

## Using This Flip Chart

Solar storms can cause fluctuations in the magnetosphere called magnetic storms. These magnetic storms have disabled satellites and burned out transformers shutting down power grids. By following the steps in this flip chart you will soon be able to answer the big question, “***Has there been a measurable disturbance in Earth’s magnetic field?***”

In the flipchart you will find **INSTRUCTION CARDS** followed by **INFORMATION CARDS**.

- **INSTRUCTION CARDS** contain every step necessary to obtain, analyze and record all required online data.
- **INFORMATION CARDS** contain a variety of sample images and helpful tips when interpreting and analyzing the data.

Don’t forget to keep your **Data Collection Sheets** nearby in order to collect all of the information you will need to complete your Space Weather News Report!



## Using The Resources

### **COLOR CODING**

We have divided all of the Space Weather Action Center resources into four 'color-coded' categories: Sunspot Regions (orange), Storm Signals (green), Magnetosphere (blue) and Aurora (purple). The same color code scheme is used in the flipchart, the data collection sheets and on the Live Data and Tutorials webpage. You can always know which section you're in with one quick glance!

### **SPACE WEATHER DATA**

All of the data links required to make your space weather observations are located on this single webpage. Beside each of the '**live data**' links you will also find '**tutorial**' links containing easy to read tutorials that that will help you when interpreting the data. You can always find your place by returning to this page!

### **THE SPACE WEATHER MEDIA VIEWER**

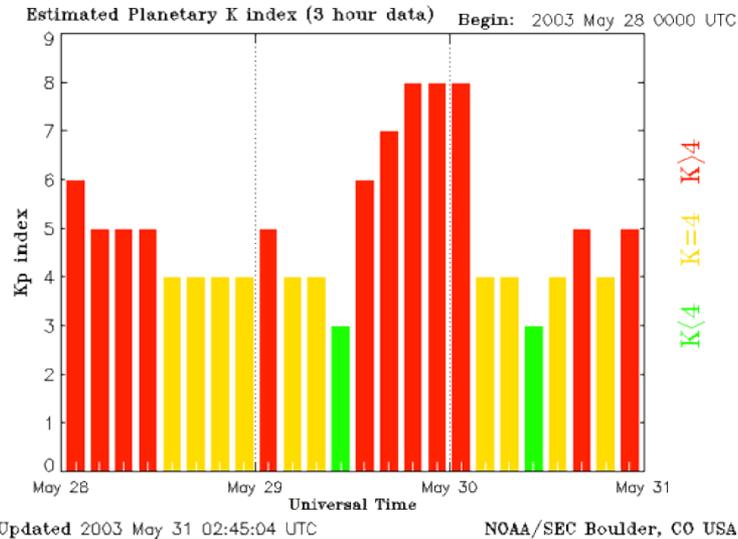
The Space Weather Media Viewer is one of the main observation tools that you will be using. Once the Viewer is open, we recommend that you simply keep it open in a separate browser tab or window for faster data access when needed.



## Kp Index (Estimated Planetary K-index)

1. Open '**Space Weather Data**' and click on "**Kp Index**" (live data)". A webpage containing a bar graph called the "**Estimated Planetary K-index (3-hour data)**" will appear. Observe the graph for any deviations. (K-indices of 5 or higher indicate 'storm-level' geomagnetic activity. Values of 7 or higher indicate a severe geomagnetic storm.)
2. Refer to your '**Magnetosphere Data Collection**' sheet to answer questions (a) through (d).
3. Close the current window and return to '**Space Weather Data**'.

## Kp Index (Estimated Planetary K-index)



### ABOUT THE DATA:

This bar graph contains the estimated 3-hour planetary K-index. It is derived at the U.S. Air Force Space Forecast Center using data from 10 ground-based magnetometers at:

- Meanook, Canada
- Sitka, Alaska
- Glenlea, Canada
- Saint Johns, Canada
- Ottawa, Canada
- Newport, Washington
- Fredericksburg, Virginia
- Boulder, Colorado
- Fresno, California

The values of the K-index are monitored minute by minute with alerts going out when levels reach 6, 7, and 8.

### FACT:

Geomagnetic storms have been associated with satellite surface charging and increased atmospheric drag.

### ANALYSIS TIPS:

The Kp index can be used to predict where you might see an aurora. The higher the Kp number the stronger the disturbance. A large disturbance in Earth's magnetic field is likely to produce strong aurora that extend further toward the equator.

The bars are green when the Kp is less than 4, yellow when the Kp equals 4, and red when the Kp is greater than 4. The red bars indicate a storm warning.

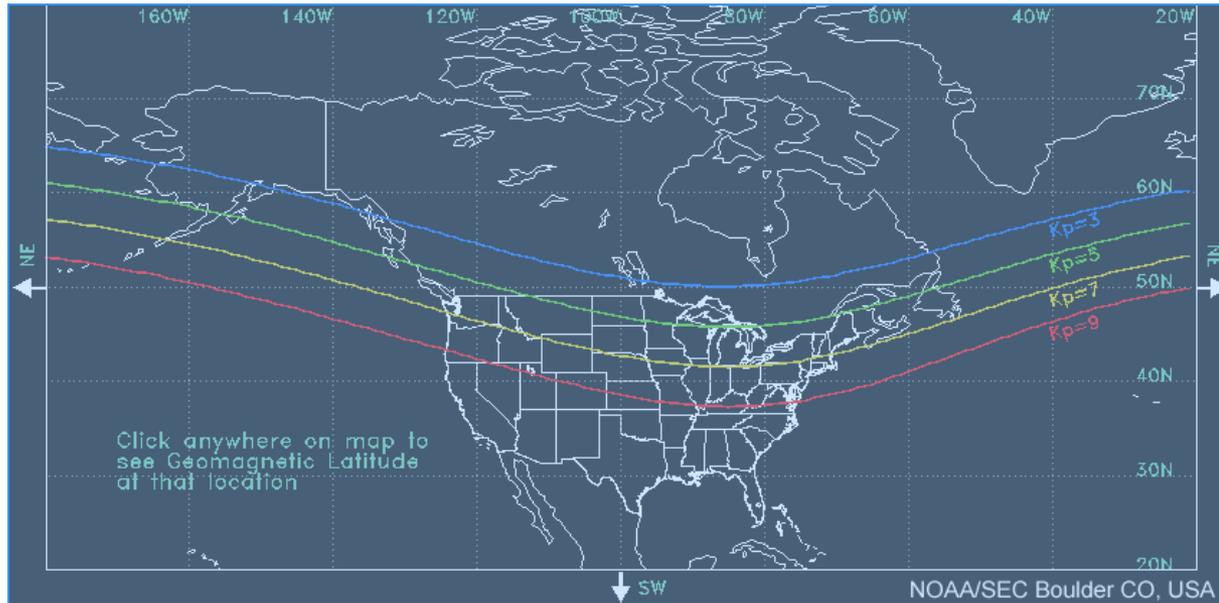
**(Optional ) Kp Auroral Map**

1. You can access the optional “**KP Auroral Map**” inside the “**Kp Index (tutorial)**” or by going directly to <http://www.swpc.noaa.gov/Aurora/globeNW.html> .
2. Click anywhere on the map to determine the geographic latitude, longitude and corrected geomagnetic latitude for your area.
3. Refer to your ‘**Magnetosphere Data Collection**’ sheet to answer questions **(e)** through **(g)**.
4. Close the current window and return to ‘**Space Weather Data**’.

## (Optional) Kp Auroral Map

### ABOUT THE DATA:

The Kp map is an optional tool that shows the connection between the Kp index and the predicted southern edge of the aurora in North America. With a Kp of 5, auroras can be expected south to the green line. With a Kp of 9, auroras can be expected south to the red line.



### NAVIGATION TIPS:

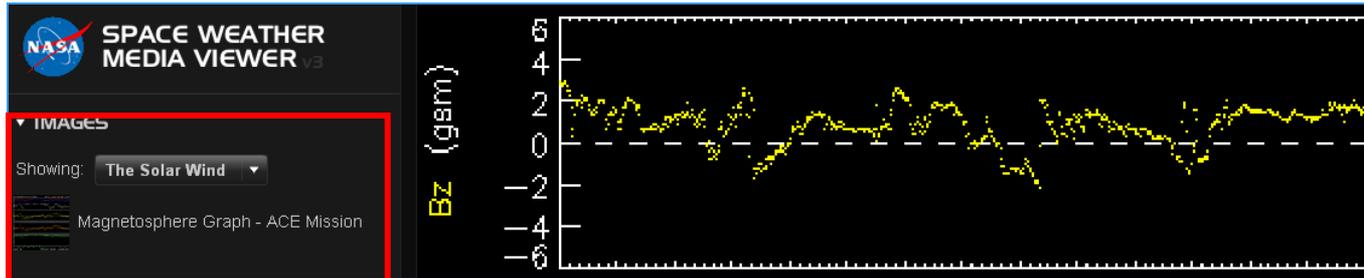
You can click on any location on the map and automatically find the longitude and latitude.

Based on the data from the Kp Index, you can use this map to determine where aurora can be seen.



## Magnetosphere Graph

1. Open “**Space Weather Data**” and select “**Magnetosphere Graph (Live Data)**”. The Space Weather Media Viewer will open. Under the ‘**IMAGES**’ section of the Viewer select “Showing: **The Solar Wind**” in the small drop-down menu. Select the image called, “**Magnetosphere Graph - ACE Mission**”.



2. You should see 4 different graphs. Locate and observe the yellow graph labeled ‘**Bz**’. (Each time the yellow line in that graph drops below the dashed white line labeled ‘0’, we know that our magnetosphere has been affected by the solar wind.)
3. Refer to your ‘Magnetosphere Data Collection’ sheet to answer questions **(h)** through **(j)** and the **(Comprehension Question)**.
4. Close the current window and return to “**Space Weather Data**” .

## Magnetosphere Graph

### ABOUT THE DATA:

This graph explains the solar wind's effects on Earth's magnetosphere. When the solar wind magnetic field is opposite the Earth's, it is called a southward field and is considered to be negative in sign. You can monitor the ACE data in this graph to identify times when this happens.

The 'Bz' component, the second plot from the top and labeled in yellow, is the one that carries information about the North-South part of the solar wind magnetic field.

You can use the following levels to determine the intensity of the storm:

Low	(0 to -2)
Medium	(-2 to -4)
High	(-4 to -6)

### ABOUT THE MISSION:

The ACE satellite is positioned about 1 million miles from Earth, and is always directly between Earth and the Sun. The data includes the time the disturbance arrives at ACE. It can provide scientist on Earth approximately one hour advance warning of geomagnetic storms.

### ANALYSIS TIP:

As the solar wind leaves the Sun, it moves out in all directions into space affecting the entire solar system. The amount of disturbance experienced by the earth's magnetosphere is dependent on several factors: solar wind speed and duration, a negative Bz. However, scientists have discovered that the most intense effects upon Earth's magnetic field occur when the solar wind's magnetic field is directed opposite to Earth's magnetic field and the intensity is 'large'.

