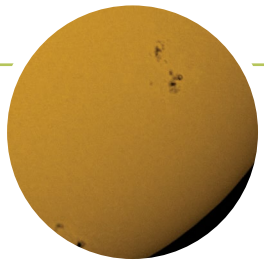
Historical Sunspot Activity: Finding Patterns

A Carolina Essentials™ Activity



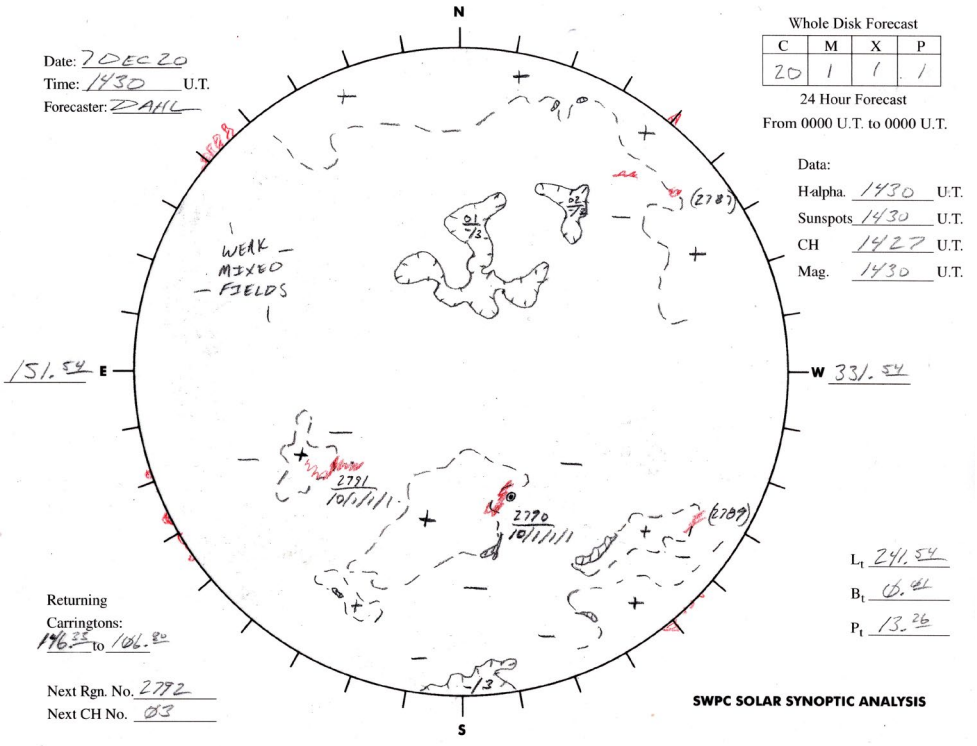
Student Worksheet

Overview

Sunspots are areas on the surface of the Sun that appear dark because they are cooler than other parts of the Sun's surface. The Sun's surface, or photosphere, is about 5,800 K. A sunspot is cooler at about 3,800 K, which is still very hot (nearly 6,500 degrees Fahrenheit). Sunspots are cooler because they form at areas where magnetic fields are particularly strong. These magnetic fields are so strong that they keep some of the heat within the Sun from reaching the surface.

Sunspots and their apparent movements across the Sun were observed and recorded as far back as Galileo's time. He used sunspot movement to establish the time it takes for the Sun to complete a single rotation. Sunspot activity, including number of sunspots, groupings, and regions, has been recorded and archived since the 1700s.

Today, the Sun's surface (or the disk we see) is mapped daily, and the information is used to forecast solar weather just as meteorologists use atmospheric data to forecast weather on Earth. The figure below is an example of a solar synoptic map drawn for August 20, 2020 that illustrates sunspots and other conditions scientists use to forecast solar weather.



NOAA/NWS Space Weather Prediction Center

Sunspot activity is cyclical, so it has regularly occurring periods of maximum sunspot occurrence and minimum sunspot occurrence. The maximum/minimum sunspot cycle has been studied and documented since the 1700s. In this activity, you will graph the monthly average number of sunspots for a 30-year period to determine the length of the sunspot cycle.

SAFETY REQUIREMENTS

No PPE is required for the activity.

MATERIALS

Sunspot data table

Graph paper or graphing computer program

Colored pencils

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Phenomenon

Look at the photo of the sun disk. Circle the individual and group sunspots. How might the disk appear in 3 days?

Essential Question

How does the sunspot cycle contribute to a model explaining the release of energy by the Sun?

Activity Objectives

1. Use monthly sunspot averages to determine if a sunspot cycle exists.
2. If a sunspot cycle exists, determine the length of the cycle.

Activity Procedures

1. Your teacher will assign you a section of the data table or the entire data table to graph.
2. Decide as a class the scale that should be used for the x-axis and y-axis.
3. Graph the data assigned.
4. Mark the maximum points on the plot with a colored vertical line.
5. Using a different color, mark the minimum points on the plot with a vertical line.
6. If you were assigned a section of the data table, join your section of the graph (or plot) to the others in chronological order to make a complete plot.

Analysis and Discussion

1. In the space below, construct a data table with the date of every maximum and minimum for the 30-year period.

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2. Calculate the time in years and months between maximums and minimums.

3. Calculate the time in years and months between every 2 maximums.

4. Average the lengths of time between every 2 maximums shown on the full plot.

5. Explain whether a sunspot cycle exists using your data table in question 1.

6. Explain how the presence of a sunspot cycle models the Sun's production of energy.