Using This Flip Chart

Sunspots are the first indicators that a storm from the Sun is a possibility. However, not all sunspots cause problems for Earth. By following the steps in this flip chart you will soon be able to answer the big question, ***"Do sunspot regions exist today that could be a source of solar storms?"***

In the flipchart you will find **INSTRUCTION CARDS** followed by **INF0RMATION 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!

Space Weather Data
sunearthday.nasa.gov/swac/data.php

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!

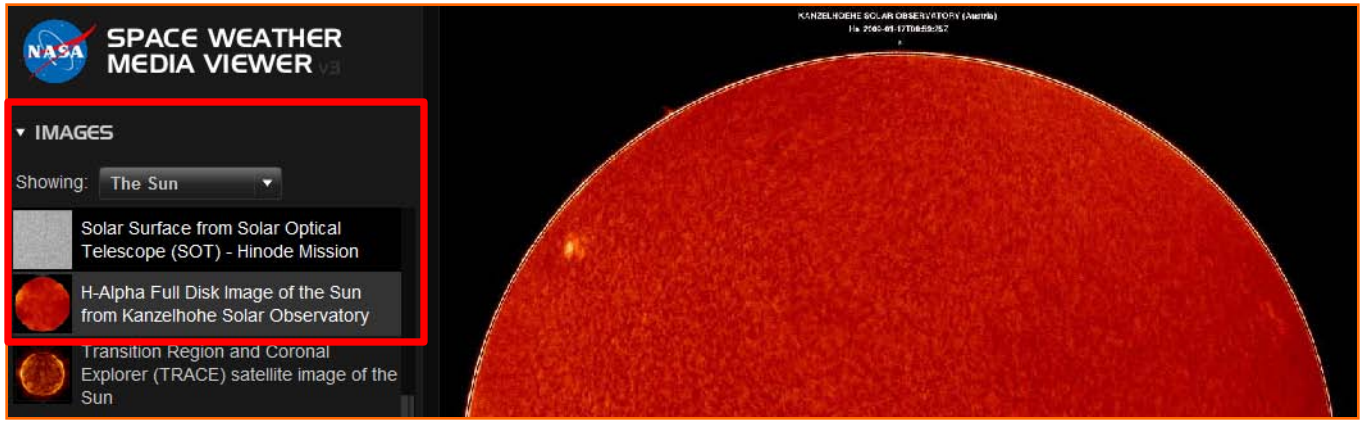
THE SPACE WEATHER MEDIA VIEWER

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.

Space Weather Data
sunearthday.nasa.gov/swac/data.php

H-Alpha Full Disk Image of the Sun

1. Open “**Space Weather Data**” and select “**H-Alpha Full Disk Image of the Sun** (Live Data)”. The Space Weather Media Viewer will open. Under the **‘IMAGES’** section of the Viewer select “Showing: **The Sun**” in the small drop-down menu. Select the image called, “**H-Alpha Full Disk Image of the Sun from Kanzelhohe Solar Observatory**”.



2. Look for any visible signs of sunspots.
3. Refer to your ‘Sunspot Regions Data Collection’ sheet to answer questions **(a)** through **(e).**
4. Keep the Viewer open for your next set of observations.

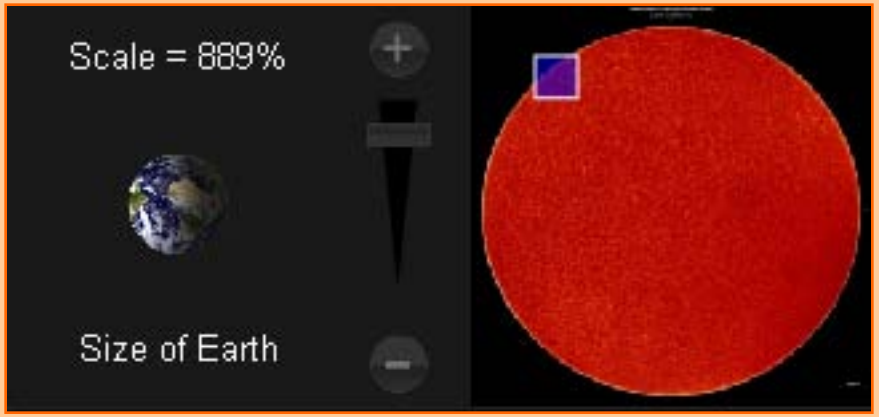
H-Alpha Full Disk Image of the Sun

ABOUT THE DATA:

Kanzelhohe Solar Observatory allows us to look at the sun through a ground based telescope using a special Hydrogen-alpha filter. These filters allow us to look safely at the Sun by filtering out all light except a specific wavelength of red light. These particular images of the Sun are updated every day if viewing conditions are good.

ANALYSIS TIP:

The size and position of sunspots can tell us about solar activity that might produce solar flares and coronal mass ejections.



With any image in the Space Weather Media Viewer you can *zoom* and *pan*. This feature allows you to see sunspots on the Sun in great detail along with the relative size of Earth. Some small sunspots may not be visible until you zoom. If you zoom in and pan down to the left, you can see the exact date and time of the image. It is important to check the date and time because the images are not updated if viewing conditions are poor (cloudy) at the Kanzelhohe Solar Observatory.

Space Weather Data
sunearthday.nasa.gov/swac/data.php

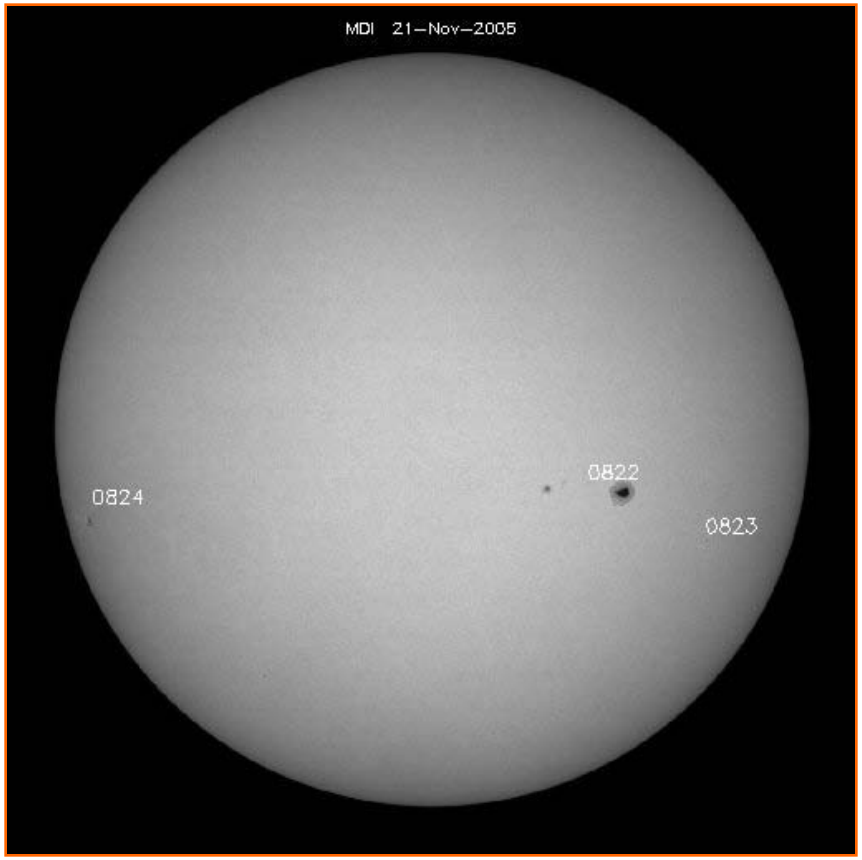
MDI with Numbers

1. Under the **‘IMAGES’** section of the Viewer select “Showing: **The Sun**” from the small drop-down menu. Select the image called, “**MDI with Numbers – SOHO Mission**”.
2. On your ‘**Sunspot Regions Data Collection**’ sheet answer question (**f**) by drawing any sunspots that you observe. Also, include any given sunspot region numbers.
3. Keep the Viewer open for your next set of observations.

MDI with Numbers

ABOUT THE DATA:
"MDI with Numbers" shows black and white SOHO MDI images with sunspot numbers printed next to the sunspots. Each sunspot region is given a number by scientists to help them communicate with each other better.

ANALYSIS TIP:
You should use these numbers as you refer to sunspots in your reports.



MDI Magnetogram

1. Under the **'IMAGES'** section of the Viewer select "Showing: **The Sun**" from the small drop-down menu. Select the image called, "**MDI Magnetogram – SOHO Mission**".
2. Answer question (**g**) on your '**Sunspot Regions Data Collection**' sheet.
3. Keep the Viewer open for your next set of observations.

Observation Note:
When black and white areas within an observed region of this image are clearly separated, there is less chance of a solar eruption. When they are mixed together, there is a better chance for a solar eruption from that location.

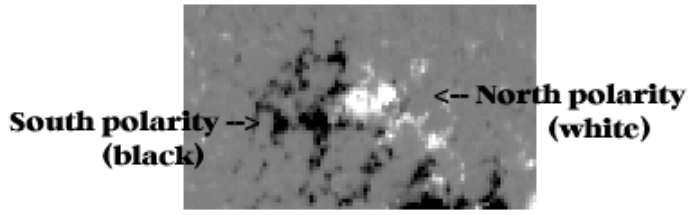
MDI Magnetogram

ABOUT THE DATA:

The fields and forces of magnetism are invisible to our eyes, so how can we see them? The **Michelson Doppler Imager (MDI)** instrument aboard the SOHO spacecraft 'can' detect the strength and locations of magnetic fields on the Sun and represent that information in specialized images called magnetograms. These images demonstrate the intensity of magnetic twisting in the solar photosphere.

ANALYSIS TIP:

Think of a bar magnet. One end of a bar has a north magnetic pole and the other end has a south magnetic pole. In a magnetogram white areas show regions of north magnetic poles while black areas show regions of south magnetic poles. The gray color shows an absence of magnetic fields.



The areas of black, white, and gray are artificially colored to represent the magnetic field lines.

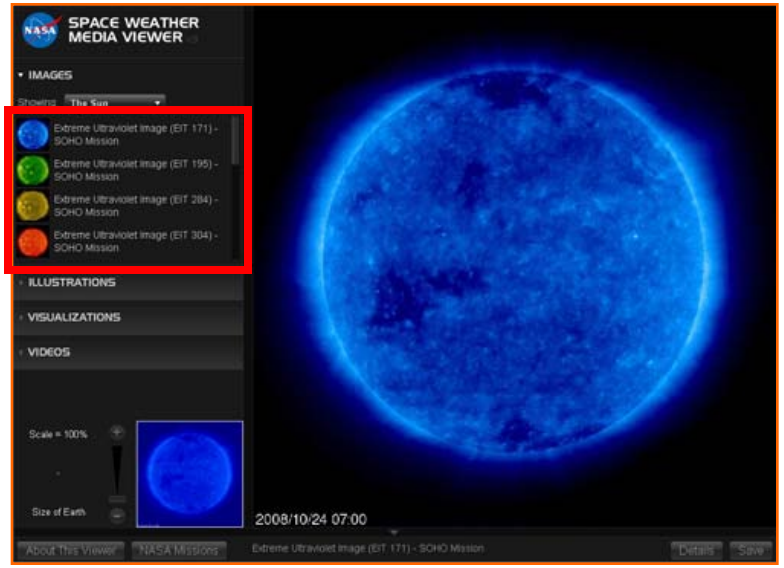
Extreme Ultraviolet Image

1. Under the **'IMAGES'** section of the Viewer select "Showing: **The Sun**" from the small drop-down menu. Select and observe the first 4 images called, "**Extreme Ultraviolet Image (EIT 171, 195, 284 and 304)**".
2. At certain times these images will be inactive due to instrument recalibration and you will see the words "CCD BAKEOUT" over the EIT images. When this happens refer to the image in the same section of the Viewer called, "**Transition Region and Coronal Explorer (TRACE)"**.
3. On your "**Sunspot Regions Data Collection**" sheet answer question **(h)**.
4. Keep the Viewer open for your next set of observations.

Extreme Ultraviolet Image

ABOUT THE DATA:

The first 4 images in the Space Weather Media Viewer show images from the SOHO EIT instrument (Extreme Ultraviolet Imaging Telescope). EIT uses filters to allow the camera to record only particular kinds of ultraviolet light. Ultraviolet light is invisible to our eyes and has no color as we know it. These images are artificially colored to help scientists know what filter was used.



ANALYSIS TIP:

Bright spots in these images tell you that there is a lot of ultraviolet light being emitted. Dark regions show little activity. You should compare these four EIT images to each other and to the SOHO MDI image that that you observed earlier.

Space Weather Data
sunearthday.nasa.gov/swac/data.php

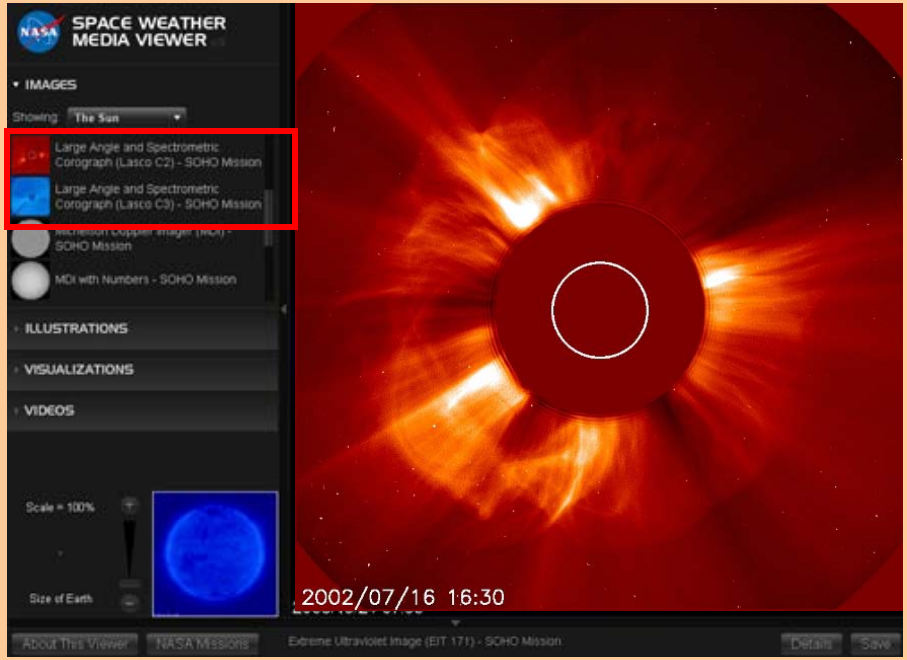
Large Angle and Spectrometric Coronagraph (LASCO)

1. Under the **'IMAGES'** section of the Viewer select "Showing: **The Sun**" from the small drop-down menu. Select and observe 2 images called, "**Large Angle and Spectrometric Coronagraph (LASCO C2 and LASCO C3)"**.
2. Refer to your '**Sunspot Regions Data Collection**' sheet to answer questions **(i)** through **(k)** and the **(Comprehension Question).**
3. Return to '**Space Weather Data**'.

Large Angle and Spectrometric Coronagraph (LASCO)

ABOUT THE DATA:
LASCO (Large Angle Spectrometric Coronagraph) is able to take images of the solar corona by blocking the light coming directly from the Sun with an occulter disk (the dark circle in the center of the image), creating an artificial eclipse within the instrument itself. The position of the solar disk is indicated in the images by the white circle.

ANALYSIS TIP:
The most prominent feature of the corona is usually the coronal streamers, those nearly radial bands that can be seen both in LASCO images.



This is a classic image of a "halo event“, so called because the circular area of the edges of the blast seem to form a kind of halo around the Sun. This can indicate that a storm is headed directly towards Earth.

Space Weather Data
sunearthday.nasa.gov/swac/data.php