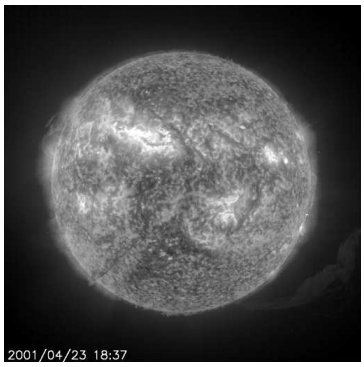
Solar Flares and Sunspots Stir our Air-Waves



A recent flurry of activity on the surface of the sun inspired plenty of discussion in Amateur Radio Circles and had many keeping an eye on propagation or Auroras! Space "weather" plays an important part in our hobby, it is therefore timely to review some of the basics of how this is reported and what the information in the bulletins means:

Amateur Radio operators who use HF generally like increased sunspots because they correlate with better worldwide radio propagation. When there are more sunspots, the sun puts out radiation that charges particles in Earth's ionosphere. Radio waves bounce off (refract from) these charged particles, and the denser these clouds of ions, the better the HF propagation.

When the ionosphere is denser, higher frequencies will refract rather than passing through to outer space. This is why every 11 years or so when this activity is higher, 10 meters gets exciting. Ten meters is at a high enough frequency, right near the top of the HF spectrum, that radio waves propagate very efficiently when the sunspot count is high. Because of the shorter wavelength, smaller antennas are very efficient on this band, so mobile stations running low power on 10 meters can communicate world wide on a daily basis when the sunspot cycle is at its peak.

There are also seasonal variations, and 10 meters tends to be best near the spring or fall equinox. If the ionosphere is not so dense, the maximum usable frequency (MUF) may be below 10 meters, and perhaps only signals with Frequencies as high as 15 meters or below will propagate.

Sunspot numbers used in bulletins are calculated by counting the spots on the visible solar surface and also measuring their area.

Solar flux, another value reported, is measured at specialised observatories, using antennas pointed toward the sun hooked to a receiver tuned to 2.8 GHz, which is at a wavelength of 10.7 cm. Energy detected seems to correlate somewhat with sunspots and with the density of the ionosphere.

Other solar activity of concern to HF operators includes **solar flares and coronal holes**, which emit protons. Since the charged ions in the ionosphere are negative, a blast of protons from the sun can neutralize the charge and make the ionosphere less refractive. These waves of protons can be so intense that they may trigger an event called a geomagnetic storm. In addition, energy from a solar flare may energize the D-layer of the ionosphere, which absorbs radio waves.

The **Planetary A index** relates to geomagnetic stability. Magnetometers around the world are used to generate a number called the Planetary K index.

A one-point change in the **K index** is quite significant. K index readings below 3 generally mean good stable conditions, and above 3 can mean high absorption of radio waves. Each point change reflects a big change in conditions.

Every 24 hours the K index is summarized in a number called the **A index**. A one-point change in A value is not very significant. A full day with the K index at 3 will produce an A index of 15, K of 4 means A of 27, K of 5 means A of 48, and K of 6 means A of 80.

The geomagnetic number reported on WWV are the Boulder K and A index, measured in Colorado. Generally, the higher the latitude of the measuring station, the higher the K and A indices reported. This is because the effects of geomagnetic instability tend to concentrate toward the polar regions of the globe. You can hear the Boulder K index updated every three hours on WWV.

(adapted from information published in K7VVV's regular Propagations Bulletins)