Solarham.com: the space weather site for radio amateurs

During my presentation on Space Weather, I didn't really have much time to demonstrate the websites that deal with the topic. The most useful of these is www.solarham.com, run by Ontarian amateur VE3EN. There is plenty of useful info on the site itself, and there are links to other websites that amateurs will find handy.

The home page has pretty much all of the info that you will require, with the graphs for **x-ray flux** and the **GOES magnetometer**, plus the **radio blackout map** being the most useful. These three refresh automatically every couple of minutes (or thereabouts), so you should only need the solarham.com home page to get up-to-date info on fadeout, x-ray flux and geomagnetic disturbance, thereby avoiding the opening of lots of browser windows.

Solar Flux (SFI), sunspot number (SN) and 304A figures are conveniently listed close to the top of the page.

A graph with the **Kp index** is shown, and is updated when the numbers from Colorado become available. While not real-time, the graph's up-to-three-days historical data will help you determine if the geomagnetic situation is likely to put any downward pressure on maximum useable frequencies. (Looked at the other way, a number of days with a solar flux index of well over 100 together with Kp figures of 2 or less over that same period should result in good conditions on the higher HF bands over sunlit circuits.) Additionally, the Kp is a simple pointer to the likelihood of occurrences of radio (and visual) aurora; a Kp of 6, say, indicates that the northern lights should be visible from our latitude and that VHF operators amateurs in northern Europe will have a good chance of getting skip off the auroral front.

The **CME Prediction Model** from the US Space Weather Prediction Centre (SWPC), to be used to get an idea of incoming solar wind speed and density over the coming days, is on the home page, although it is not real time and you'll have to click on the image to start the animation. The info from the **ACE satellite** (nearly a million kilometres from Earth in the direction of the Sun) is in real time, however, and evidence of especially-dense/fast solar wind will be detected here shortly before any affect is felt on Earth. (Keep in mind that the SWPC's predictions may be out by several hours, and the estimated severity of the space weather events may differ markedly from reality. The predictions are by no means perfect substitutes for up-to-date measurements.)

Although there are half a dozen measures shown by the ACE satellite, the key indicators are speed, density and 'Bz', which is the strength of the solar wind's magnetic field in the vertical (i.e. north-south) plane. A strong negative (i.e. southerly) Bz could facilitate a significantly-disturbed magnetic field, even when neither the solar wind's speed nor its density is particularly high. This is because of a 'coupling' with the Earth's *north*-orientated magnetic field, leaving our magnetosphere more vulnerable to disturbance. Another point to note about the Bz is that it can flip polarity in a very short space of time, and do so without warning. This occurs during a 'solar sector boundary crossing', when the origin of the solar wind impacting Earth changes from the Sun's northern hemisphere to its south, and vice versa. This is, in turn, due to the Sun's plane of rotation being on a slight angle to the plane on which the Earth revolves around the Sun. My understanding is that efforts to predict the timing of such change is not precise enough to be useful, but I could be wrong.

The strength and orientation of the Bz and the speed of the solar wind measured at ACE are shown in the two 'speedometer'-type indicators near the top of the home page, with the orange and red regions being the respective levels that Bz and wind speed result in the magnetic field being significantly disturbed. (This is rule-of-thumb, only. The GOES magnetometer and the Kp graph will enable you to know for sure how severe any disturbance is.)

The line on the home page starting with the Bz needle through to the graph of x-ray flux provides pretty much all of the information you will need to get a snapshot of the present space weather situation.

In order to get a fuller understanding of the space weather, I suggest reading VE3EN's descriptions and explanations of recent space weather events on the right-hand column of the page, which are interesting and informative. (There are links to some pretty nifty videos, too.) Below this section is a reproduction of the **US Government's daily space weather summary**. It may appear a little dry at first, but is quite a useful complement to VE3EN's contributions above, the latter which generally deals with the eruptive events on the Sun, excluding the less-spectacular space weather phenomena. (It should be noted that VE3EN is predominantly a six-metre operator and aurora watcher, so only very potent space weather is really relevant to him.) In the the US Government's summary, space weather events over the previous couple of days are succinctly described and short-term forecasts are provided for solar activity (i.e. the likely frequency and severity of flares) and disturbance to the geomagnetic field. The probability (in %) of X- and M-class flares for each of the next three days are indicated. Just note the date and time of the summary, as it may be a dated yesterday.

You may notice the 'Proton' and 'PCAF' numbers shown at the bottom of the US Govt summary. The former relates to the probability of a significant 'proton event', when the Sun sends streams of these positively-charged parts of atomic nuclei towards the Earth at relativistic (near-light) speeds. These are mainly the concern of operators of satellites in geostationary orbit, but can also cause aurora and polar cap absorption fadeout ('PCAF'), whereby HF signals traveling nearby the geomagnetic poles are absorbed by a heavily-ionised D layer of the ionosphere. As this does not directly affect us here, at more temperate latitudes, I avoided it in my presentation. However, it's a definite headache for those trying to contact say, the Canadian west coast, the north-east Pacific or Australia/New Zealand on the long path. Given the speed of the particles, the onset of PCAF can very rapidly follow the eruptive event on the Sun that caused it. In some cases it is a solar flare – with attendant surge in x-ray flux – but not necessarily. If you're want to communicate via the polar environs, best keep an eye on the SWPC's Radio

Blackout Indicator (and the ‘Protons’ graph near the top of the SolarHam home page.

Below the US Government summary is a description of the **sunspot groups** that are on the Sun’s Earth-facing side. (These groups are officially termed ‘active regions’, and each is allocated a number). We are most interested in the ‘magnetic class’, shown in the final column in the table. A spot group with a magnetic class of simply ‘A’ or ‘B’ are considered stable, and so are unlikely sources of either numerous and/or powerful flares. Other magnetic classes are more complex and unstable and, consequently, more likely to be flare generators. The flare probability figures described above take into account the magnetic class as well as the position of the spot group with respect to the centre of the Sun’s disc as viewed from Earth. (Flares of equal intensity will be most potent in terms of x-ray energy felt at Earth if their associated sunspot groups are at the centre of the disc – that is, facing directly toward our planet.)

You should find that solarham.com gives you all the information you’ll require. Nevertheless, you may wish to have a look at www.spaceweather.com, which is designed with amateur astronomers in mind. (It deals with meteor showers, (visual) aurora and satellites, predominantly.) The information on it is well-presented and avoids jargon. For those very new to space weather, this site will be especially useful.

73

Evan Duffield
M0TJU