

UCONN VSTLF Installation Instructions

1. Installation

1.1 Install java virtual machine. Get java from

<http://www.java.com/en/download/index.jsp>

1.2 Extract VSTLF.zip file into a directory. (In fig.1 'H:\VSTLF')

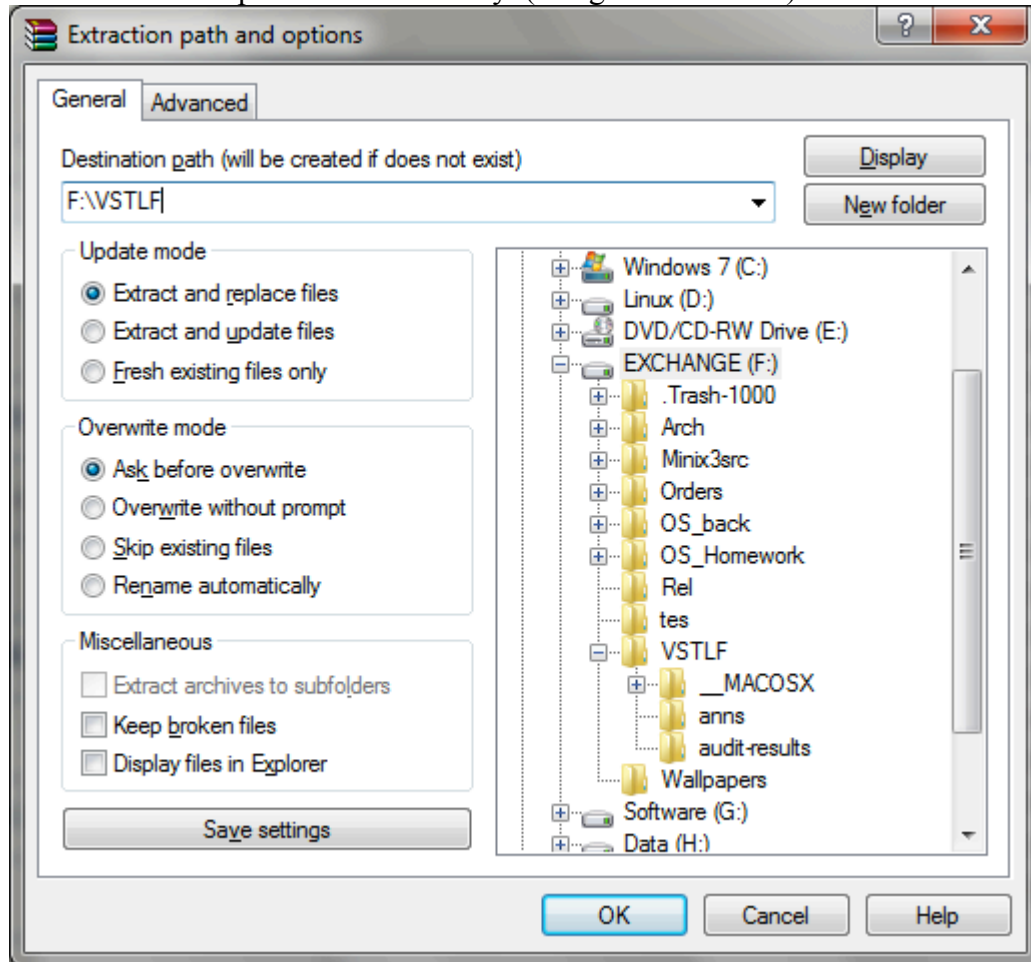


Fig 1. Extract VSTLF.zip

1.3 In this folder there is a java archive file 'uconn-vstlf.jar' and a directory 'anns'. 'uconn-vstlf.jar' is the executable file. The directory 'anns' contains 12 neural network banks, each of which is used to forecast loads for five minute intervals in an hour.

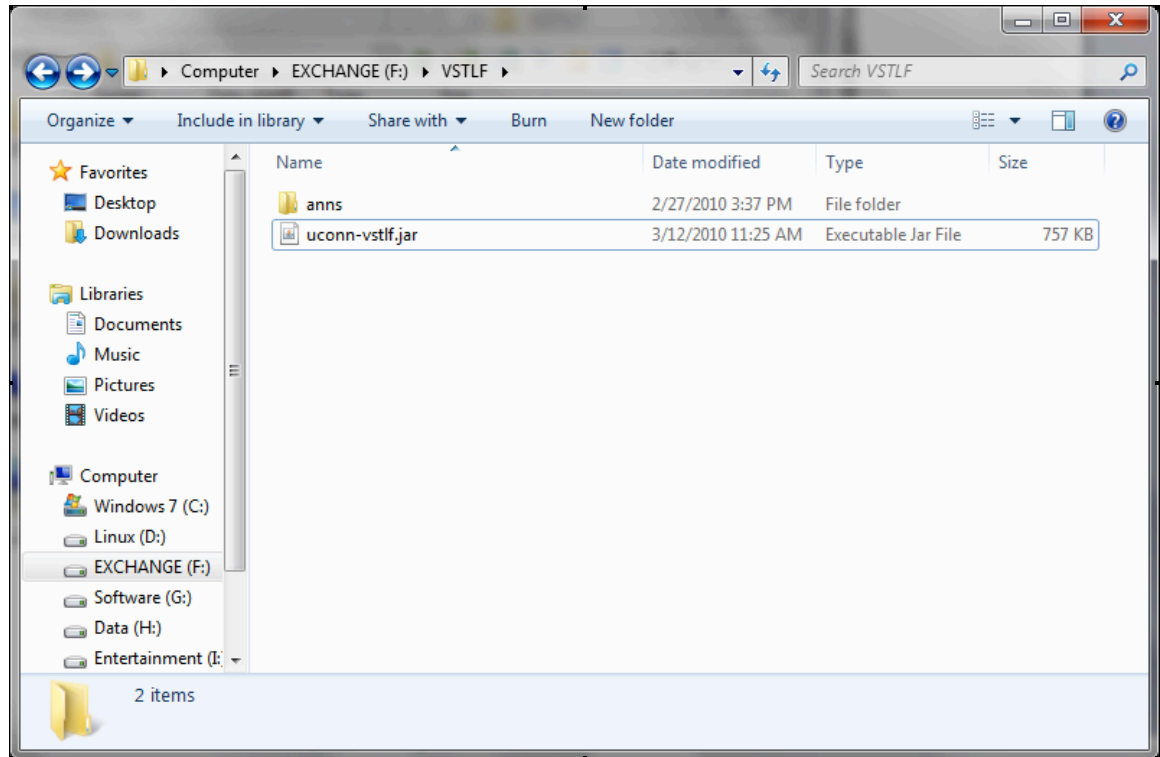


Fig 2. The VSTLF directory

2. Training

To train the neural networks, run the following command:

```
java -Xmx300m -jar uconn-vstlf.jar train <lowBank> <highBank> <xmlFile>
```

<lowBank>, <highBank> are the number of the ANN bank in [0,11]. <xmlFile> contains the 5minute load data for training. The parameter “-Xmx300m” sets the heap size of Java Virtual Machine to be 300m, which is necessary for training from large set of data.

An example is shown is the following figure:

```

C:\> Command Prompt - java -Xmx300m -jar uconn-vstlf.jar train 0 11 isone_2009_five_min_load.xml

F:\VSTLF>java -Xmx300m -jar uconn-vstlf.jar train 0 11 isone_2009_five_min_load.xml
Extracting 5m load signal from isone_2009_five_min_load.xml
Parsing XML
3000
Sorting List
Adding to .load5m.pod
Training about to commence. This will take about 36 hours. Please confirm that
you would like to continue. <Y/n>
Y
Training System for offset: 0 minutes.
Building training set from 2009 - 0 - 2 0:0:0 to 2009 - 11 - 31 0:0:0

```

Fig 3. Training ANN banks

It trains ANN0~ANN11 using 5 minute loads in isone_2009_five_min_load.xml. Since training 12 ANN banks took almost 36 hours, it is advised to train these ANN banks on several computers. For example, train ANN0~5 on one computer and the rest on another.

When training completes 12 files named “bank0.ann”, “bank1.ann”... are generated. Put these files in the directory ‘anns’. As shown in figure 4:

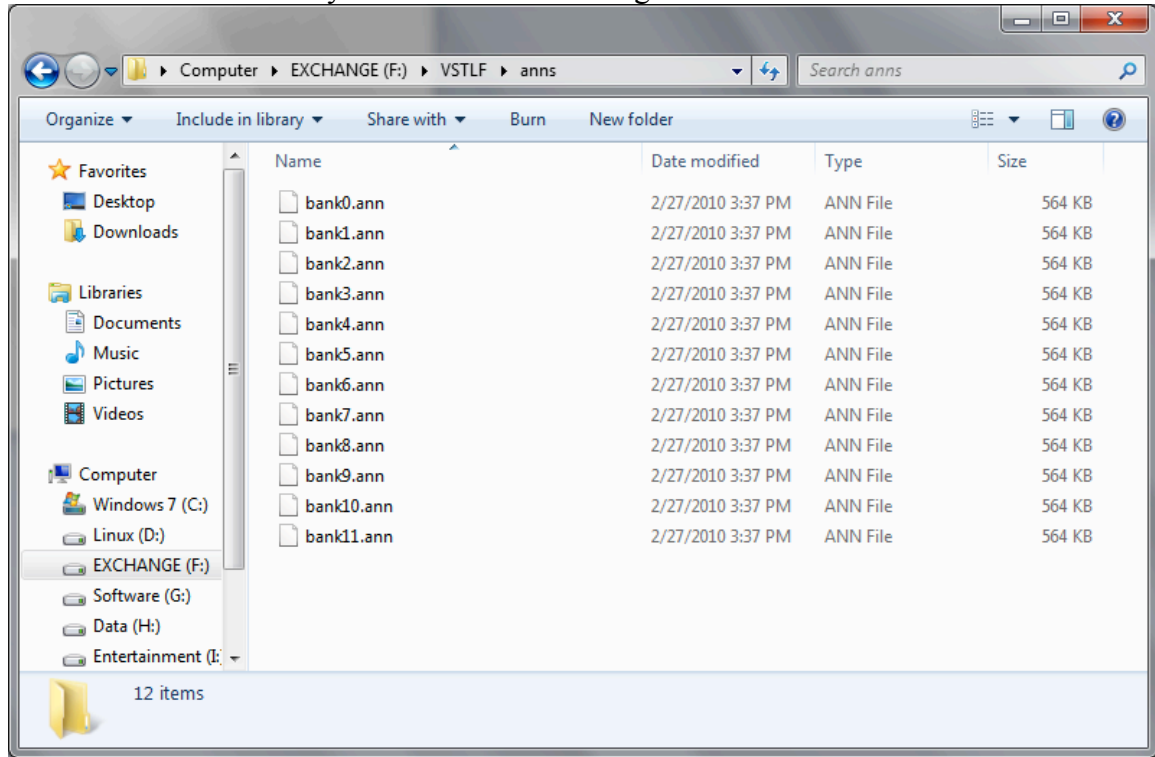


Fig 4. Ann bank directory

3. Run the VSTLF GUI

The main entry point of the VSTLF system is the GUI (Graphic User Interface). To run the vstlf system, enter the following command:

```
java -jar uconn-vstlf.jar run-gui <currentDataFile> <24hrDataFile>
```

<currentDataFile> is a xml file containing 4 second loads. <24hrDataFile> is an xml file containing the 5 minute loads in the last 24 hours (It is used only for starting the vstlf system). These files are provided by ISO.

To run the gui, follow the steps below

3.1. Reset the vstlf system by running the following command.

```
java -jar uconn-vstlf.jar reset
```

It is necessary since the vstlf system will remember the state of the last run.

3.2. Setup the parser to parse the data in real time database into <currentDataFile>.

3.3. Prepare the file <24hrDataFile> containing 5 minute loads in the last 24 hours.

3.4. Make sure the 12 trained ANN bank files are in ‘anns’ directory.

3.5. Run the command:

```
java -jar uconn-vstlf.jar run-gui <currentDataFile> <24hrDataFile>
```

The GUI will start up and output the forecast information.

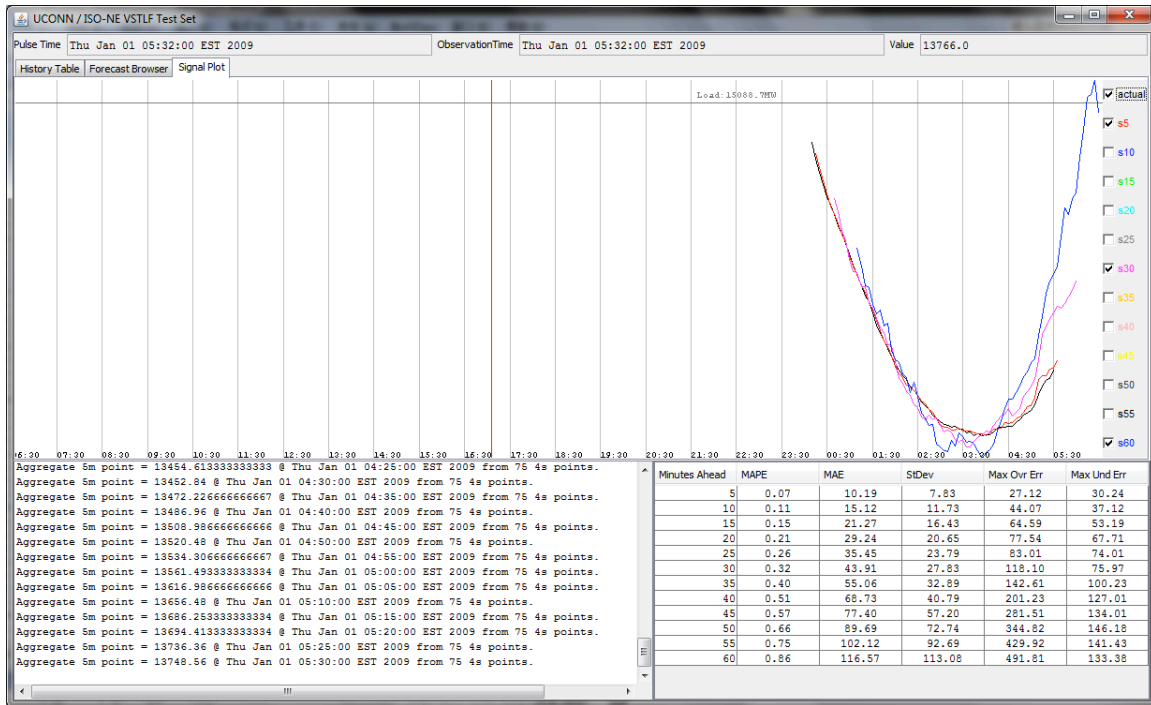


Fig 5. VSTLF GUI

4. Test

To forecast loads starting from a historical point, enter the following command:

```
java -jar uconn-vstlf.jar run-gui <currentDataFile> <24hrDataFile>
"<testDate yyyy/MM/dd - HH:mm:ss>" <clockInterval>
```

The command line is similar to the one in section 3. It has two extra parameters.

"<testDate yyyy/MM/dd - HH:mm:ss>" is the historical point you want to start from. <clockInterval> is the speed (measured in milliseconds) the loads are fed. (It can be much smaller than 4s to speed up the test). <currentDataFile> is an xml file (or Perst database) containing 4 second loads. <24hrDataFile> is an xml file (or Perst database) containing the 5 minute loads in the last 24 hours (from the historical point).

As an example, the following command starts VSTLF from 2009/01/01 by reading historical data from Perst databases ('4s_Jun2008-9.pod' and '5m_2007-Mar2009.pod'). A 4 second historical load is fed every 20 milliseconds.

```
java -jar uconn-vstlf.jar run-gui 4s_Jun2008-9.pod 5m_2007-Mar2009.pod
"2009/01/01 - 00:00:00" 20
```

a GUI displaying the test will show up (as in Fig 6).

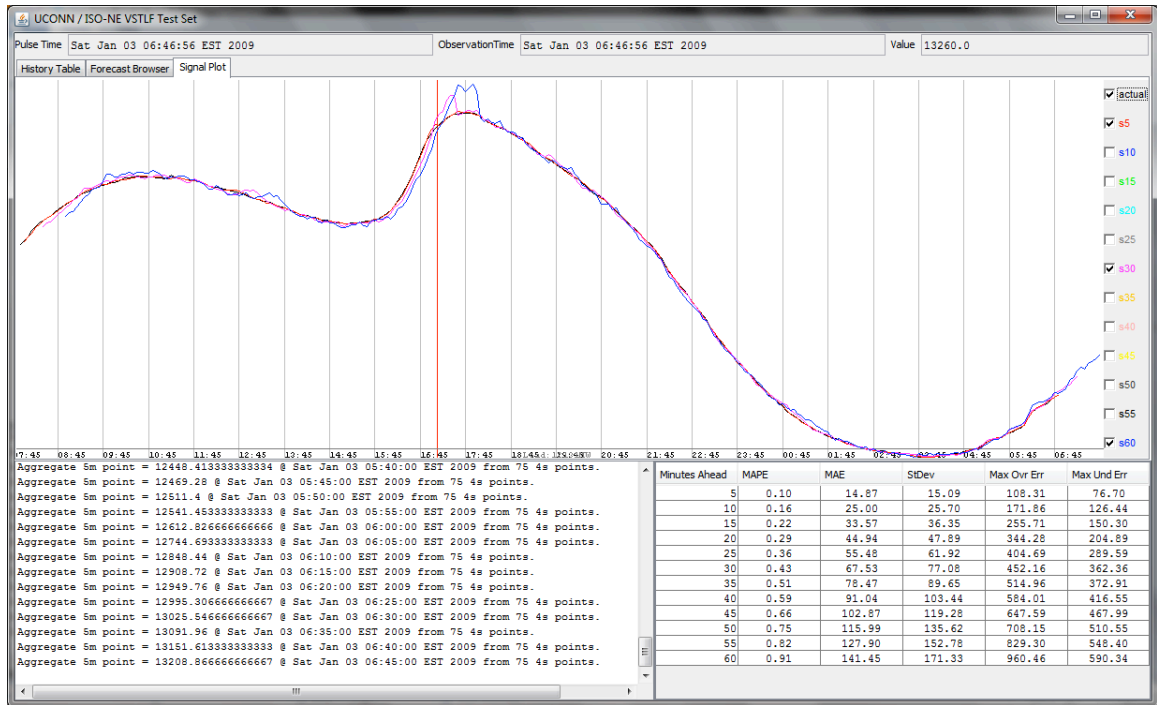


Fig 6. VSTLF GUI (Running in test mod)

5. VSTLF GUI

The GUI of VSTLF displays the following information:

5.1 The historical load from the source file. As in fig 7:

History Table		Forecast Browser	Signal Plot
Time	Value	Filtered	
Mon Jan 05 15:50:00 EST 2009	16763.79		
Mon Jan 05 15:50:00 EST 2009	16763.79		
Mon Jan 05 15:45:00 EST 2009	16725.17		
Mon Jan 05 15:40:00 EST 2009	16691.55		
Mon Jan 05 15:35:00 EST 2009	16666.68		
Mon Jan 05 15:30:00 EST 2009	16653.03		
Mon Jan 05 15:25:00 EST 2009	16662.55		
Mon Jan 05 15:20:00 EST 2009	16648.96		
Mon Jan 05 15:15:00 EST 2009	16638.49		
Mon Jan 05 15:10:00 EST 2009	16633.67		
Mon Jan 05 15:05:00 EST 2009	16631.56		
Mon Jan 05 15:00:00 EST 2009	16623.17		
Mon Jan 05 14:55:00 EST 2009	16657.40		
Mon Jan 05 14:50:00 EST 2009	16656.81		
Mon Jan 05 14:45:00 EST 2009	16653.83		
Mon Jan 05 14:40:00 EST 2009	16660.65		
Mon Jan 05 14:35:00 EST 2009	16669.25		
Mon Jan 05 14:30:00 EST 2009	16679.65		
Mon Jan 05 14:25:00 EST 2009	16687.21		
Mon Jan 05 14:20:00 EST 2009	16700.63		
Mon Jan 05 14:15:00 EST 2009	16720.13		
Mon Jan 05 14:10:00 EST 2009	16730.01		
Mon Jan 05 14:05:00 EST 2009	16735.67		
Mon Jan 05 14:00:00 EST 2009	16758.73		

Fig 7. Historical Loads GUI

5.2 The forecast done every five minute, as in fig 8. The right side shows the actual loads and comparison with the forecast loads.

History Table	Forecast Browser	Signal Plot
<div> <div>Tue Jan 06 03:00:00 EST 2009</div> <div>Tue Jan 06 03:05:00 EST 2009</div> <div>Tue Jan 06 03:10:00 EST 2009</div> <div>Tue Jan 06 03:15:00 EST 2009</div> <div>Tue Jan 06 03:20:00 EST 2009</div> <div>Tue Jan 06 03:25:00 EST 2009</div> <div>Tue Jan 06 03:30:00 EST 2009</div> <div>Tue Jan 06 03:35:00 EST 2009</div> <div>Tue Jan 06 03:40:00 EST 2009</div> <div>Tue Jan 06 03:45:00 EST 2009</div> <div>Tue Jan 06 03:50:00 EST 2009</div> <div>Tue Jan 06 03:55:00 EST 2009</div> <div>Tue Jan 06 04:00:00 EST 2009</div> <div>Tue Jan 06 04:05:00 EST 2009</div> <div>Tue Jan 06 04:10:00 EST 2009</div> <div>Tue Jan 06 04:15:00 EST 2009</div> <div>Tue Jan 06 04:20:00 EST 2009</div> <div>Tue Jan 06 04:25:00 EST 2009</div> <div>Tue Jan 06 04:30:00 EST 2009</div> <div>Tue Jan 06 04:35:00 EST 2009</div> <div>Tue Jan 06 04:40:00 EST 2009</div> <div>Tue Jan 06 04:45:00 EST 2009</div> <div>Tue Jan 06 04:50:00 EST 2009</div> <div>Tue Jan 06 04:55:00 EST 2009</div> <div>Tue Jan 06 05:00:00 EST 2009</div> </div>	<div> <div>Time</div> <div>Tue Jan 06 04:35:00 EST 2009</div> <div>Tue Jan 06 04:40:00 EST 2009</div> <div>Tue Jan 06 04:45:00 EST 2009</div> <div>Tue Jan 06 04:50:00 EST 2009</div> <div>Tue Jan 06 04:55:00 EST 2009</div> <div>Tue Jan 06 05:00:00 EST 2009</div> <div>Tue Jan 06 05:05:00 EST 2009</div> <div>Tue Jan 06 05:10:00 EST 2009</div> <div>Tue Jan 06 05:15:00 EST 2009</div> <div>Tue Jan 06 05:20:00 EST 2009</div> <div>Tue Jan 06 05:25:00 EST 2009</div> <div>Tue Jan 06 05:30:00 EST 2009</div> </div>	<div> <div>Actual</div> <div>12413.59</div> <div>12475.32</div> <div>12529.40</div> <div>12591.85</div> <div>12667.03</div> <div>12746.76</div> <div>□</div> <div>□</div> <div>□</div> <div>□</div> <div>□</div> <div>□</div> </div> <div> <div>Forecast</div> <div>12417.10</div> <div>12477.28</div> <div>12523.47</div> <div>12581.05</div> <div>12656.05</div> <div>12736.13</div> <div>12890.50</div> <div>13017.05</div> <div>13109.03</div> <div>13208.28</div> <div>13304.04</div> <div>13401.49</div> </div> <div> <div>Difference</div> <div>3.52</div> <div>1.96</div> <div>5.93</div> <div>10.80</div> <div>10.98</div> <div>10.63</div> <div>□</div> <div>□</div> <div>□</div> <div>□</div> <div>□</div> <div>□</div> </div>

Fig 8. Forecast GUI

5.3 The plot of the forecast.

a) Click checkboxes on the right side to select the plot of actual load or forecast loads in next 5 minutes, 10 minutes, 15 minutes and so on (up to 60 minutes).

b) The grey vertical lines represent the five minute intervals. The red line represents the sunset time.

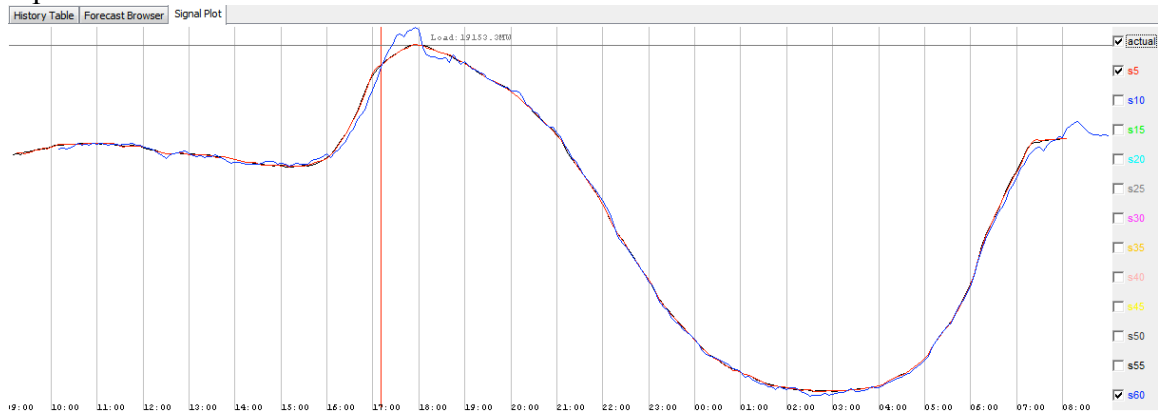


Fig 9. Plot of the forecast

5.4 Messages issued during forecast. As in Fig 10:

```
Aggregate 5m point = 17989.173333333332 @ Mon Jan 05 20:10:00 EST 2009 from 75 4s points.
Aggregate 5m point = 17910.933333333334 @ Mon Jan 05 20:15:00 EST 2009 from 75 4s points.
Aggregate 5m point = 17837.24 @ Mon Jan 05 20:20:00 EST 2009 from 75 4s points.
Aggregate 5m point = 17753.173333333332 @ Mon Jan 05 20:25:00 EST 2009 from 75 4s points.
Aggregate 5m point = 17662.133333333335 @ Mon Jan 05 20:30:00 EST 2009 from 75 4s points.
Aggregate 5m point = 17600.226666666666 @ Mon Jan 05 20:35:00 EST 2009 from 75 4s points.
Aggregate 5m point = 17532.853333333333 @ Mon Jan 05 20:40:00 EST 2009 from 75 4s points.
Aggregate 5m point = 17453.84 @ Mon Jan 05 20:45:00 EST 2009 from 75 4s points.
Aggregate 5m point = 17384.36 @ Mon Jan 05 20:50:00 EST 2009 from 75 4s points.
Aggregate 5m point = 17290.826666666668 @ Mon Jan 05 20:55:00 EST 2009 from 75 4s points.
Aggregate 5m point = 17188.24 @ Mon Jan 05 21:00:00 EST 2009 from 75 4s points.
Aggregate 5m point = 17064.733333333334 @ Mon Jan 05 21:05:00 EST 2009 from 75 4s points.
Aggregate 5m point = 16910.546666666665 @ Mon Jan 05 21:10:00 EST 2009 from 75 4s points.
Aggregate 5m point = 16779.506666666668 @ Mon Jan 05 21:15:00 EST 2009 from 75 4s points.
```

Fig 10. Messages

5.5 Statistics of the forecast. As in Fig 11:

Minutes Ahead	MAPE	MAE	StDev	Max Ovr Err	Max Und Err
5	0.09	13.34	12.83	108.31	76.70
10	0.14	21.55	21.83	171.86	126.44
15	0.18	28.39	30.16	255.71	150.30
20	0.24	36.52	40.12	344.28	204.89
25	0.29	44.59	51.32	404.69	289.59
30	0.34	53.44	63.86	452.16	362.36
35	0.40	62.00	74.14	514.96	372.91
40	0.46	71.33	85.66	584.01	416.55
45	0.51	79.66	97.46	647.59	474.68
50	0.57	89.12	110.23	708.15	563.41
55	0.63	97.69	122.88	829.30	597.63
60	0.69	107.26	136.80	960.46	615.60

Fig 11. Statistic of ANN banks