# MAP 573 - Group 12

## Time Series Forecast using (LSTM) RNN network

## Zone

Zone 1 Load ▼

## Stations
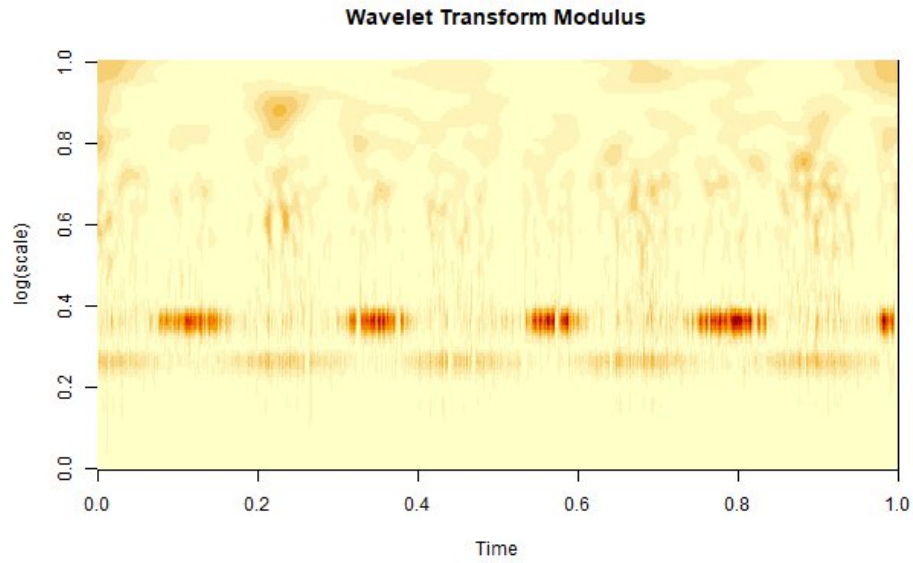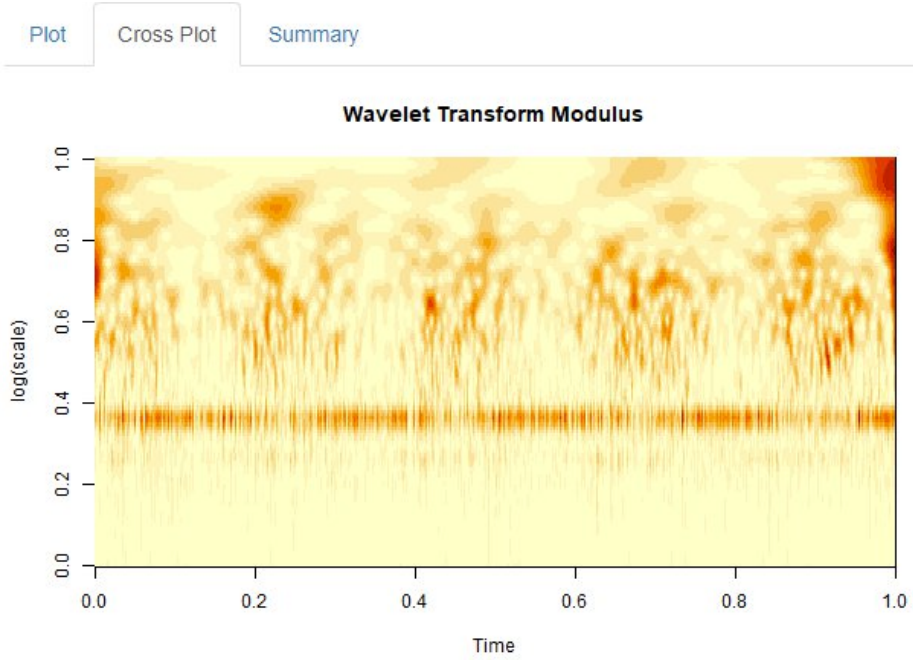
St. 1 Temp. ▼

Plot    Cross Plot    Summary



Series: x
Raw Periodogram

bandwidth = 7.22e-06

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bandwidth = 7.22e-06
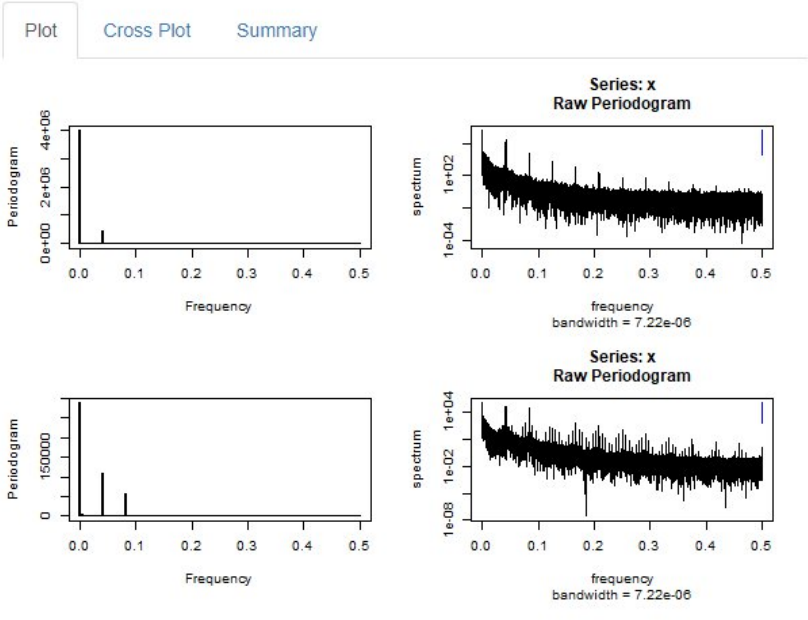
## Zone

Zone 1 Load ▼

## Stations

St. 1 Temp. ▼

Plot    Cross Plot    Summary

|      | freq     | spec       | time        |
|------|----------|------------|-------------|
| 5    | 0.000125 | 4025684.51 | 8000.0000   |
| 4    | 0.000100 | 2337549.63 | 10000.0000  |
| 1667 | 0.041675 | 434769.70  | 23.9952     |
| 6    | 0.000150 | 423043.14  | 6666.6667   |
| 3    | 0.000075 | 268865.82  | 13333.3333  |
| 7    | 0.000175 | 203511.15  | 5714.2857   |
| 8    | 0.000200 | 161062.58  | 5000.0000   |
| 1666 | 0.041650 | 119681.53  | 24.0096     |
| 9    | 0.000225 | 74830.33   | 4444.4444   |

|      | freq     | spec        | ttime        |
|------|----------|-------------|--------------|
| 9    | 0.000225 | 74830.326   | 4444.44444   |
| 1662 | 0.041550 | 6671.546    | 24.06739     |
| 1671 | 0.041775 | 24016.055   | 23.93776     |
| 1667 | 0.041675 | 434769.696  | 23.99520     |
| 3333 | 0.083325 | 26247.817   | 12.00120     |
| 1    | 0.000025 | 51773.199   | 40000.00000  |
| 1666 | 0.041650 | 119681.534  | 24.00960     |
| 3334 | 0.083350 | 6708.850    | 11.99760     |
| 27   | 0.000675 | 3717.744    | 1481.48148   |

Plot    Cross Plot    Summary

**Wavelet Transform Modulus**



**Wavelet Transform Modulus**

**Stations**

St. 1 Temp.

# Periodicity

24

# Sliders

0  50  90

0  9  18  27  36  45  54  63  72  81  90

Plot    Summary    Table

Plot    Summary    Table

Jan 01 2004
Jul 01 2004
Jan 01 2005
Jul 01 2005
Jan 01 2006
Jul 01 2006
Jan 01 2007
Jul 01 2007
Jan 01 2008
Jun 30 2008
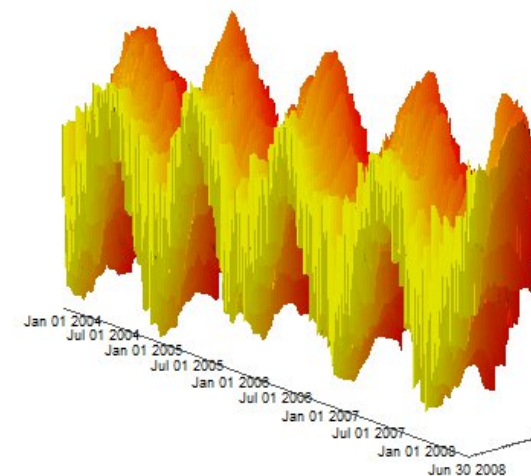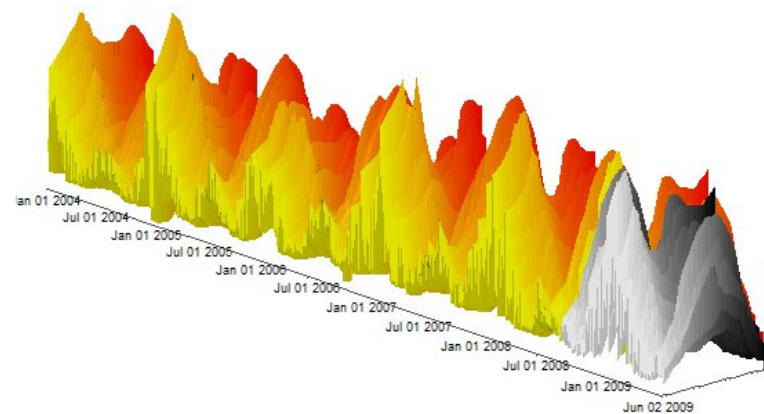
**Zone**
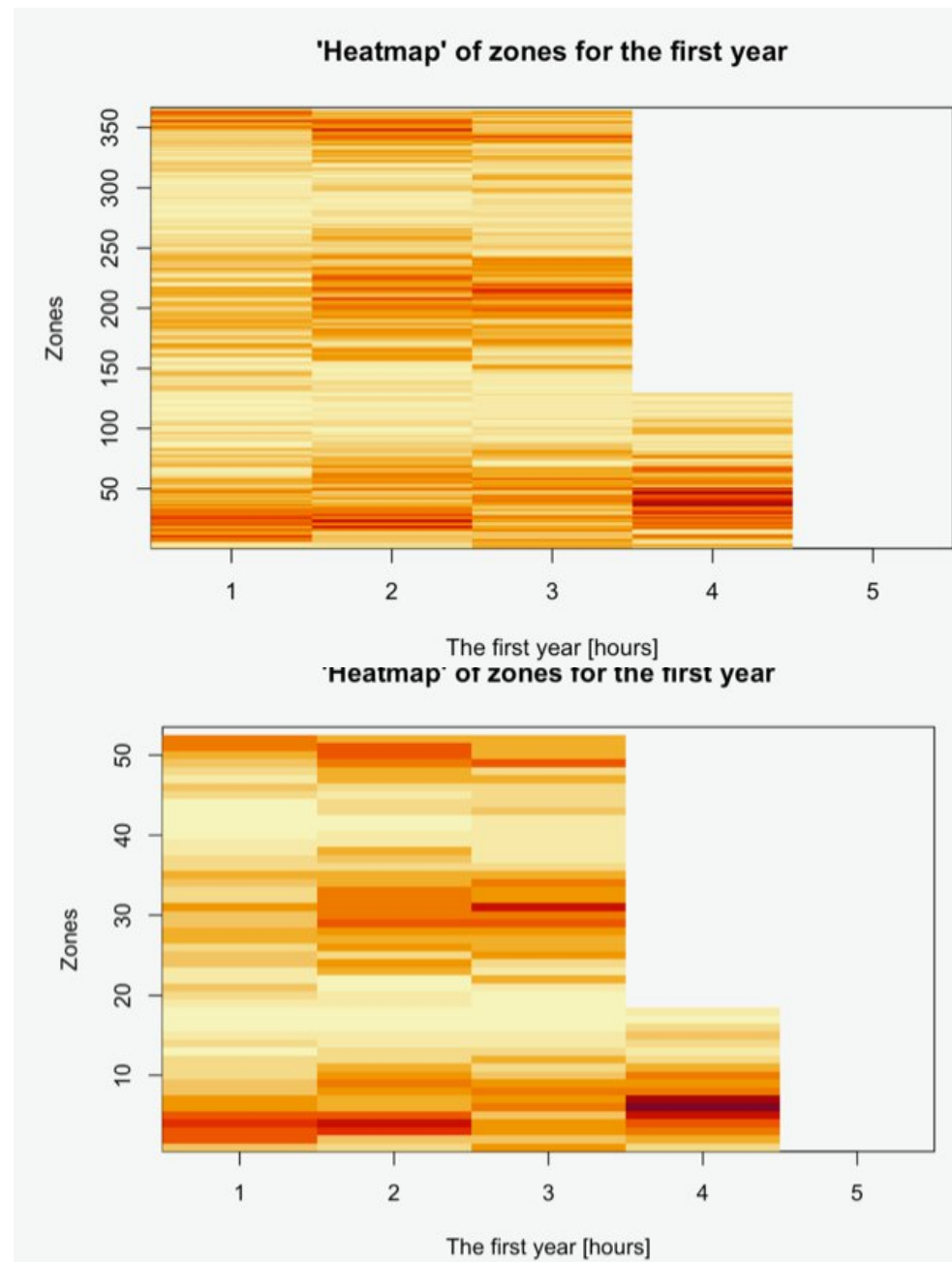
Zone 1 Load

# Periodicity

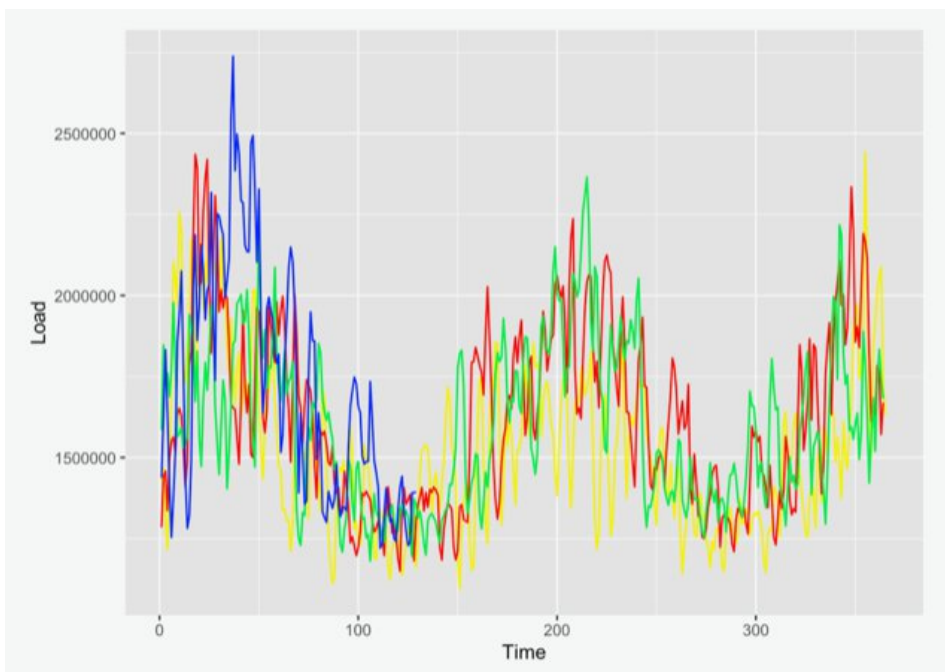24

☐ Normalize

# Sliders

0  50  90

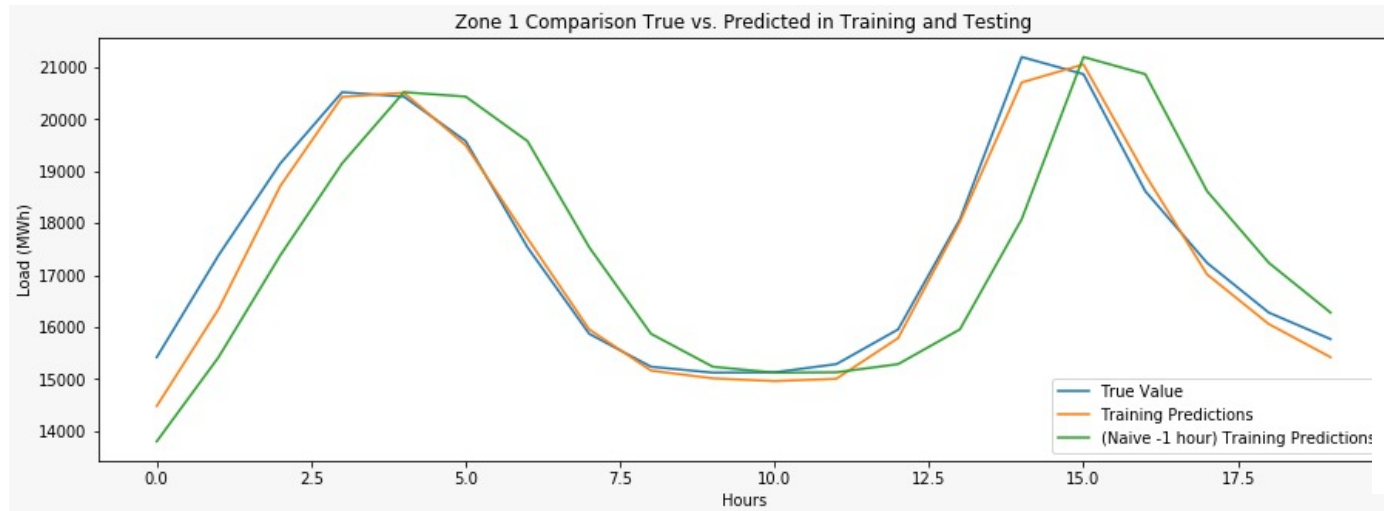0  9  18  27  36  45  54  63  72  81  90

**Forecast Zone**

Zone 1 Load

☑ Include Forecast Data

Jan 01 2004
Jul 01 2004
Jan 01 2005
Jul 01 2005
Jan 01 2006
Jul 01 2006
Jan 01 2007
Jul 01 2007
Jan 01 2008
Jul 01 2008
Jan 01 2009
Jun 02 2009

'Heatmap' of zones for the first year

The first year [hours]

'Heatmap' of zones for the first year

The first year [hours]
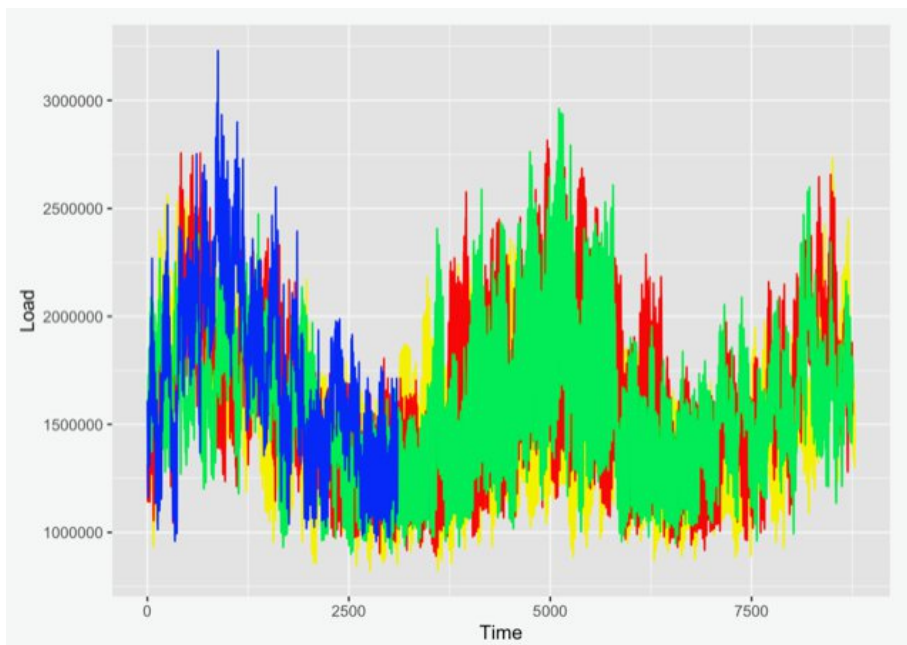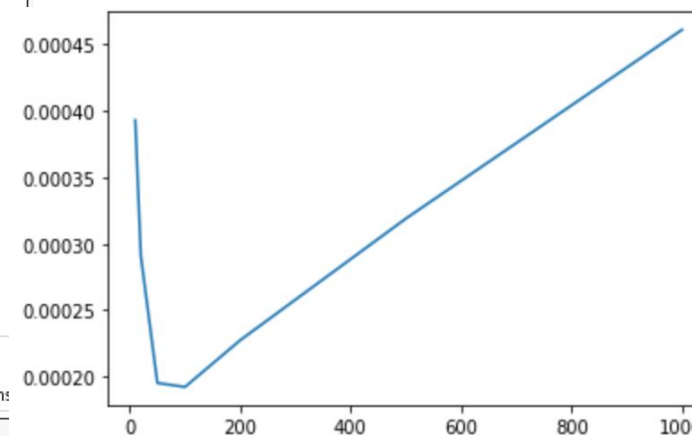
Window size x loss

Training data error: 642.36 MSE
Test data error: 853.60 MSE
(Naive -1 hour) Training data error: 1442.77 MSE
(Naive -1 hour) Test data error: 1478.30 MSE
(Naive -1 day) Training data error: 2951.79 MSE
(Naive -1 day) Test data error: 3516.40 MSE
(Naive -1 week) Training data error: 4463.22 MSE
(Naive -1 week) Test data error: 5433.01 MSE

Box cox transformations did not improve error. GRU increased training speed and achieved similar accuracies.