

# Solar Activity

## Part 1: Observations

### Sunspots and Solar Active Regions

1. Open the web browser bookmarks and click on the 'Solar-SOHO' link. You will see a window with 5 displays.

[http://iswa.ccmc.gsfc.nasa.gov:8080/lswaSystemWebApp/index.jsp?i\\_1=71&l\\_1=419&t\\_1=269&w\\_1=451&h\\_1=373&i\\_2=5&l\\_2=662&t\\_2=633&w\\_2=395&h\\_2=427&i\\_3=4&l\\_3=218&t\\_3=644&w\\_3=417&h\\_3=428&i\\_4=137&l\\_4=15&t\\_4=253&w\\_4=388&h\\_4=400&i\\_5=139&l\\_5=907&t\\_5=261&w\\_5=399&h\\_5=409](http://iswa.ccmc.gsfc.nasa.gov:8080/lswaSystemWebApp/index.jsp?i_1=71&l_1=419&t_1=269&w_1=451&h_1=373&i_2=5&l_2=662&t_2=633&w_2=395&h_2=427&i_3=4&l_3=218&t_3=644&w_3=417&h_3=428&i_4=137&l_4=15&t_4=253&w_4=388&h_4=400&i_5=139&l_5=907&t_5=261&w_5=399&h_5=409)

2. Focus on the top row first (below the 'Available Cygnets' menu). On the left side is the white light image of the Sun, and on the right is the magnetogram image. These two images were taken by the SOHO spacecraft (<http://sohowww.nascom.nasa.gov/>). Notice the date in the lower left hand side of the image. The functions of this spacecraft are being replaced by the SDO spacecraft (<http://sdo.gsfc.nasa.gov/>) so the most recent data is not available. Historical data is available though going back over a decade.
3. Use the 'Global Date/Time' feature to set the date to the first day of 2011. Compare the white light image to the magnetogram image. Discuss the following with your group.

#### ***Discuss with your group:***

- ***What is the relationship between sunspots and magnetically active regions?***
- ***Are all sunspots associated with magnetically active regions?***
- ***Are all magnetically active regions associated with sunspots?***
- ***How does the structure of the active region differ between the northern and southern hemisphere?***

1. The bottom two panels show images taken by the SOHO spacecraft in the Extreme Ultraviolet (EUV) range for a give wavelength. The 'blue' image is 171 Angstroms and the 'green' image is 195 Angstroms. Bright regions show areas where the coronal plasma above the solar surface is heated to temperatures that irradiate at that wavelength. These are referred to as 'active regions'. Dark regions are interpreted as being 'holes' in the coronal where the plasma has been evacuated.

#### ***Discuss with your group:***

- ***How do the EUV active regions compare the the strong magnetic regions on the magnetogram?***
- ***Where are the coronal holes located? How do they correspond to the active regions?***
- ***Can you make out the coronal holes at the poles as well as at the lower latitudes?***

1. The last panel, in the middle of the top row, shows a computer model results of the solar magnetic field. Model results are not available for all dates so look carefully at the date to make sure the results exist.

### **Active Regions and Coronal Holes Throughout a Solar Cycle**

1. Review this page <http://www.swpc.noaa.gov/SolarCycle/> on the Space Weather Prediction Center website to determine approximately where we are in the solar cycle. You can also look at [http://solarscience.msfc.nasa.gov/images/ssn\\_predict\\_1.gif](http://solarscience.msfc.nasa.gov/images/ssn_predict_1.gif) from NASA.
2. Use the 'Global Date' Setting to view historical data from SOHO back to 1998. Explore how the position and configuration of the magnetic active regions changes over the course of a solar cycle. (Note that the SOHO data begins during the approach to Solar Maximum of Solar Cycle 23 while we are currently in the rising phase of Solar Cycle 24.)

#### ***Discuss with your group:***

- ***What happens to the average latitude of the active regions over the solar cycle?***
- ***What are the indicators of the beginning of a new solar cycle? When does Solar Cycle 24 begin?***
- ***Is the beginning of the solar cycle occur during solar maximum or solar minimum?***

1. Review the position and configuration of the coronal holes through out the solar cycle.

#### ***Discuss with your group:***

- ***Where are the coronal holes mainly located near solar minimum? Solar Maximum?***

### **Configuration of the Solar Magnetic Field**

The last panel in the middle of the top row shows a computer model prediction of the solar magnetic field that uses the measured magnetogram as input. We will explore this further in part 2.

### **Viewing the Latest Data**

1. Scroll through the Cygnet menu at the top of the page under the solar tab and search for the 'SDO AIA 4500' (page 5 of the solar page) data feed and the 'SDO HMI' (page 6) magnetograms. Click on each and and arrange the windows. Also choose one of the SDO composite images. Reset the global date to the current date

#### ***Discuss with your group:***

- ***Based on these images, what is the current phase of the solar cycle? What are the indications you used to draw this conclusion?***