

Magnetic observatories generate a huge amount of data – far too much for anyone to digest easily. To help scientists take a quick measure of Earth’s magnetic storminess, they invented the ‘Planetary Variability’ index. The magnitude of the disturbance in Earth’s magnetic field is measured at 13 observatories and then averaged together. This average value is then reported every three hours as the **Kp Index**.

The bar graph above shows the changes in this index during the time of a major magnetic storm on November 20, 2003. Prior to the storm, Earth’s magnetic field was in a typically disturbed state with variations between Kp 2 to 4. But after a solar disturbance collided with the magnetic field, the variations jumped to Kp 7 and higher within a few hours. This particular storm caused spectacular Northern Lights seen all across North America and Northern Europe.

**Question 1** – If each bar is 3-hours wide, how long did the storm last above a level of Kp = 4?

**Question 2** – At what time did the storm reach its maximum Kp value?

**Question 3** - If New York City is 4 hours behind Universal Time, what time was it in New York during the height of the storm?

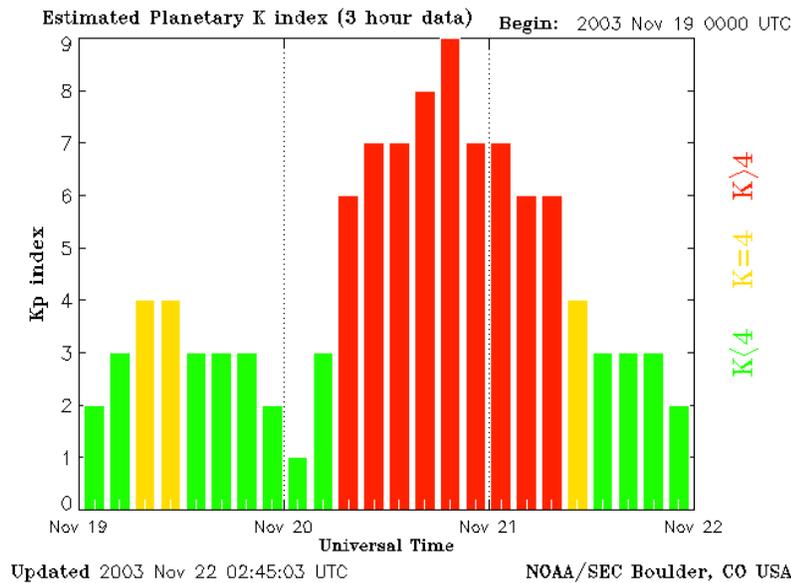
# Answer - Extra Credit Problem

3

In this activity, students will:

1. Extract information from a bar graph
2. Extract basic information from a graph.
3. Calculate a percentage
4. Learn about magnetism

Benchmark:



**Question 1** – If each bar is 3-hours wide, how long did the storm last?

**Answer:** The red portion of the bar graph which covers the most intense phase of the storm extends 9 bars or  $9 \times 3\text{h} = 27$  hours!

**Question 2** – At what time did the storm reach its maximum Kp value?

**Answer:** This occurred at the bar which spans the times 19:00 to 21:00 UT so you can take the start time as 19:00 UT, or the end time 21:00 UT or the mid-point time of the bar of 20:30 UT.

**Question 3** - If New York City is 4 hours behind Universal Time, what time was it in New York during the height of the storm?

**Answer:** Taking the mid-time of 20:30 UT, the Eastern Standard Time in New York would be  $20:30 - 4:00 = 16:30$  EST or 4:30 PM.