Elmers Corner: Getting Started With Radio Propagation Part 2
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By now I trust those of you who read last month's column have gotten a taste for learning about propagation and have put some of this new knowledge to good use! Armed with numbers such as the monthly **MUF** (maximum usable frequency), the **LUF** (lowest usable frequency), and information regarding atmospheric layers one may predict with some degree of accuracy just which bands will be open at any given time of day. This is powerful stuff!

This time around we will look at how various solar conditions affect propagation, but still from an introductory perspective. I hardly consider myself an expert!

Solar Activity
The sun plays a big role in what happens to radio signals. Recently there have been a number of solar disturbances which have played havoc on HF signals, surprising a number of folks since Solar Cycle 24 is supposed to be winding down. "Wait . . . what do you mean . . . Solar Cycle . . . what??"

Solar Cycles are 11-year periods or "cycles" which are reasonably predictable with solar *minimums* and *maximums*. There is nothing tricky here to remember—high activity means there are a lot of sunspots active, while low activity means fewer sunspots and less activity. For our purposes higher activity *generally* means better DX conditions. But as they say, you have to take the bad with the good, and heightened solar activity also means some signals will not be as good (lower bands), and there will be more interruptions to good signals as we experience solar flares, solar winds, and CMEs. And yes, I will talk more about these in a moment!

Let me state right here that regardless of the solar activity, the solar cycle, or the people bemoaning conditions for whatever the reason, there are always bands open somewhere around the world at any time of day. The study of propagation helps you understand when conditions might be more favorable than others, but there is almost never a time when you cannot talk to someone, somewhere assuming you have the radio/antenna capability.

When I first became a ham we were in the midst of a low point in the solar cycle, and everywhere I looked I saw reports of how the bands were dead, nothing was happening, yada yada yada. The fact is I

worked all over the world in those "terrible" conditions, and I discovered the real truth I mentioned above—there is always somewhere to work whenever you turn on your radio.

If you don't believe me, just check out the bands whenever there is a DX contest going on. People are walking all over one another to stack up those points and be declared master of the radio universe and chief muck-a-muck of the airwaves. On those days suddenly "propagation" is just fine! Blaming low activity on poor solar conditions is an example of a self-fulfilling prophecy; if enough people believe good contacts are impossible no one gets on the air and so no good contacts are possible.

Remember too, a quiet band is not necessarily a dead band. Often the bands are quiet simply because no one is putting out a call (hint hint)!

The Sunspot Cycle

Sunspots are just one of several solar conditions which have a great impact on RF propagation, but they get the most attention by far. Why are sunspots (or the lack thereof) blamed for all the ills of radio silence? Sunspots are caused by thermal irregularities on the surface of the sun. These spots denote areas of the sun which are cooler than the surrounding area. A larger number of sunspots indicates higher *UV* (ultraviolet) activity, which leads to a more highly-charged atmosphere. More ionization in the "F1" and "F2" layers of the atmosphere means better signal propagation overall. Low numbers generally mean a weaker ionosphere and therefore lower propagation.

Sunspot cycles last about 11 years, swinging from high (*maxima*) to low (*minima*) and then back again. When the sunspots are gone for long periods of time we say the sunspot cycle is at a minimum. Tracking sunspot activity does give a good indication overall of propagation activity, particularly on frequencies above 10 MHz.

For our purposes here the temperature of the sun is not as important as the magnetic activity. The presence of sunspots indicate a higher level of magnetic activity and this changes the ionization of the atmosphere, directly impacting RF activity. During periods of high activity frequencies above 10 MHz come alive, and bands such as 10-meters can stay open all night (I personally can't wait for the next real maximum!). The downside to this condition is that the lower frequency bands such as 80- and 160-meters close up due to absorption.

Low magnetic activity does not mean conditions are necessarily poor for radio signals. While low solar activity means less HF activity on some bands, signals in the usable HF range are more stable because there are less geomagnetic storms and solar flares, and fewer CME (Coronal Mass Ejections, or magnetic explosions). Each of these solar disruptions can adversely affect propagation, so I'll discuss them briefly below.

Solar Flares
Solar flare activity brings with it magnetic fluctuations which can produce unstable HF signal propagation and higher signal absorption in the atmosphere, particularly in the "D" layer. Flares and other magnetic disturbances such as coronal holes can cause radio blackouts on the sunlit side of the earth lasting minutes or hours. These instances are sometimes referred to as a *SID* (Sudden Ionospheric Disturbance). Lower bands are usually affected first, but then the higher bands will also be affected if the disturbance is strong enough. Fortunately they do not last long, and often there are some excellent opportunities as the flare dies down but the atmosphere remains charged.

Coronal Mass Ejections
CME produce those beautiful Northern (and Southern!) Lights as the atmosphere becomes highly charged with trillions of watts of energy. While visually stunning, these solar events can cause satellite and ground-based radio signal blackouts, and if strong enough these disruptions can permanently damage equipment. On the other hand, the greater ionization produced by these ejections can bring about opportunities in the higher frequencies, particularly 6- and 2-meters.

Northern and Southern lights can produce some very interesting signal propagation known as Aurora propagation. While 10-meter contacts are possible, most aurora activity occurs at 6-meters and above, sometimes reaching as high as 1.2 GHz. Signals are bounced off of the aurora with directional antennas, and contacts up to 1400 miles are not uncommon. What makes this type of propagation a bit tricky is the movement of the aurora ionization patterns; adjustments have to be made to track the aurora as it moves along the atmosphere. I will talk more about scatter propagation next time.

Geomagnetic Storms
Geomagnetic storms are disruptions caused by a solar wind shockwave which typically strikes the Earth's magnetic field 24 to 36 hours after a solar flare or CME event. Solar wind pressure changes cause higher

ionization which may last for several days, or longer in some instances. One of the stronger storms in recent history caused major power outages in Quebec in 1989. Northern Lights were seen as far south as Texas, a once in a lifetime experience for many to be sure!

Solar activity is monitored on a daily basis; such is the level of importance and impact on day-to-day communications which the sun can have on our lives. Fortunately for those of us interested in the radio hobby there are many online resources for predicting and analyzing this activity, and the hobby is all the better for it!

I recommend getting in the habit of checking conditions on a daily basis if at all possible so that opportunities for unusual contacts don't pass you by. Over time your log books will be filled with those one-of-a-kind entries you'll be bragging about to your radio friends (and anyone else who will listen!) On the Elmers Net page of the OHKYIN website in the notes section you can find a set of notes going into some detail explaining what some of the numbers/readings mean when viewing those ubiquitous propagation banners.

Wrap-up

Remember, every day is a chance to work stations all around the world if you just turn on your radio. Learning as much as you can about propagation will make every listening opportunity better, and even your serendipitous encounters will be more frequent, I promise! After all, as the old saying goes, "chance favors the prepared mind!"

Until next time, happy signal hunting!

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