HEATBURSTS by Andrea Melvin

The concept of a heatburst was introduced by Cline in 1909 after an unusual event in Cherokee, Oklahoma. For eighty-five years, heatbursts were considered rare events. But in 1994, scientists gained a tool that resulted in new research. Loyal readers will recognize this date as the launch of the Oklahoma Mesonet.

Scientists quickly realized that their lack of knowledge about heatbursts wasn't due to the rarity of the events but because they are small-scaled and short-lived. The National Weather Service weather monitoring stations are spaced several tens of kilometers apart. A heatburst would have to occur directly over an NWS station for scientists to notice it. The stations are so far apart that it is nearly impossible for more than one station to record the event. Additionally, the NWS stations take hourly measurements. The hour interval is too large to record a heatburst event unless the event occurred at the top of the hour. The NWS network would record only one measurement spike. Most heatburst events contain a series of spikes. Heatbursts, generally, last anywhere from 15 minutes to several hours.

In the first five years of operations, the Oklahoma Mesonet detected 51 separate heatburst events. Only 10 events had been documented in the scientific literature between 1909 and 1994. The 30 km station spacing and 15-minute observations of the Oklahoma Mesonet make it much easier to record these events. Now that the Oklahoma Mesonet takes 5-minute observations, we may see another increase in the number of heatburst events.

Current Accepted Causes for Heatbursts

Heatbursts occur when a downdraft of air rushes to the surface. As the air is compressed it warms and dries out. The winds increase in speed as they move toward the ground. When the air reaches the surface it is forced outward in all directions.

Researchers are working to gather enough data to determine the cause of these intense downdrafts. The most common source of downdrafts is a supercell thunderstorm. When these storms suddenly collapse all the molecules suspended in the updraft fall quickly to the earth. The updraft reverses to a downdraft. However, there have been cases of heatbursts occurring in the downdraft region of a rear inflow jet, in mesoscale convective systems along with several other theories.

Effect on Vegetation and Trees

The intense temperature spike and plummeting dew points result in major damage to vegetation and trees. Just like on a hot summer day, the lack of moisture in the air forces the plants to increase their rate of transpiration. The water lost by the plants can be so severe that the plant will wilt and lose its leaves. This process is similar to the effect of heat stroke on a person. The internal systems of the body/plant are stuck in overdrive. The duration and intensity of the heatburst event damages the internal systems of flowers and vegetables beyond repair.

Temperature and dew point are not the only problems for plants during a heatburst event. Strong heatburst winds knock down trees, power poles and sever plants at the stem.

References

Lane, Justin D. (2000) A Climatology of Heatbursts as Detected by the Oklahoma Mesonet: October 1993 Through September 1998, M.S. Thesis, The University of Oklahoma, 141 pp.

Classroom Activity

A heatburst event occurred on April 19, 2005. Several Oklahoma Mesonet stations were effected including Cheyenne, Hobart and Mangum. The location of these stations are shown in Figure 1. This particular event lasted several hours. Use the meteograms provided (pg. 26-27) from each of the three stations to answer the following questions.

1. What time did the heatburst event begin? Which station recorded the event first?

2. For each station, how much did the temperature increase?

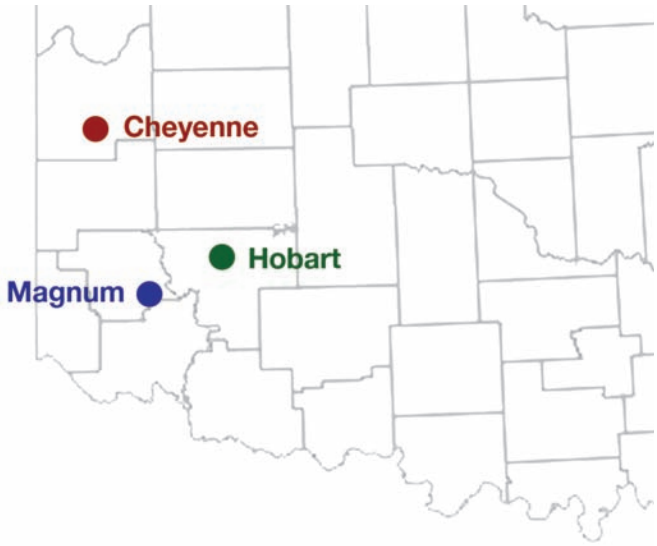
3. What was the lowest dewpoint temperature observed? At which station?

4. Which station experienced the most extreme winds? What was the maximum wind gust?

5. Which station experienced the most number of pulses (Note: Pulses refer to the number of temperature increases accompanied by dew point decreases.)?

6. What time did the heatburst event end? Which station recorded the last pulse?

FIGURE 1 - Oklahoma Map



Answers (See page 7)

FIGURE 2 - Radar Image

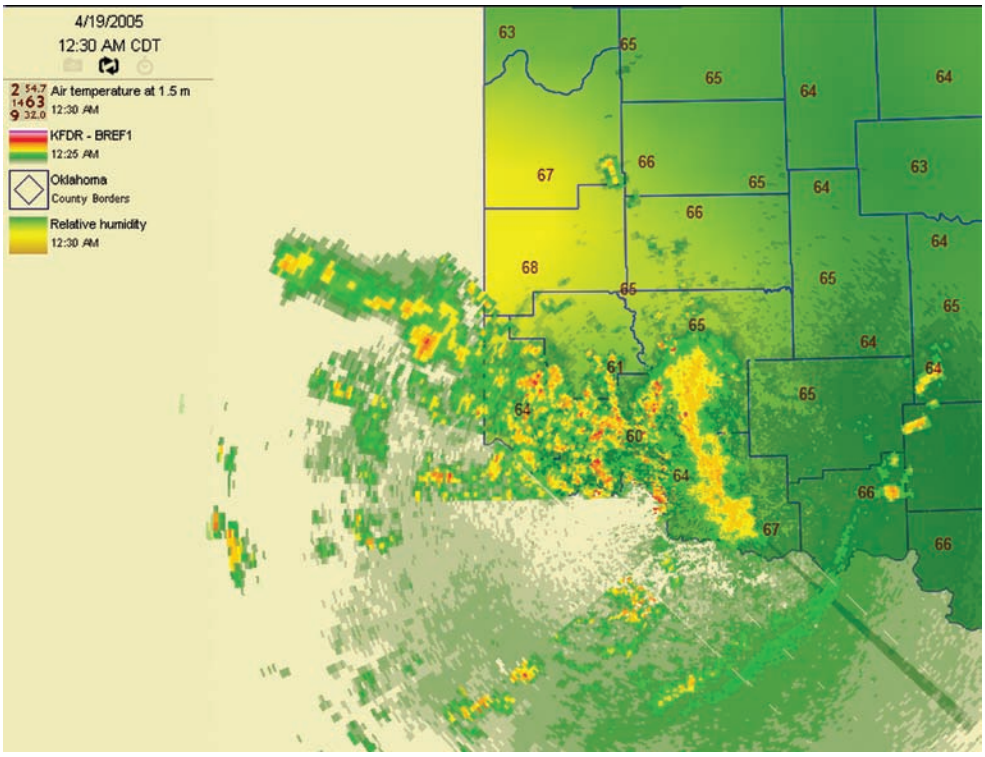


FIGURE 3 - Cheyenne Meteogram

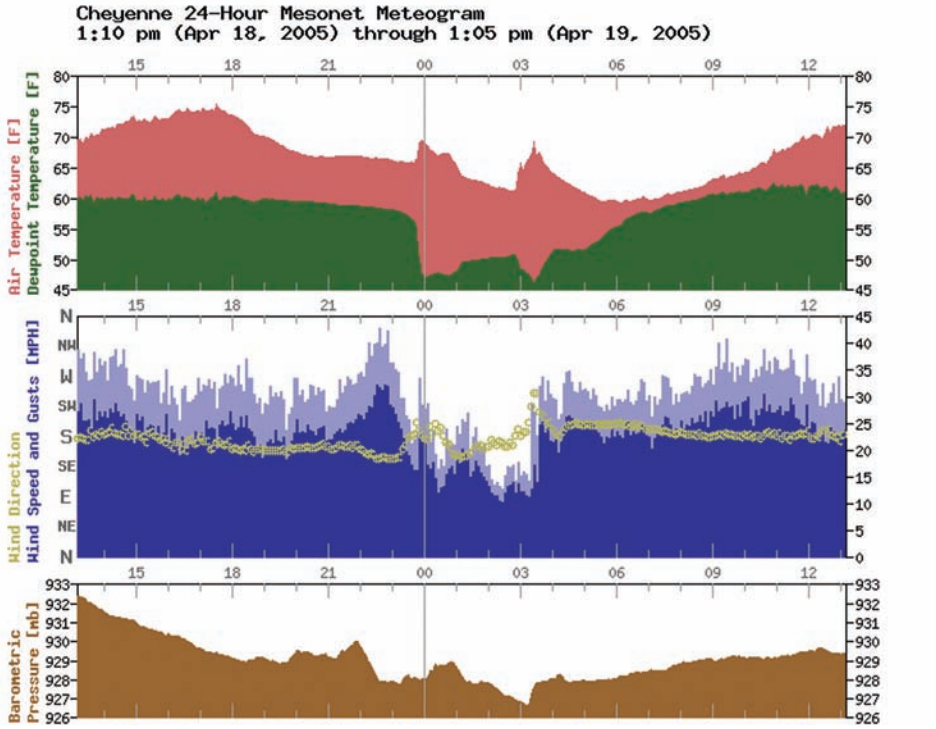


FIGURE 4 - Hobart Meteogram

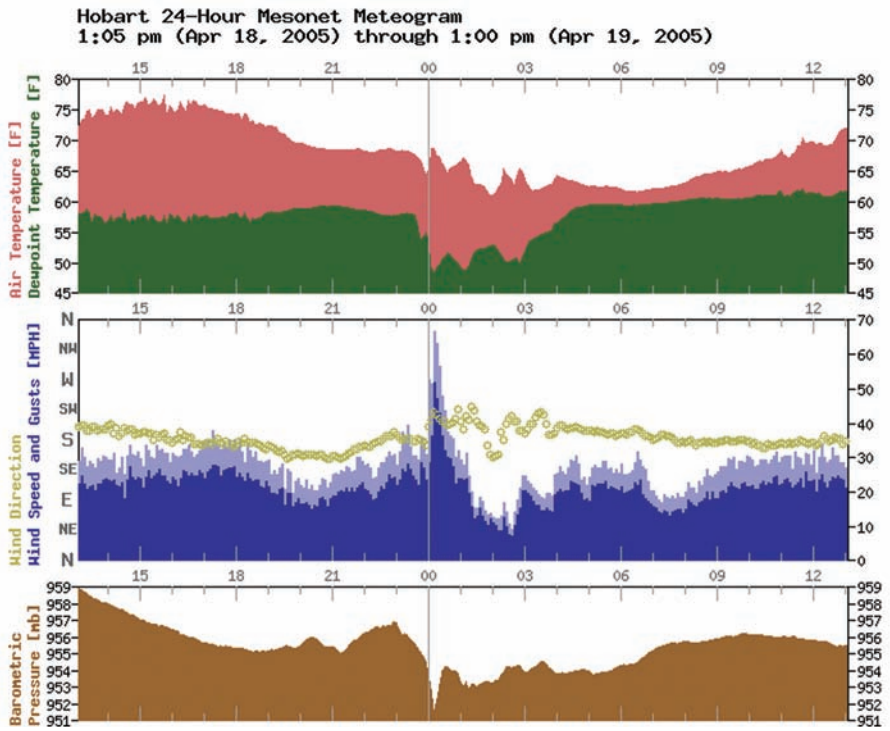


FIGURE 5 - Magnum Meteogram