Natural Radio

News, Comments and Letters About Natural Radio

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Summer and the vegetable crop are winding down as the cool crisp nights are beginning a little earlier each day, signifying the beginning of the aurora season and also increased Natural Radio activity.

For over 100 years, scientists have noticed that auroral activity peaks around the Fall and Spring equinoxes. Some of the reason for this is understood, while parts of it still remain a mystery.

The Interplanetary Magnetic Field (IMF) spirals out from the Sun due to the Sun's 27 day rotation cycle. The way this field propagates out is called the "Parker spiral" after the scientist who first described it. The Earth's magnetic dipole axis aligns most closely with the Parker spiral in April and October. As a result, southward (and northward) excursions of B_z are greatest then, and southward pointing B_z means more geomagnetic activity.

The Parker spiral is also the path the CMEs usually follow when they are ejected from the Sun. CMEs don't follow a straight line from the Sun to the Earth.

Of course the Parker spiral is a simple ideal model – so is representing the Earth's field as a simple dipole field. While there's lots of room for unpredictability here, we are still more likely to see auroral displays and hear Natural Radio signals in October and April than at other times of the year.

Now is the time dust off your WR-3 and enjoy the fall colors and crisp air. Also, keep an eye on the space weather reports for coronal holes or unanticipated CME's that might cause auroras.

Cycle 24 On the Way – On July 31 a Sunspot with backwards magnetic orientation appeared on the surface of the Sun. The spot only lasted a few hours but this magnetic field polarity reversal usually signifies the beginning of a new Sunspot cycle. Several weeks later another backward spot appeared that lasted for several days. It appears that we have reached solar minimum and the beginning of cycle 24.

Viewing the Sun In 3-D – After several postponements, the STEREO, Solar TErrestrial RElations Observatory mission is scheduled to be launched as early as October 25.

STEREO is truly amazing. It will consist of two, almost identical, golf cart sized spacecraft placed into different orbits around the Sun. One will lag behind the Earth's orbit and the other will be ahead of it. The two perspectives of the Sun will allow 3-D images to be created.

The spacecraft is on a two-year mission, and will explore the origin, evolution and interplanetary consequences of coronal mass ejections. The benefit for those of us that track geomagnetic storms is that 3-D views of coronal mass ejections should allow a much better prediction of their trajectories. The 3-D models should also allow a better prediction of how these CMEs rotate on their way to earth and thus offer a better prediction of their magnetic alignment and thus their coupling to the Earth's field. So we should have a better idea if and when a given CME will hit the Earth and what its likely effect will be.

The mission is being managed by NASA's Goddard Space Flight Center in Greenbelt, Md. The satellite was designed and built at the Applied Physics Laboratory at Johns Hopkins University.

The Solar-B satellite was launched on September 23, by the Japanese Aerospace Exploration Agency's (JAXA) Space Science Research Division. This joint project of Japan/US/UK consists of a coordinated set of optical, EUV, and X-ray instruments that will study the interaction between the Sun's corona and its magnetic field. The goal is a deeper understanding of the mechanics behind solar flares and CMEs. Solar-B will be another tool to help us predict "space weather" by telling us much about how the Sun generates magnetic disturbances and the high-energy particle storms that propagate from the Sun to the Earth and throughout the solar system.

Terrestrial Weather Affects Space Weather – Much of the research being done into space weather concerns how and if it affects our weather here on Earth and to what extent. New research suggests that besides space weather affecting what happens in the troposphere, our terrestrial weather can affect space weather.

Scientists have discovered that tides of air generated by intense thunderstorm activity in tropical rainforest areas along the equator were changing the structure of the ionosphere.

"This discovery will help improve forecasts of turbulence in the ionosphere, which can disrupt radio transmissions and the reception of signals from the Global Positioning System," said Thomas Immel of the University of California, Berkeley, lead author of a paper on the research published August 11 in Geophysical Research Letters.

The greatest electron density of the ionosphere is in the F-layer. Sensors on board NASA's Imager for Magnetopause to Aurora Global Exploration (IMAGE) satellite recorded two bands of plasma close to the equator in the F-layer at a height of almost 250 miles which glow in ultraviolet light.

Using digital images from the IMAGE satellite, scientists discovered four pairs of bright regions where the electron density was almost twice the average. Three of the bright pairs were over areas with lots of thunderstorm activity -- the Amazon Basin in South America, the Congo Basin in Africa, and Indonesia. A fourth pair of bright regions appeared over the Pacific Ocean.

But there was a problem with determining what the method of interaction was. How could tides of air currents in the troposphere be affecting the ionosphere 250 miles above the Earth? The air molecules are just too far apart to interact at that altitude.

However, it was found that these moving tides of air could affect the E-layer which is much lower, and in an area where the air is denser. The E-layer becomes partially electrified during the day due to ionization by UV rays from the Sun. High altitude winds blow this plasma across the Earth’s magnetic field.

Since plasma is electrically charged, its motion across the Earth's magnetic field acts like a generator, creating an electric current. This electric current shapes the plasma above into the two bands. Anything that would change the motion of the E-layer plasma would also change the electric current it generates, which would then reshape the plasma bands directly above in the higher F-layer..

There were some immediate and obvious implications for space weather and propagation. The researchers identified four sectors on the Earth where geomagnetic storms may produce greater ionospheric disturbances – North America being one of the four.

It will be interesting to watch further research and see if there is any connection to whistlers. Models generated form this data should also help produce more accurate HF and MF propagation predictions.

The full article along with pictures from IMAGE of the plasma bands appears at http://www.nasa.gov/centers/goddard/news/topstory/2006/space_weather_link.html.

New Version of Spectrum Lab – Spectrum Lab, the popular spectrum analysis and filter program by Wolf Büscher, DL4YHF, has been updated several times over the summer with the latest version being 2.7 b8.

In addition to many improvements to the code, some highlighted features are ASIO support, new pre-configured settings, FFT-based filter now supports I/Q-processing; including frequency conversion and simplified color palette selection. Wolf also added a pre-configured setting to down-convert the ultrasonic signals from bats. (This is very useful at solar minimum when there isn’t much else to listen to.)

Information and download at http://people.freenet.de/dl4yhf/spectra1.html.