

## **Planetary Wonderings**

### **March Focus: Sun-Earth Day & Space Weather**

**By Mary-Frances Bartels, NASA Solar System Ambassador**

After writing a column like this for a few years there are bound to be “repeats” of subjects. The first time Sun-Earth Day was mentioned was in March 2006. The Sun was the topic for December 2005. This column will be a different take on these subjects than before. Feel free to read over those early columns for the history of Sun-Earth Day and missions to the Sun. Sun-Earth Day is almost always on the day of the vernal equinox --- March 20<sup>th</sup> this year.

The theme for the 2008 Sun-Earth Day is “Space Weather Around the World.” What is *space* weather? You ask. Space Weather is a term scientists use to describe conditions on the Sun (i.e. coronal mass ejections, solar flares, radiation storms), in the solar wind, and in earth’s magnetic field. Space weather conditions can influence the performance and reliability of space-borne and ground-based technological systems and can endanger human life or health.

Space weather, while a fairly new science, is extremely important to modern life. Solar storms can disable satellites used for weather forecasts, GPS navigation, television and radio broadcasts, and financial services. Radio bursts from solar flares can directly interfere with cell phone reception while coronal mass ejections (CMEs) hitting Earth can cause electrical power outages, the most famous of which is the Quebec outage of 1989, which left some Canadians without power for as long as six days.

Air travel can be affected, too. Often the shortest distance between two places on the earth, say between New York and Tokyo, is over the North Pole. Thousands of flights per year fly over the pole. Solar storms affect the poles more than the rest of the planet. Airplanes flying over the poles during a solar storm can experience radio blackouts, navigation errors, and computer reboots, all caused by space radiation. Avoiding the poles during solar storms solves the problem, but it costs extra time, money and fuel to “take the long way around.”

Lastly, astronauts are affected by space weather. Those on the International Space Station are still protected somewhat by the earth’s magnetic field, but any that may venture to the moon or Mars are not. SOHO (Solar and Heliospheric Observatory), a joint project between NASA and the European Space Agency, can now detect the beginning of a solar storm and give a one hour warning for ISS astronauts. Other methods of detection are in the works.

One of my favorite sites for space weather, especially in the height of the solar cycle is <http://www.swpc.noaa.gov/SWN/index.html> . This page shows three “dials” indicating solar wind data in addition to a map of the auroral oval. Want to know a secret about those solar wind “dials?” If all three needles point in a red zone, and you live near or north of 40° N latitude, and are away from city lights, you stand a fairly good chance of seeing an aurora. It might even be possible to see one from the city under “red zone” conditions. Alternatively, if the auroral oval map shows red over the area where you live, go outside and you might see some “natural fireworks.” From the SWPC home page (link near bottom of page referenced above) one may also subscribe to alerts and space weather forecasts.

With the new year came the official beginning of a new solar cycle. Solar cycles last about 11 years and are characterized by periods of high solar activity followed by low activity. During the time of high activity the sun’s magnetic polarity switches; that is, the north and south magnetic poles switch places. The sun has been quiet for the past few years with many days having no sunspots at all. During this lull the few sunspots there were hovered around the equator. On January 4 a higher latitude sunspot with a polarity opposite that of the lower latitude ones appeared. Because of these characteristics scientists officially declared the beginning of the new solar cycle, called Solar Cycle 24. Do not expect fantastic auroras just yet, though. It takes

several years to get from Solar minimum to Solar Max. It is expected that this new cycle will peak around 2011 or 2012.

On another note, I am saddened to report that Ulysses, one of my favorite missions, a collaboration between NASA and the European Space Agency, is succumbing to the ravages of space. The mission to the sun in an unusual solar polar orbit, was launched in 1990. In press release 2008-031 NASA reported that the craft's power source is failing and that Ulysses could be essentially "dead" within the next few weeks. Read more about this mission in the December '05 and May '07 issues of PW.

**Resource of the Month:** Since it is related to the topic of discussion last month, that is, the moon, this resource is out of order, but too good to pass up. Most readers know that I am a science fiction fan. Did you know that the very first science fiction story was written by Johannes Kepler, the same Kepler that formulated the planetary laws of motion? It was called *Somnium*, or *The Dream*, and details a voyage to the moon. Check out what is available at Amazon at <http://tinyurl.com/3bz4r8> .

**Activity of the Month:** Discover what *magnetic latitude* is. How does it differ with longitude? What is the magnetic latitude at your house? What is the  $K_p$  index? Compare minimum  $K_p$  indexes needed for visible auroras between my previous residence in Colorado (39.8210N, 105.0092W) and Columbus, OH which are at very nearly the same geographic latitude. At which location is it easier to see auroras? Why?

Suggestions, questions, and comments about "Planetary Wonderings" are welcomed and may be directed to stargazer @ keeplookingup.net (remove spaces). Past columns may be found at [www.keeplookingup.net](http://www.keeplookingup.net) (all past columns, click on "Planetary Wonderings" on the right side of opening screen) and at <http://www.freelists.org/archives/astronomyed/> (columns from Jan. 2007 to the present).

**Remember to *keep looking up!***

Sources (not mentioned in the article):

[http://science.nasa.gov/headlines/y2008/10jan\\_solarcycle24.htm?list116241](http://science.nasa.gov/headlines/y2008/10jan_solarcycle24.htm?list116241)

[www.spaceweather.org](http://www.spaceweather.org)

<http://www.space.com/scienceastronomy/080219-soho-radiation.html>

[http://www.windows.ucar.edu/tour/link=/space\\_weather/space\\_weather.html](http://www.windows.ucar.edu/tour/link=/space_weather/space_weather.html)