P2.31 VALUE OF ONE-MINUTE DATA IN AN OPERATIONAL MESONET

James Finney and Loren D. White*
Jackson State University, Jackson, Mississippi

1. ABSTRACT

Since 2001, real-time data have been available from about 25 stations of the Louisiana Agriclimatic Information System (LAIS) managed by Louisiana State University. Jackson State University is currently in initial phases of developing a similar mesonet within Mississippi, building upon the experiences of LAIS. Approximately 100 stations are planned, with spacing and standards specifically intended for consistency with the NWS Modernized Coop Observing System. Example data will be shown of cases where one-minute meteorological observations have been crucial for describing events from the Mississippi and Louisiana mesonets.

2. INTRODUCTION

Many existing networks of electronic weather stations gather hourly data, but tradition and the expense of communication collectively limit the availability of higher-resolution data. However, more than 20 stations in the Louisiana Agriclimatic Information System (LAIS) have had one-minute data available at http://www.lsuagcenter.com/weather since approximately September 1, 2001. The Mississippi Mesonet is projected to eventually consist of around 120 identical weather stations, all reporting one-minute resolution data within five minutes of observation. The first station, located at Mississippi State University's Coastal Plain Experiment Station near Newton, has been operational since April 1, 2004, and reports data to the LSU AgCenter web site mentioned above.

Illustrated on this poster are several examples of weather events which hourly data describe poorly, but one-minute data describe well. In some cases, the event is hardly noticeable in the hourly data.

Example data will be shown of cases where one-minute meteorological observations have been crucial for describing events from the Mississippi and Louisiana mesonets.

3. OBSERVATIONS

One-minute data from the Rice Research Station at Crowley, LA, clearly illustrate the period of relatively calm winds from the eye of Tropical Storm Lili passing the station (Figure 1). This feature is completely missed by the hourly averages.

The hourly data also put the highest speeds later than correct. Part of this error comes from the authors' choice of hourly averages rather than end-of-hour values, but one-minute data clearly are better descriptors of the actual event.

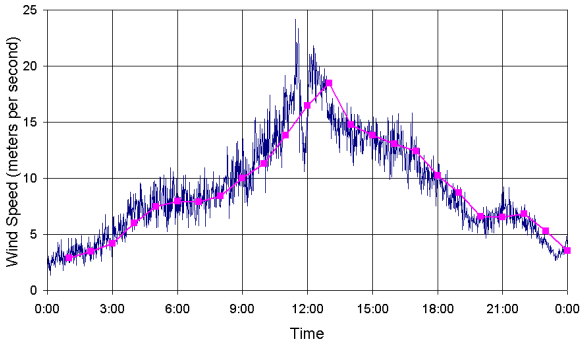

Figure 1: Comparison of minute and hourly wind speed data, Rice, 10/3/02 (Tropical Storm Lili).

A small tornado struck the Citrus Research Station farm near Port Sulphur, LA, just after 5:30 pm on October 11, 2001. The LAIS weather station was several tens of meters left of the storm's path. The minimum pressure (999.6 millibars) and highest wind speed (32.11 meters per second) occurred between 5:33 and 5:35. Although the graphs of pressure (Figure 2) and wind speed (Figure 3) aren't detailed enough to show those extremes, it is clear that the one-minute data are more illustrative than the hourly data.

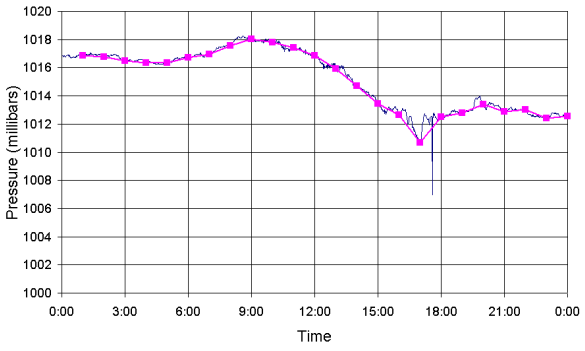

Figure 2: Comparison of minute and hourly pressure data, Citrus, 10/11/01 (nearby tornado).

* *Corresponding author address:* Loren D. White, Jackson State University, Department of Physics, Atmospheric Sciences and General Science, Jackson, MS 39217; e-mail: white@twister.jsums.edu.

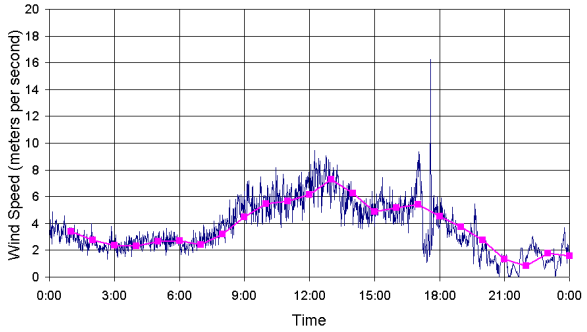

Figure 3: Comparison of minute and hourly wind speed data, Citrus, 10/11/02 (nearby tornado).

Because an earlier event happened to occur at around 5 pm, it appears on the hourly data. However, there is no evidence of the tornado in the hourly record even though it is clearly visible in the one-minute data. An argument could even be made for archiving all the raw three-second data; limitations of datalogger unfortunately still make that impractical in most cases.Cold front passages are another type event for which one-minute resolution is useful. In the example illustrated in Figure 4, a cold front passed the Sweet Potato Research Station near Winnsboro, LA, just before 2 am March 5, 2004.

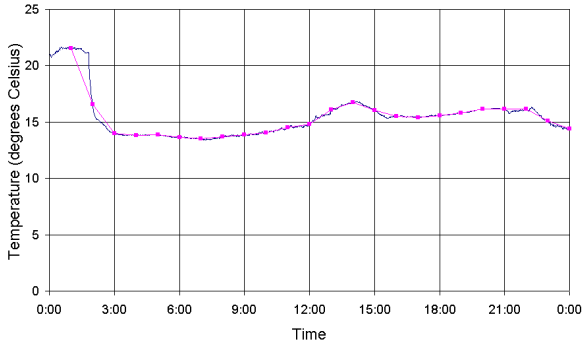

Figure 4: Comparison of minute and hourly air temperature data, Sweet Potato, 3/5/04.

The temperature fell from 21 to 15 degrees C in 20 minutes. The hourly data show a similar drop (21.5 to 16.5 C) between 1:00 am and 2:00 am. Unfortunately, neither the abruptness of the temperature drop nor the time of occurrence are shown by the hourly data. The next example is a phenomenon observed often in the first several months of the Newton site's operation: the temperature rises briefly at night, then falls back down again – all in the apparent absence of any frontal activity. This event is illustrated well by the one-minute data (Figure 5), and missed almost completely by hourly data.

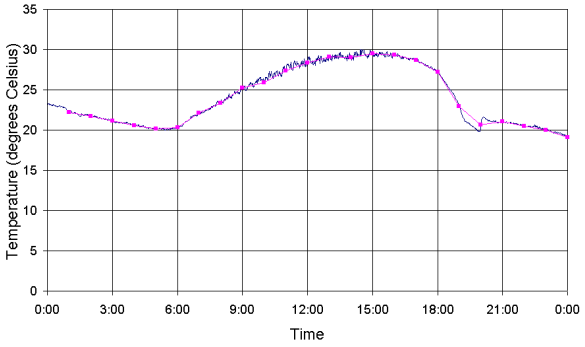

Figure 5: Comparison of minute and hourly air temperature data, Newton, 8/6/04.

One-minute data is also helpful for identification of measurement errors that would not otherwise be apparent. For example, Figure 6 illustrates both the effect of trees on the eastern horizon which reduce incoming radiation just after dawn, and the shadow of a guy wire just before noon. The radiation sensor was subsequently moved higher on the tower, though the trees remain. The drop in radiation in the early afternoon is probably from a cloud.

The conclusion is that there is a clear advantage to collection of one-minute resolution data when memory and communication capacity allow it.

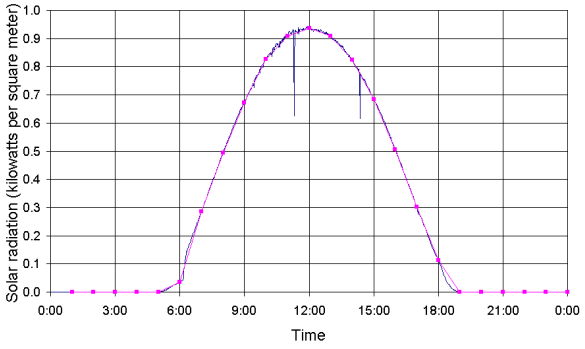

Figure 6: Comparison of minute and hourly solar radiation data, Newton, 8/6/04.