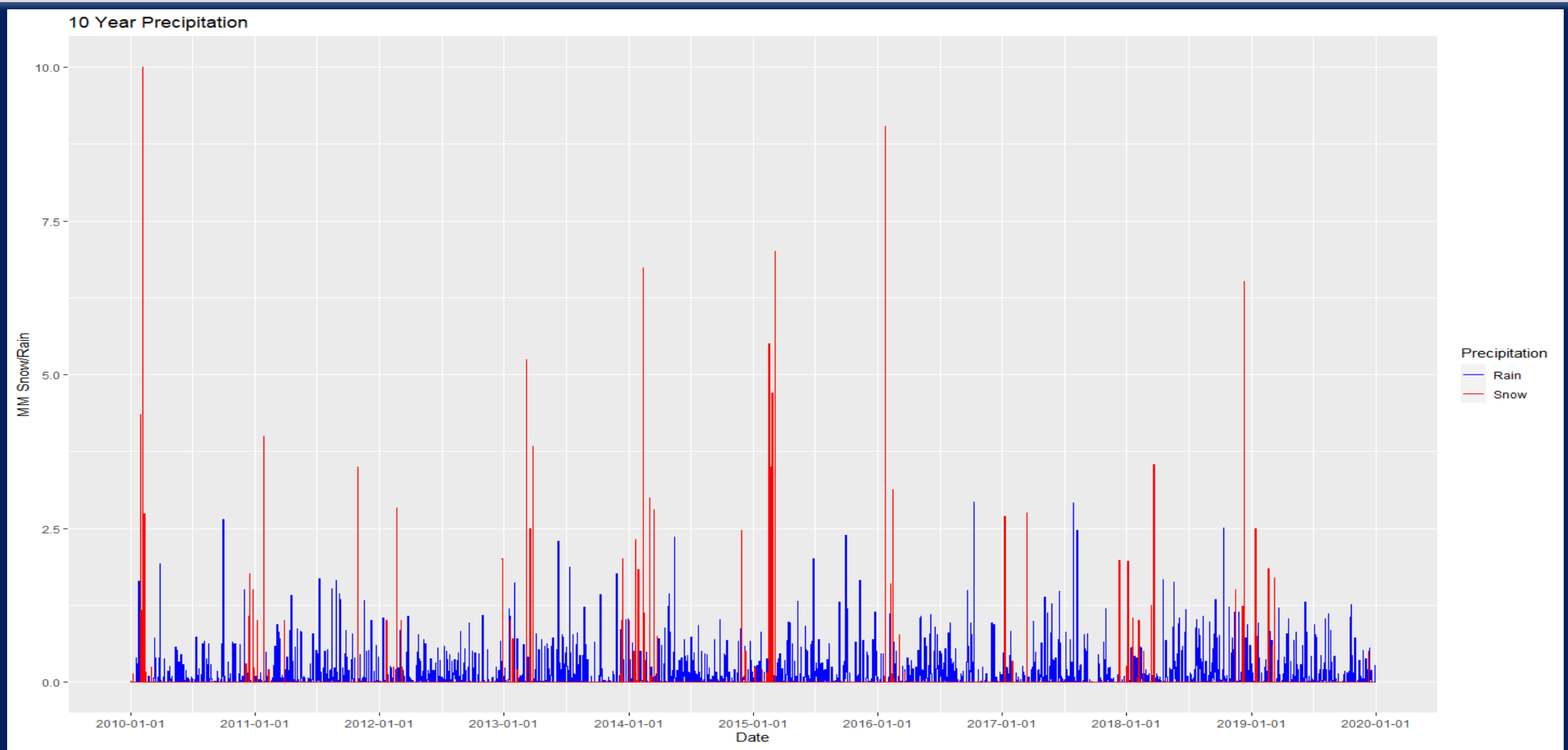
Megawatt load over 10 years, averaged hourly




January
14000
12000
10000
8000
MW
2015-01-01 01:00:00
2015-01-01 13:00:00
2015-01-02 01:00:00
2015-01-02 13:00:00
2015-01-03 01:00:00
2015-01-03 13:00:00
2015-01-04 01:00:00
2015-01-04 13:00:00
2015-01-05 01:00:00
2015-01-05 13:00:00
Date Time
April
11000
10000
9000
8000
7000
MW
2015-04-01 02:00:00
2015-04-01 14:00:00
2015-04-02 02:00:00
2015-04-02 14:00:00
2015-04-03 02:00:00
2015-04-03 14:00:00
2015-04-04 02:00:00
2015-04-04 14:00:00
2015-04-05 02:00:00
2015-04-05 14:00:00
Date Time
July
16000
14000
12000
10000
8000
MW
2015-07-01 02:00:00
2015-07-01 14:00:00
2015-07-02 02:00:00
2015-07-02 14:00:00
2015-07-03 02:00:00
2015-07-03 14:00:00
2015-07-04 02:00:00
2015-07-04 14:00:00
2015-07-05 02:00:00
2015-07-05 14:00:00
Date Time
October
12000
11000
10000
9000
8000
7000
MW
2015-10-01 02:00:00
2015-10-01 14:00:00
2015-10-02 02:00:00
2015-10-02 14:00:00
2015-10-03 02:00:00
2015-10-03 14:00:00
2015-10-04 02:00:00
2015-10-04 14:00:00
2015-10-05 02:00:00
2015-10-05 14:00:00
Date Time

Data Investigation: Weather

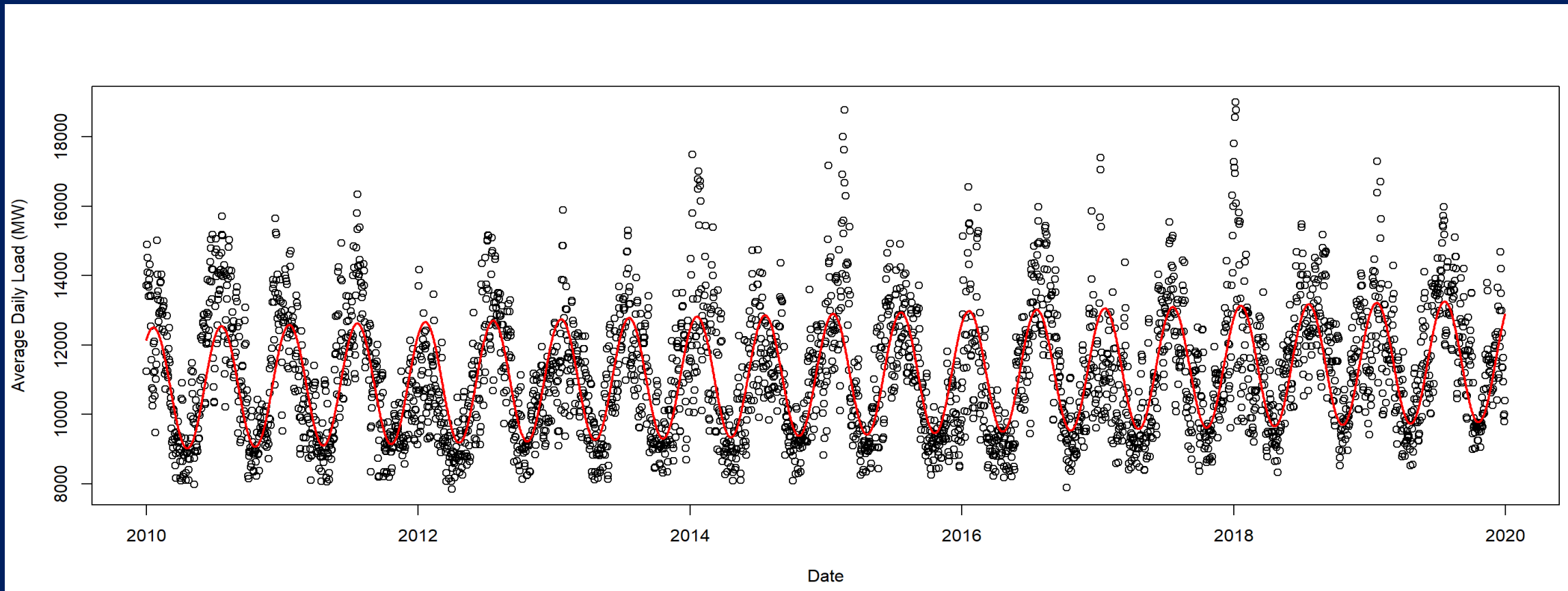
Daily average precipitation over 10 years for rain and snow



Modeling

Time Only: R^2 = 0.473
With Rain: R^2 = 0.476

```
term1 = sin(4*pi * as.numeric(df$date)/365.25)
term2 = cos(4*pi * as.numeric(df$date)/365.25)
model <- lm(MW ~  date + term1 + term2 + rain, data = df)0
```



https://www.heraldgoa.in/Review/POWER-TO-PEOPLE-WHEN-RAIN-REIGNS/115395.html

Conclusions

- Power demand behaves cyclically over time
- Model with rain was only 0.3% better.
- Not enough difference to conclude that rain affects power load.
- Further improvements to the model could be made by accounting for daily/weekly variation, and considering temperature.