METEOGRAMS by Andrea Melvin

Meteograms are graphs of standard atmospheric variables, presented in an easy-to-read chart, for a given station. The graphs plot each 5-minute Oklahoma Mesonet observation over the past 24 hours. The charts include:

- air temperature and dewpoint (with the freezing line highlighted);
- wind speed, direction, and gusts;
- barometric pressure at the site (i.e., station pressure) (Note: This graph has been omitted from these examples.);
- accumulated rainfall; and
- solar radiation (with the theoretical maximum highlighted).

The example meteogram is from Norman, OK on January 29-30, 2002. As you read from left to right across the graph, you see data collected 24 hours ago to the most current data. Pay close attention to the scale when viewing meteograms from day to day. The numerical values of the scale adjust to fit the maximum value recorded. The minimum value may not be zero. Along the top of the graph, you will find the time axis. The axis is shown as a 24-hour clock (e.g. 00 is Midnight, and 15 is 3 pm). A vertical gray line marks 00 or midnight on each of the graphs.

Temperature (TAIR) and Dew Point (TDEW)

The pink curve represents air temperature and the green curve dewpoint temperature. The scale used is in degrees Fahrenheit (°F). A horizontal gray line highlights the freezing line. This line will not be visible on graphs with a scale minimum above 32°F. Notice that between 11 pm and 12 am the temperature at Norman drops below freezing.

Wind Speed (WSPD), Wind Direction (WDIR), and Maximum Wind Speed (WMAX)

The second graph shows both wind speed in light blue and wind gusts or maximum wind speed in dark blue. The winds are measured in miles per hour (mph) and the scale is shown on the left. The small yellow circles represent the direction of the winds. Using the scale on the right, the values are listed as N for north, NW for northwest, W for west, SW for southwest, S for south, SE for southeast, E for east, NE for northeast, and N for north. Usually, wind direction is given in compass degrees (e.g., north is 0° and 360°).

From 4 am to noon, the winds in Norman are from the north and northeast at less than 6 mph gusting to less than 9 mph.

Pressure (PRES)

The third graph on a typical meteogram is barometric pressure in millibars. All of the meteograms found on the Oklahoma Mesonet website contain this graph. For this example we have removed the pressure graph to save space.

Rainfall (RAIN)

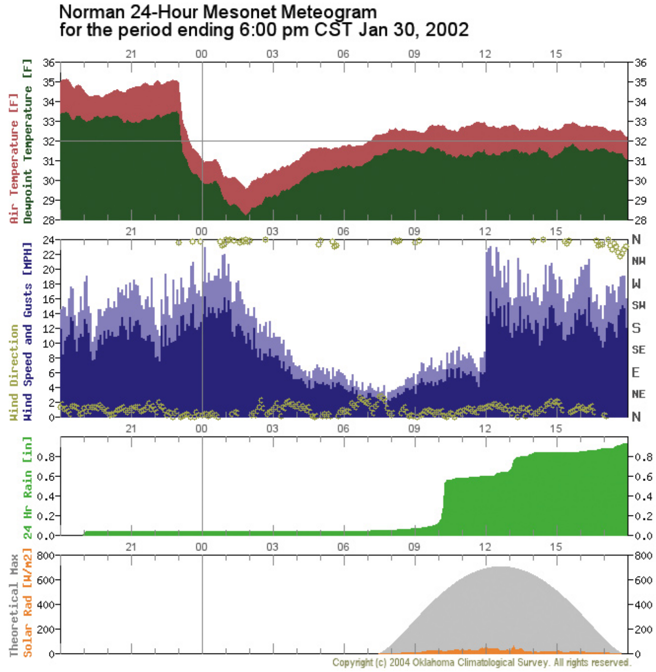
The third graph (i.e., fourth graph on a typical meteogram) is rainfall in inches. Unlike the other graphs of a meteogram, the rainfall graph represents a 24-hour accumulation of rainfall beginning at 0 UTC or 6 pm CST (7 pm CDT). Each day at 0 UTC the rainfall amount is reset to 0 inches. This is the only time the rainfall amount will appear to decrease. At all other times the graph will be blank (e.g., no rain) or steady (e.g., no rain falling at that time) or increasing (e.g., raining at that time). The graph will appear like a staircase. When rain is falling, the graph will increase. When the rain stops, the graph will level off and continue to report the same value until rain is detected or the time become 0 UTC.

In our example, it began to rain lightly in Norman at 7 pm on November 29th and quickly stopped. Drizzle or mist began again at 7 am on the 30th. At 10 am heavier rain was recorded.

Solar Radiation (SRAD)

The fourth graph (i.e., fifth graph on a typical meteogram) is solar radiation in watts per square meter (W/m2). Solar radiation is a measurement of the amount of sun energy absorbed by the earth's surface. High amounts of solar radiation correlate with clear skies while lower amounts represent cloudy skies. The gray curve shows the maximum amount of solar radiation the station could receive based on location, day of year, and time of day.

For Norman, the amount of solar radiation received is much less than the maximum value. This was an extremely overcast day. Little solar radiation actually reached the surface.



Classroom Activity

Winter weather events can be just as damaging as tornadoes. Winter weather impacts travel, school, and the ability of utility companies to supply electricity for lights and heat. In this activity, we will look back at a major winter storm during the winter of 2001-02. The following meteograms are based on data taken at the El Reno Mesonet site. El Reno is located in central Oklahoma, west of Oklahoma City. This event caused major damage to our electric utility infrastructure.

For questions 1-7, refer to the meteograms from El Reno. Day One refers to the meteogram ending 6 pm on January 30th, while Day Three refers to the meteogram ending 6 pm on February 1st (Day Two is not shown). Questions 8-11 look at the effects of a winter storm on an Oklahoma Mesonet station and our utility companies.

1. The Day One temperature trace indicates that temperatures dropped below freezing at what time? After midnight, what was the highest temperature observed at El Reno? What would happen to liquid water at this temperature?

2. Does the solar radiation panel of the Day One meteogram indicate clear or cloudy skies? Explain your answer.

3. After midnight on Day One, the wind speed slowly declined to near zero, and very little rainfall was recorded. However, moderate rain was falling at the time. Knowing this, what caused the Mesonet station's wind vane to stop turning, and prevented the rain gauge from recording rainfall?

4. Temperatures remained below freezing throughout Day Two (not shown). When did the temperature rise above freezing on Day Three?

5. Does the Day Three solar radiation panel indicate generally sunny or generally cloudy skies?

6. A few hours after the temperature rose above freezing, the wind vane sprung back into action and precipitation slowly accumulated in the rain gauge, despite generally clear conditions. What was happening?

7. Bonus question! The solar radiation panel of the Day Three meteogram shows sunlight well above the expected clear-sky values early in the morning. What caused this additional "sunlight" recorded by the Mesonet station?

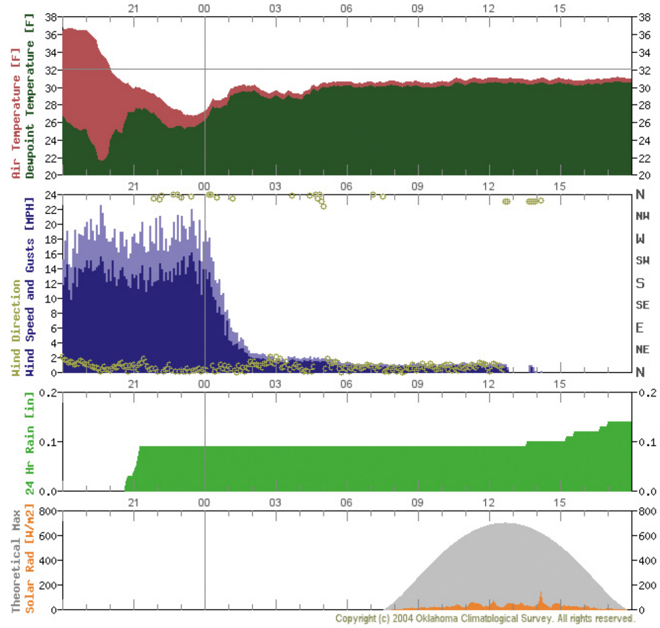
8. Each Oklahoma Mesonet station sits on a 10m x 10m plot of land. Using the conversions and equations provided, calculate the weight of ice 1 inch thick covering the entire plot. The density of ice is 0.00092 kg/cm3. (Hint: Think of the ice as a rectangular block 1-inch tall.) Be careful to use the same system of units for your calculations. Provide your answer in kilograms and pounds.

9. The utility company uses a network of power lines to provide homes and businesses with electricity. In freezing rain events, ice collects on the power lines. The distance between two power poles is 326 feet. The thickness of the ice around the power line is 4 inches. Calculate the weight of the ice. (Hint: Assume the ice forms a cylinder around the power line.)

Conversions
1 inch (in) = 2.54 centimeters (cm)
1 foot (ft) = 12 in
1 meter (m) = 100 cm
1 kilogram (kg) = 2.205 pounds (lbs)

Equations
volume of a cube = length x width x height
volume of a cylinder = π r2 * length
mass = density * volume

El Reno 24-Hour Mesonet Meteogram
for the period ending 6:00 pm CST Jan 30, 2002



El Reno 24-Hour Mesonet Meteogram
for the period ending 6:00 pm CST Feb 1, 2002