TALL TOWER INVESTIGATIONS OF MISSOURI WINDS

Progress report 4 – July 18th, 2007

General

An extensive Interim Data Report is being circulated alongside this progress report. This combines data from the KCP&L sponsored study with that from other projects to provide a comprehensive overview of the winds observed in Northwest Missouri over a nine month period. By the end of March 2007, six towers had now been fully instrumented for more than 6 months. The two towers that had been instrumented as part of the project funded by Kansas City Power and Light (Miami and Raytown) were set up first. Three of those funded by the DNR / Ameren / Aquila project (Maryville, Blanchard and Mound City) had been recording data for eight months. These three, along with the Chillicothe tower and the KCP&L towers were used to compile a comprehensive review of the data collected up to March 31, 2007.

Tower Instrumentation

The two towers being used for the project funded by Kansas City Power and Light are both operational. The first in Miami, MO was set up on 30th June 2006 and the second, at Raytown (Kansas City), on 25th July 2006. Both have operated since those dates with data being collected. The Raytown tower has a working cellphone modem which is allowing us to automatically download data each day. Significant icing affected the towers in mid-January leading to loss of data for a period and it is suspected that a limited amount of damage was sustained during this storm. In particular, data from channel 3 on the Miami tower has not been recording good data and it is suspected that a wiring connection to the sensor was loosened by the ice. Unfortunately, without employing a crew to climb the tower and survey (and possibly repair) it is not certain whether this is indeed the problem. However, due to the redundancy of the systems in place, good data continues to be collected at both sites.

Data

In the tables below are simple monthly means of wind speed recorded by each of the anemometers on each of the towers. For Miami we now have a complete year of data, while for Raytown, eleven months of data have been collected. However there were serious icing problems starting in mid-January 2007, and a more detailed evaluation (quality control) of the data is required before reliable results from that period are presented. For many instruments this was a more severe and prolonged event than that which occurred in November/December 2006. In January the freezing appeared to persist for longer, with one of the top level instruments at Raytown being frozen well in to February. This appears to have led to persistent problems and data loss on this channel. Unfortunately, there also appears to have been damage to Channel 3 on the Miami tower. By visual inspection it can be seen that the anemometer appears to be operating, so it is uncertain what the problem is. Most likely it is a wiring issue but the sensor would have to be examined to ascertain this.

For the three months (April, May, June) a new analysis has been performed which selects the higher wind speed from the two sensors at each height. This is done because it has been noticed that there are times where significant differences are sometimes seen. These are assumed to result from

sheltering of the anemometer by the tower and the further assumption is that the higher wind speed at each time comes from the more exposed sensor and is a more accurate observation of the true wind speed. (Further tests of these assumptions will be made by using the directional data collected by the wind vanes at the times of interest.) A similar method is used to calculate the overall mean wind speed in section 9 of the extended data report.

For the Miami tower we can now provide a preliminary estimate of the mean annual wind speed at each height and that is also shown in the table below. The most important thing to note is that the observed wind speeds are significantly lower than those presented by the wind map. The 100m wind (corresponding to the channel 4 value presented here) from the map is 7.36 ms^{-1}. This is consistent with the other towers and the projection of the annual wind speed for Miami presented in the Interim Data Report. There are a number of possible reasons for the differences. The first is that the wind map could be genuinely overestimating the available wind. Second is that the present year is a quiet period for wind and that more data needs to be collected to see if this is the case.

Month	Ch 1	Ch 2	Ch 3	Ch 4	Ch 5	Ch 6
July 2006	5.00	4.61	5.61	5.26	5.94	5.98
August 2006	5.17	4.93	5.80	5.56	6.09	6.28
September 2006	5.23	5.31	5.81	5.83	6.04	6.44
October 2006	6.30	6.21	7.08	6.94	7.43	7.80
November 2006	6.39	5.71	7.19	6.48	7.51	7.21
December 2006	6.82	6.80	7.72	7.57	8.09	8.54
January 2007	6.14	6.35	7.22	7.03	7.30	7.74
February 2007	6.35	6.54	N/A	7.14	7.16	7.65
March 2007	7.52	7.40	N/A	8.16	8.61	9.13
April 2007		7.14		7.41		8.39
May 2007		5.99		5.76		7.21
June 2007		5.51		5.61		6.62
Year (jul06-jun07)		**6.38**		**6.83**		**7.68**

Table 1: Monthly average wind speed (in m s^{-1}) for each channel of the Miami tower.

Month	Ch 1	Ch 2	Ch 3	Ch 4	Ch 5	Ch 6
August 2006	4.10	4.13	4.79	4.78	5.56	5.64
September 2006	4.49	4.55	5.25	5.32	6.03	6.18
October 2006	4.93	5.00	5.90	5.94	6.86	6.99
November 2006	4.83	5.02	5.91	6.08	6.98	7.43
December 2006	5.17	5.31	6.36	6.35	7.51	7.35
January 2007	5.54	5.77	6.45	6.54	7.11	8.10
February 2007	5.26	5.48	6.06	6.13	6.82	7.25
March 2007	5.70	5.75	6.70	6.55	7.56	6.53
April 2007	5.87		6.66		7.26	
May 2007	4.69		5.64		6.45	
June 2007	4.59		5.40		6.06	

Table 2: Monthly average wind speed (in m s^{-1}) for each channel of the Raytown tower.

Data Analysis

The accompanying report provides an in depth analysis of the data collected to the end of March 2007. While there is much still to do and many interesting analyses that have not yet been undertaken, the primary finding is that the mean wind speeds observed by the towers are lower than those provided by the AWS Truewind wind map of Missouri. There are a number of possible reasons for the differences. The first is that the wind map could be genuinely overestimating the available wind. Second is that the present year is a quiet period for wind and that more data needs to be collected to see if this is the case.

Also revealed by the report, and of concern, is that the stronger winds generally occur during the nighttime hours when energy demand is lower. Again a more detailed analysis is intended to determine the proportion of the time that the wind is observed to be above certain threshold values at each hour of the day, once a complete year's worth of data has been collected at the towers.