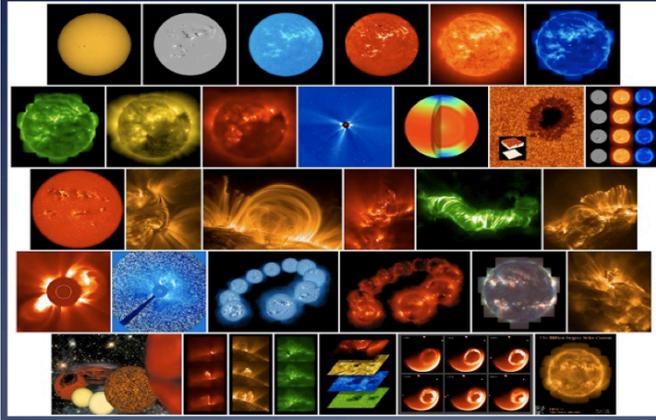
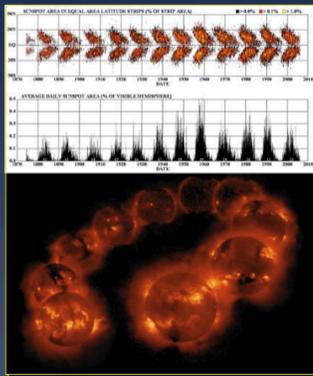


Observing the Sun



The Solar Magnetic "Cycle"



- 11-year change in activity levels
- 22-year reversal of magnetic field
- Amplitude varies from 0 to 250
- 0.1% change in energy output
- Observed for 400 years, yet nobody can fully explain how it works!

Coronal loops

Sunspots associated with magnetic field lines

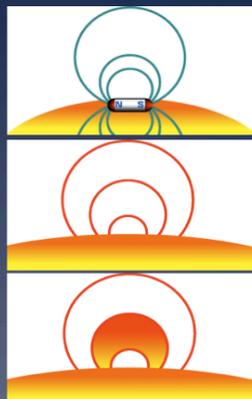
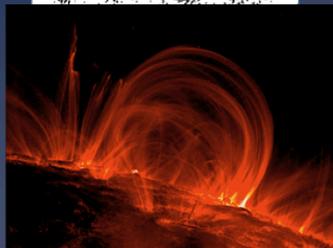
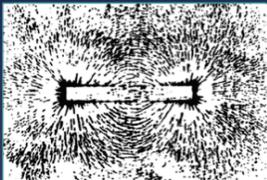


Source: NASA

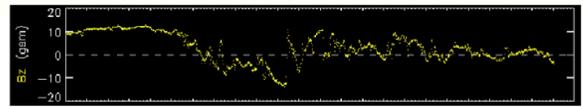
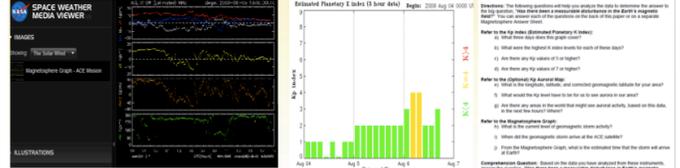


Source: The Sun, A Biography - 2006

Magnetic Fields on the Sun



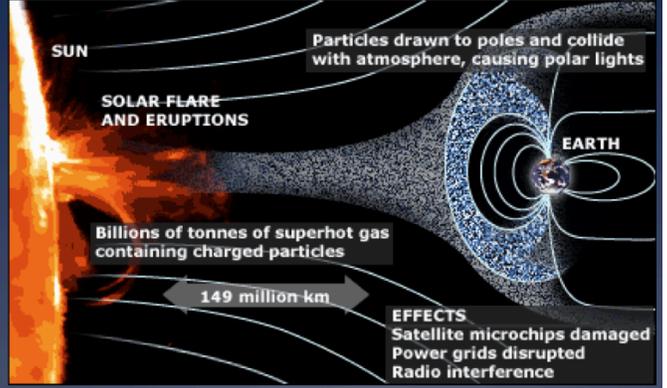
Magnetosphere Data



- Low if the Bz is between +3 nT and +5 nT,
- Medium if the Bz is between +5 nT and +10nT,
- High if the Bz is +10nT or larger,
- Extreme Some of the most severe storms in the past several years have registered Bz values between +20 and +40 nT!

Why we care..... "space weather"

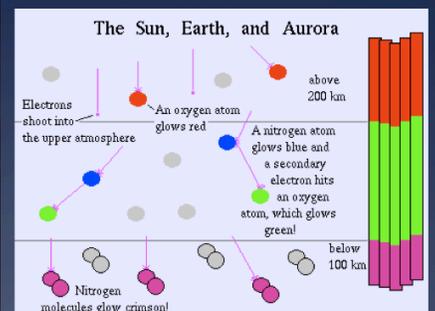
SOLAR ACTIVITY AND ITS EFFECTS ON EARTH



Space Weather Problems Cost the US Economy \$100 Ms / year



Colors of the Aurora



Creating a Unit

- Focused Lessons
- Reasonable Length
- Uses Technology
- Meets Standards
- Student Centered
- Constructivist

Creating a Unit

Web Quest / Create Semantic Map Background Information (1-2 Days)

Data Collection / Lab Activity Using SWAC or Classroom (2-3 Days)

Presentation to Class Have Class Debate (2 Days – Make PowerPoint – Present) Should We Continue Studying The Sun?

Assessment

Galileo

Students used computer simulations of the sky to test interpretations of astronomical phenomena.

- **Observation:** They examine images from telescopes and simulations of the sky and make interpretations
- **Contextualization:** Relate them to reference materials
- **Collaboration:** They work in groups
- **Cognitive Apprenticeship:** Teacher first talks about how he would analyze the material, then coaches them as they work
- **Interpretation Construction:** Students make their own hypotheses and test them against reference materials
- **Multiple Interpretations:** Students all discuss their interpretations
- **Multiple Manifestations:** Students see how basic principles of astronomy, physics and chemistry can be used to make sense of astronomical data

New Technologies

SWAC APP

Learners as Designers
Knowledge Construction, Not Reproduction



Resources At Your Disposal

Syllabus

NASA Space Weather Action Center:

<http://sunearthday.nasa.gov/swac/>

Endeavor Resource page:

<http://www.us-satellite.net/shortcourses/endeavor/sonlinks.html>

NASA Explanation of Heliophysics Content:

<http://science.nasa.gov/heliophysics/>

Current NASA Missions:

http://www.nasa.gov/mission_pages/sdo/main/index.html

NOAA's Space Weather Prediction Center:

<http://www.swpc.noaa.gov/>

- "The Weekly"

NASA's Solar Dynamics Observatory:

<http://sdo.gsfc.nasa.gov/>

Resources At Your Disposal

NASA Space Weather Action Center:

<http://sunearthday.nasa.gov/swac/>



DOWNLOADABLE MATERIALS

We have recently updated all of these materials to Version 4 (V4). Please make sure you have the latest versions.

FLIP CHARTS

With these Flip Charts your students will be able to analyze data and predict a solar storm with ease and accuracy by following the step by step instructions. Each Flip Chart contains introductory space weather information and tips on data analysis and website navigation!

Printable Flip Charts

- Sunspot Regions Flip Chart V4 (229K)
- Storm Signals Flip Chart V4 (142K)
- Magnetosphere Flip Chart V4 (788K)
- Aurora Flip Chart V4 (500K)

Data Collection Sheets

Bring your journals to life with these 'easy to understand' Data Collection Sheets. Each sheet provides the necessary questions and refreshers on how to interpret necessary space weather data.

Data Collection Sheets

- Sunspot Regions Data Collection Sheet V4 (27K)
- Storm Signals Collection Sheet V4 (19K)
- Magnetosphere Collection Sheet V4 (31K)
- Auroras Collection Sheet V4 (27K)

<http://www.us-satellite.net/shortcourses/endeavor/sonlinks.html>

NASA Curriculum Resources:

- **LIVE from the Aurora - Educator's Guide**
- Exploring Magnetism with Worksheets and Rubrics (5 files)
 - Exploring_Magnetism
 - Worksheets_1
 - Worksheets_2
 - Rubric_1
 - Rubric_2
- Magnetism and Electromagnetism
- Exploring Magnetism on Earth with Worksheets
- Space Weather
- Northern Lights
- Exploring Earth's Magnetic Field

Misc. Links:

- **Today's Magnetic Solar Link (GONG)**
- **Hear the Sun - 3rd one down**
- **Sunspot Observing System for Students**
- **Make a Pinhole Camera**

