TITLE: Solar Radiation

CONNECTIONS TO THE CURRICULUM:
5th Grade Mathematics

OVERVIEW:
The length of the day and the total incoming solar radiation on a clear day are directly related to the time of the year and a location's latitude. On a given clear day, stations at the same latitude should have approximately the same amount of total incoming solar radiation and the length of the day will be the same.

STANDARDS:
Core Content
MA-05-1.1.3
Students will compare (<, >, =) and order whole numbers), fractions and decimals, and explain the relationships (equivalence, order) between and among them.

MA-05-1.2.1
Students will apply and describe appropriate strategies for estimating quantities of objects and computational results in real-world problems.

Program of Studies
MA-05-2.1.3
Students will use measurements to identify, describe, sort and compare attributes of objects and apply these to solve real-world and mathematical problems.

MA-05-2.2.3
Students will convert units within the same measurement system [U.S. customary (inches, feet, yards, miles; ounces, pounds, tons), metric (millimeters, centimeters, meters, kilometers; grams, kilograms), money, or time] and use the units to solve problems.

GEOGRAPHIC SKILLS:
Acquiring Geographic Information
Organizing Geographic Information
Answering Geographic Questions
Analyzing Geographic Information

TIME: 45 Minutes

MATERIALS REQUIRED:
Pencil
Graph Paper
Microsoft Excel Software
Computer
Moorehead and WKU Mesonet Data

OBJECTIVES:
Using a graph of Mesonet daily solar radiation, the student will be able to determine the times of sunrise.

Using a graph of Mesonet daily solar radiation, the student will be able to determine the length of the day.

SUGGESTED PROCEDURE:

Opening

Review the terms following terms before initiating lesson:

- Solar Radiation
- Watts per square meter
- Latitude
- Longitude
- Absolute Location
- Relative Location

Strategies/Activities

1. Locate 2 Mesonet stations which lie in a line west to east and are located at approximately the same latitude.

2. Download time-series Mesonet data from these stations for one full day, preferably when the skies are clear at all of your chosen stations. (Do not use different days for the two stations.)

3. Graph the solar radiation at each of your chosen sites for an entire day. (You do not have to plot from midnight to midnight -- you may start at any time, as long as one full day is plotted.) You may graph all of the sites on one plot or each site on a separate plot. If you choose the latter, make sure the scale on both your X and Y axes are identical between all plots (e.g., all plots use 0 to 24 hours on the X axis and 0 to 1000 Watts per square meter on the Y axis).

4. Label the X and Y axes with the appropriate parameter name and units (e.g., Solar Radiation in Watts per Square Meter). Label each graph of solar radiation according to the Mesonet site plotted.

Closing

1. When do the solar radiation readings begin to increase from zero at each station? Are these times the same? Why or why not?

2. How long are the solar radiation data above zero for each station? Are these lengths the same? Why or why not?

3. How much solar radiation is striking each station at its peak (i.e., what is the value in Watts per square meter)? Are they different between the stations? Why or why not?

SUGGESTED STUDENT ASSESSMENT:

- Evaluation of the charts and graphs that are produced with the Microsoft Excel Software.
- Informal assessment by mere observation during guided and independent practice will help the teacher gain insight on student comprehension.

EXTENDING THE LESSON:
If you were to graph solar radiation at the same number of stations using longitude from north to south across Kansas and Oklahoma, how would your results differ than if you were comparing stations from using latitudes from east to west?

Based on what you learned, find some cities across the United States and the world that have the same length of day as your chosen sites. Predict if the weather is as warm or cold at these locations as it is at your Mesonet sites. Is the total amount of sunshine on a clear day the only determining factor in how warm or cold a location will be? Why or why not?

ADAPTIONS:
Challenged Learner:
Have these children chart their results on graph paper instead of the Microsoft Excel Software.

Challenging Learner:
Have these children research solar radiation that has been documented by NASA from another planet and have the students analyze, evaluate, and compare the data to the date gathered from the Mesonet sites. Possibly find trends and relationships and possible reasons for why these conditions are the way they are.

RELATED LINKS:
- Kentucky Mesonet Website
- Oklahoma Mesonet Website
- Oklahoma EarthStorm Website
- National Weather Service Website

Google to search for Solar Radiation documentation from NASA for other planets

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Adapted from Oklahoma Mesonet Site